Noonomy

2nd revised and extended edition

Excerpts from reviews of S.D. Bodrunov's *Noonomy*

Professor Bodrunov is distinguished by his fine and extremely useful sense of historical changes and trends which define social evolution. The concept he has offered provides a vivid illustration of Marx's idea of the upcoming transition to communism as a higher stage of social development.
Samir Amin
Professor, Director of the Third World Forum

This monograph outlines our path into the future devoid of compulsory labour, poverty and fighting over limited resources. Many thinkers have dreamed of such society, but their attempts at building it could not succeed in the absence of an appropriate technological foundation. Sergey Bodrunov shows how the combination of quickly growing technological capabilities and a mature spiritual culture can deliver the humanity from the kingdom of necessity to the kingdom of freedom provided that people become truly sapient. The book determines the limits of homo economicus who remains the key figure of mainstream economy. In order to move beyond these limits and prevent self-destruction of human civilisation, Bodrunov proposes a new methodology for the organisation of socioeconomic knowledge – noonomy, which will use the technological progress to introduce a rational core into the management of the chaotically developing economy, something we have failed to accomplish so far due to cultural regression and moral decay. Bodrunov incorporates various components of rational socioeconomic development management and proves its feasibility. Unlike *The Communist Manifesto* or the IMF, the author of this book does not fall prey to illusions or get carried away by abstract doctrines. He relies on his engineering and executive background to design the future, which appeals to all sentient human beings and, consequently, encourages them to engage in working toward this future.
Sergey Glaz'ev
Academician of the Russian Academy of Sciences
Adviser to the President of the Russian Federation

Noonomy develops ideas earlier presented by Daniel Bell, J.K. Galbraith, and Manuel Castells, which interpret the transition of capitalist societies from an industrial to a post-industrial type of society. The book is innovative and predicated on a discussion of nooproduction and the noonomy. It is a well-referenced and informative book that provides a critique of neo-liberal economic fundamentalism. It introduces English language readers to the Russian discussion of the noosphere concept by writers such as Vladimir Vernadsky. The author links systems of economic management, digital and cognitive technologies – the knowledge-based economy – to the emergence of a new type of post-industrial civilisation. The book brings out the importance of understanding future technologies and the horizons they open up for human development. This is an interesting book, which raises many fundamental questions

not only in economics but also in public policy, particularly with regard to the environment. Sergey Bodrunov not only brings out the urgency of the 're-industrialisation' of Russia, but also emphasises the need for such development to be modern and embedded in new technology.
David Lane
Emeritus Reader in Sociology, Emmanuel College, Cambridge University

A deep inquiry into sources of well-being and the need for an integration of technology and culture in constructing a knowledge economy under environmental challenges and resource constraints. Western readers will especially value Sergey Bodrunov's synthesis of Russian and Western texts – notably those of my father – in the development of his ideas. *Noonomy* is a model, among other things, of transnational and cross-cultural research and reasoning.
James K. Galbraith
Professor, University of Texas at Austin

This interesting book considers the implications of current trends in technological evolution for the economy and human society. Bodrunov rejects the common view that the growing role of information has superseded material production and argues that advances in information processing have transformed material production. In this PROVOCATIVE work, Bodrunov acknowledges an intellectual debt to John Kenneth Galbraith's ideas about the centrality of technology and specialized knowledge in the contemporary economy. Bodrunov's critique of contemporary global capitalism is well founded, and his proposals for Russia's development are much needed.
David Kotz
Professor Emeritus, Department of Economics, University of Massachusetts, Amherst

Sergey Bodrunov is a top Russian scholar and global expert in issues pertaining to the transition from the new industrial economy to a new quality of public life, which he labels the noonomy. His theoretical ideas have been presented at numerous international forums and in a series of books. Bodrunov's latest monograph, *Noonomy*, synthesizes his prior achievements. The author's practical conclusion is particularly pertinent: Russia needs to adopt a socioeconomic policy that would allow for accelerated progress by critically assessing and incorporating the Chinese and Northern European experiences, i.e. the introduction of an efficient planning system in conjunction with the market. China and Russia should eliminate the influence of the neoliberal economy, pursue comprehensive strategic cooperation in the process of developing a new generation of industrialization and noonomy, jointly combat economic hegemonism and make a difference for the people of the two countries and the world!
Enfu Cheng

Professor, President of the Academy of Marxism, Chinese Academy of Social Sciences, Chairman of the World Association for Political Economy

The author would like to thank his colleagues who provided their reviews of the book for this publication.

Contents

Foreword to the English Edition

This work is the English translation of the updated and revised edition of *Noonomy*, first published in 2018. It also includes materials from colloquiums held at S.Y. Witte Institute for New Industrial Development (INID) that significantly elaborate and expand ideas presented in the first edition of *Noonomy* (M.: Kul'turnaia Revoliutsiia, 2018). Moreover, this edition incorporates excerpts from *The Coming of New Industrial Society: Reloaded* (2nd ed. SPb: S.Y. Witte INID, 2016), which provide a more detailed account of challenges pertaining to Russia's reindustrialisation based on cutting-edge technologies as a first step towards a new state of society.

As soon as *Noonomy* was published, it caught the eye of numerous Russian and foreign specialists. Therefore, the author felt the need to provide the English-speaking audience with an opportunity to read the book. Since the study of noonomy and related issues is not complete and Sergey Bodrunov and the institute where he is Director (S.Yu. Witte INID, St. Petersburg) continue their research in this direction, the version of *Noonomy* that was submitted for translation had undergone major revisions. It now includes sections dedicated to some practical aspects pertaining to the implementation of the author's theoretical views.

Introduction

The series of crises in the late twentieth and early twenty-first centuries clearly showed that the world has changed. The increased instability of social systems, global financial turbulence and the beginning of tectonic shifts in the world economy indicate that our civilisation is on the verge of an inexorable transition g to a new formation which cannot be adequately described by conventional economic and philosophical constructs and existing social and economic models.

So what constitutes the main driving force behind the current changes? Where are we headed?

Long ago, Karl Marx referred to the society of his day as "the realm of necessity" and dreamed of "the realm of freedom":

> Just as the savage must wrestle with Nature to satisfy his wants... so must civilised man... in all social formations and under all possible modes of production. With his development, this realm of physical necessity expands as a result of his wants; but, at the same time, the forces of production which satisfy these wants also increase.[1]

Human *wants* urge humans to perform *conscious activities aimed at satisfying them.* From the beginning of times, people have been satisfying their wants by creating various material goods, i.e. by engaging in activities known as *material production*. To an extent, human history can be viewed as the development of material production driven by the need to satisfy growing social demand, or, as Marx put it, "the development of productive forces,"[2] i.e. the increase in humanity's material production capabilities for satisfying its wants, material and other. Moreover, *the stage of development of material productive forces determines the economic structure of society, its mode of production, which corresponds to* a historic epoch. The

[1] Karl Marx (1998) *Capital*, Vol. III. In: *Karl Marx & Frederick Engels Collected Works*. Vol. 37. New York: International Publishers. P.807.
[2] Ibid. P. 806.

development of technologies today brings us closer to Marx's "realm of freedom" which translates into freedom from want and lower dependence on the need to allocate time, resources and effort to the production of material goods. At the same time, technological development logically raises the following questions: what actually stipulated the changes in the state of material production? How and why did they occur? What trends govern the development of material production?

The study of *social production* answers these questions. On the one hand, itserves as the point of convergence for such fundamental issues as the balance between material production and the service sector, the economic structure and trends in the development of its material foundation, the correlation between industrial and postindustrial tendencies. On the other hand, it directs our attention to practical matters, including reindustrialisation, import substitution, revival/integration of high technology production, science and education industrial policy, etc.

The book goes beyond the concern (shared by the author) about the urgency of reindustrialisation through cutting edge technologies. It criticises post-industrialist ideologies and emphasises the importance of developing material production. However, the author's approach does not just mirror John Kenneth Galbraith's idea of the new industrial society. Rather, it offers a much more profound narrative. It involves, *first*, "the negation of negation" of the new industrial society described by Galbraith fifty years ago. It allows, firstly, for a critical synergy of modern technological achievements and production management solutions on a new technological basis and under new economic and institutional formats. Secondly, it involves the dialectical negation of post-industrial trends by preserving its core achievements (such as the more prominent role of people in the production process, the higher importance attributed to environmental and social aspects of production, and the boost in knowledge intensity of public production.) and weeding out the vices. It is necessary to speak of *the society's inevitable transition to a new developmental stage*, one the author refers to as *the new industrial society of the second generation*, or the NIS.2.

However, the study of social development trends does not stop there. NIS.2 serves as the stage in the evolution of the society that constitutes a prerequisite for the transition to noosocial development based on non-economic methods of demand satisfaction – the noonomy. That term is used as the title of thus work so as to underscore the author's stance on human development prospects.

The human civilization is at a dangerous crossroads. We will either go down the path of unchecked use of new technologies in the pursuit of senseless increase in consumption, destruction of the environment and deformation of the human nature or find a way to control technological development through the application of human intellect reliant on the criteria of humanitarian culture.

The latter path stipulates (a) abandonment of economic rationality criteria which justify any inflation of production volumes as long as it boosts profitability, and (b) transition towards using criteria for reasonable satisfaction of specific wants. The author introduced the term 'noonomy' to signify a non-economic method of management based on humans' withdrawal from immediate production, focus on personal development through creative activity and subjugation of a rather autonomous technosphere's development to criteria of human culture.

Once humans withdraw from immediate production, this method of management is regulated not by interpersonal production relations (because they become obsolete, as humans withdraw from production), but by interaction between the human society and relatively autonomous technosphere. With respect to technosphere, humans assume goal-setting functions and control over areas for the use and technological application of the results of cognition.

Both in its terminological and semantic aspects, the concept of noonomy resonates with the idea of the noosphere.

The idea of the noosphere was first expressed by Edouard Le Roy (1870-1954), Pierre Teilhard de Chardin (1881-1955) and Vladimir Vernadsky (1863-1945). Vernadsky's lectures on geochemistry, delivered in 1922-23 at Sorbonne and attended by Le Roy and Teilhard de Chardin, provided an impulse for the development of these ideas. Le Roy introduced the term 'noosphere' into the scholarly discourse1. Teilhard de Chardin and Vernadsky provided a detailed explication of the noosphere in late1930s.

Teilhard de Chardin perceived the noosphere as a qualitatively new state in the concentration of consciousness that created global spirituality, i.e. a web of thinking interconnections that encircled Earth. He believed that the concentration of consciousness on a global scale was closely related to the fusion of human communal spirituality which, in the course of further evolution, would lead to the emergence of the 'spirit of one Earth'2.

Vernadsky's approach to the idea of the noosphere was closer to the natural sciences perspective. He emphasized that humankind's rational activities were becoming the main transformative force both for the biosphere and the Earth's geological shell (biogeosphere)3.

But what we see in all these concepts is not so much as a scientific theory, but an interpretation of the undisputed fact that human life and the functioning of the human society – distinguished by the ability to act rationally – are becoming a key factor in the Earth's (or at least its surface's) condition and evolution and simultaneously a decisive factor that determines the humankind's own destiny.

The supremacy of human intellect inevitably foregrounds the issue of its development and main imperatives. That brings up the following question: what social order can secure reasonable application of such a powerful tool as the human intellect and ensure that it not be used just as an efficient instrument for the satisfaction of zoological instincts warped by the modern civilization? The idea of the noosphere does not provide an answer to that question.

The answer can be found in the concept that stipulates the transition to the noosocial order, i.e. the noosociety. Noonomy then serves as a basic element of the

[1]Edouard Le Roy. *L'exigence idéaliste et le fait de l'évolution*. Paris: Boivin & Cie, 1927.
[2] See: Novikov, Iu.Iu. and B.G. Rezhabek. *Vklad E. Le Rua i P. Teiara de Shardena v razvitie kontseptsii noosfery*. URL: http://www.nffedorov.ru/w/images/3/36/Lerua.pdf
[3] Vernadsky, V.I. *Nauchnaia mysl' kak planetnoe iavlenie*. Moscow: Nauka, 1991.

noosociety, as a global ‘nomos’ (principle, structure, order...) that determines the non-economic method for organizing human activity and satisfying human wants with an emphasis on cultural imperatives as opposed to economic rationality.

The term ‘noonomy’ derives from Greek words ‘noos’ (νους – intellect) and ‘nomos’ (νομός – law, order). Since noonomy is defined as a mode of organization of productive activity, it would seem logical to refer to the Greek word ‘oikos’ (οἶκος – house, household) as well. But under the modern scientific tradition, terms which derive from this word are used to signify economic reality, and we are keen on avoiding any association of the noonomy with an economic social order.

We do not employ a mechanical combination of the terms ‘noosphere’ and ‘economy’, but draw on the Greek term ‘noos’ in the following meaning: intellect reliant on the criterion base of truth as a perceived timeless value.

The perception of noonomy as a non-economic method for organizing human activity under the noosociety prevents us from construing this future as capitalist. As economic criteria for human activity and economic relations become obsolete, so will ownership relations and all related categories of the capitalist economy. At the same time, the theory of noonomy perceives the future differently as opposed to socialist and communist perspectives. Economic and capitalist categories are presumed to fade not as a result of a revolutionary social change and deprivatization of property, but through gradual evolution and deescalation of social conflicts. That is why the system of ownership and income distribution (which lose their significance, if not disappear entirely) do not serve as key points of noonomy. Instead, the concept of noonomy prioritizes new management criteria based on cultural imperatives.

However, we aim neither to speculate about the future nor to foresee it. Rather we wish to assess, in a global context, the prospects for civilizational development and find the path that contemporary civilisation, including Russia’s, can take in order to reach that future, one that is smarter, kinder, freer and, in every aspect, more deserving of the label ‘ civilised’.

The future is fundamentally uncertain by definition. Let us leave aside disputes about the ratio of predestined and uncertain elements and assume that there can be various scenarios for the future at each stage of civilizational development (within the boundaries set by the laws of the universe). The future therefore depends on all of us. Some might argue that the material tackled here is way too remote and vague and plenty of other, more relevant, material and urgent issues await our attention. No doubt: the author has dedicated many pages to such matters. Even so, by focusing only on the urgent, we risk losing the strategic perspective. We overlook the only path that can lead us out of the labyrinth of current problems and risk failing to buildthe bridge that will take is over deep gullies, pitfalls, sloughs and ravines of historical advancement towards a better future. If we want to cross that bridge, we have to start building it today, with our own hands – no matter how remote and uncertain the future seems to us. If we refuse to create the future now, we risk not seeing it at all or, alternatively, risk making more difficult.

As a Chinese proverb says, "a journey of ten thousand miles begins with a single step". In that spirit, I decided to make yet another attempt, adding to a multitude of prior undertakings, to step forward and submit my work to your judgment, my dear reader.

Part One "Methodology" discusses basic principles of the research method used in the book. Key role of material production constitutes an essential principle that underlies the approach to explaining social development processes. Change in the public structure of production depends on changes in its elements, i.e. technologies, labor, production management and its product. At the same time, the author emphasizes an essential and ever increasing role of knowledge in the development of production technologies that occurs through a change in technological modes and is accompanied by changes in the structure of manufactured product and evolution in the level of saturation and structure of human wants.

Part Two "Nooproduction: Run-Up" assesses first steps towards the formation of nooproduction that are currently being made. From the technological perspective, our society is still an industrial society. A post-industrial society never came into being, albeit post-industrialist concepts have affected economic policy by justifying deindustrialization of the economy. That is why the technological progress takes on the role of industrial progress, and the new technological revolution based on the transition to the sixth technological mode will also comprise an industrial revolution. The new industrial state described by J.K. Galbraith will yield to a new industrial society of the second generation (NIS.2). The NIS.2 is characterized by a new type of material production, i.e. knowledge intensive material production which manufactures knowledge intensive products.

Part Three “Nooproduction: New Technologies as a Challenge to the Humanity and Society” considers risks associated with unchecked development of new technologies. These technologies expand opportunities for the satisfaction of human wants, while production growth also increases environmental stress. Even though new technologies cut production-related material costs, such phenomena as irrational expansion of wants and growing simulative wants driven by the pursuit of market expansion lead to the consumption of increasingly large volumes of natural resources. We observe the emergence of new technological risks related to the possibility of interfering in the very human nature and the loss of control over directions in the evolution of the technosphere. Humans are forced out of immediate production, which raises the issue of finding occupations for people who used to be employed in dying professions. The resolution of all these issues depends on whether production goals are transferred under the control of human intellect. Such transfer will allow for the abandonment of simulative consumption, decrease in environmental stress and elimination of risks associated with thoughtless interference into human nature. Production orientation on personal development and creative potential will allow for creative activity, science and culture to become main employment sectors.

Part Four “Towards Noonomy” is dedicated to issues related to humans’ separation from nature that occurs not as a result of contrasting humankind and nature, but as a result of removing humans’ zoological side. Truly sapient humans exercise rational control over their relations with nature. By withdrawing from immediate production, humans separate themselves from the technosphere as well and cease to be its part or appendage. That puts an end to the spontaneous evolution of the technosphere, and its development is steered in the direction favored by the humankind. But in order to achieve this result, we need to transition from the economic rationality that targets an increase in production volume and sales towards a new rationality based on the development of human knowledge. Humans' withdrawal from immediate production and disappearance of economic relations provide the necessary foundation for that. Henceforth knowledge and cultural norms of the human society must regulate production operations. Here is where noonomy comes into play, for it serves as a non-economic way of regulating production activities of an autonomous technosphere by steering its development in accordance with personal development needs.

Part Five "Will Russia Close the Gap to Become a Leader?" considers problems in the Russian economy from the perspective of the transition to the NIS.2 and noonomy. Presently, Russia faces major challenges caused by its profound deindustrialization. Without reindustrialization, the Russian economy cannot be brought to assume a leading position. Catch-up development is not going to resolve these issues, and the only solution is to transition to the trajectory of accelerated development in at least some technological areas. The upcoming technological revolution will create a window of opportunity for that. In order to implement its technology, research and education potential, Russia needs a transitional economic system that would ensure the intensification of innovative processes and accelerated technological update of production. That requires an active industrial policy and strategic planning that would promote export-oriented production. This policy involves the delineation of technological development priorities, as well as ensuring reintegration of production, science and education into a unified complex at macro and micro levels.

The conclusion highlights the following issue: methods for transitioning from the current social order to the noonomy must correlate with the tendency of humans' transition from zoological principles to truly humane values and must have a constructive – as opposed to destructive – core.

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[1] Links to some of these conversations and seminars are available on the INID website https://inir.ru/

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PART 1. METHODOLOGY

Noonomy is such a look into the future of mankind, which is based on the study of modern trends in the development of technologies and the social changes caused by them. In order for the study of the connection and mutual influence of these processes to enable us to establish the laws and cause-effect relationships that determine the transition to a new type of social structure, it is necessary to rely on certain methodological approaches in their study.

Chapter 1. The Role of Material Production

Only the material production is forming the ground for all other production processes and for very existence of human society. Therefore the development of material production is forming also the basis for development of a society. So, we start from study of the nature and proprieties of material production.

1.1. Production Development and Social Structure

The ideas and arguments of this book must qualify as hypotheses because noonomy as a non-economic form of business activity has not yet become a tangible and undoubted reality. However, scientific hypotheses are no mere groundless speculations. They are based on research into actual facts and regularities. Noonomy is such a vision of the humanity's future. It is based on studies of modern trends in technological development and the social changes they cause.

Research intoconnections between these processes and their mutual influence gives us an opportunity to establish patterns and casual links that compose a transition to a new type of social structure. Such research requires certain methodological approaches as leverage.

First of all, to achieve this goal a *historical perspective* on the issue is required. It involves understanding the nature of the historical development of a techno-sphere and of its interaction with human society in a way that reveals the patterns that define the transition from one stage of development to another, from the present to the future, with objective necessity.

Machinery and technologies, on the one hand, and social interactions between people, on the other hand, are most closely entwined in the process of material production. Material production serves as both production of material conditions for the life of a human society (a human society cannot exist without producing) and production of social interactions between people, production of their social life, and production of a social being. People's social interactions in the process of production and the social structure of production are as good as the nature of material production and the nature of people's production activity. The social structure of production, in its turn, serves as a basis of all other social interactions between people. However, these social interactions (social structure, culture, ideology, politics, social psychology, etc.) are not passive replicas of relations of production. In their turn, they have a dynamic influence on the development of the production sphere.

Production is a process through which a human transforms what he is given by nature, adjusting it to his needs and shaping it as required for consumption. However, nature can be transformed only when it is clear how it works, and when its laws have already been revealed. This is so not only in relation to the immediate activity, but also to its remote effects, which also influence human's natural habitat and human himself. Absence of understanding of these remote effects makes the productive activity fraught with the most serious consequences. We can see it in the processes of degradation of natural environment. So the scientific cognition of the world is ever more important, not only to improve machinery and technologies, but to preserve the very existence of mankind.

The social structure is influenced by all components of the production process: productivity level, the type of tool applied, technology, the form of the product, the content of labour activity and, consequently, ways to organise production.

Different development stages of the production process are characterised with their own economic and social structures. The transition from hunting and gathering with and mostly stone tools to an agricultural economy supplemented by craft manufacture with use of metal tools resulted in division of labour, beginning with the division of land husbandry and cattle breeding, separation of crafts from agriculture, etc. It formed the background of the transition from an exclusively subsistence economy to one with surplus production that, at the same time, made room for various forms of exploitation.

. The transition from mainly hand implements and natural sources of energy such as muscle power of people and animals, water and wind, to the new mode of production, was based on deep specialization of tools and on the usage of universal heat engines that do not depend on natural source of energy. The spread of machinery and technologies encouraged the development of commodity exchange, currency circulation and capitalist relations and they, in turn, led to the domination of capitalist production method and global market development.

Machine production brought along a huge progress for division of labour, incredible growth of productivity, a greater diversification of needs and the discovery of ever new ways to satisfy them. That progress helped form the illusion of ‘human domination over nature’. It is, however, one-sided: people cannot interact with nature without taking objective laws of its reproduction into account. Actions against objective laws of environment reproduction result in not achievements, but damage and even catastrophe.

Machine production was the first stage of industrial production and essentially involved mass production of standardised items to satisfy people’s needs and was based on the application of scientific knowledge. Howcwe, industrial production can also satisfy individualised needs, not just those of the masses. Today’s industrial production is based on both machine and non-machine technologies built on human control over various processes – physical, chemical, biological, and informational. Industry constitutes the secure core of the modern economy. It is industry's evolution that has largely determined changes in the economic and social system over the past 250 years.

Since the second half of the twentieth century, the economy of developed countries has exhibited dramatic growth of services, while material production has been declining. This is reflected in lower employment levels industry's diminished share of GDP. Similar structural shifts can be observed in the economy of newer industrial countries. Most scholars interpret these shifts as progressive and perceive them as harbingers of the transition to the postindustrial stage while a small number expressed concern about deindustrialisation and the decline of capitalist civilisation.[1]

Does the growing service sector necessitate the decline in the role and significance of material production? Is the increase in the share of services unequivocally a positive and progressive development? Has the industrial method of production become a thing of the past? These and related questions stem logically from the analysis of recent structural shifts in developed economies and compel the study of basic concepts related to production process and its result.

1.2. The Product and the Production Process

The product is an object obtained through the transformation of natural materials through the application of knowledge and adapted to satisfy human wants. The product can be a material object or the provision of services (which usually requires the use of some material products), While human wants can be

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[1] See *Heilbroner, R. (1974). An Inquiry Into the Human Prospect*. New York: Norton; Heilbroner, R. (1976). *Business Civilization in Decline*. New York: Norton; Heilbroner, R. (1974). Economic Problems of "Postindustrial" Society. In D. Potter and Ph. Sarre, eds. *Dimensions of Society*. London, p. 234.

satisfied by products (objects) are not necessarily material, , it is important to bear in mind that:

(1) provision of services (with very few exceptions) requires the use of at least some material products. Most services cannot be rendered in the absence of material production;

(2) only material products allow for the satisfaction of what we call ‘basic wants’, such as food, clothing, housing, transportation, communication, etc. in general, service providers can operate only when there are people that manufacture basic material products.

With the development of production, the role of natural elements in man-made goods decreases, and technosphere comes to the fore. Nowadays, the development of technosphere is driven not by instruments of production and their skilled application, but by the power of knowledge which is incorporated in these instruments and underlies the ability to apply them and boost production efficiency. These tendencies determine the evolution of the product which can be measured through the analysis of the level of complexity of the product. . The concept of the level of complexity of the product can be expressed quantitatively by recording the number of processing stages required to convert raw resources and materials into a finished product. However, it is much more important to perform a qualitative assessment of product level.

Philosophically speaking, any product constitutes materialised human knowledge incorporated. The general trend in production has been towards greater efficiency in the use of natural resources and energy, decreasing their consumption per unit. Increasingly complex production instruments and, most importantly, the greater the share of knowledge in the production of higher-level products are integral to this trend.

Production, i.e. the transformation of natural materials into an object adapted to satisfy human wants, and its key elements are human labour, raw *materials* and *resources, technologies* and production *management*. The synergy between these elements is extremely important.

Thus, the production process consists of the following core elements: labour, technologies, coordination of human labour and applied technologies. In order to create a product that meets certain quality, quantity and other standards, it is necessary to manage/organise the production process.

1.3. Industrial Production Method

Historically, *the development of social c production* has gone through *two stages:*

(1) production based on the use of simple manual tools and human/animal muscle energy or, occasionally, that derived from another purely natural force (wind or water power). Equipment complexity is low as is the knowledge required and both barely change over time;

(2) industrial production, which signifies the transition to mass production of standardised products based on technological application of scientific knowledge. At its initial phase, most of the work is performed with the help of machines. Machines also produce and/or convert the energy that powers the production process. The body of knowledge required is significantly more extensive and requires continuous updating. Basic traditional skills no longer suffice, requiring broader application of scholarly knowledge. Methods of production management also become increasingly complex.

Of course, the later, more complex stage would not have been possible without the earlier one.

Primitive had no concept of machines. People used human energy to produce goods or animal energy when a process, such as tilling, cargo transportation, etc., warranted more effort. As their knowledge and experience evolved, people began using other natural resources and their exploration of nature resulted in wide application of exothermic oxidation of organic compounds (combustion) in pottery (baking), metallurgy (smelting), metal processing (forging, casting) and cooking (boiling, frying, smoking). Our ancestors used wind power to propel sailboats, windmills and hydraulic systems. Mills also operated on water power.

It is important to point out that mills were the first machines to be widely used during the preindustrial era.

Another step in the direction of more developed production was taken with the development of manufacturing based on the division of previously unified production processes (component or process specialisation) into simple operations, which allowed for the transition from manual labour to the use of mechanical devices.

In the late seventeenth century, production underwent a major change. Accumulated knowledge in product manufacturing, energy use and conversion, mechanics, etc. brought about the shift to machine production. The invention of the steam engine and discovery of electricity, as well as the development of mechanical and electrical power transmission, conversion and storage, facilitated the transition to wider uses of mechanical devices and spread a qualitatively new type of production.

Previously, complex machines and mechanisms could be operated only on locations with access to wind or water power, but that was no longer necessary. Production could be organised virtually anywhere, as long as fuel for steam or combustion engines was available for delivery or electrical power produced elsewhere could be transmitted to the production site. Thus, the production process reached a new level of stability due to its independence from natural elements.

Moreover, complex machinery propelled by new energy sources allowed for the mass production of homogeneous goods with uniform characteristics (standard sizing, same quality, etc.) and increased production volumes, product variety and quality. Machinery enabled standardization, unified production and opened up possibilities for further production automation based on the substitution of human skills with complex machinery.

These new production methods required dramatically less energy and raw materials while the share of , complex machinery in the structure of production increased, as did the scope of knowledge applied in industrial production. The role of knowledge became even more critical as production shifted to technological processes based not on mechanical technologies, but on employing natural processes – physical, chemical, and biological –in the process of industrial production.

The technological application of knowledge as part of the production process *incorporates two aspects: material* (employees with relevant qualifications, equipment, devices, primary goods) and *immaterial (*knowledge allowing for the most rational application of the material component). It is the knowledge embedded in a product that determines its level of complexity, consumer characteristics and its ability to satisfy growing human wants.

So far, humanity has not put forth any new production methods apart from preindustrial and industrial production. Therefore, depending on the method of production, a product can be either industrial or non-industrial. Non-machine technologies (e.g. biotechnologies), still have a long way to go before they can serve as the foundation of a new method of public production.

As noted earlier, products can be material and immaterial (services). The same applies to the industrial product. Services might be labeled industrial if, for example, their provision relies on the use of industrial products or a service is meant to facilitate an industrial production process. In this case, the service cannot be rendered under the non-industrial method of production. Both industrial products and industrial services seek to satisfy human wants that emerge at the social development stage characterised by the prevalence of the industrial production method. From this perspective, there is no difference between industrial services and industrial products.

1.4. Industrial Labour

Human labour is the active agent whoblends all production components into a single process. Labour is " in the first place, a process in which both man and Nature participate, and in which man of his own accord starts, regulates, and controls the material reactions between himself and Nature. He opposes himself to Nature as one of her own forces, setting in motion arms and legs, head and hands, the natural forces of his body, in order to appropriate Nature's productions in a form adapted to his own wants. By thus acting on the external world and changing it, he at the same time changes his own nature. He develops his slumbering powers and compels them to act in obedience to his sway."[1]

Thus, the main characteristic of labour is its practical orientation, wherin humans apply their efforts to the achievement certain goals and results. In order to succeed, they need to know exactly what they want to achieve, i.e. have the image of the end product in mind. Moreover, it is necessary to understand what technologies can help to ensure the sought outcome. That understanding requires special knowledge. Additionally, people need to have the necessary skill set to make an idea work when it comes to actual implementation. Another important factor is the human ability to concentrate and fully utilise knowledge, skills and energy in order to achieve the end result - the product of labour.

The content of labour also depends on material conditions, such as the supply of primary natural materials, resources and equipment. Industrial labour manufactures the industrial product, which can be defined as a high-level product (characterised by high level of complexity) that possesses uniform (standard)

[1] Karl Marx (1996) *Capital*, Vol. I. In: *Karl Marx & Frederick Engels Collected Works*. Vol. 35. New York: International Publishers., p. 187.

characteristics and is fitted for large-scale production of homogeneous products. As opposed to its non-industrial counterpart, industrial labour employs qualitatively bigger volume of applied knowledge. While this knowledge may be distributed unevenly between various workers, they should collectively possess all the knowledge required to perform the labour.

Qualifications of employees working in industrial production depend not only on their experience, but also training, special skills and acquired knowledge. Industrial labour usually involves workers who completed relevant the training and obtained the knowledge required for the production of an industrial product. Industrial employees should know and understand the nature of applied technologies, equipment characteristics, including its limitations and most rational applications, as well as characteristics of primary materials and resources and processing methods required for the achievement of intermediary and end results. Thus, industrial labour efficiency essentially relies on employee knowledge.

1.5. Technologies

Fundamentally, technology stands for the aggregate of all production methods and processes. According to more sophisticated definitions, *"technology* (from *Greek techne* – art and *logos* - word, reason) is the means for transforming matter, energy and/or information in production, including material processing, assembly of finished products, quality control and management. Technology incorporates methods, devices, work cycles and sequences of operations and procedures and is closely linked to all the media, equipment, instruments and materials applied. Aggregate technological operations constitute the technological process."[1]

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[1] *Raizberg B.A., L. Sh. Lozovskii and E.B. Starodubtseva E.B. (1999). Sovremennyi ekonomicheskii slovar'*. 2nd ed. Moscow: INFRA-M.

Without understanding the technologies and without knowledge, which is necessary for technology development and application, it is impossible to provide the production process achieving of set goals. "Natural sciences more or less adequately ***describe*** objective natural processes, while technical equipment uses this information ***to manage*** such processes more or less adequately by converting them into ***purposeful,*** i.e. technological, processes."[1]

From their inception, industrial technologies have increasingly required the application of scholarly knowledge. While the first machines and their application could be designed by self-taught amateurs, further systemic development of machinery and industrial production in general required deep penetration of knowledge into technological processes. The evolution of theoretical mechanics, physics and chemistry in the seventeenth and eighteenth centuries provided the scientific foundation for the breakthrough that ensured the transition to industrial production. The nineteenth century saw the development of a separate theory of machines and mechanisms. A sharp increase in their application and the continuously increasing complexity of all components of industrial production, in turn, encouraged new research across a wide range of disciplines, including the study of materials for the development of rational processing methods and creation of materials with preset parameters, as well as the exploration of various energy types (mechanical, heat, electrical) and their generation, conversion, transmission and application in the production process. Extensive research enabled the creation and implementation of complex machinery, and the analysis of sophisticated physical and chemical processes informed the evolution of industry. Scientists also examined the work process in order to increase labour efficiency.

The structure of technology as an integral part of the production process is extremely complex. It involves material components (equipment, devices and

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[1] *Abachiev S.K. (2012).* Tekhnika mashinnaia i bezmashinnaia: sushchnost', istoriia, perspektivy. *Naukovedenie*. **3**, 4. naukove-denie.ru/sbornik12/12-34.pdf

materials that serve as the physical embodiment of technology and are propelled by it) and an equally important immaterial part (knowledge pertaining to the application of the aforementioned material component), which explains why the term "technology" encompasses not only technological processes, but also the branch of science dedicated to the study of these processes.

It can be argued that the level of technology directly depends on the volume of knowledge incorporated in the technology. Technologies based on the application of the latest scientific achievements are often referred to as "high technology."

The complexity and infinite variety of industrial technologies necessitated the further differentiation and division of labour and nowadays the majority of production process participants have no knowledge of the full production cycle or the underlying technology and just perform specific limited functions within the technological process.

1.6. Production management

Production management becomes particularly important in industrial production for two main reasons. The first has already been addressed: increasing complexity of the production process and rational integration of its components require extensive special knowledge. The second reason is the shift from the predominantly individual to the collective production process based on professional interaction between multiple participants. Under industrial production, due to the differentiation and division of labour, the management of interactions between production process participants is critical.

Thus, production management resolves two major issues, as it rationally organises (a) technological processes and (b) employee interactions. Production management solutions should correlate in order to prevent conflict between technological process efficiency and employee interests.

The development of production management has been lagging behind other elements of industrial production. The nineteenth century was marked by the semi-spontaneous implementation of line production based on spatial placement of machines and mechanisms into production lines that allowed for consecutive operations with primary materials and components, but the first deliberately created production management method (e.g. Taylorism, Fordism, assembly line production) were not introduced until the beginning of the twentieth century.

Conveyor assembly that evolved from the production line concept (employees performing consecutive operations along the conveyor belt that moves the assembled product) required significant improvements in production management, especially pertaining to the timely delivery of sufficient quantities of parts and blocks to each assembly point. This necessitated advancements in logistics to ensure reliable and uninterrupted operation of production facilities and sites responsible for the supply of relevant components. Such an approach to production management engendered just-in-time (JIT) delivery that eliminated the need to store large quantities of parts, blocks, resources and materials.

Still, conveyor assembly could not prevent the conflict between technology process efficiency and employee interests. Conveyor work was perceived as monotonous and mind numbing (for good reason). Rigid hierarchy of production management that correlated to the conveyor method was also unpopular with employees. In an attempt to resolve these tensions, manufacturers introduced various production management innnovations. In some cases, team assembly was successfully implemented, replacing the conveyor method. Hierarchical management was supplemented with the doctrine of "humane production relations" that encouraged employee engagement.

Due to continuous growth of technology, labour and product complexity, production management has been playing an increasingly important role in boosting efficiency. Every step in the improvement of industrial technologies requires corresponding advancements in production management targeting higher efficiency of industrial product and services production. The complexity of production management directly correlates with the volume of knowledge involved in the development and application of production management methods.

1.7. Knowledge

Thus, the nature of knowledge incorporated in a product ultimately determines *the product level.* Knowledge determines the consumer characteristics of a product and its technical parameters. The greater the knowledge applied in the process of production, the higher the product's ability to meet increasingly versatile human wants.

The increase or decrease in the share of knowledge in a product results in scaling up (augmentation) or down (decomplication) of product level. Similarly, the increase in knowledge capacity of technologies leads to their upgrade while the decrease causes technological simplification, and the increase in employee knowledge enhances qualifications while the decrease causes deskilling.

Since the late nineteenth century, the prominent role of knowledge in industrial production has led to the delineation of knowledge creation, transfer and technological application into a separate branch of public production. Science, education, and R&D have been steadily awarded higher budget allocations and a larger share in the gross domestic product (GDP). Knowledge creation and transfer segment has been interacting more and more closely with actual production.

Chapter 2. Interaction between Knowledge, Technologies and Wants

As shown in Chapter 1, knowledge making a principal role in the development of technologies. The level of knowledge, implementing in technologies, determine both the possibilities to satisfy human wants and the formation of these wants.

2.1. Technological Modes

The development of technologies during industrialisation leads to considerable qualitative changes not only in production, but in every aspect of society. As changes gather pace, at some point the gears shift and society attains a new level of want satisfaction and oftheir qualitative expansion.

It is important to move past the abstract formula of that productive forces determine or shape social production relations and find the criteria that would allow for the delineation of qualitatively different periods in the development of equipment and technology that determine qualitative differences in social needs, their scope and ways of satisfying such needs. Such a delineation, based on qualitative criteria emerges from the theory of technological modes developed by Sergey Y. Glazev and Dmitriy S. Lvov. According to Glazev and Lvov, a ***technological mode*** constitutes a system of interrelated production processes (including interdependent technological chains) that share the same technical level and together constitute a subsystem of a more general economic system, alternative to other mode of division into subsystems, such as division into the industry sectors.

There has been a lot of research on technological complexes as they occur in stages of technological development. Back in his time, Joseph Schumpeter noticed that the development of innovations was discontinuous. He saw the innovative activities of entrepreneurs leading to technological renewal of production as critical factors in the acquisition of competitive advantage and the main driver behind economic development.[1] Schumpeter referred to periods of rapid increase in the rate of innovation as *clusters*[2] although the English term ***waves of innovation became more popular.***[3]

In 1975, West German scholar Gerhard Mensch introduced the term *technical system* (from the German ***Techniksysteme).*** In 1970-1980, the follower of the innovation diffusion approach, Englishman Christopher Freeman formulated the concept of ***technoeconomic paradigm,*** which was further developed by his colleague Carlota Perez.[4] The term *technological mode*, which is used in Russian economics, is analogous to the terms ***waves of innovation, technoeconomic paradigm* and *technical systems.*** This term was first introduced in 1986 by D.S. Lvov and S.Y. Glazev.[5]

As defined by Glazev, the technological mode is a stable holistic structure with a closed production cycle that incorporates various industrial activities from the extraction of primary resources to the manufacturing of finished products, which is suitable to the social type of consumption. The nucleus of the technological mode is a set of basic technologies used over a considerable period of time or characteristic of particular spheres and sectors of the economy. Technological innovations that form the nucleus are referred to as the key factors. The sectors that intensively use these key factors and play the leading role in promoting the new technological mode are called leading sectors.[6]

Material conditions for the appearance of each new technological mode emerge from the preceding model. The economy develops by means of gradual and permanent change in technological modes; at the early stage, each new technological mode utilises old energy resources, transport infrastructure (according to S.Y. Glazev) and ICT infrastructure (according to most theorists in the field of innovative development of the

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[1] Schumpeter, J.A., [1911] (1983), The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle. Transl. from German. New Brunswick, NJ: Transaction Publishers

2 Menshikov S.M. and Klimenko L.A. (2014). Dlinnye volny v ėkonomike: Kogda obshchestvo meniaet kozhu. 2nd ed. M.: LENAND, 192.

3 Blaug M. (1986). Schumpeter Joseph A. 1883-1950. In: Great Economists Before Keynes: An Introduction to the Lives & Works of One Hundred Great Economists of the Past. Brighton: Wheatsheaf Books.

4 See: Perez C. (2002).Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages. Cheltenham, UK and Northampton, MA: Edward Elgar.

5 See: Lvov D.S. and S.Y. Glazev. (1986). *Teoreticheskie i prikladnye aspekty upravleniia NTP. Ekonomika i matematicheskie metody*, 5.

6 Glazev S.Y. and V.V. Kharitonova, eds. (2009). *Nanotekhnologii kak kliuchevoi faktor novogo tekhnologicheskogo uklada v ekonomike*. M.: Trovant, 11.

economy). These only become adequate to the new technological once the new mode becomes dominant in the main economy sectors with the gradual substitution of the previous technological mode. The defining characteristics of the technological mode listed by S.Y. Glazev, in addition to the nucleus, include its organisational and economic regulation mechanism.[1]

Each new technological mode significantly expands society's manufacturing capabilities. Concurrently, significant changes take place in production management, rendering labour and capital, its major factors, – more efficient. From the middle of XX century onward, technological progress has become another important factor. The world's leading countries perceive the development and introduction of technological innovations as a major factor of socio-economic development and a guarantee of economic security. In the U.S., for instance, this factor contributes up to 90% of growth in national income per capita.This conclusion made by Robert M. Solow who was analysing Cobb-Douglas production function.[2]

This approach is in some ways similar to the studies of howtechnological evolution and changes in the economic system influence each other conducted by Western sociologists and futurologists (Daniel Bell, Alvin Toffler, Manuel Castells, Taichi Sakaya, et al.). The emergence of "post-industrial society", "information society", "third wave" and related concepts reflects the growing interest in studying socio-economic shifts caused by technological changes. However, these works were mostly descriptive and did not engender any new theories that would explain the nature and laws underlying the interactions they explored. Moreover, they considerably overestimated the significance of post-industrial tendencies and did not pay enough attention to the manner in which deindustrialisation and financialisation undermined the production potential of the world's leading countries.

1 See: Gurieva L.K. (2004). *Kontseptsiia tekhnologicheskikh ukladov. Innovatsionnaia ekonomika.* 10.

[2] Solow R.M.. Technical Change and the Aggregate Production Function. *The Review of Economics and Statistics,* Aug. 1957, Vol. 39, No. 3, pp. 319-320.

Therefore, the description of the future economy as the "society of services" provided by Bell and his Russian colleagues[1] and the description of the future economy as the economy of knowledge, etc., do not appear too convincing. Nevertheless, if studied critically, these studies contain information on the changes in economic systems produced by technical progress. Research has fairly convincingly shown that ***changes in technologies, above all changes in leading production factors and industries, lead to changes in the economy*** and with them, changes in other spheres of society, such as institutions, dominant social structures (from the global to the family level), ideologies, modes of political action, etc.

Six successive technological modes are commonly held to have defined recent history and the are related to the 'long waves' idenfitied by N.D. Kondratyev. It should be noted that if the dissemination of a new technological mode coincides with the upward phase of the Kondratyev cycle, this technological mode continues to exist even after the wave that created it subsides and is replaced by another. The six technological modes are the following:

The first technological mode (1770-1830) was formed as a result of the appearance of machinery in the textile industry. Main industry – textiles.

The second technological mode (1830-1880) was brought about by the invention of the steam engine and the development of railway transport and transcontinental shipping. Many areas of production were mechanised. Main industries – railway equipment, steam engines, steel.

The *third* technological mode (1880-1930) was characterised by the development of the power sector, introduction of internal combustion engines, development of heavy machine-building, electrical technology, aviation and automobile industries, and the use of radio, telephone and telegraph for communication.

[1] "Post-industrial society is society that has transferred from producing mostly commodities to producing mostly services." (Bell D. (2000). *Griadushchee postindustrial'noe obshchestvo. Opyt sotsial'nogo prognozirovaniia*. Trans. from English. M., 120; also see: Bell D. (1986). *Sotsial'nye ramki informatsionnogo obshchestva. Novaia tekhnokraticheskaia volna na Zapade*. M.: Progress). In Russia, V.L. Inozemtsev continues the school of thought originated by D. Bell (see Inozemtsev V.L. (1998). *Za predelami ekonomicheskogo obshchestva*. M.).

The fourth technological mode (1930-1980) was based on broad application of internal combustion engines working on oil, petroleum products and gas, development of petrochemical technologies, and the appearance and spread of synthetic materials. Computer hardware and software appeared, and space exploration began.

The fifth technological ***mode*** (early 1980s – present) is characterised by broad-scale dissemination of information and telecommunication technologies, based on developments in the sphere of microelectronics and information technology. New developing technologies include biotechnologies (including genetic engineering), robotics, fibre-optics and space communications.

The ***sixth technological mode*** started in the 2000s. It will feature expansion of biotechnologies, other non-machinery and hybrid technologies, and nanotechnologies.

Different sources name slightly different key technologies and sectors as constituting the nuclei of different modes and their time periods. What is important, however, is that these modes represent a coherent technological system, in which the nucleus of the mode ties together the elements of its technological chains. The effectiveness of the technological mode depends on the degree of technological and economic connectedness of the elements of the chain, as does the speed of inter-sectoral and regional transfer of new technologies.

Each technological mode becomes the foundation of the next stage in society's development, as the key factor behind the changes.

2.2. Shifts in the Structure of Wants: Role of Knowledge and Culture

Technological revolutions determine shifts in the structure of wants: today the vector of demand is shifting from life-sustaining means to personal development. Yet this shift is not happening automatically or smoothly either. Growth of spiritual demands is often met by an increase in the consumption of "spiritual gum" – surrogate forms of culture.

Related issues cannot be understood by simply referring to Maslow's hierarchy of needs, which alleges that as vital, material needs get satisfied, the significance of higher order needs grows, since the needs that have already been satisfied no longer act as motivators. Maslow's hierarchy does not explain anything; it just registers empirically observed trends,[1] whereas we need to sort out why this very shift in the structure of demand is happening and what problems accompany it.

Maslow's key mistake (also typical of some of his followers and critics) is the attempt to explain changes in demand as arising solely from individual motivation. However, the logic of movement from one set of needs to another can be understood only by analysing social phenomena; the causes should be sought in the basics that determine people's social lives.

When and why does a different set of needs move to the forefront once a society provides large-scale opportunities for the satisfaction of subsistence requirements? The reason is not so much the degree of satisfaction of vital needs. Satisfaction of one set of needs is a *condition for,* but by no means the *cause of* transition to the next. While it may be that only when vital needs have been satisfied can there be a transition to higher ones, there is no guarantee that it will happen. What determines that is the change in the nature of people's basic labour activity. It is in that labour activity that creative functions are sprouting, albeit unevenly, with the progress of knowledge-intensive technologies that provide for more complete satisfaction of vital needs and effect an transition to the satisfaction of higher needs, up to an including what Maslow called self-actualization. It is production, rather than consumption, that dictates the need for humans to be creative and responsible (owing to the mighty potential of the technosphere that humans set into motion). For this reason, nurturing a "person of culture" in the broadest sense of the word is becoming increasingly important for future

[1] See: Maslow, A. H. (1943). A Theory of Human Motivation. *Psychological Review*, 50. pp. 370–396. Maslow's concept was strongly criticised for lack of conformity with empirical data. Although his basic idea about the existence of a hierarchy of needs and the transition from lower to higher needs has generally not been discarded, it is recognised that interrelations between the needs of various levels are far more complicated than Maslow argued (for instance, the transition may be directed both up and down the hierarchy). See, for example, Clayton Alderfer's concept of a needs hierarchy: Alderfer, C.P. (1969). An empirical test of a new theory of human needs. *Organisational Behaviour and Human Performance.* 4 (2), pp. 142-75. doi:10.1016/0030-5073(69)90004-X

economy and determines the growth of spiritual demands. This focus plays a critical part in the advancement towards the NIS.2.

The combination of knowledge and cultural codes, archetypes and imperatives is of fundamental importance because the human acquisition of any specific knowledge pertaining to the satisfaction of a specific need or, in other words, the fulfillment of the gap t between demands and capabilities, is not a single-vector mechanism. Knowledge by virtue of its objective existence, its universal nature and infinity, is not limited to a single, particular method of satisfying any specific need, but offers an unlimited multitude of ways. Humans only need to choose an optimal/acceptable path (at any given stage, under the specific limitations imposed by the current subsystem), and that is why we are given our cognitive capacity (not the capacity to "create" or "produce" knowledge !), along with free will and the ability (again, based on knowledge!) to make decisions and choices.

This is why I prefer to put such run-of-the-mill terms in inverted commas when referring to the process of cognition when it means the disclosure of another "quantum" of knowledge by an individual through an act of cognition similar to the acquisition of material resources. The production of knowledge may be certainly defined through its information and communications aspect, and such a definition, albeit rather basic in that it does not distinguish between knowledge and information, is often convenient and, therefore, frequently used in current economic mainstream research for quantitative assessment. The system of relations between humans as part of the universe (the world created by the Lord, if you will) and the rest of the world implies an opportunity to manifest free will and make an informed choice when resolving contradictions between Human and Nature and inside human society.

At the same time, individuals judge which method is the most favourable (from a given perspective) for resolving a concrete contradiction based on their level of knowledge in the particular subsystem (and this should be emphasised!).

By cognising the world, humans are cognising themselves as part thereof. The evolution of human demands inevitably results in the evolution of the wish to cognise oneself, his/her place in the world and self-interest; To satisfy the needs the humans must determine these needs by understanding their own nature and their interrelations among themselves. When humans come in contact with the surrounding environment, they wish to cognise the “interests” of its elements – inorganic and organic nature and similar creatures – and subsequently to integrate those “interests” in the process demand satisfaction (and settle contradictions). Humans become detached from the environment and perceive themselves as individuals, triggering the formation of self-awareness and that of society.

While resolving contradictions or making a decision, a human with an established sense of self perceives other members of the society as individuals who also have their own interests, right to choose and abilities. Relations between the members of society, i.e. public relations emerge from the fulfilment of multiple inter-related tasks and the need to satisfy multiple demands (including contradictory ones!). And, with the development of the society, the so-called “public good” is shaped and recognised.

Thus, public relations essentially constitute contradictions settled within the framework of rules, norms, laws, etc. set by a society (based on the public consensus, underpinned by a society’s perception of the public good, including, for instance, its accumulated knowledge!). Violation of those norms and rules (infringement of public interests) is perceived by the society as an act of destruction that destabilises the social order and destroys its structure.

The development of a human being as a person and an individual leads to contradictions of the second and third order: inter-personal conflicts and tensions between the individual and the society. In the presence of (a) contradictions andv(b) aforementioned settlement mechanisms, an individual has the right (freedom and possibility) to choose any of the available options. The decision may be optimal or sub-optimal and destructive (for the society, for part or certain elements thereof and, after all, for individuals themselves, in terms of the satisfaction of any of their needs!). It can create tensions in an individual's subsystem, the overall system and, in extreme cases, can result in the destruction of the system.

Hence, the need arises to create a natural barrier that would prevent an individual from making sub-optimal decisions.

The formation of a human being as an individual and a person leads, as I have stated above, to comprehending not only the properties, but also the "wants" of other elements of the world, including the needs of other members of the society and public demands. This comprehension has resulted in the formation of a layer of relations that includes material forms of existence adeptology of any particular methods for satisfying material demands – for food, clothes, housing, etc.) and the satisfaction of spiritual needs (adherence to or acceptance "by consensus" of any particular forms and norms of communication – language, customs, traditions, behavioural norms, religious apologetics, etc.), which are now aggregately denoted as culture.

Culture imposes natural and historical restrictions on soboptimal human actions and deviations in the course of human demand satisfaction. These restrictions become progressively more significant as humans cognise the increasingly larger space of their existence, and as human demands "escalate"/grow. Being shaped from a human being's awareness of him/herself as a person and an individual, and of the surrounding environment and the world as the medium for dual existence as both a biological and a spiritual entity, these restrictions constitute specialised knowledge about "what is good and what is bad" in the current context. Consequently, each time people have to make a decision, they can make an informed choice taking the restrictions into account to best of their abilities.

Knowledge offers humans an opportunity to satisfy their demands solely using "technologies" (as the totality of known methods and tools for achieving the desired results) in the broad sense of the word. In terms of product/service creation, we should mention production technologies (prevailing technologies nowadays being industrial ones that, thanks to their accelerated development, shape and drive modern society towards the NIS.2), while products intended for "consumption" in the spiritual sphere are, for instance, cognitive technologies.

Technology and culture are two sides of the same coin; these phenomena of social development rest upon knowledge as the universal macrocosm. There is no dichotomy between the two.

I hold that we should believe in the human and be optimistic. Why? Because humankind is certainly an animal, a natural entity emergent from nature, so hawse hence as humans possess a quality that has enabled us to survive so far in this harsh environment. This quality will never go away: it is the urge to lead, earn, make, obtain, conquer, seize something from somebody else, to compete and become a leader, etc. This has enabled the humankind to survive. And this is what underpins the key trend in the society's current economic development. Yet this is not the only path of social development.

Humans, it should be recalled, still *emerged from* nature, i.e. left it. Why? Because they also have another quality – the capacity for gradual self-awareness as a person, and this awareness goes beyond material things. That is why humans formulated and accepted panhuman values. Everyone understands them, even if some deny those values. In religion, for instance in Christianity, we have the ten commandments which serve as the criteria for human "quality" used to improve ourselves.

When I speak of culture, it relates directly to our topic. And why is it so important? Because, for example, if someone creates a computer virus, somebody else will create an antivirus, so thereis always a fight between good and evil. And the more of this good we manage to put into an individual, the more of this sacral spiritual knowledge we pour into them and the more we teach them to be aware of this, the less controversial all the subsequent transitions associated with increasing access to knowledge will be. All these progressive moments are associated specifically with the self-awareness of a human as a social being, as a culture-comprehending, consuming and perceiving creature.

Therefore, we are developing in a spiritual way as well. And I strongly believe that the more humankind evolves, the more technocratically advanced the society gets, the more spiritual humans should (and will!) become. Otherwise, there is no way to survive.

Let me repeat: *the need to satisfy ever-growing human demands is driving the development*. That said, humankind cannot satisfy its demands without resorting to the technological application of knowledge. While in the early periods of civilizational development humans relied predominantly on knowledge as a product of empirical experience, now they cannot do without large-scale "production-acquisition" and application of scientific knowledge. Moreover, human demands can take a conscious and clearly formulated shape only when they are backed by knowledge obtained by an individual. At the same time, new knowledge makes it possible to reveal, shape and satisfy new wants. At this point, it becomes obvious that material production can by no means be reduced to mere creation of samples of material culture and that knowledge applied in this process has a huge impact on our social life.

It is the application of knowledge that distinguishes human labour from instinctive activity of animals, and *it is thanks to knowledge that material production is shaping humans as social beings*. A person is determined by what he/she does.[1] Material production is an activity based on knowledge; therefore, individuals can produce something only as knowledgeable entities; they become involved in the production process, acquiring knowledge as may be required, and leave this process taking the acquired knowledge with them. This very fact plays an immense cultural role.

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[1] The fact that a person's operating activity determines his/her image as a social creature was stressed by Karl Marx: "the way people live their lives shows who they are. Who they are, therefore, coincides with their production, both with what they produce and how they produce it. The nature of individuals thus depends on material conditions determining their production." (Marx, K. and F. Engels. (1955). Nemetskaia ideologiia [The German Ideology]. In *Collected Works* – 3. Moscow: Gospolitizdat, p. 19). "Society itself, i.e. the man himself in his public relations, always constitutes the final result of public production." (Marx, K. (1969). *Ekonomicheskie rukopisi 1857–1859 gg.* [Economic Manuscripts of 1857–1859]. In K. Marx. and F. Engels *Sochineniia* [Collected Works]. Vol. 46, Part 2, p. 221). The ideas of the dependence of people's social existence on their activity were further developed by Soviet philosophers and psychologists. See: Batishchev, G. S. (1969). Deiatel'naia sushchnost' cheloveka kak filosofskii printsip [Activity-driven Essence of Man as a Philosophical Principle]. *Problema cheloveka v sovremennoi filosofii.* [The Problem of Man in Modern Philosophy.] Moscow: Nauka, pp. 73–144. Leont'ev, A. N. (1975). *Deiatel'nost'. Soznanie. Lichnost'* [Activity. Consciousness. Person]. Moscow: Politizdat.

Only humans have this unique ability to discover in the external objective world and formulate some properties, laws and patterns. And humankind alone is able to apply discovered knowledge in order to transform the outer world; humans use this knowledge to find appropriate subjects (materials) and to create – by means of those subjects – both the methods of their transformation (technology) and the goals of that transformation, i.e. the creation of products that satisfy human wants (understood broadly, both tangible and intangible). Without knowledge, it is impossible not only to create something new that does not exist in nature, but also to copy something that already exists because even the idea of copying something is already a creative act. In order to wish to copy the certain product or technology we must understand that the copying is possible and suitable way to satisfy our needs; we must study the existence of necessary conditions for copying; we must estimate efficiency of copying and the long-run consequences of it.

As we have noted above, in material production based on modern industrial technology, empirical knowledge is superseded by scientific knowledge, and the development of modern technology is impossible without constant scientific research aimed at the discovery of new ways to satisfy human wants. Knowledge is becoming a basic resource of modern production, and huge layers of various kinds of knowledge become embodied in the modern material product. High-tech production results in the growing circulation of knowledge, both in the process of exchanging scientific and technical information and exchanging products in which relevant knowledge is embodied and "materialised." The circulation of knowledge as a production resource has several specific features: it is indestructible during consumption, it is often "augmented" while used; and the cost of processing/copying the information that carries that knowledge is relatively low compared to the costs of its original production.

Thus, the humankind has the ability to cognise the world, understand its own demands and find ways to satisfy them.

The observations presented in the Part 1 serve as a preamble to uncovering the role that the increasing significance of the knowledge of material production plays in the formation and development of human culture today.

PART 2. **NOOPRODUCTION: RUN-UP**

Before we start musing on the coming global changes and their short- and long-term consequences, it is worth considering where these changes come from so we may better understand their direction and potential.

Chapter 3. New Industrial Society and Post-Industrialist Chimeras: Lessons from the Recent Past[1]

Though there are many signs of change, our economy remains (and, I dare say, will remain for a long time) an industrial one – at least in its technological basis. We shall discuss attempts to contest this point and the results of such endeavours later on. The main task of this chapter is to show how the contemporary steps in the industrial technologies are forming the society and making the prerequisites for the further development.

3.1. Industrial – New Industrial – Postindustrial Society?

The Industrial Revolution that began in the 18th century and continued for the next century (and was still taking hold of less developed countries in the 20th century) marked the transition to industrial production. Still, the industrial mode of production was not an unchanging phenomenon and and the dominant industrial technological structures were changing, so too was society. In the second half of the 20th century, John Kenneth Galbraith articulated the ongoing changes in his book *The New Industrial State*[2].

It is pertinent to recall Galbraith's key arguments in this rather remarkable work beginning with those that allow us to capture the relation between the material and technical that determine the economic structure and going on to the purely economic aspects.[3]

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[1] Sections 1.1 and 1.2 of this chapter are based on revised fragments from Chapter 8 of the book by Bodrunov, S. D. (2016). *The Coming of New Industrial Society: Reloaded*. Moscow and St. Petersburg: S. Y. Witte Institute for New Industrial Development, pp. 128–142.

[2] Galbraith J.K. (1967). *The New Industrial State*. Boston: Houghton Mifflin Co.

[3] These parameters are identified based on the key points of studies carried out by S.Y. Glaz'ev, A. V. Buzgalin and A. I. Kolganov. See: Glaz'ev, S. Y. and V. V. Kharitonov, eds. (2009). *Nanotekhnologii kak kliuchevoi faktor novogo tekhnologicheskogo uklada v ekonomike.* [Nanotechnology as a Key Factor of the New Technological Mode of the Economy.] Moscow: Trovant; Kolganov, A. I. and A. V. Buzgalin (2005). *Ekonomicheskaia komparativistika. Sravnitel'nyi analiz ekonomicheskikh sistem: uchebnik dlia studentov vuzov, obuchaiushchikhsia po ekonomicheskim spetsial'nostiam.* [Economic Comparative Studies. Comparative Analysis of Economic Systems: Textbook for High School Economics Students.] Moscow: INFRA-M.

First, we take the changes in the material and technical basis of the economy during the period preceeding the emergence of the new industrial state. Galbraith points to the application of an "increasingly intricate and sophisticated technology to the production of things. Machines had continued to replace crude human power andas they are also used to instruct other machines, they also replace the cruder forms of human intelligence."[1] These processes lead to industrial consolidation requiring increasing amounts of capital investment and ever higherskills. This results (bear in mind that we are talking about the economy of the mid-20th century) in the development of major corporations as the main type of economic organisation – organisations that dominate the economy and are able to attract capital required for such production. According to Galbraith, these corporations were able to mobilise adequately qualified labour and drive scientific and technological progress in the middle of the 20th century.

The other side of the story was the decline of trade unions, "[U]nion membership as a proportion of the labor force is no longer increasing. It reached a peak (of 25.2 percent) in 1956 and has since declined."[2] This went hand in hand with structural changes in the professional composition of the labour force. The number of people wanting to get higher education grew considerably, although real opportunities for obtaining such an education were expanding at a more moderate rate.

The new form of economic organization now dominated the whole economy. "Eighty years ago the corporation was still confined to those industries – railroading, steam navigation, steel-making, petroleum recovery and refining, some mining – where, it seemed, production had to be on a large scale. Now it also sells groceries, mills grain, publishes newspapers and provides public entertainment, all activities that were once the province of the individual proprietor or the insignificant firm."[3] The separation between the owner-entrepreneur, production organiser and beneficiary that had started long ago was becoming pervasive. Galbraith, building upon the reflections

[1] Galbraith, J. K. (2007). *The New Industrial State*. Princeton University Press, p. 1.
[2] Galbraith, J.K. (2007). *The New Industrial State*. Princeton University Press, p. 1.
[3] Ibid., p. 1.

of some authors of the early 20th century such as Thorstein Veblen,[1] Adolf Berle and Gardiner Means,[2] and Stuart Chase[3] and, to an extent, echoing Karl Marx's ideas on the division of capital in joint-stock companies into equity and working capital, pointed out that in the early 20th century

> the corporation was the instrument of its owners and a projection of their personalities. The names of these principals – Carnegie, Rockefeller, Harriman, Mellon, Guggenheim, Ford – were known across the land. They are still known, but for the art galleries and philanthropic foundations they established and their descendants who are in politics. The men who now head the great corporations are unknown. Not for a generation have people outside Detroit and the automobile industry known the name of the current head of General Motors.[4]

This trend was somewhat idolised by Galbraith because it stimulated operational efficiency through the distribution of functional duties among specialists and active engagement of professionals in management activities. On the other hand, the growing power of technocracy concealed a different process –increasing concentration of capital in the hands of very few people because top managers, in spite of their huge incomes, still only rendered services to actual owners of corporations. Thus, in our opinion, Galbraith's conclusion that technocracy is taking over corporations and the economy was somewhat exaggerated (and Galbraith pointed out the dependence of what he termed the "technostructure" on the corporate elite in his later works).[5]

The growth of corporate capital inevitably changed the economic role of the state. Under the new conditions of the mid-20th century, most critically, "the state

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[1] Veblen T. *The Engineers and the Price System* (2001, originally published in 1921). Kitchener: Batoche Books, 2001. http://socserv2.mcmaster.ca/~econ/ugcm/3ll3/veblen/ Engineers.pdf

[2] Berle A. and G. C. Means. (1932). *The Modern Corporation and Private Property*. New York: The Macmillan Company. http://www.unz.org/ Pub/BerleAdolf-1932

[3] Chase, S. (1932). *A New Deal*. New York: The Macmillan Company, 1932. (The title of this book – the New Deal – was used by F.D. Roosevelt for his election campaign).

[4] Galbraith, J.K. (2007). *The New Industrial State*. Princeton University Press, p. 2.

[5] See: Galbraith, J. K. (2004). *The Economics of Innocent Fraud: Truth for Our Time*. Boston, New York: Houghton Mifflin Harcourt.

undertakes to regulate the total income available for the purchase of goods and services in the economy. It seeks to ensure sufficient purchasing power to buy whatever the current labor force can produce."[1] This had to increase the role of planning considerably:. "The large commitment of capital and organization well in advance of result requires that there be foresight and also that all feasible steps be taken to ensure that what is foreseen will transpire. Secondly, consumer demand became an object of management by state and big corporations. Galbraith rightly emphasises that the nature of technology and associated capital requirements, as well as the time that it takes to develop and manufacture a product, drive the need for state regulation of demand.

A corporation that is considering introducing a new model car has to be able to persuade people to buy it. Determining whether or not people have the money to buy it is equally important. This becomes crucial when production requires large and long-term investments. Uncertainty about whether the product comes to market at a time of depression or growth creates the need to stabilise aggregate demand. The state and, more importantly, corporations must thus *create* (and not simply track) demand. Galbraith stresses: "The decisions on what will be saved are made, in the main, by a few hundred large corporations. The decisions as to what will be invested are made by a similar number of large firms to which are added those of a much larger number of individuals who are buying dwellings, automobiles and household appliances. No mechanism of the market relates the decisions to save to the decisions to invest."[2] Galbraith acknowledged that this statement (which echoed the views of John Maynard Keynes) was a bit of an exaggeration during an era when the neoliberal model of market economy was making a comeback; however, in our view, it has regained its relevance in a number of countries in recent decades.

Galbraith's work permits us to understand clearly the deep difference between a small enterprise that is fully controlled by a single person and owes all its success to

[1] Galbraith, J.K. (2007). *The New Industrial State*. Princeton University Press, p. 3.
[2] Ibid, p. 51.

this fact and a corporation and the sorts of economies they compose. Whereas millions of small firms constitute an economy with a market system, from thousands of giant corporations, constitute a "planning" system.

Critically, Galbraith's distinction rests on changes in applied industrial technologies. However, his conclusions weresoon pushed aside by popular concepts of the post-industrial society which used a similar argument about shifts in technology leading to shifts in industrial structure to *deny* the fundamental role of material production in the economy. No one had bothered to disprove Galbraith's conclusions – they were simply forgotten and the discussion shifted to the enthusiasticforecasts of the post-industrial theorists.

For all their diversity and varying degrees of detail and argumentation, works in the "post-industrial wave" feature a common set of fundamental characteristics of the new quality of society and the economy. Their point of departure is the same as Galbraith; shifts in *technology* lead to shifts in the *structure of economy*. However, starting with Daniel Bell's[1] works on post-industrial society and Alvin Toffler's musings on the "third wave,"[2] these works arrived a radically different conclusion, one denying the leading role of material production. Their thesis has been gaining support. Theories of "information society" and "information economy" appeared, followed by the concepts of "knowledge society/economy," digital economy, etc. The works of Sakaiya, Castells and many others enjoyed great popularity.[3] Russia also produced some works in this vein, including books by V. L. Inozemtsev, whom we have already mentioned. His extensive monographs included multiple references to works of his

[1] Bell, D. (1973). *The Coming of Post-Industrial Society: A Venture in Social Forecasting*. N.Y.: Basic Books.
[2] Toffler A. (1980). *The Third Wave*. London: Pan Books Ltd. in association with William Collins Sons & Co. Ltd.
[3] See, for example: Sakaiya, T. (1991). *The Knowledge-Value Revolution or a History of the Future.* Tokyo, New York: Kodansha International; Toynbee, A. (1948). *Civilization on Trial*. Oxford University Press; Castells, M. (1999). *The Information Age, Volumes 1-3: Economy, Society and Culture.* Wiley-Blackwell.

Western colleagues and became a sort of encyclopaedia of Western post-industrialism in Russian circles.[1]

The growth of the service industry and the decline in the share of material production soon became the fundamental and determining feature of the new trend.[2] Certainly the share of these two sectors in in the economies of all developed countries changed dramatically during the 20th century. By the 1970s or the 1980s, the role of material production declined dramatically and the service sector today accounts for over 70% of the GDP of developed countries and more than 75% of the labour force.[3]

Most researchers did not overlook such obvious problems as the structure of the service industry and degraded content of labour performed by most employees engaged in it. Still, while noting material differences between various sectors of the service industry and the nature of activity performed in those sectors, post-industrialists confined themselves to celebrating the rapid growth of information, telecommunications and professional services.[4] In the meantime, the question of the extent to which the work performed in key growth areas of service employment as trade, freight and shipping operations, catering, hospitality, or cleaning could be termed 'post-industrial' was overlooked.

The post-industrialist thesis also draws attention to the fundamentally new *type of resources*. According to Castells or Sakaiya, for example, information has become the main resource and product of the post-industrial economy.[5] The spread of

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[1] See: Inozemtsev, V. L. (2000). *Sovremennoe postindustrial'noe obshchestvo: priroda, protivorechiia, perspektivy.* [The Modern Postindustrial Society: Nature, Contradictions, Prospects.] Moscow: Logos; Inozemtsev, V. L. (2003). *Na rubezhe epokh. Ekonomicheskie tendentsii i ikh neekonomicheskie sledstviia.* [At the Turn of the Era. Economic Trends and their Non-Economic Consequences.] Moscow: Ekonomika.

[2] Bell, D. (1973). *The Coming of Post-Industrial Society: A Venture of Social Forecasting*. New York: Basic Books.

[3] World Employment and Social Outlook 2015: The Changing Nature of Jobs. International Labour Office. Geneva: ILO, 2015, p. 25.

[4] The individualisation of sectors in the service industry is described, for instance, by the patriarch of post-industrialism Daniel Bell: Bell, D. (1999). *Griadushchee postindustrial'noe obshchestvo.* [The Future Postindustrial Society.] Moscow: Akademiia, p. 158.

[5] See, for example: Castells, M. (2009). *The Rise of the Network Society.* Wiley-Blackwell; Castells, M. (2005). *The Network Society: A Cross-Cultural Perspective*. Edward Elgar; Sakaya, T. (1991). *The Knowledge–Value Revolution or a History of the Future*. Tokyo, New York: Kodansha International.; Masuda, Y. (1983). The Information Society as Postindustrial Society. Washington: World Future Society.

information processing, storage and transmission devices, computer technologies and, later, the internet is a distinctive feature of the new quality of economic and social life of recent decades. This shift has enormous significance.[1] Indeed, information has a whole range of properties that significantly distinguish it from material products. It does not disappear upon consumption; its production costs are incomparably higher than its distribution costs; it takes a highly educated employee to create it; and even its consumption may require certain competences.[2]

Hence, *the dominant type of employee* in the post-industrial economy, according to its theoreticians, was a professional, typically with a college degree and who possesses the certain work force and human capital – a special production and investment resource. Therefore, many post-industrialists conclude that we are moving towards the "society of professionals".[3]

The world where information is produced by highly qualified professionals (holders of the aforementioned human capital) was supposed to be accompanied by radical changes in the primary unit of the economy: large industrial complexes were to be replaced by individual "electronic cottages" interconnected by the world wide web. This, along with new computer and internet technologies, was supposed to result in an essentially network-based economic and social structure.

As far as economic relations were concerned, however, no profound changes were expected. What is more, the new economic structure – with its novel computer and internet technologies, individualisation of production and the increasing role of

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[1] The author has spent a significant amount of time studying specific features of information products. See: Bodrunov, S. D. (1995). *Upravlenie rynkom informatsionnykh produktov i uslug na osnove kontseptsii marketinga* [Managing the Market for Information and Service Products Based on the Marketing Concept]. Moscow.; Bodrunov, S. D. (1995). *Infomarketing* [Infomarketing]. Gomel: BelANTDI.
[2] Mulgan G. J. (1991). Communication and Control: Networks and the New Economics of Communication. Oxford: Polity, p. 174; Crawford, R. (1991). In the Era of Human Capital. N.Y., p. 11.
[3] Sergeeva, I. and V. Bykov (2010). Material'nye i nematerial'nye faktory motivatsii truda [Material and Non-Material Factors of Labour Motivation]. *Chelovek i trud*, 9, p. 43; Inozemtsev, V. L. (2001). Postindustrial'noe khoziaistvo i "postindustrial'noe" obshchestvo (K probleme sotsial'nykh tendentsii XXI veka) [Postindustrial Economy and Postindustrial Society (On the Issue of Social Trends of the 21st Century)]. *Obshchestvennie nauki i sovremennost'*, 3, p. 145.

each individual worker –was supposed to become (and, for many, has already become, to an extent) the basis for the reduction in the role of the state (as a regulator of the economy and a social protector) and the foundation of a peculiar renaissance of *market relations* and *private ownership*. It was believed that both the revival of small individual private entrepreneurship and the spread of private ownership to those areas that had previously been less affected by it (intellectual property, in particular) would become a reality. Of course, there were some post-industrialist scholars were not part of this mainstream: Castells, for example, emphasised the possibility of the development of the public sector and public regulation of intellectual production.

All these changes were expected to result in a new social society structured by strata determined by knowledge.[1] How credible were these post-industrial claims?

3.2. Postindustrialist Chimeras

There is no doubt that the importance of production, distribution and application of knowledge is growing in importance in modern society. If we pose the question in a broader way, however, it is not just about knowledge – it is also about the socioeconomic significance of all components of human culture. A person of culture is one of the most important pillars of positive social development. Moreover, industrial production underpinned by (but by no means reducible to) necessary knowledge cannot develop efficiently without true culture. Norms and rules enshrined in human behaviour are not merely a projection of the knowledge a person possesses. These rules are to a great extent determined exclusively by a society's culture, i.e. the rules of conduct (individual and group behaviour, corporate ethics) and rules governing business operations (keeping one's word, taking responsibility, being proactive, etc.)

[1] The dissemination of information technologies, processes miniaturisation, flexible production systems, etc. in the late 20th century drove the development of extra-corporate labour management methods. Most Western and Russian researchers who explore this phenomenon acknowledge the development of new forms of capital-free intellectual work. For a critical overview of these processes, see: Rifkin, J. (1995). *The End of Work: The Decline of the Global Labor Force and the Down of the Post-Market Era*. N.Y.: G. P. Putnam's Sons.

which, along with other important factors, shape the business climate, including favourable (or unfavourable) conditions for industrial activity.

A renowned Russian economist, Professor of the Emperor's Moscow University and Saint Petersburg University Ivan Kh. Ozerov blamed Russia's backwardness on her culture at the beginning of the 20th century:

> We have too little culture... This is the root of all our failures... No matter what issue we get to discuss, we will always get stuck on the lack of culture... Red tape, reliance on the off chance – all that stems from a low level of culture. In our industry, low productivity is once again a consequence of the lack of culture, the feeble development level of workers... And this cultural poverty also affects our ruling classes and the government. Otherwise, our policy, both general domestic and economic, would have been different. However, due to the lack of culture, we do not understand that organic healing and change in the fundamental conditions of living should be brought to the forefront, so we continue to rely on quack remedies.[1]

The distinguished professor's solution is still relevant today: "we will have to create a business-friendly climate around ourselves, restructure the educational system, adjust our behaviour, get rid of the brakes that fetter the endeavours and aspirations of enterprising personalities, and create solid guarantees for the development of human individuality and initiative."[2]

Post-industrialist scholars refuse to see a correlation between the cultural sphere and development of material production. The only thing that is obvious to them is a certain crude determination of the social order by technological and structural shifts. Furthermore, they tend to extrapolate from profound changes in the lifestyle of a

[1] Zhirnov, E. (December 14, 2015). Vremia otchaianiia, paniki mysli [The Age of Despair, Panic of Thought]. *Kommersant Vlast'.* 49, p. 35.
[2] Zhirnov, E. (December 14, 2015). Vremia otchaianiia, paniki mysli [The Age of Despair, Panic of Thought]. *Kommersant Vlast'.* 49, p. 35. http://www.kommersant.ru/doc/2861286

relatively narrow section of workers dealing with modern information, telecommunication and media technologies to the majority of society. While they do recognise, here and there, that the post-industrial Valhalla excludes most in the overgrown service industry and the resulting rise in the social contradictions, they tend to forget about this in their conclusions.

A beautiful picture of the proximate future that is "just around the corner" is thus born: most people have personal computers and can therefore potentially be considered private owners capable of doing business – of being "self-employed." So now, they can ignore the rusting ruins of industrial Detroit. As far as they are concerned, they are a ghosts of an obsolete industrial past. It is far more tempting to imagine chimeras of "electronic cottages" growing in the middle of a post-industrial desert connected by the World Wide Web.[1] The cottages are inhabited by representatives of the modern "creative" class engaged in the production of electronic toys for "advanced" users, design of clothes for models to grace the catwalk, and the invention of gadgets able to perform useless yet attractive functions for those willing to put out huge amounts of money. Meanwhile, other equally "creative" managers, marketing and finance specialists are thinking of ways to make customer digest all this, or at least believe in the endless rise in the value of shares issued by "creative" corporations that manage the activities of the "self-employed."

In this world, class struggle does not exist, neither do conflicts of socioeconomic interests. There is still competition, but it rewards the worthy – the most knowledgeable and creative people who can afford to spend their earnings on turning their abilities and relations into human and social capital. Somewhere on the edge of this glittering new world lurk dishwashers, housemaids, shop attendants, drivers and loaders. Even further afield, across the oceans, some Mexicans, Koreans or Filipinos spend twelve hours a day making fashionable dresses and running shoes, assembling computers or working

[1] For the concept of "electronic cottage," see: Toffler, A. (1980). *The Third Wave*. London: Pan Books Ltd in association with William Collins Sons & Co. Ltd., Chapter 16. The "electronic cottage" is not actually a chimera at all. However, the idea that it has transformed the image of modern production is a myth through and through.

themselves to death at steel foundries… What can you do? Those who failed to demonstrate sufficient capabilities in order to get into the virtual reality of post-industrial society end up on the sidelines.

How great it must feel to get away from the gloom of industrial reality and start creating your own virtual reality, turning it into big money (which is increasingly virtual, too). Who cares about it as long as the mirage of the virtual reality does not collide with grim reality?

The theoretical message of post-industrialism actually denies the industrial basis of social development, and this is its essential flaw. Writers in this tradition usually examine the structure of the economy, GDP and export, the number of people employed in various sectors of production and other quantitative indicators that describe the state of the economy only to reach the erroneous conclusion that the industrial development path is a dead-end.

Post-industrialists worship knowledge and information, as well as the role of creators, transformers and disseminators of knowledge and information, attaching self-sufficing importance to them. Any informational mirage, or "white noise" becomes a symbol of movement down the path of post-industrial progress. And this makes sense to some extent – especially in the financial market where modern alchemists rule the roost, turning virtual "white noise" – any rumors, insignificant events, misinterpretation of facts or semblance of facts, even fakes – into considerable profit and taking it out of the real sector of the economy. Money-makers of that sort do not care what kind of knowledge it is, what the content of that information is, or what purpose it serves. The only thing that matters is to be able to turn *any virtuality* into real money.

Contemporaneous with neoliberalism, it is unsurprising that the post-industrialist thesis accepts the neoliberal model of the market economy. It is the only type of economy in which the service industry can be the key area of business, financial transactions can be the main field of capital accumulation, and a free market covering all spheres of social life can be the dominating mechanism that ensures balance and growth. This liaison between post-industrialism and neoliberalism formed the foundation for the mythical "new economy"[1], the economy which supposedly opens up developed countries to crisis-free growth and development.[2] The acceptance of neoliberalism, also known as "market fundamentalism", by many scientists, is directly associated with a range of rather unique processes.[3]

There is, first, the process of financialization, involving the expansion of the domain of financial institutions to an extent that it now dominates and determines the economy and ownership relations. [4] Investment priorities have shifted in that capital is progressively redirected from production to financial transactions, while investments in production have become dependent on financial market chimeras. Control over property and basic property rights has moved to financial institutions. Finally, the financial sphere has become one of the key (and, in some cases, the main) sources of GDP growth,. All this has resulted in financial bubbles and (indirectly) the global financial and economic crisis.

Second, neoliberalism, this time in the guise of 'globalization' gave rise to a massive southward drift of industrial production capacities and accelerated industrialisation of semi-peripheral, and later peripheral, countries, which encompassed perhaps half of the world's population. The growing geopolitical and

[1] In the President of the United States' Annual Report to Congress in 2001, it was declared that the United States had entered the period of new economy that would bring unprecedented prosperity. See: *Economic Report of the President. Transmitted to the Congress January 2001 together with the Annual Report of the Council of Economic Advisers* 2001. Washington, DC: U.S. Government Printing Office, p. 19.

[2] It was declared that "the business cycle – a spawn of the industrial era – is most likely going to become an anachronism." See: Petzinger, Thomas Jr. (December 311999). So Long Supply and Demand. There's a New Economy out there and it Looks Nothing Like the Old One. *Wall Street Journal*.

[3] Grinberg, R. S. (2009). Bol'shoi krizis: pora ukhodit' ot radikal'nogo liberalizma [Major Crisis: Time to Abandon Radical Liberalism]. In *Glavnaia kniga o krizise*. Moscow: Iauza. Eksmo, pp. 59–72.

[4] Lapavitsas C. and I. Levina (November 2010). Financial Profit: Profit from Production and Profit upon Alienation. *Research on Money and Finance*.

economic influence and power of China, India and BRICS pose new challenges for developed countries.

Third, the process of deindustrialisation has started in the economies of many developed countries, primarily in the United States. This resulted in the emergence of a hitherto unseen factor – the industrial dependence of developed countries on the periphery. Moreover, China has emerged as a modern pioneer of hi-tech production, and the United States and the European Union are now facing the threat of the world's second-largest economy freeing itself from technological dependence on developed economies. This new challenge forces theoreticians and practitioners of developed economies to reflect on the problems of restoring material production and developing a new industrial economy.

The idea of post-industrial "virtualisation" of production and human needs has led, among other things, to a slowdown in scientific and technological progress against the background of the explosive growth of innovations. Not majority of these innovations are considerable, either. The s*imulation of innovations* has become widespread: in order to distinguish your product or service in the market, it is sufficient to make it look new or, at best, tweak lower order specifications in order to wow consumers. It is no coincidence that radically new technologies which can change the profile of modern material production occupy some rather modest niches, and a revolutionary transformation of technological foundations of material production as a whole has not yet come to pass. As Kovalchuk has noted, "Actually, humanity has not made any radical technological breakthroughs in recent decades. Technological progress is advancing linearly, by way of modification and improvement of previous inventions, such as increasing the number of elements in an electronic chip, for instance. No global discoveries have been made, and there has been no real need for them."[1] This problem is also extremely relevant for many former Soviet countries, in

[1] Koval'chuk, M. V. (2011). Konvergentsiia nauk i tekhnologii – proryv v budushchee [Convergence of Science and Technology – Breakthrough into the Future]. *Rossiiskie nanotekhnologii*. 6 (1–2), p. 13. http://www.nrcki.ru/files/pdf/1461850844.pdf

particular the Russian Federation, where deindustrialisation processes have progressed exceptionally far.[1]

3.3. New Normal in the Global Economy

These trends point to a crisis in the modern economic system. It is not the problems of the financial system that lay at the heart of this crisis – although they do constitute an important component of it as consequences of its real causes. Do the ruling elites of the world's leading nations understand these causes? Are they looking for any solutions to the situation?

It would seem that not all of them are working on finding a solution. So far, there are no obvious signs of concern or decisive action, even in the area of reforming the financial system, which was the immediate trigger of the most recent crisis. Instead, the term "New Normal" functions to avoid recognising real issues at hand.

This term was first used at the 2009 G20 Summit in Pittsburgh and was then actively promoted by the Public Investment Management Company.[2] In Russia, it was first used in 2010 by Ksenia Iudaeva, who was working at Sberbank of Russia at that time.[3] Later, Alexey Ulyukayev, who at the time was Deputy Chairman of the Bank of Russia, also started using the phrase. "I really like the term the New Normal (I cannot say who came up with it)," he said.[4] The problems which accumulated in the economy

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[1] The author's stance on the issue of deindustrialisation of Russia is outlined in the report presented at the Abalkin Readings of the Free Economic Society of Russia in Moscow on December 11, 2013 and published in: Bodrunov, S.D. (2014). Reindustrializatsiia rossiiskoi ekonomiki – vozmozhnosti i ogranicheniia [Reindustrialisation of the Russian Economy – Opportunities and Limitations]. *Nauchnye Trudy VEO Rossii*. 1 (180), pp. 15–46.

[2] Mohamed A. El-Erian. (August 13, 2012). Paul Ryan's Plan and the Next "New Normal." *The Washington Post*.

[3] Iudaeva, K. (2010). New Normal dlia Rossii [The New Normal for Russia]. *Ekonomicheskaia politika*. 6, pp. 196–200.

[4] Uliukaev, Aleksei (2012). Vystuplenie na Gaidarovskom forume 2012 [Speech at the 2012 Gaidar Forum]. *Ekonomicheskaia politika.* 2, p. 27.

were thus effectively declared the New Normal,[1] with people obstinately refusing to use the word "crisis."[2]

But what is happening with the global economy in general? Where does this situation, this New Normal come from? Is its arrival objective? Or is it a consequence of some errors committed by major "ruling" economies?

We can certainly agree that many of these woes stem from various contingent reasons those emphasising them are right in this sense. Their studies typically deal with issues and elements taken out of the context of global civilisational development. They explain well enough the cause-and-effect relations between selected elements. However, this pervasive method of analysis does not permit an adequate model of the future from which to make decisions that are informed by an appreciation of the larger historical context and thus capable of developing and implementing an adequate economic policy and set up appropriate public institutions.

Only by finding the roots of this phenomenon we will be able to assess the credibility of the thesis that we are in a New Normal, how inevitable it was, whether it is possible to overcome it and the options available for developing the economy.

Let me try and make my own contribution to the clarification of these matters.

The New Normal refers to the reality today. The reality that is new for all of us. And, in fact, it is the "norm" (the reason why I used quotation marks here will become clear later on). It is certainly new, i.e. unusual, to us. And it is under-explored by economists. It has befallen the society of scientists, managers, asset owners, and regular people, who were wholly unprepared for it. And its features, in general terms,

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[1] Here is how Uliukaev described the New Normal: "First, lower rates of global economic growth in all segments… very high volatility of all markets – the commodities markets, the stock exchange and the currency markets… exhaustion of instruments used in the state economic policy to solve development problems, including the problems of cyclicity" (Uliukaev, Aleksei. Vystuplenie na Gaidarovskom forume, p. 2729).

[2] Alekseevskikh, A. and E. Shishkunova (July 19, 2012). Aleksei Uliukaev: "Eto ne krizis, eto novaia normal'nost'" [Aleksei Uliukaev: "This is Not a Crisis; This is a New Normal"]. *Izvestiia*.

have been described correctly. Moreover, it is both objectively happening and is thus, in a certain sense, inevitable – and is therefore dubbed "normal."

However, it also originates from objective things – the start of the transition to a new stage of our civilisational development, the initial phase of a new industrial society of the next (second) generation. After all, we have reached the limit of the existing development model's efficiency. And this constitutes the deeper basis for the changes that we are undergoing and anticipate now, poised on the razor's edge, burying our heads in the sand and calling this positioning on the verge of an abyss the new (un)normal. Changes are coming that have never been witnessed before, but soon will be. Profound reforms are necessary.

But we do not want to get ahead of ourselves. Let us come back to reality. The current model has gone through a series of stages – from initial efficiency in terms of economic growth to crises as consequences of the accumulated contradictions of development inherent to it. At the start, they were overcome by means available within the model itself and there would be a new upsurge, which in its turn would lead to the next crisis... However, with time, the methods for overcoming crises became more and more "structured," "artificial" and inconsistent with the very nature of the economic system, but still able to prolong its life (through national and international regulators, measures and structures, liberal or mobilising models…) all the way to... agony?!

The current state of the global economy – the New Normal – is, in fact, a sign of the upcoming agony of the existing, more or less customary, development model which manifests itself through global decline in investment,[1] "volatile demand and prices in

[1] The lack of investments, which threatens an increasing decline, is lamented by experts at the World Bank: Vsemirnyi bank ukazal na riski dlia mirovoi ekonomiki [World Bank Points Out Risks for Global Economy]. *Vesti.Ekonomika*. January 10, 2018, 12:05. http://www.vestifinance.ru/articles/96065; as well as by specialists at the Organisation for Economic Co-operation and Development (OECD): Bazanova, E. (March 9, 2017). Mirovaia ekonomika popala v lovushku nizkikh tempov rosta – OESR [Global Economy Trapped by Low Growth Rates – OECD]. *Vedomosti*. https://www.vedomosti.ru/economics/articles/2017/03/09/680409-mirovaya-ekonomika-popala).

the energy markets,[1] volatility of unsecured currencies, lack of growth in the revenue of the majority of population in developed countries,[2] and overall universal perplexity.

Our research proves that all this is unsurprising. The advancement of technology created a gap between the organisation of the economy that had already become archaic and new technological capabilities. This results in constant market fluctuations, growing tensions and even, to some extent, the appearance of seemingly unexpected leaders, such as Donald Trump in the United States.

The problem is that we are starting the transition to a new development paradigm[3], and the old models and methods for overcoming crises no longer work. As I see it, another important feature of the New Normal indirectly addressed by some (including, among others, specialists with very different ideas like former minister of finance, liberal Alexey Kudrin, businessman and business-ombudsman Boris Titov andformer advisor of president, statist Sergey Glaz'ev, who agree perhaps on only one point – recognising the need to intensify efforts aimed at technological development – and their apologists) is the realisation of the need to ensure technological development as a basis for civilisational progress as such. We, however, have been making this argument for some time.[4]

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[1] Volatility in energy markets has grown 1.5–2 times over the past decade. See: Negomedzianov, Iu. A. and G. Iu. Negomedzianov (2015). Otsenka riska po real'noi volatil'nosti [Risk Assessment by Actual Volatility]. *Finansy i kredit*. 24 (648), p. 23. The same fact is also recognised in other sources: Neft' vo vlasti volatil'nosti [Oil at the Mercy of Volatility]. REGNUM, August 16, 2017, 09:43. https://regnum.ru/news/2310661.html.

[2] According to the results of research conducted by the McKinsey Global Institute, a research branch of McKinsey & Company consulting company, the average income of the population in the West has stopped growing over the past decade. Researchers warn that the trend towards declining income will persist during the next decade at least. See: Manukov, Sergei (July 14, 2016). Ostanovka Zapada [The Halt of the West]. *Expert Online*.

[3] An earlier version of this argument appeared in Bodrunov, S. D. (2016). O nekotorykh voprosakh evoliutsii ekonomiko-sotsial'nogo ustroistva industrial'nogo obshchestva novoi generatsii [On Certain Issues of the Evolution of the Socioeconomic Structure of the Industrial Society of a New Generation]. *Ekonomicheskoe vozrozhdenie Rossii*. №3 (49), pp. 5–18.

[4] See, for instance: Bodrunov, S. (2005). Modernizatsiia oboronno-promyshlennogo kompleksa i obespechenie bezopasnosti gosudarstva [Modernisation of the Military-Industrial Complex and State Security Assurance]. *God planety*.14, pp. 107–112; Bodrunov, S. D. (2012). *Analiz sostoianiia otechestvennogo mashinostroeniia i imperativy novogo industrial'nogo razvitiia* [Analysis of the State of National Machine Building and the Imperatives of New Industrial Development]. St. Petersburg: S.Y. Witte Institute for New Industrial Development (INID); Bodrunov, S. D. (2012). *Novoe industrial'noe razvitie Rossii v usloviiakh VTO: ekspertiza priniatykh kontseptsii innovatsionnogo razvitiia Rossii* [Russia's New Industrial Development under the WTO: Expert Assessment of the Innovative Development Concepts Adopted by Russia]. St. Petersburg: S.Y. Witte Institute for New Industrial Development (INID); Bodrunov, S. D. (2013). K voprosu o reindustrializatsii rossiiskoi ekonomiki [On the Reindustrialisation of the Russian Economy].

For the most developed countries, the acuteness of the problem of accelerating industrial and technological development is not that evident; it is hidden because of their higher technological development (compared to other countries), greater research and development potential and the supposed continuous flow of innovations. Meanwhile, for Russia, which is clearly losing not only to technological leaders, but also to many average players, this is an extremely pressing issue.

Therefore, it is clearly no coincidence that the issue of overcoming technological backwardness is among the priorities of Alexey Kudrin's and Boris Titov's respective projects battling it out as part of Russia's economic development programme. For example, "in a presentation of the Russian Centre for Strategic Research (CSR) prepared by the former Minister of Finance Alexey Kudrin and submitted to the Kremlin... the technological backwardness of Russia compared to developed countries is recognised as the number one threat."[1] Titov also mentions "technological backwardness – non-competitiveness of goods and services; underdeveloped industrial, transport and social infrastructure" in his programme as one of the major threats to economic development.[2]

Let me note tangentially that we are behind not because we are not smart enough, but because, as a renowned politician said on a different occasion, with the collapse of the Soviet Union, the Soviet economy was "torn to pieces."

This example of concern regarding the technological backwardness of Russia has more broad context, demonstrating that the dependence of the economic

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Ekonomicheskoe vozrozhdenie Rossii. 4 (38); Bodrunov, S. D. (2014). Rossiiskaia ekonomicheskaia sistema: budushchee vysokotekhnologichnogo material'nogo proizvodstva [The Russian Economic System: The Future of High Technology Material Production]. *Ekonomicheskoe vozrozhdenie Rossii*. 2 (40); etc.

[1] Filiakhov, R. and P. Orekhin. (June 1, 2017). Bum i revoliutsiia Kudrina [Kudrin's Boom and Revolution]. *Gazeta.ru*. www.gazeta.ru/business/2017/05/31/10701803.shtml

[2] Srednesrochnaia programma sotsial'no-ekomonicheskogo razvitiia Rossii do 2025 goda. Strategiia Rosta. [Mid-Term Program of the Social-Economic Development of Russia until 2025. Growth Strategy]. Institut ekonomiki rosta imeni Stolypina P. A. [Stolypin Growth Economy Institute]. http://stolypin.institute/en/strategy-of-growth/

development from the level of technological progress is the critical point for any country in the world economy.

Within the next ten years, the world will move to a new technological mode, in which technological change will become an integral part of the production process. This will bring along new requirements in terms of the integration of production, science and education. Continuous change and innovation will be necessary.

A different economy and a different life, as well as new opportunities await us in all spheres. Colossal, fundamental shifts are taking place in technology, materials, processing techniques, methods of production organisation, and management techniques. There are dozens of examples.

Unmanned automobiles, a fundamentally new level of confidence ensured by innovative technologies (e.g. blockchain), reliable electronic voting tools – all these changes urge us to rebuild our institutions, public administration systems and, ultimately, even the basic economic concepts and the social order.

For example, tablets combine the functions of a computer, television, watch and store. This results in numerous job cuts in all sorts of industries, saved minerals, metal and oil. On the national scale, we observe a huge drop in the GDP. That is to say, the GDP goes down because of the introduction of tablets, while the quality of life goes up. So, should we really be that concerned about quantitative indicators – the growth or decline of the GDP? There is no point in looking incessantly at figures; instead, other parameters, such as the accessibility of required knowledge, medicine, healthcare etc., should be monitored.

When General Motors refused to sell Opel to Sberbank, they did so on the understanding that the most valuable commodity was knowledge, not the hardware.[1]

[1] At the very early stage of preparing the deal, "GM wanted to have the opportunity to buy Opel back, then refused to hand the intellectual property of Opel over to Magna and Sberbank…" (Magna i Sberbank prokatili mimo Opel [Magna and Sberbank Miss Out on Opel]. *Gazeta Kommersant*. November 5, 2009 https://www.kommersant.ru/doc/1268884). "Unofficially, GM didn't like that Russian automakers could get control over the technical developments of Opel and use

That is what becomes crucial in production, the key resource of the economy, while the significance of other resources is decreasing.

This means that the advantage of Russia as one of the major suppliers of raw materials will definitely shrink in the next decade. We need to understand that as soon as possible and redirect all resources towards the development of the sphere of knowledge – education, science and technology.

There will be many pitfalls on the way. But there will be progress, too! At the initial stages of the NIS.2, evidently continuing in the good old tradition of prior development (we cannot escape from this, it is inherent and will be overcome only through further technological development!), technological leaders will strengthen their positions in the global economy by attracting, consolidating and retaining key NIS.2 resource – knowledge – thus becoming manufacturers of knowledge-intensive products and of knowledge itself. In the context of the knowledge-intensive economy, these countries will become key producers. Take for instance the ongong recover of the United States and Europe from their post-industrial delusion (at least in its oversimplified version) and consequent pull-back of their production (i.e. their hi-tech production) from Asia!

According to experts, reshoring (bringing offshore production capacities back to the country or creating new domestic production facilities) is taking place in industries which require a high level of management control over quality standards, e.g. in the defence industry, in spheres where observing and protecting copyright and patent rights is essential and, finally, in industries that are most sensitive to production automation and robotisation technologies. "Robotisation makes production in the United States

them in their production" (General Motors prodal Opel za 2.2 milliarda evro [General Motors Sells Opel for 2.2 Billion Euros]. https://meduza.io/news/2017/03/06/general-motors-prodal-opel-za-2-2-milliarda-evro). The same is echoed by British newspaper *The Times*, referring to WikiLeaks data. See: Uncovered: GM's clash with the Kremlin over Opel. *The Times*. July 25, 2011. https://www.thetimes.co.uk/article/uncovered-gms-clash-with-the-kremlin-over-opel-nvlk09mpz58 competitive compared to the cheapest manual labour."[1] The same is observed in Western Europe: "The rate of reshoring is minimal in low-tech sectors of processing industry and maximum in hi-tech segments."[2]

Now, what about other countries? What will happen to them in this scenario? The rest risk forming the "service" sector of the global economy. And many may say this is not such a bad prospect for them. After all, people in these countries are, generally speaking, not likely to grow any poorer than they already are. If they become too poor, the "producer" countries will not have a market for their goods, which they will surely try to prevent – not out of altruism, but for reasons of self-protection, preservation and prolongation of their own "producer" status. This rationality, evidently, has the limits: developed countries have no interest to support the purchasing power of poor countries on the level, providing them efficient and independent economic development.

Still, compared to the leading countries, the "servicing" countries will gradually grow poorer!

This will have two consequences.

First, there will be a rather long period of unequal/uneven access of people from different economies both to the key resource (knowledge) and to the opportunities for satisfying their growing demands. It will last until knowledge is transferred into universal ownership/usage without exception. It is impossible to predict how long this stage last since it will depend on a multitude of factors: from the rate of scientific and technological progress and the actual capacity of humankind to adapt to new levels of acquiring knowledge (to say easier, from the formation of institutes providing the

[1] Zotin, A. (January 27, 2018). Robotizatsiia vmesto globalizatsii. Chto takoe reshoring i chem on opasen [Robotization Instead of Globalisation. What is Reshoring and Why is it Dangerous]. *Kommersant*. https://www.kommersant.ru/doc/3526726

[2] Kondrat'ev, V. (January 18, 2017). Vozvrashchenie proizvodstva, ili novaia industrializatsiia Zapada [The Return of Production, or a New Industrialisation of the West]. *Zhurnal VESPA*. https://vesparevenge.ru/?p=1496

general spread of knowledge and permanent acquiring of new knowledge) to other characteristics not related to the economy.

Second, there is the obvious possibility of a global conflict erupting between the two "blocks" over access to the key resource. Such conflict cannot be ruled out, although the very nature of knowledge – with diffusion as its key feature – might contribute to its gradual de-escalation and to the transition of civilisational development to a conflict-free phase of developed NIS.2.

This second is, however, a long-run projection and, as John Maynard Keynes said, the "long run is a misleading guide to human affairs. In the long run, we are dead". Understanding that our civilisation is going to follow the path of transformation into NIS.2 and that those who fail to catch this train will be doomed to lag behind (for the foreseeable future), we have to make every effort and adopt the model of economic growth that prioritises the development of hi-tech production and the concurrent development of knowledge-intensive and knowledge-promoting segments (broadly speaking – science and education), while not forgetting about people's spiritual development.

We are at a stage in global history that is similar to the turning points of the 20th century. The most vivid example would be the 1930s and the Great Depression. What came of that is common knowledge. Attempts to resolve the problem at the international level (through the League of Nations, etc.) were premature and unsuccessful, and thus failed to remedy the situation, [1] leading to the Second World War. Economies were ruined. Entire nations and cultures suffered.

[1] The attempts of the League of Nations to establish a "tariff truce" came to naught. The League of Nations report could only state: "It has become clear that the international trade mechanism is in danger of the equally comprehensive frustration as the international financial system has suffered" (League of Nations. 1933. World Economic Survey 1932/33. Geneva: League of Nations, pp. 16–17. See also: Irwin D.A. (May 6, 2009). Avoiding 1930s-Style Protectionism: Lessons for Today. *Effective Crisis Response and Openness: Implications for the Trading System*. Ed. by S.J. Evennett, B.M. Hoekman, O. Cattaneo. Washington, D.C.: World Bank and Centre for Economic Policy Research.

By the time the Second World War ended, the moment was more propitious. The Marshall Plan,[1] the Bretton Woods system,[2] the United Nations... These were elements of a more successful solution at the international level because they were better designed, more balanced and fit to cope with the challenges of that historical phase, more realistic and feasible. These measures and institutions saved Europe and Japan from hunger and new shocks, and they saved the United States from depressive trends and disintegration. All these countries claimed their leading positions and progressed towards prosperity. It is clear, that in the same time this policy was the instrument of strengthening of US economic and political leadership and the weapon against the influence of USSR and communist ideas as well.

Now we are in a somewhat similar period (in terms of "the tension of uncertainty," I would say). So we also need to acknowledge that without sound measures that would take into account basic trends of civilisational development we may well end up in a catastrophe.

It looks like the world has already started to realise this. And recent efforts to reshore industries and perform hi-tech reindustrialisation of domestic economies that have been initiated by the United States, the European Union and other nations that

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[1] In the first three years of implementing the Marshall Plan, (1948–1951), industrial production of countries which were receiving aid exceeded pre-war indicators by 40%, and agricultural production went up by 20%. Unemployment was abated, and inflation restrained. U.S. funding accounted for around 11% of the United Kingdom's GDP, 12% of France's GDP, almost 22% of West Germany's GDP and a little over 33% of Italy's GDP. European economic revival also ensured a market for U.S. produce, as well as cheap raw material supplies from Europe to the United States. Moreover, since the disbursement of the Marshall Plan funding was entirely controlled by the U.S. administration, this contributed to the strengthening of the positions of U.S. monopolies in Europe. Aid under the Marshall Plan was provided on the condition that communists would be removed from the governments of aid recipients. (See: Sidorchik, Ai. (May 23, 2015). Troianski kon' Ameriki. Kak "plan Marshalla" lishil Evropu nezavisimosti. [The Trojan Horse of America. How the Marshall Plan Deprived Europe of Independence]. *Argumenty i fakty*. http://www.aif.ru/society/history/troyanskiy_kon_ameriki_kak_plan_marshalla_lishil_evropu_nezavisimosti)

[2] July 1944 United Nations Monetary and Financial Conference in Bretton Woods laid down the foundation for the global monetary system that would remain in place until the early 1970s. The effectiveness of the system was accompanied by monetary and financial dictate of the United States. The USSR also took part in the conference, but refused to ratify its documents. The USSR's refusal triggered a highly negative reaction on the part of the United States and the formulation of the doctrine of containment outlined in the so-called "long telegram" of the American charge d'affaires in Moscow to the U.S. Secretary of State (The Charge in the Soviet Union (Kennan) to the Secretary of State Moscow, secret. February 22, 1946, 9 p.m. [Received February 22, 3:52 p.m.]. *Foreign Relations of The United States, 1946, Eastern Europe, The Soviet Union*. Vol. VI, p. 861. 00/2-2246: Telegram. https://history.state.gov/historicaldocuments/frus1946v06/d475)

"get it" constitute their new Marshall Plan aimed to save their countries. That is it – their adaptation to New Normal!

Meanwhile, Russia is lagging behind yet again, for we proceed apathetically, fail to get to the heart of the matter. The country risks missing out and getting stranded! Therefore, we have to adopt – willy-nilly – a concept painfully similar to the basic ideas of NIS.2[1] and develop and implement a programme targeting harmonisation (both with the global economy and with our own citizens) of our transition from conventional industrialism on a global scale and our self-inflicted deindustrialisation to a new economy – the economy of the NIS.2.

3.4. Technological Progress and the Role of Financial Capital

Financial capital emerged in a certain historical moment and has been growing by ramping-up of one of money's key functions: that of the hoard for further investment. In every form of society, something must be hoarded to invest, such as seed to sow. However, the development of capitalism and its financial relations mean that the chief form the hoard takes is that of money. In that respect, financial capital, which preexisted capital in production, fit the historical process of capitalism formation in a most seamless manner and developed further with it.

Financial capital is a form of capital. It has the same peculiarity as the capital in general. Its aim function is growth of profit: . What provided financial capital growth through the production process? Namely due to the fact that only investments in real economy allowed to produce and extract profit .

Though in recent decades financial capital has become dominant, and started demanding greater freedoms, markets and investment opportunities. However, it is an

[1] See Chapters 8–10 in Bodrunov, S. D. Bodrunov, S. D. (2016). *The Coming of New Industrial Society: Reloaded*. Moscow and St. Petersburg: S. Y. Witte Institute for New Industrial Development.

illusion to imagine it can function in isolation or exist in isolation from material production.

And what is going on in material production? Acceleration of scientific and technical progress, on the one hand, needs significant financial investments, and, on the other hand, makes the material grounds used by financial capital (not financial only, but capital in general, including financial capital through meditation) – products of real material production in particular – more and more technologically advanced, less cost-intensive and, consequently, relatively cheaper. This means the shrink of sales volume and, so, the volume of profit. Therefore, any time later an opportunity to achieve the main goal disappears, as well as the instrument as such, which provides growth of capital. The instrument is changing, so is the goal – thus we get the following chain: financial capital enables technological development; technological development enables destruction of financial capital, because the goal, the capital target function disappears.

Financial capital was extremely progressive at a certain stage. Without it, development, a new stage of human development called ‘capitalism’ would have been impossible. Capitalism on its first stage was more progressive in many respects than the previous system, hence it won. Specifically, industrial capitalism advanced material production and made societies more prosperous than they had ever been. Industrial production without financial capital.

It is another matter, however, that the time soon comes when societies are satiated. The question then arises, how to make a profit? It seems there is nothing to make a profit on. Markets need to be expanded either through innovations which lead to new products requiring more money to create it and bring it to the market (which is usually extremely costly and presents higher risks), or through an old product (which is usually cheaper and less risky) capturing new markets. Either way capitalism now appears rapacious. It will spend as little as possible, absorb as many resources as possible while reducing costs. . Such rapacious methods include, in addition to sales of really useful products, ‘peddling’ of simulative products – it means the products some or even all of proprieties of which only simulate the utility. The capitalism goes from progressive measures of development to not progressive one. Usually a real product used to come first, it was progressively, a simulative product followed, which became not progressively. Non-economic measures to extract profit, such as war and capture of new territories – also not progressively.

There are many contradictory (progressive vs. not progressive) trends like these. Which trends will win? It depends on the ratio of two speeds - a speed of production development, or technical progress, and a speed of understanding of social consequences by a human, understanding of a social superstructure to be changed. It is changing as well, but following material production only. Yes, it has an effect on material production, boosts it, and the evolving need makes people think that this superstructure comes first. But in terms of relations establishment and changes within society it is secondary after material production.

In our contemporary societies there are enough individuals who are ready to use violence for economic advantages: from bombing other country to kill neighbor guy for new sneakers. We can see the examples of such “unmatured” behavior in everyday life. Some people are identifying the utility of products only with the level of price, in spite the fact that cheaper products very often are more useful (or, at least, not less useful) than expensive one. Society also matures with accumulation of knowledge, accumulation of situation understanding, but a facilitating element therewith – satisfaction the needs, real needs at least.

If we see it as ‘maturity of society’, then we have problems. Our society has not ‘matured’ enough to use technological progress and its achievements appropriately. It has not matured in part because this technological progress still has not ‘fed’ everyone – people still lack goods and their needs are not met. And why has society not ‘fed’ everyone, if nowadays so much grain is produced in the world to bake enough bread for all people? Why do millions, even billions of people starve? Because we have a capitalistic method of goods appropriation. Technological progress has combined with financial capital and it has absorbed the results of this progress by redistributing income in favor of itself, against production capital, and the satisfaction real needs of people.

Hence this link between simulative needs and financial capital: the latter can fatten on anything, including good old fleecing of other people and peoples. At the expense of simulative drumming about things to be bought, rather than innovation margin and new markets, it does its best to turn sugar into shit, to add very financial profit. Such a situation occurs at every stage of technological progress. Consider this: each transition to a new technological stage is accompanied by its own forms of expansionism: wars, conflicts and so on. It would seem though – needs satisfaction must provide people a better living. Why does it happen? Because there is evident disharmony, a gap between public conscience and capabilities of technological progress.

Why is this situation so acute now, even more than before? Because each burst of technological progress provides much more opportunities than on the previous stage and when used in the wrong way, risks increase significantly. Now technological progress provides so many opportunities that practically every terrorist group can have chemical warfare agents. Let us say, if there is a man ‘with a knife’ who also possesses financial capital? He can even hire someone ‘with knifes’ to clean the market under multiple specious excuses. We see it nowadays in one guise or another. If social medium has not matured as a social medium, it may become a threat for itself. That is what I mean.

I can say that when we consider the financial capital issue as a component of the noonomy concept, it is not about qualitative changes of the instrument itself, the capital. Changes in technologies, qualitative changes in production, qualitative changes in society, etc. occur in exactly the same way. Generally, we face a transition similar to a qualitative leap for entire social structure of ours.

Please, note that when the quality of any system is changed, the system is changed as well. There are always components, connections, etc. within the system. The social and economic system is extremely coherent and it develops dynamically.

But hereby all components of the system in their interconnection have certain impact on each other in the process of development, and each of them is developing at its own pace. Disharmony, dysfunction of paces, uncoordinated development of components of the system can result in disruption of the system, because tension between connections cannot be unlimited. There is a limit every time.

It needs to be understood that in relation to other systems, in reference to each other, in the context, the economic and social is developed in the following way: social medium, and a human as a social medium element creates a need; a need is met within a production system. The production system as such is formed and extended through knowledge. Then it becomes primary for development of social medium in general. Technological changes on each new stage lead to the following transformation of the society and social interactions. So economic and social relations, including all kinds of economic relations, not production relations only, are connected in any case one, way or another, through production, even if indirectly.

Therefore it needs to be understood that all of this is a uniform system, where various components can be found. Below we will speak about division of production system and social medium which is to take place in the noosociety, but it does not mean that there will be no general system of relationships - it will be a general system. A human, as well as humanity, social medium in general, will be ‘noo’ in this system; and production system there will be as a component of the general system that satisfies the social medium needs.

Any transition, any technological change leads to a change of technological ways. Each production mode had formed a new type of society: industrial production method along with new technologies of that stage led to establishment of capitalist society among other things, not vice versa. Now every new stage provides new, much wider opportunities to satisfy human needs. So if we say that we are going to satisfy human needs much to a greater extent that now, and these needs will not be reasonable, we will use technological progress as an instrument, so to speak, given to a child or to a underdeveloped creature.

If a child is given a hammer, it will not drive a nail. It does not know what the hammer is for, as well as a method to use it properly and wisely. It will hit its own leg or break a glass or cut itself, etc. At the moment, a human is in the same state once again, but opportunities of the current stage, which is particular for that, are so huge that they can easily drive a human to the brink of a catastrophe at once if used in a wrong way.

Chapter 4. Technological Prerequisites for Transitioning to a New Stage of Industrial Production

The second stage of the new industrial economy (NIS.2) – one that is based on the latest technologies – is almost upon us. However, what technologies are we talking about? I do not mean we should make a list of specific innovations that can be expected. That is not the point. It is important, rather, to understand the specific features of the technologies that will distinguish them from the technologies of the previous stage, as well as the shifts that these new technologies will bring about in the entire system of material production.

4.1. Knowledge Intensive Industrial Production[1]

For all changes in material production over the past century, industrial technologies remain the foundation of our economies. Industrial production ensures the continuous growth of labour productivity in material production based on scientific and technical progress. Increased productivity in this sector produces redundancy in the labor force and creates opportunities for employment growth in the service sector.

Preserving and increasing the significance of the industrial core of production are critical for the development of the world economy. It is the transition of industrial production to a qualitatively new technological level that will determine the our economic future. Many recognise this, even Trump: he has overturned a number of Obama's decisions that he deemed disadvantageous for the United States, and these are numerous. However, he has not overruled any of the decisions that stimulated, in spite of the crisis, the return of large-scale production activities from Asia and Latin America to the United States.[2] What is more, measures of this kind have been stepped

[1] Sections 2.1 and 2.2 of this chapter are based on revised fragments from Chapter 9 of the book by Bodrunov, S. D. (2016). *The Coming of New Industrial Society: Reloaded*. Moscow and St. Petersburg: S. Y. Witte Institute for New Industrial Development, pp. 143–160.

[2] See: Kondrat'ev, V. (2017). Reshoring kak forma reindustrializatsii [Reshoring as a Form of Reindustrialization]. *Mirovaia ekonomika i mezhdunarodnye otnosheniia*. 9 (61), p. 62.

up lately.[1] Moreover, this has been done as part of the very first steps of the new President of the United States, who – unlike his predecessor – understands how the real economy works.[2]

The world is entering the era of the next (fourth) industrial and technological revolution and only economies competitive in such production will be able to establish themselves as leaders. Leadership will not come from the production and sale of natural resources, or even from industrial production focused on the old technologies, but in the development and application of new high technologies, as well as the provision of highly qualified human capital able to implement that technology. Technological leaders will be the economic leaders of the future.

The industrial and technological revolution implies large-scale technological application of scientific knowledge and continuous changes in the technological basis of production. This presents ever greater opportunities to satisfy the needs of the people (and not only their material needs) and leads to the creation of new needs. As a result, characteristics of human life change. The content of production activities, level of qualifications, education and culture, features of everyday life, social environment, and, ultimately, the entire social order – all these get reshaped.

The development of R&D, education, healthcare, information, telecommunications and professional (business) service segments, regarded by post-industrialists as symbols of the rapid growth of the service economy, depend directly on the implementation of the result of activity in these segments in material production. It is not without reason that the sector of so-called industrial services (such

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[1] "President Donald Trump and White House trade advisor Peter Navarro would like to see U.S. companies' manufacturing operations come back home. Navarro noted recently that the administration is working on a phase-four stimulus package of at least $2 trillion that would focus on strengthening American manufacturing and include incentives for U.S. companies to reshore operations". Yardeni E., Doherty J. Trump wants jobs coming back to the U.S. from China — but companies and consumers might disagree. June 22, 2020. URL: https://www.marketwatch.com/story/trump-wants-jobs-coming-back-to-the-us-from-china-but-companies-and-consumers-might-disagree-2020-06-22

[2] The new fiscal law intended to stimulate the return of business to the United States that was passed by the Congress and then signed by the President on 22 December 2017 reduces the corporate tax from 35 to 21% (Supian, V. (18 January 2018). Novaia ekonomicheskaia politika Donal'da Trampa: vozmozhny li reformy v SShA v usloviiakh politicheskogo krizisa? [Donald Trump's New Economic Policy: Are Reforms Possible in the United States amidst Political Crisis?] *Nezavisimaia gazeta*. http://www.ng.ru/ideas/2018-01-18/5_7153_trump.html

as maintenance, upgrade and repairing of machinery and equipment, logistics, engineering, technological control and consulting, applied researches in industry, transportation services for industry) based on material production processes and focused on servicing these processes has acquired great importance in recent times.[1]

Knowledge is required, above all, to advance towards new stages of the technological progress.

So, in what direction are material production technologies headed?

The new industrial society and the economy of the 21st century should become a "negation of the negation," a dialectic removal of both late industrial system described by John Kenneth Galbraith and informational and post-industrial trends considered by Daniel Bell and his followers.

Now, how do we conceive this "negation of the negation"? Let us analyse the real trends in the revival of modern material production, primarily those changes that have already become (or are becoming) a reality. First of all, there is the increasing significance of information technology to which post-industrialist theoreticians have quite rightly pointed. We, however, e do not regard it as an evidence of the diminishing role of material production. We draw a different conclusion from this fact – the conclusion about constantly progressing knowledge intensity of material production.

We are not merely making note of the increasing role of information, as many theoreticians of the information society do.[2] And we are not talking so much about information production as we are about a new type of material production.[3] There is a big difference here. We know that, world-wide, the creation of information often turns into the production of white noise, where economic resources are used to create signs[4]

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[1] See: Bodrunov, S. D. (2016). *The Coming of New Industrial Society: Reloaded*. Moscow and St. Petersburg: S. Y. Witte Institute for New Industrial Development, pp. 27–37.

[2] Post-industrialists have long been interested in the information society and knowledge-based society. See: Drucker, P. (1969). *The Age of Discontinuity; Guidelines to Our Changing Society.* New York: Harper and Row; Machlup, F. (1962). *The Production and Distribution of Knowledge in the United States.* Princeton; Masuda, Y. (1983). *The Information Society as Postindustrial Society.* Wash.: World Future Soc., etc.

[3] The issue of knowledge-intensive industry has been debated for a long time. However, there is still some lack of certainty in the understanding of what the knowledge-based economy and knowledge-intensive industry are. See: Smith, K. (2000). *What is the "Knowledge Economy?" Knowledge Intensive Industries and Distributed Knowledge Bases.* Oslo, pp. 2, 7–9.

[4] Baudrillard, J. (1981). _*For a Critique of the Political Economy of the Sign*. _St. Louis, Mo: Telos press Ltd.

or simulacra of benefits instead of promoting the growth of labour productivity, improvement of human qualities, and solutions to social and environmental problems.[1] Such "informatisation" eventually leads to the virtualisation of social life and destruction of human personality, spirituality and social relations, as well as the unity of nations and states.

Rising knowledge intensity of material production technologies is a process that critically synthesises the achievements of industrial and information economy. This critical synthesis is clearly expressed in the fact that the defining role in hi-tech production shifts to operations and processes in which humans act not as auxiliaries to the machine (production line or conveyor belt), but as a bearer of knowledge that transforms the technology so that the man "stands beside the production process" and "relates himself to that process as its overseer and regulator."[2] In this case, we can speak of the knowledge intensity of material production and its product.

A fundamentally *new type of material production* – knowledge-intensive production – is formed on that basis. Its key features are:

- continuous increase of the information component and decrease of the material component; miniaturisation, the tendency to decrease energy, material and capital intensity of products;
- specific features of *production process* and trends in the development of technology (flexibility, modularity, standardisation etc.);
- *network structure model* that replaces vertically integrated structures;
- use of advanced methods of production organisation and management (just-in-time, lean production, etc.);[3]
- environmental friendliness and focus on *new sources of energy*;

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[1] Buzgalin, A. V. and A. I. Kolganov. (2012). Rynok simuliakrov: vzgliad skvoz' prizmu klassicheskoi politicheskoi ekonomii [Market of Simulacra: An Assessment from the Perspective of Classical Political Economy]. *Filosofiia khoziaistva*. 2, 3.

[2] Marx K. (1975). Economic Manuscripts of 1857-58. In: Marx K., Engels F. Collected Works. New York: International Publishers. Vol. 29, p. 91.

[3] For more detail, see: Ohno, T. (1988). *Just-In-Time for Today and Tomorrow.* Productivity Press; Wadell ,W. and N. Bodek (2005). *The Rebirth of American Industry.* PCS Press; Malakooti, B. (2013). *Operations and Production Systems with Multiple Objectives.* New York; John Wiley & Sons; Tillema, S. and M. Steen. (27. June 2015). Co-Existing Concepts of Management Control: The Containment of Tensions Due to the Implementation of Lean Production. *Management Accounting Research.*

- development of qualitatively new technologies in material production, transport and logistics (nanotechnology, 3D printing, etc.);
- decreasing role of traditional manufacturing industries due to the expansion of additive technologies;
- focus on quality and performance.

Application of new knowledge in manufacturing is a continuously accelerating process because of its increasing synergy effect (which is inherent to knowledge as a phenomenon). The interaction of different sort of technologically implementing knowledge may result in final effect, which is bigger than the sum of the separate effects of implementing different knowledge. As a result, knowledge intensive production allows growing demands to be satisfied more quickly. The rising level of new technology implies a decrease in the capital, material and energy consumption in the process of production, which in the long run creates opportunities to reduce the amount of resources required to meet a nominal share of human requirements.

It seems appropriate to provide some comments on the matter of reducing energy consumption. Here the situation is somewhat special, since the tendency to decrease energy consumption is not immediately evident. Indeed, it should be noted that the transition to new technologies, while expanding production volumes, has actually demonstrated the opposite for quite a while now; the history of industrial development continues to prove that it is based on the search for new ways to increase access to progressively more powerful energy sources, up to nuclear energy. This has become especially true with the move to information technology. Few of us ever consider the fact that it takes the same amount of energy for a computer to perform an internet search as it does a kettle to boil a litre of water. Bitcoin miners consume energy in volumes that are comparable to those of factories. Meanwhile, it takes a considerable amount of other resources to generate electricity. The point is that, firstly, it would take considerable effort and expenditure to perform manual search for the same answers that a search engine can provide and, secondly and most importantly, this is taking place right now (!) with current technology. At the same time, we have to understand the principal trend of the development of this technology. The human brain consumes just 10 watts to process the amount of information that all existing computers combined are still unable to handle! Mother Nature is far thriftier than we are; her "technology" is still billions of times more efficient compared to ours in terms of energy efficiency. That is why the main directions of advances in technological development in terms of energy efficiency is to move closer to "natural" technologies, integrate with them, get embedded into natural links of energy exchange. This will also allow for the reduction in the costs of other components used in energy generation. We also need to tackle the problem of resource depletion and environmental issues. And, thirdly, we are nevertheless talking about the consumption of the same amount of energy per one unit of useful effect, rather than on material production as a whole. And here it is already evident that the production of one gadget in terms of one useful function requires fewer energy resources compared to the production of separate devices that would independently perform the same functions.

Thus, at some point, the "knowledge" component starts to exceed the "material" in many products. This conclusion is well illustrated in the graph below, which shows unit share of material and intellectual costs as part of total production costs and where these lines intersect (see Fig. 1).[1]

[1] This graph was dubbed "Bodrunov's Cross" during a discussion that took place at a session of the Department of Social Sciences at the Russian Academy of Sciences (See: Grinberg, R. S. (2016). Umnym fabrikam nuzhny umnye liudi i umnaia ekonomika [Smart Factories Need Smart People and a Smart Economy]. *Ekonomicheskoe vozrozhdenie Rossii*, 4 (50), 155).

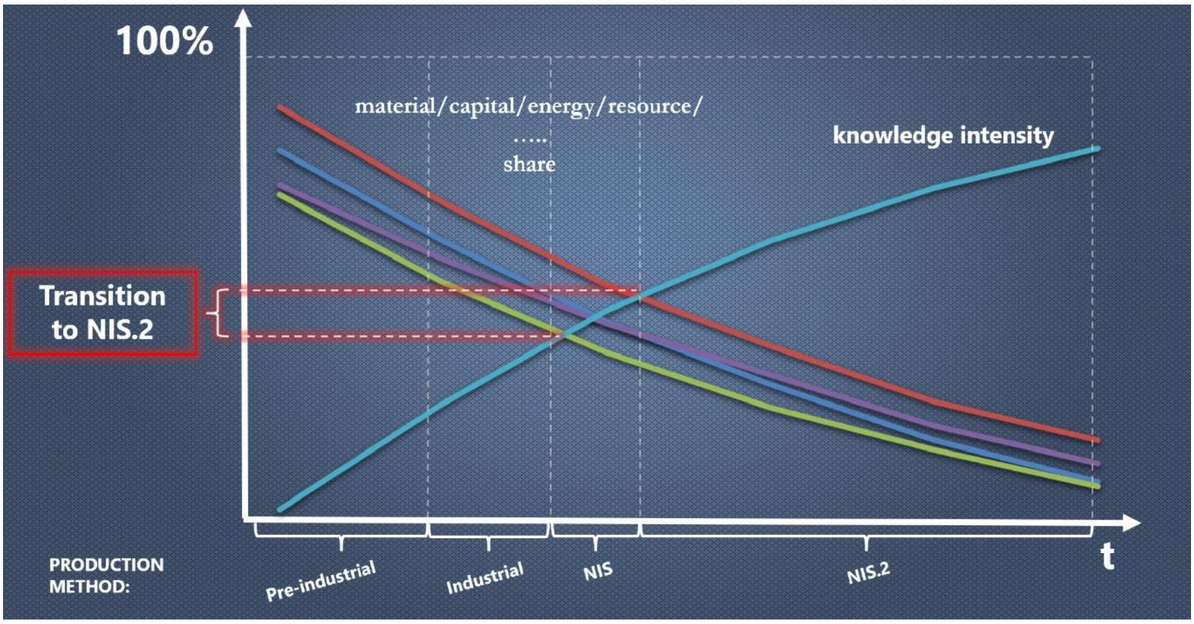

Fig. 1. Historic shifts in the share of product components[1]

There are many instances demonstrating that the moment is already here, that "The time has come!"[2] Take the iPhone, for example. According to Apple, the material part of production makes up just 4.8% of the total cost. Such material-to-knowledge ratios are common in the majority of hi-tech industrial products and clearly signify the emergence of a distinct trend.

Further development of this trend will result in a potential (not automatic – it require the shifts in the grounds of human wants) declining demand for resources, and the position of resource-producing countries in the global economy will change accordingly. In terms of the global balance of natural resources, this will mean a reduced burden on natural reserves and engender new development opportunities that maintain (and restore) the environmental balance.

Based on all of the above, I would like to stress that *knowledge became the main resource already and it will become the most significant resource of the future*. Today,

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[1] Bodrunov, S. D. (2016). Novoe industrial'noe obshchestvo. Proizvodstvo. Ekonomika. Instituty [The New Industrial Society: Production. Economy. Institutes]. *Ekonomicheskoe vozrozhdenie Rossii*. 2 (48), 11 (Fig. 4).

[2] In cooperation with the team at the S. Y. Witte Institute for New Industrial Development, the author calculated the dynamic of unit share of intangible costs in the automotive industry. The lack of comparable data for long periods of time meant that these were not entirely correct, so they are not given here. Nevertheless, they provide sufficient basis to establish the overall trend.

oil, gas and timber are considered important that are fought for, competed over, etc. However, future competition will not focus on timber. Figuratively speaking, firewood will not be important. What will be important is the means of igniting it, perhaps a method of combustion that would ensure maximum energy yield. Besides, it will take less energy to produce one unit of product. New, less energy-intensive technologies will be created and implemented. A new type of production – knowledge-intensive production based on knowledge-intensive technologies that ensure the production of knowledge-intensive industrial products able to satisfy the growing demands of people, including the demand for customised products, different from the mass standardised production of the previous generation. Production of this type cannot be delivered without a high level of knowledge of all its components – materials, labour, organisation of the production process, market conditions and, especially relevant in our opinion, applied technologies (we shall discuss their special role later on). Knowledge in its explicit, "pure" form is moving to the forefront and shall remain there once and for all as a key resource of industrial, technological and social development.

4.2. Characteristics of Modern Technological Development. Sixth Technological Mode

The world has entered a race for new knowledge, one which opens up the possibilities for technological development in a number of new directions. Biotechnology, genetic engineering, alternative power, nanotechnology, and additive, cognitive and social technologies are developing rapidly, building upon the world of conventional machinery. We are witnessing the progressive transition to hybrid technologies,[1] where various combinations of machine and non-machine technologies

[1] On February 4, 2018, Google provided 714,000 results for the query "*gibridnye tekhnologii*" ("hybrid technologies" in Russian) and 497,000,000 results for "hybrid technology" (in English). The links mentioned hybrid technologies in industrial processing, automotive industry, medicine, artificial intelligence, pre-sowing treatment of seeds, security of electronic systems, nuclear desalination plants, etc. It is hard to think of an area where hybrid technologies cannot be used. Nevertheless, no general definition of the term "hybrid technology" was found in online Russian or English sources.

are used as tools for regulating and guiding natural processes in order to achieve the desired goals. This, in turn, will pave the way for a new technological revolution.

When determining an industrial development strategy, it is important to bear in mind that changes in material production will be *systemic*, *comprehensive* and *interrelated*. Let us identify some of the key changes that should be taken into account when *creating a new industrial system aligned with the advanced frontier of science and technology in the 21st century*.

Key features of industrial development in the near future will be as follows:

- updated content of technological processes;
- change in the structure of industrial enterprises (microlevel);
- change in the structure of industry itself (mesolevel);
- change in the structure of the economy as a whole;
- change of approaches to production organisation/localisation;
- emergence of new types of industrial cooperation;
- enhanced production integration with science and education;
- transition to the ideology of continuity of innovation process in production;
- establishment of economic relations and institutions that are aimed at industrial/scientific and technical progress;and
- change in international economic relations.

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We should not confine ourselves to mastering technologies for manufacturing new products that meet modern requirements. It is necessary to introduce *new standards* in product quality management, operations management, logistics and human resources. *Changes* should embrace *all elements of the production process:* its *organisation, technological base*, *manufactured product* and, certainly, the *design* and *quality* of industrial *labour*. For instance, in terms of changing the nature and forms of industrial production organisation, it is worth looking at the trend towards *production* *customisation* that has been gaining ground since the late 20th century, as well as the *customer-oriented* method of organising work.

Key technological challenges for the industry in the 21st century are as follows:

- acceleration in the pace at which new technologies are improving labour productivity and reducing production costs;
- increasing customisation of production, technologies and products;
- spread of modularity in product manufacturing across industries;
- rapid intellectualistion, computerisation and robotisation of production;
- development of network technologies and the implementation of the network principle of production organisation;
- miniaturisation/compaction of production;
- tendency towards low-cost and waste-free production;
- ever-increasing rate of the transfer of technologies from research&development to production and between production sectors;
- trend towards a closer working relationship between developer and manufacturer, shorter times of product implementation;
- expansion of the areas with the intellectualisation of labor, mostly in sphere of high technologies;
- clustering of industries;
- growing role of individual, motivational, psychological, social and other characteristics of production process participants;
- reduction of labour costs for the production of new products accompanied by the growth of product development costs;
- change in the production profitability structure towards science-intensive and high added-value products.

The most significant challenge is the principle of production customisation in certain technological spheres, such as machine-tool building, aircraft engineering (civil and military), heavy engineering, etc. Production customisation and establishment of closer contacts between the producer and individual customers is part of using modern information and telecommunication technologies. The development of the internet has led to the creation of an enormous number of websites enabling business to business (B2B) and business to customer (B2C) communication. An effective toolkit for direct customer–producer interaction has thus been created. Coupled with extensive development of fundamentally new technologies (virtual engineering, computer visualisation, 3D printing, etc.), this will, in the near future, make the practically *waste-free* production of *customised* industrial goods and their almost *instantaneous delivery* to the customer a reality.

At the same time, production customisation contributes to the transition to *network principles – not only in business but also in the organisation of material production processes*. This allows for quick setup and change in the structure of interactions between manufacturer and its suppliers, as well as with subcontractors and outsourcers in general. Products can thus be quickly tailored to the requirements of a specific customer, and manufacturers can then transition to new products designated for other customers, users, markets, etc. In turn, network organisation contributes to a more extensive customisation of production, so these processes acquire an *avalanche-type character*.

In order to evaluate the parameters of this technological breakthrough, let us use the approach based on the theory of technological modes developed by S. Y. Glazev and D. S. Lvov (both members of the Russian Academy of Sciences).[1] According to research conducted by the Russian Academy of Sciences, the leading economies are now building upon the fifth technological mode and moving towards the sixth, while the Russian economy is basically stuck in the fourth mode with some elements of the fifth.

The fifth and sixth technological modes are characterised by the *practical application of knowledge*. A new concept of the *knowledge-based economy* has even emerged. Scientific knowledge accounts for an increasing share of added value. Hence,

[1] L'vov, D. S. and S. Iu. Glaz'ev. (1986). Teoreticheskie i prikladnye aspekty upravleniia NTP [Theoretical and Applied Aspects of Managing Scientific Progress]. *Ekonomika i matematicheskie metody*. 5.

the wide use of the term "innovation" to mean not simply something new, but novelty created through applied development of scientific knowledge.

We are witnessing the transition to the sixth technological mode, a world of bioengineering, nanotechnology, robotics and novel medical science that will increase, several times over, the life expectancy, quality of life, virtual reality technologies, etc. The outlines of the technologies that will form the basis of the economy of the future are beginning to take shape. According to expert estimates, assuming that the current rates of technical and economic development are maintained, the sixth technological mode will be formed in the 2020s and enter the maturity phase in the 2040s. That said, a new *scientific, technical and technological revolution* will started in 2020–2025, triggered by developments that will synthesise the achievements in the above-mentioned areas (and probably in other areas, too).

Right now, we cannot predict specific social shifts that this technological revolution will lead to, since even the structure of its basic technologies is still rather unclear. However, there is one thing we can positively assert: the sixth technological mode will be based, to an even greater extent than in previous technological modes, on the generation and application of scientific knowledge in production for the purpose of manufacturing highly knowledge-intensive products.

Knowledge-intensive material products constitute the new quality of the key resource and output of the new industrial economy of the 21st century. They exhibit features of both an informational and a "conventional" material product, inheriting the informational component, as well as many of its properties and problems, from the former, and the real, objective utility for the reproduction of both material production itself and human qualities required for it from the latter.

The features of knowledge-intensive products can be defined using the notion of *product (complexity) level*.[1] The general trend in the development of industrial production points to a significant decrease in the use of natural energy sources and

[1] For a definition of this concept, see: Bodrunov, S. D. (2016). *Griadushchee. Novoe industrial'noe obshchestvo: perezagruzka* [The Future. New Industrial State: Reloaded.] Moscow: Kulturnaia revoliutsiia, pp. 13–14.

natural productive forces. What is more, unit consumption of raw materials used in production usually decreases, while the share of knowledge in the product structure surges forward. At the end of the day, it is the knowledge implemented in the product that determines its level, consumer properties and characteristics or its capacity to satisfy people's growing demands.

In the elevation of product complexity, the integration, convergence and the mutual influence of information technology, biotechnology, nanotechnology and cognitive science are particularly important. This phenomenon has been referred to as the *NBIC convergence* (from the first letters of *N* for nano, *B* for bio, *I* for info and *C* for cognitive technologies). The term was introduced in 2002 by Mihail Roco and William Bainbridge, authors of the work that is regarded as the most significant in the field – the report on *Converging Technologies for Improving Human Performance* produced by the World Technology Evaluation Centre (WTEC).[1] The report outlines the specifics of NBIC convergence, its role in the development of the global civilisation and its evolutional and culture-forming significance.

The same report suggests (?) the concept of NBICS convergence which incorporates social sciences.[2] Although this approach gained some traction in both the Western and Russian scholarly discourse,[3] there is so far no evidence to suggest that the social sciences have made a significant contribution to the resolution of issues related to the development and application of convergent technologies. Instead, scholars in the social sciences have focused on social problems arising from new technologies rather than suggest ways of integrating social knowledge into the

[1] See: Roco, M. and W. Bainbridge, eds. (2004). Overview Converging Technologies for Improving Human Performance. In *Converging Technologies for Improving Human Performance: Nanotechnology, Biotechnology, Information Technology and Cognitive Science.* Arlington, p. 1. http://www.wtec.org/ConvergingTechnologies/Report/NBIC_report.pdf

[2] Spohrer, J. (2004). NBICS (Nano-Bio-Info-Cogno-Socio) Convergence to Improve Human Performance: Opportunities and Challenges. In M. Roco, M. and W. Bainbridge, eds. *Converging Technologies for Improving Human Performance: Nanotechnology, Biotechnology, Information Technology and Cognitive Science.* Arlington, p. 102. http://www.wtec.org/ConvergingTechnologies/Report/NBIC_report.pdf

[3] Koval'chuk, M. V. (2011). Konvergentsiia nauk i tekhnologii – proryv v budushchee [Convergence of Science and Technology – Breakthrough into the Future]. *Rossiiskie nanotekhnologii*. 6 (1–2), p. 21. http://www.nrcki.ru/files/pdf/1461850844.pdf; Koval'chuk, M. V., O. S. Naraikin and E. B. Iatsishina. (2011). Konvergentsia nauk i formirovanie novoi noosfery [Convergence of Sciences and Formation of a New Noosphere]. *Rossiiskie nanotekhnologii*. 6 (9–10), pp. 10–13.

development of such technologies. It is likely that the urgency of integrating the new technological wave into a new social context is yet to be perceived not only by the public, but also by scholars in the social sciences.

NBIC convergence was illustrated by a diagrams showing how the latest technologies overlap. The diagrams are underpinned by the analysis of scholarly publications and visualisation method based on cross-references and cluster analysis.[1] Key areas of the latest technologies are placed at edges of the diagrams and intersect. At the intersections, the tools and developments from one area are used to promote a different field. Moreover, scientists sometimes reveal similarity in the objects of study performed in different areas.

In view of the links described above and interdisciplinary nature of modern science, it is possible to expect (in the long term) a merger of NBIC areas into a single scientific and technical area of knowledge.

This area will explore almost all levels of knowledge: from molecular nature of matter (nano) to the nature of life (bio), mind (cogno) and information exchange processes (info).

Thus, characteristic features of NBIC convergence are as follows:

- intensive interaction between the aforementioned scientific and technological areas;
- considerable synergy;
- extensive coverage of explored subject areas– from the atomic level of matter to smart systems;
- identification of prospects for qualitative expansion of technological potential of human individual and social development.[2]

Despite the growing role and significance of non-machine technologies (bioengineering, etc.), the sixth technological mode still does not go beyond the

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[1] Borner, K. et al). *Mapping the Structure and Evolution of Science. Knowledge in Service to Health: LeveragingKnowledge for Modern Science Management*. http://grants.nih.gov/grants/km/oerrm/oer_km_events/borner.pdf

[2] Praid, V. and D. A. Medvedev. (2008). Fenomen NBIC-konvergentsii: Real’nost’ i ozhidaniia [NBIC Convergence Phenomenon: Reality and Expectations]. *Internet publications of the Russian Transhumanistic Movement*. http://transhumanismrussia.ru/content/view/498/110/

framework of industrial production. Attempts at categorising production equipment that works on nonmechanical principles (using acoustic waves – ultrasound and infrasound, electromagnetic fields, radio frequency radiation, plasma, elementary particle fluxes, etc.) as non-machinery equipment[1] are logically flawed. Supporters of this stance claim that non-machine devices (unlike machines with artificial operating elements) use natural processes as their "operating elements." However, the movement of electrons in wires created by an electric power generator is just as "natural" as the mechanical impact of a lathe knife consisting of natural molecules of iron and carbon. Will the lathe cease to be a machine if we replace its manufactured knife with a "natural" diamond?

Convergent (hybrid) technologies, on the contrary, give industrial production a second chance by combining the machine and non-machine principles of interacting with nature to create products that would satisfy human needs at minimum material cost. Technology based on new types of machinery (printers) integrated with information technologies and virtual reality tools (3D printing) opens up a wide range of opportunities. Perhaps this will lead to a sharp increase in the use of additive technologies and a reduction in the share of conventional processing industries. The processing of feed stock using "destructive" or "subtractive" operating technologies (cutting, grinding, filing) is replaced by processes involving the 'additive' assembly of elements into a product (combining or building up, usually layer upon layer, in order to create an object based on a 3D model).

We should keep in mind that there are certain conventional industrial technologies that can be classified as additive: casting, baking of construction materials and powder metallurgy. These technologies are now being integrated with 3D printing technologies. We are now witnessing the creation of 3D printers capable of printing entire buildings and facilities, or at least large blocks of such structures. We are building houses out of elements produced by 3D printers, and recently a Russian-made

[1] Abachiev S.K. Tekhnika mashinnaya I bezmashinnaya: suschnost, istoria, perspektivy [Machine and machinless technic: essence, history, prospects]. *Internet-journal "Naukovedenie"*. No. 3, pp. 8-11. URL: https://cyberleninka.ru/article/n/tehnika-mashinnaya-i-bezmashinnaya-suschnost-istoriya-perspektivy/pdf

3D printer was used in Yaroslavl to build an entire house for the first time ever.[1] A printer produced by the same company was used by Specavia to print an entire office and hotel in Denmark.[2]

Additive technologies embrace a wide range of manufacturing methods (extrusion and jet-powered feed, sheet lamination, photopolymerisation, powder synthesis, direct localised energy release) and materials (plastic, new plastic materials, metals, composites, hybrid materials, materials for metal casting processes, ceramics, materials for testing, etc.).[3]

3D printing technologies are already being combined with the capabilities of biotechnology in order to create 3D-printed human organs for transplantation. So far, only bioprostheses (implants) made of artificial materials to replace human bone and cartilage, as well as hand prostheses, have been used. At present, experiments to grow tissues (liver, kidney, bladder, skin) are only used to test pharmaceuticals; however, it is clear that these are the technologies of the future (see Fig. 2).[4]

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[1] Europe's First 3D-printed residential building was presented in Yarolslavl. (12 November 2017). https://specavia.pro/

[2] The Construction of Europe's First 3D Printed Building Has Begun (12 November 2017). https://3dprinthuset.dk/europes-first-3d-printed-building/

[3] For a review of additive technology capabilities, see: Prosvirnov, A. (11 December 2012). Novaia tekhnologicheskaia revoliutsiia promositsa mimo nas [The New Technological Revolution is Sweeping By]. Agentstvo ProAtom.. http://www.proatom.ru/modules.php?name=News&file=article&sid=4189

[4] Biopechat' organov na 3D printere, kak eto rabotaet? [Bioprinting of Organs on 3D printers, How Does it Work?]. (12 November 2017). https://make-3d.ru/articles/biopechat-organov-na-3d-printere/. See also: articles on 3D Bioprinting Solutions website: Interv'iu Iusefa Khesuani [Interview with Yusef Khesuani] (8 November 2017); Doklady sotrudnikov kompanii na ezhegodnoi konferentsii po biofabrikatsii v Pekine [Reports of Company Employees at the Beijing Annual Biophabrication Conference]. (27 October 2017). http://www.bioprinting.ru/

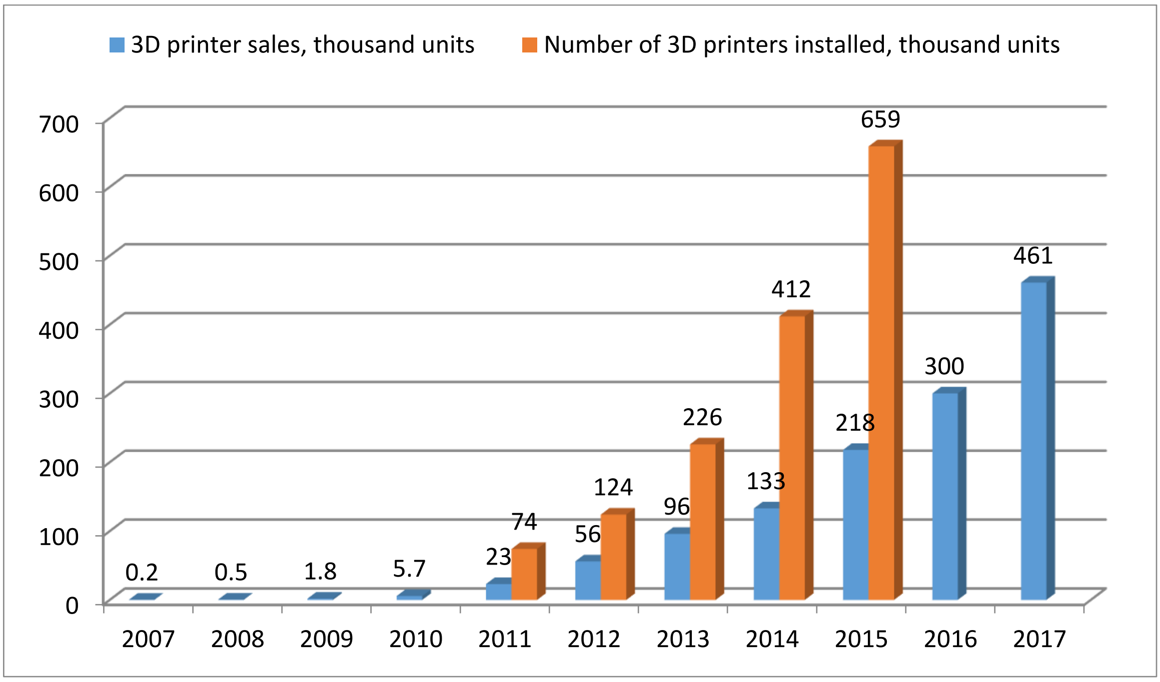


Fig. 2. 3D printer sales and number of installed devices

Sources:

For 2007-2016: Long L. (2018). 3D Printing Is Poised to Continue Outpacing Growth of Traditional Manufacturing May 08, 2018 URL: https://www.engineering.com/AdvancedManufacturing/ArticleID/16873/3D-Printing-Is-Poised-to-Continue-Outpacing-Growth-of-Traditional-Manufacturing.aspx

For 2017: Adams S. (2018). Half million 3d printers sold in 2017 – on track for 100m sold in 2030 // 3D Printing Undustry, April 06th, 2018. URL: https://3dprintingindustry.com/news/half-million-3d-printers-sold-2017-track-100m-sold-2030-131642/

The task of reaching the frontiers of the sixth technological mode and, further still, becoming a technological leader, is obviously extremely difficult.

Even a country like Russia is by no means fit to meet this challenge. The current technological leaders are simply too far ahead. In 2015, for example, in the U.S., the share of productive capacities of the fifth technological mode constituted 60%; 20% related to the fourth technological mode; less than 15% belonged with the third technological mode; and 1% was of the second technological mode. About 5% of production qualified as being in the sixth technological mode.

In terms of technology, the Russian economy is highly diversified. According to the Russian Academy of Sciences, more than 50% of technologies pertain to the fourth technological mode, and 33% are part of the third technological mode. The share of fifth-mode technologies is around 10%, while sixth-mode technologies are still at the embryonic stage. In order to become a *technological leader* within the next 10 years, Russia needs to create advanced production of the sixth, as well as the fifth, technological modes. The jump to the 6th technological mode is possible, but it require some deep changes in the economic system. The economy must be re-oriented on the acceleration of investments into R&D sector and redistribution of financial flows to provide prevailing growth of high-technology industry.

And the output of these modern production facilities should be significant. The country needs more than just a “technological breakthrough”; it also needs to improve all components of modern material production (materials, labour, production and application of knowledge and organisation of production). Only then we can talk about moving towards the new industrial society of the second generation – NIS.2. That is why Russia, whose national economy has been undermined by an unprecedented 30-year period of deindustrialisation following the collapse of the Soviet Union, needs to reindustrialise its economy on a new hi-tech basis, as we have repeatedly argued.[1]

4.3. From Technology Changes to Changes in the System of Material Production

The trend towards an ever-increasing rate of technological change, the acceleration of its acceleration of the pace at which scientific achievements are transferred to industrial production, making for a breathless pace of innovation, defines the development of industrial society at its new stage, NIS.2. . There are many signs indicating that this new stage in the development of industrial production is approaching: in particular, elements of innovative activity, such as the *technology*

[1] Bodrunov, S. D. (2013). *Formirovanie strategii reindustrializatsii Rossii* [Development of Russian Reindustrialisation Strategy]. St. Petersburg: S.Y. Witte Institute for New Industrial Development (INID); Bodrunov, S.D. and V.N. Lopatin. (2014). *Strategiia i politika reindustrializatsii dlia innovatsionnogo razvitiia Rossii* [Reindustrialisation Strategy and Policy for Russia’s Innovative Development]. S.t Petersburg: S.Y. Witte Institute for New Industrial Development (INID); Bodrunov, S.D. (2015). *Formirovanie strategii reindustrializatsii Rossii* [Development of Russia’s Reindustrialisation Strategy]. 2nd ed. St. Petersburg: S.Y. Witte Institute for New Industrial Development (INID); Bodrunov, S. D, ed. (2015). Integratsiia proizvodstva, nauki i obrazovaniia i reindustrializatsiia rossiiskoi ekonomiki [Integration of Production, Science and Education and the Reindustrialisation of the Russian Economy]. *Sbornik materialov Mezhdunarodnogo kongressa “Vozrozhdenie proizvodstva, nauki i obrazovaniia v Rossii: vyzovy i resheniia.”* Moscow: LENAND, etc.

transfer, are already being incorporated into the production process not occasionally or episodically but as an integral part of today's industry.

The growing role of knowledge-intensive technologies and relevant production resources , as well as the need to speed up the pace of their development and improvement, spark changes in the macrostructure of the economy. The classical industrial system, composed of industrial and service production in which the latter supersedes for former, is being replaced by a new industrial economy of the second generation *dominated by a complex of industries that generate knowledge-intensive products*. Such system requires not only the industries where such products are produced, it also requires other sectors that generate knowledge and educate people able to master that knowledge and use it in material production. Thus, the economy of the 21st century should be based on a complex (see Fig. 3) that incorporates the following at micro- and macrolevels:

- *hi-tech material production* that creates knowledge-intensive products;
- *science* that creates the know-how;
- *education and culture* that mould people who possesses the necessary knowledge and can apply it in production.

While material production remains fundamental, the main source of this development of production in the new system is the cognition of the outside world. Cognition has been an inalienable human characteristic ever since we distinguished ourselves from animals and turned into social creatures.

We have repeatedly emphasised that any product which is generated as a result of production activity contains, in addition to its material basis, an intangible element – namely *knowledge*. It is present in all components of the production process – in *materials*, *technologies* (the instruments of production), *the organisation of production* and, finally, in human *labour* involved in the production process. Hence, knowledge, along with the material basis, constitutes an *integral part* of the product.

Macrolevel

Hi-tech material production: knowledge-intensive product

Science: knowledge and know-how

Education and culture: a human who possesses knowledge and is capable of producing innovations

Microlevel: enterprises combining key elements

Hi-tech material production Science Education and culture	Hi-tech material production Science Education and culture	Hi-tech material production Science Education and culture

Fig. 3. Economic complex of the 21st century

By exploring the world, human beings have become cognizant of their wants and ways to satisfy them. And,by expanding our knowledge of the world, we have inevitably increased our awareness of these wants, which, in turn, results in the need to obtain new knowledge about ways to satisfy these wants, and so on. We can also understand this in relation to the idea that God created humankind, but left it with the means to satisfy its wants only partially and as it advanced towards better satisfaction through new knowledge, new wants arose. The contradiction between new wants perceived by a human being and the impossibility of their immediate satisfaction (which would, of course, render humans God-like) drives human activity cognitive towards the (ever-receding) prospect of complete want-satisfaction!.

Therefore, knowledge provides the foundation for perception of the orderliness of the Universe, while a person's awareness of his or her continuously expanding wants and the need to search (acquire knowledge, explore) for ways to satisfy them has become the key, principal driver of human development, people's detachment from the biological world and the progress of civilisation.

Thus, in the course of their development, human beings progress along the path of *becoming aware* of their continuously growing wants and *exploring* ways to satisfy them. The acquired *knowledge*, being potentially unlimited, always reveals both the answer sought and a wider perspective, thus forming new wants. This perspective is limited at each stage of cognition solely by the current ability of the person to cognise it.

This is the essence of human development, including scientific and technical progress and the development of social relations. In the course of accumulating knowledge, human beings have been drifting away from their original natural environment, and the knowledge we have accumulated has served as a tool of this separation. The knowledge made it possible to confront primeval forces of nature by transforming the natural environment to adopt it to the human needs. We have been moving away from self-awareness as a person towards the ever-expanding transformational activity – up to the conscious transformation of ourselves. Developing the possibility to use and transform the natural proprieties of things, the humans can start to implement these possibilities to change its own proprieties: from increase the extraction of knowledge and support the health to the intervention into the human body to improve it.

This explains how we gained knowledge and applied it to production. First, we applied understanding of certain mechanical forces, then we learned about a considerably more knowledge-intensive force of electricity, and now we use information and cognitive resources as a basis for the acquisition of further knowledge. Precise determination of the ratio between the *knowledge* acquired and applied in production by human beings and the *information* used by human beings will play a significant role henceforth, so it may be a good idea to discuss it in more detail.

In terms of cognitive (or perhaps, more precisely, conscious) activity, knowledge plays a cognitive role, on the one hand, and a communicative role, on the other. The latter is in fact what we call information. Information equals knowledge minus gnosis (cognition). Information is a knowledge, which transfers from one person to another. And the transfer is inevitably linked with the loses of information in the process of interpersonal communication. Knowledge is wider than information, but this difference depends on the accuracy of communication and the quality of the means of communication and its level of knowledge intensity. For it is not without reason that Fyodor Tyutchev formulated his well-known maxim in his poem "Silentium": "A thought once uttered is untrue!" That is to say, the vocal means of communicating information are imperfect, according to the poet's insightful idea. And he is right! A thought that encompasses more knowledge than we can convey using our imperfect means of articulation is more extensive than what speech can reproduce. According to some estimates, written messages convey our thoughts with an accuracy of 14%, and even direct verbal interactive communication ensures an accuracy of 60% maximum.[1]

It stands to reason then that information is *knowledge that is being transferred (in the course of communication)*. It is a part of knowledge. Therefore, it can be argued that information is almost pure knowledge corrupted only by the degree of imperfection (distortion) of the information carrier. For instance, a healthy brain has lower distorting capacity compared to our vocal apparatus. Any hindrance in communications, regardless its nature, can distort information. Another example: interference varies depending on the length of radio waves and the environment. Less interference translates into more accurate rendition of information and a less distorted original message.

Knowledge can be applied to anything. If applied in operational processes (in the conventional economic meaning of the term), it signifies technology, or, cumulatively, a technological space. Such space is always expanding with the

[1] Orekhov, V. (2015). *Prognostika: ot proshlogo k budushchemu chelovechestva*. [Prognostics: From the Past to the Future of Humankind.] Zhukovskii: MIM LINK. https://books.google.ru/books?id=ATjBAQAAQBAJ&printsec=frontcover&hl=ru#v=onepage&q&f=false

improvement of the means for transferring knowledge and a decrease in interference in this process. What we call technology is merely conventionally detached part of knowledge. If applied to behavioural norms, knowledge similarly creates another space of human activity – a culture that is likewise expanding with the constant improvements in knowledge acquisition and application. . That is to say, culture, from this perspective, is merely another conventionally detached part of knowledge developed and applied to create the norms of human spirituality and morality. Culture in this sense consists of both behavioural norms (taking the interests of other people into account) and cultural production and activity – for example, works of art or festivals. The common intersection of these two spaces, technology and culture, is the creatosphere, a space of transformation and creation (and, as pre- and early modern conceptions of art understood so clearly, of nearing the Creator!). The parts and the whole of the creatosphere in their own ways serve (through the creation of objects, services, works of art, concepts, ideas, etc.) to satisfy growing human wants.

However, the human being, as a dual creature, consisting of bio and noo is nevertheless integral. The human has a biological body and a necessity to maintain its existence, and human also possessed a brain ("noos" – in Greek) which became a determining factor in human life. This is why a genuine incorporation of production aimed at satisfying material wants and desires and culture which creates and expresses sociality and spirituality is in fact so important. Science and education are integral to this: they are not separate spheres. Science includes in itself the knowledge of nature from which technology originates and which it uses. The part unused by technology we classify as fundamental knowledge. Science also includes knowledge of society and culture, including that of their origins in fields such as philosophy, linguistics and even theology. Here too, there are parts that are directly applied in creating human society and culture and other parts that remain at a distance from them, being more fundamental. Finally, as far as education is concerned, everything is even clearer – it is a "servant of two masters." It teaches unintelligent homo sapiens to be reasonable and savvy (technology) and kind (culture).

Thus, knowledge essentially permeates all spheres of human life. However, since, at this stage of societal development, production determines all other spheres, let us first look at the role of knowledge in the production process.

It is worth noting once again that, throughout the history of social development, a *continuous increase in the relative share of knowledge* both in all production components and in the product itself has taken place on the back of a relative reduction of the "material" part. Nevertheless, as we have already pointed out, it would be wrong to conclude that the *determinant role* of material production is becoming a thing of the past. It would be more appropriate to draw the conclusion that there has been a continuous growth in the knowledge intensity of the *product of material production and, thus, a transition to a radically new type of material production*.

These are the prospects for the future – the NIS.2. The question for us now, however, concerns the immediate prospect: what comes next?

We must ask this question because after all, the "next" is being born now as a challenge to humankind and society.

The emergent new industrial society of the second generation resolves the contradictions of the previous era – albeit not all of them (some most profound contradictions associated with the purpose of human life persist) – and introduces some new ones. They include the technologisation of human life and the human itself. The he possibility of achieving an environmental balance is associated with the risky intrusion of technology into living matter. Hence the need to look into the future from a wider historical perspective in order to search for development paths that combine the rationality of a technical approach with a spiritual wisdom in the setting of goals and objectives. Production should not pursue ever greater consumption or status or mere accumulation of capital. It should be guided by human reason. However, for that, the human mind also needs to evolve and alter its current hierarchy of values. In this sense, Vernadsky's concept of the noosphere turns out to be a far-sighted outlook of this new state of society.

The NIS.2 brings us to the point where human beings are beginning to emancipate themselves from production activity and, for the first time in history, from being preoccupied with the earning of daily bread. Meanwhile, production is losing its economic casing. What distinguishes the noosocial stage is that production also loses its historical importance as the fundamental structuring or determining element of society. It is gradually being squeezed out as humans go beyond the limits of material production.

At the same time, while material production changes qualitatively, it largely preserves its industrial nature technologically and continues to rely on machine production. At the same time, machine production is no longer the "factory system" of the past where employees act as auxiliaries to a system of machines. This 19th century system has indeed survived well into the 21st century. however, the currently emerging Industry 4.0[1] and smart factories that are closely linked with the Internet of Things suggest the prototype of a different machine and industrial production – untended production with no direct human involvement. The fundamental difference of the transition from the old industrial system to the NIS.2 is in the intellectualisation of production and the level of knowledge intensity of production and product.

The new industrial method of production demonstrates such a degree of knowledge intensity that it diminishes the significance of material and human labour costs, thus enabling humans to practically stop applying their own physical force, or even that of natural products such as oil or even uranium, in the course of production. Whereas earlier, humans remained "inside" the production process as its operators or controllers (even as they performed increasingly intellectualised functions, in nooindustrial production they will finally step away from production.

The transition to new technology changes both the nature of production and the entire structure of the economy: employment undergoes drastic alterations, and the structure of human wants evolves markedly in accord with the motivation for human

[1] Concept "Industry 4.0" appeared in Germany in 2011, and it means the introduction of modern IT (big data, artificial intellect, industrial internet of things and robotization based on them) into industrial technologies.(Klitou D., Conrads J., Rasmussen M, Probst L. Pedersen B. (2017). Germany: Industrie 4.0. Digital Transformation Monitor, January 2017, p. 3.).

activity. Such changes are not anticipated at some remote time in the future, in the coming NIS.2; they are transpiring right before our very eyes.

4.4. Transition to Knowledge Intensive Products and Structural Shifts in the Economy[1]

As I have already said, the unfolding new technological revolution is leading us into the New Industrial Society of the Second Generation (NIS.2). This society is going to be dramatically different. First and foremost, the very nature of socioeconomic relations will change. Humans will have radically different, almost infinitely broad possibilities of satisfying their non-simulative wants. Consequently, the importance of the relationship between the social nature of production and the private of appropriation its products, labeled the key contradiction of capitalism by the Marxist classics, will diminish radically. Production will become “separated” from humans, and appropriation of its products will become an act of simple and extremely accessible satisfaction of individual wants without any detriment to other individuals.

This development becomes possible with the unfolding technological progress of industrial production. As technologies of the newest generations develop, humans do not retreat from industrial production but make it a foundation for a controlled and guided natural process.

Information technology makes it possible to integrate control over various industrial technologies (mechanical, physical, chemical, biological, etc.) in order to tackle more complicated tasks and satisfy more diverse wants. But is the modern global economy able to deliver on this possibility?

There are many who claim, based on the global statistics of the last two decades, that the global economy has been continuously slowing down, except for certain regions, such as China, which are developing through the extensification, rather than

[1] Section 3.1 of this chapter is based on revised fragments from Chapter 15 of the book by Bodrunov, S. D. (2016). *The Coming of New Industrial Society: Reloaded*. Moscow and St. Petersburg: S. Y. Witte Institute for New Industrial Development, pp. 260–282.

intensification, of mass industrial production. However, these conventional statistics, while they may paint an accurate picture of the rate of capital accumulation, fail to capture other realities. The situation appears to be the exact opposite in terms of satisfying human wants. As far as satisfying human wants is concerned, humankind may be actually entering its Golden Age right now. A careful analysis of the situation makes it plainly obvious!

Let us consider a consumer value intended to satisfy specific human wants, for instance, a watch. It satisfies the need to know the time. For example, twenty years ago, a watch cost USD 100. Mobile phones appeared around the same time. Suppose that the first phones cost USD 1000. A person who bought such a phone satisfied the need to maintain a mobile connection with others. Thus, a person who satisfied two needs at a time created demand worth USD 1100 (for a watch and a mobile phone). Technological development resulted, however, in technological synergy. Soon, new gadgets combined the two functions: showing time and providing mobile communication; technological development made it possible to manufacture such "integrated" products satisfying two needs at once at a lesser cost. Let us say, the price of such a gadget is now USD 300. So, a person who would like to satisfy the above two needs would create a demand worth USD 300. It means that, in terms of the statistics the global economy operates with, we are witnessing a drop in demand, as it has gone down from USD 1100 to USD 300.

Standard statistical accounting methods tell us that the end result would be a reduction in the GDP (see Figure 4). An objection presents itself: there are significantly more people who would like to satisfy these two needs for USD 300 than there are people who would be able to satisfy them for USD 1100. This is surely right: the number of people who can afford to satisfy the two needs for USD 300 is, indeed, greater than the number of people who can afford the same for USD 1100. Nevertheless, the number of people who want to satisfy these two needs at all is limited because among the people with relatively lower income the share of buyers, who want to purchase the gadget for USD 300, will be less, than among the high-income group, who let themselves to buy gadgets for USD 1100.If the trend progresses, the aggregate demand created by people satisfying their two needs for USD 300 will eventually be less than the aggregate demand created by the number of people who could afford to satisfy the two needs for USD 1100. Consequently, since the number of customers is physically limited, this trend will sooner or later result in a drop in the statistical indicator.

Consequently, we see a critical difference between the "accounting" picture and the reality of satisfying needs. Given the huge amount of combined functions integrated into new knowledge-intensive products satisfying people's escalating needs, what we have now is not a slowdown of economic growth but, on the contrary (in terms of the satisfaction of human wants!), a dramatic expansion of possibilities. We may be said to be imperceptibly entering the era of the NIS.2 characterised particularly by progressively ample satisfaction of people's increasing needs thanks to the progress of technology.

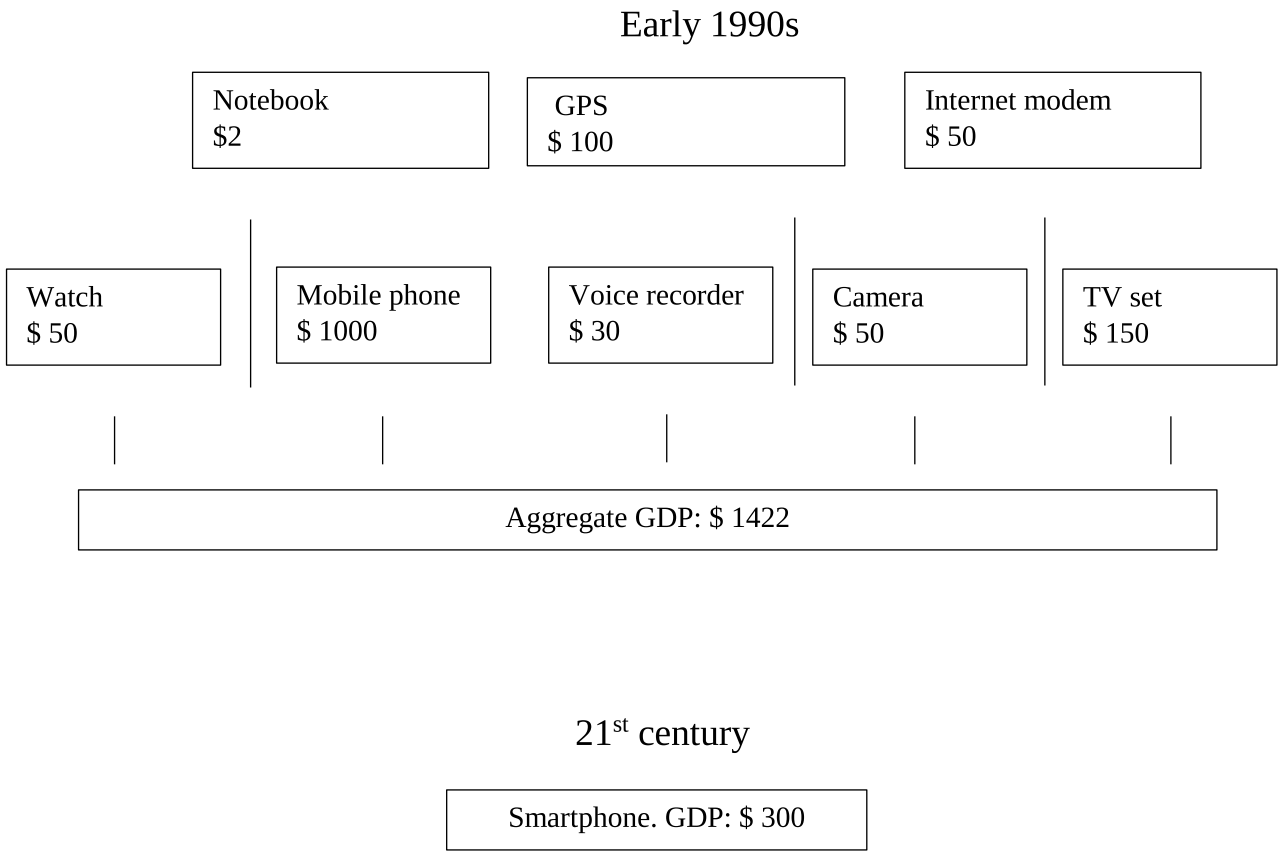


Fig. 4. Synergy of wants satisfaction in a single gadget reduces GDP

The knowledge-intensive product is thus evolving its capacity to satisfy the incessantly expanding range of human needs (the evolution from a watch and a telephone to a smartphone with immense expansion of available functions). Technological progress means that a single knowledge-intensive product of the NIS.2 era can satisfy a multitude of human needs previously satisfied by various/several industrial products. This is a good illustration for the philosophical principle of mutual reflection in the economy: mutual influence of subjects leads to new needs emerging from satisfying old ones. Technologies created to satisfy current wants are, at the same time, opening up the opportunities to satisfy new ones.

The opportunities for considerably more comprehensive satisfaction of human wants are outrunning the growth of the wants themselves. Let us note parenthetically the highly curious issue of not using new products' full potential: how can we utilise new options to prevent them from going to waste?

Meanwhile, since NIS.2 knowledge-intensive products reduce the need for material resources per unit of "old" needs while the share of knowledge in the knowledge-intensive product is preserved/increased, there emerges a platform for keeping the proper balance with the natural environment and overcoming ecological problems.

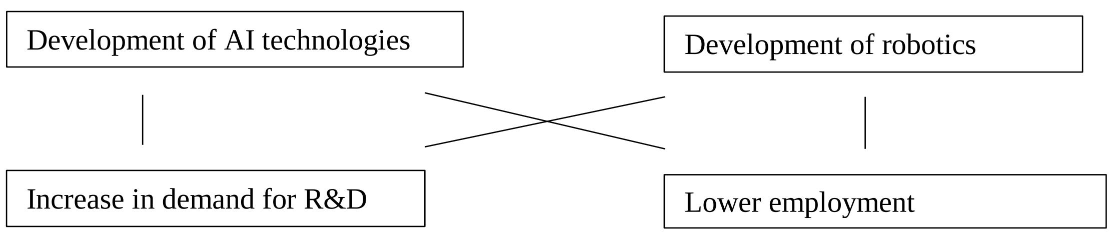
Yet are humans ready for such a turn of events? Clearly, the bare fact that competition over material and other wealth becomes less cutthroat makes it easier to shape the so-called "new historical community of people," to use the once-popular description of the Soviet people. Still, human nature cannot be changed overnight, can it? Is not this the hard truth? It is the truth, but not the entire truth! Humans are developing. An individual can change significantly over time under certain circumstances, in particular, through education. Our principal "educator" is culture in the broadest sense of the word. Moreover, it is culture *together* with material production ("labour," according to the classics) that created the human being, and – together with the new industrial production! – it is going to create the person of the next generation who will be "stationed above production processes, next to actual production" and engaged in predominantly intellectual positive activity.

We could have ended the section on this optimistic note, but we must address another grave concern: the destiny of humans in the new industrial future.

With the intensification of industrial development and sweeping deployment of new technology, a huge number of people are becoming redundant and losing their jobs. A frequent question is: where should they go? A rapid increase in social conflict and tension is predicted, supposedly due to technological progress that is leaving millions of people unemployed. Yet there is not really going to be any social upheaval. The thing is that, as we have already repeatedly emphasised, the transition to the NIS.2 implies the emergence of an important feature: "acceleration of acceleration" and the sweeping acceleration of knowledge content buildup in products in all components of the new type of industrial production (knowledge-intensive production). A vast number of people – labour resources – will be needed to support this process of ever-accelerating "production" of knowledge.

In the 19th – early 20th centuries, many experts feared that the progress of industrial production and the use of industrial technologies in agriculture would result in rural unemployment, putting millions of peasants out of jobs. Yet no such thing happened because the labour released from agricultural work (owing to the industrialisation of agriculture) moved to the industrial sector that was actively developing at that time. The same will happen with the NIS.2: once the labour involved in the technology of the previous industrial cycle is released from the "old" industrial sphere, it will move to the segment of knowledge production which will grow rapidly and continuously in all components of knowledge-intensive production. This sector of the NIS.2 economy will develop fast, "accelerate the acceleration", and it will accommodate most of the human resources released.

Continuously increasing knowledge intensity of material production creates the infinite need for the technological application of new knowledge, and that creates vast opportunities for engaging people squeezed out from conventional industrial production and the service segment during the advance towards the NIS.2 associated with higher labour productivity. At the same time, such a release of workers will not in itself lead to the growth of the postindustrial sector. That will require meeting the demand for human resources of a higher caliber capable of contributing to the knowledge intensity of the new production. In fact, we can discover a field of potentially incessant growth of employment in production, technological application of new knowledge and in the development of industries which service this process (education, a complex that supports a healthy lifestyle, culture, etc.). (See Fig. 5).



Increase in employment in R&D

Release of labour

Fig. 5. Structural shifts in employment ensuing from the development of new technologies

This shift in the structure of employment was predicted by twentieth-century humanists and sci-fi writers in the 1960s, and now we observe the same forecast:

> Surely, the resource and production sectors of the economy will not disappear. In the new society, however, they will become secondary to the creative sector, which will ensure technological development and automation of industrial production. Employment will be considerably reduced in the industrial and traditional service segments, but it will grow in creative economic sectors. Resources will be redistributed from energy-intensive production and manipulative advancement to the development of science, education, healthcare, environmental protection and arts.[1]

In the meantime, we should remember that new technology cuts jobs and reduces employment. Released workers cannot find new jobs automatically, and new jobs are not created in a snap of fingers either. A large number of people may end up homeless if technology progresses way too fast and society fails to employ released labour resources in new areas immediately. So there should be some sort of coordination of actions, a certain state policy to ensure people's adaptation in society. Predictive planning of staff training is required to offer proper career counseling to young people.

[1] Eidman, I'. (15 February 2010). Global'nyi krizis i griadushchaia epokha tvorchestva [The Global Crisis and the Forthcoming Era of Creativity]. *Open Electronic Newspaper Forum.msk.ru*. http://forum-msk.org/material/assembly_articles/2469023.html

Why am I talking about this? Because people will be able to find their place in this new cooperation of production only if there is a state policy that would take into account all these nuances. Otherwise, social self-awareness will become impossible, and emergent social tensions will have to be resolved with different, far less attractive, instruments as has happened all-too-often in the past, with one group expropriating another. This is not the solution, although this is what is actually happening at the moment. It is like social security: some work, others benefit. In principle, however, if we are talking about the general direction in which things are moving, then I see our prospects as becoming more or less normalised, since technological development does not take place by itself, for its own sake, and new technology comes to satisfy our needs. So the need to remove this sort of tension will also call for new solutions, including technological ones, and they will eventually diffuse the tensions. Still, there will be plenty of pitfalls along the way, I reckon, just like in any historical process. There is no such thing as strictly progressive history. We need to take this into account. We need to make the necessary calculations, coordinate our actions, develop a step-by-step approach, etc.

If we introduce, for instance, robotisation, which we are going to do, a large number of people will find themselves out of work, and they will need to be employed in order to prevent tragedies. If we are talking about automation up to the introduction of "unmanned" technology in, for example, chemical production, then chemists will be released: where will these people go? How can we adjust the situation? Where should we look for solutions?

This kind of question is already being raised in the State Duma. On September 25, 2017, the Council for Legislative Support of Digital Economy Development under the Chairman of the Lower Chamber of the Russian Parliament held an extended meeting. Its participants discussed the law on robotics. They were concerned about robot-human relations, the chance of a robot harming a human by its actions or lack thereof and the problem of robotisation leading to the extinction of entire professions and growing unemployment.[1]

The situation requires social innovations that would enable us to remove the aforementioned tensions just as the changes take place: we need to identify sore spots, so to say, and develop appropriate solutions. Relevant research is already being conducted on a global scale and, in fact, it is progressing extremely actively! Such research focuses on unmanned devices (in various fields), smart homes, power grids, telecommunications, development of 3D printing technologies (in mechanical engineering, electronics, construction, medicine, etc.). Today's new basic technologies, many of which have already been "revealed", have enormous development potential; by penetrating other spheres and producing synergy, they will directly and indirectly influence everything around them, right down to the structure and mechanisms of communication between people and to the social structure in general. Notably, this is quite obvious from the National Technological Initiative of the Russian Academy of Sciences.[2]

We will need to ensure more intensive training and large-scale retraining (which is not really an insurmountable task; we have seen examples of such shifts in our own history – in fact, this is what happened in the 1930s, during the industrialisation era). That is why, similarly to the previous era, the "new industrialisation" will require a realignment of the education system. What kind of realignment? Given the fact that, in the current transition to NIS.2, workers are required to continually top up their knowledge in order to be able to carry out their duties, continuous retraining will be

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[1] See: Sokolova, M. (5 October 2017). Roboty nastupaiut na liudei [Robots Advancing on People]. *Parlamentskaia Gazeta*. 28 September – 5 October 2017; Zamakhina, T. (26 September 2017). Robotu nuzhny popravki [Robot Needs Amendmends]. *Rossiiskaia Gazeta*, 216 (7382).

[2] See materials on new technology markets: Skvoznye tekhnologii NTI (Kliuchevye nauchno-tekhnicheskie napravleniia, kotorye okazyvaiut naibolee sushchestvennoe vliianie na razvitie rynkov NTI) [End-to-end STI Technologies (Key scientific and technical areas that influence most significantly the development of markets)]. *National Technological Initiative Portal*. http://nti.one/technology/. See ibid documents on STI technological barriers. See also: Website of the Russian Academy of Sciences. (15 September 2017). Akademik Evgenii Kablov: rossiiskaia nauka – istochnik znanii i tekhnologii dlia shestogo tekhnologicheskogo uklada [Academician Evgenii Kablov: the Russian Science is a Source of Knowledge and Technology for the Sixth Technological Mode]. http: //www.ras.ru/digest/showdnews.aspx?_language=ru&id=057a020d- 2e34-463f-bf00-a954b78d0611

necessary, that is to say, we will need to create a system of education as a *continuous* process, so-called “lifelong education,” according to O. N. Smolin.[1]

Yet the path towards the resolution of this problem does not appear to be smooth and unhampered. The potential need to tackle a massive amount of research necessary for the technological progress stumbles upon the concerns of the financial elite over losing some control over the economy. The need to bribe the scientific elite and concede some profits to it limits the strata of people who are bribed. Financial capital owners are ready to sacrifice opportunities for technological progress in order to confineeconomic power to the narrowest possible circle of technology professionals, while preventing them from becoming a massive and influential social group. This conflict can be overcome only as long as the balance of power between the financial capital and technocracy shifts towards the latter, so that technocracy can mobilise sufficient public resources for its exponential growth.

[1] “We need to abandon the idea of elite education, a separate education system for the rich and the masters, and instead promote the idea of education for all and lifelong education.” (Smolin, O. N. (5 July 2012). *Obrazovanie cherez vsiu zhizn’: problemy zakonodatel’stva i razvitiia prosvetitel’skoi deiatel’nosti* [Lifelong Education: Problems of Legislation and Development of Educational Activity]. Verbatim record of a speech at the 5 July 2012 meeting of the State Duma Committee for Education).

PART 3.

NOOPRODUCTION: NEW TECHNOLOGIES AS A CHALLENGE TO THE HUMANITY AND SOCIETY

The outlook of social production is changing dramatically. New technology brings along unprecedented new opportunities. But the accelerating evolution also engenders new risks. Is humanity going to be able to make a sensible choice? Will it be able to use these opportunities to its advantage and avoid the hidden pitfalls that jeopardise it? And what does the very possibility of such a sensible choice depend upon?

Chapter 5. Global Choice of the New Technological Revolution: Techno or Bio. Or Else?

New technologies offer alluring prospects of improving not only humanity's conditions of life but its very nature, going beyond the limits of transitory human body and the biological reflective apparatus called "brain". However, unless it is able to provide a viable answer to the question, 'what for?', it will jeopardize its very future in an orgy of unequal and destructive consumption.

5.1. New Technologies and Two Scenarios of Public Development

Scientists and the public are both increasingly aware that the new technological mode can both completely reshape the individual and human social life and enable people to realise their potential and that this will likely require a fairly radical restructuring of our social order: "The more we reflect on ways to use the immense benefits of the technological revolution and the more thoughtfully we look into ourselves and the basic social patterns embodied and created by these technologies, the greater is our capability to structure this new revolution in order to make the world better."[1] This is how this idea was formulated by the Chairman of the World Economic Forum in Davos.

So far, however, the need for a radically new social order is an integral part of the applying and developing new technological order has only been hazily registered. With no fundamental research focused on this question, it has been addressed only by superficial amateurish speculations dictated by political or ideological opportunism.Meanwhile, the technological prerequisites for transitioning to the new mode and new level of human wants satisfaction appearing, and with it the very mechanism of the wants formation changing. This, in turn, triggering great social

[1] Schwab, K. (2017). *Chetvertaia promyshlennaia revoliutsiia. Vvedenie* [The Fourth Industrial Revolution. Introduction]. Moscow: Izdatel'stvo E. https://www.litres.ru/klaus-shvab/chetvertayapromyshlennaya-revoluciya-21240265/chitat-onlayn

changes in public relations and institutions and, ultimately, in the social conditions determining the vector of technological development.

As the sixth technological mode moves society towards the new industrial society of the second generation (NIS.2), the problems and contradictions it brings in its train require that we move to the noosocial stage because *the technological forces awakened by humanity can no longer proceed without conscious social control* capable of directing society in productive rather than destructive directions. Before the study of transition from NIS.2 to noosocial stage, it is necessary to understand the conditions for new technological revolution. This revolution, linked with the sixth *technological* mode, based on NBICS convergence, which requires a digitalization as its core point. The problem is that, if the information digital component is applied to an economically and technologically outdated model, the result is bound to be scant. Victor Ivanter, member of the Russian Academy of Sciences and Director of the Institute of National Economy Forecasting, has stated it clearly: "According to our estimates, if the Russian GDP keeps growing within one or two per cent per annum, digitalisation will remain a mere hope. To transition to a digital economy, we need our growth rates to equal the average global ones at the very least; preferably, they should be around five to six per cent."[1] And the level of economic growth, which is necessary to provide digitalization, cannot be attained without deep changes in the model of economic development/

The other aspect of the problem is technological. While applying merely "digitalising" technologies of the fifth or even third and fourth mode will certainly yield benefits, the only way to lead in this technological race is to use infodigital technology as an integrating tool for NBICS convergence.

So, while not neglecting the digitalisation of technologies of the fifth and fourth mode, we mustincorporate the full scope of existing technologies into a single "digital space" for a new level of technological synergy. Yet only a purposeful buildup of sixth-mode technologies using NBICS convergence makes it possible to create an adequate

[1] Ivanter, V. (27 August 2017). Odnoi tsyfry ne khvatilo [One Digit Short of]. *Rossiiskaia Gazeta*. Federal issue 7357 (191). https://rg.ru/2017/08/27/viktor-ivanter-cifrovaia-ekonomika-ne-porozhdaet-bezraboticu.html

technological platform for digitalisation that would ensure the utmost success in reducing the resource intensity of production through increasing its knowledge intensity.

The same is suggested by Kristin Lindow, a Moody's analyst. According to her, prior to the global financial crisis, the digital revolution was regarded as one of the main factors capable of increasing labour productivity. After it, however, "these views were largely revised, as other concurrent changes in the area of technology also had to be included on the list of such factors."[1]

Is it possible to initiate these changes now? If yes, in what sorts of economies?

In answering these questions, we must begin with the acknowledgement that changes in technologies and economic relations also require a new type of human activity and a new type of human.

Humanity has to make one of the most important choices in its history:

- turn towards *homo sapiens*,
- or head to a dead-end – a technetronic society[2] where elites satisfy their ever increasing and essentially simulative demands, while most people are employed in the service segment, which is getting increasingly subservient – with potential loss of control over technosphere development.

We face this choice because the advanced development of the technosphere has run ahead of the lagging development of society's ability to use technological achievements to fulful sustainable non-simulative demands of individuals and the society. Figuratively speaking, the public mind currently resembles a monkey playing with a hand-grenade. Humanity's extremely high level of technological development can potentially cause irreparable damage to civilisation, unless there is an appropriate "balance" in the public consciousness that could prevent this from happening.

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[1] *TASS Russian Information Agency*. (26 October 2017). Tsifrovizatsiia rossiiskoi ekonomiki ne obespechit ee rost – analitik Moody's [Digitalization of Russian Economy Won't Ensure its Growth, a Moody's Analyst Argues.]. Portal finanz.ru. http://www.finanz.ru/novosti/aktsii/cifrovizaciya-rossiyskoy-ekonomiki-ne-obespechit-ee-rost-analitik-Moodys-1005725983

[2] "Technetronic society (techno-electronic) society – this is a totally mechanized of society, which dedicates all of its efforts and resources towards material production and consumption, directed by computers, transmitting its messages via electronic media <…> a society in which man becomes but a cog in the great machine" (Cohen A. (1990). Love and Hope: Fromm and Education. New York: Gordon&Breach. P. 47).

We face, therefore, a crisis. A multitude of negative trends have accumulated thanks to the development of the technosphere. The human habitat in its biological sense is endangered, while the problems of human interaction with the technosphere and increasing dependence of humans on the technical and information environment are also mounting, resulting in some sort of "cyborgisation" of humans (even without physical alteration of the human body, which should not be long now). *Humans are facing increasing insecurity of their existence* as both biological and social beings.

We stand at a stage of our civilisational development where accelerating growth of man-made "technetic species" (in strict compliance with the law of the "acceleration of acceleration" for innovations) is rapidly reducing biodiversity in good part because of rising simulative human demands requiring more and more natural resources to satisfy them. (See Fig. 6).

Immensely growing and essentially simulative demands
Potential loss of control over technosphere development as a consequence of focusing on satisfying artificially exaggerated demands
Extremely high level of technological development that might potentially cause irreparable damage to civilisation
Increasing dependence of humanity on the technical and information environment
Accelerating growth of man-made "technetic species" to the detriment of rapidly destroyed biodiversity
Growing technological burden on the habitat

Advanced development of the technosphere with lagging development of the part of the public mind that is in charge of rational use of technological achievements

Weak controls over sensible behaviour determined by the cultural content and development level

Fig. 6. Factors in the crisis scenario of civilisational development

The society that can realise technological potential in productive rather than destructive ways will firmly move itsfocus from conventional (material and tangible) resources to the basic NIS.2 resource – knowledge implemented in technology. In epistemological terms, we need to shift our priorities and our very aims.

There are two possible scenarios here: technocratic and noosocial.

The first is "technocratic." We have been moving steadily in this direction with no end in sight. This scenario is based on the current dominant paradigm of economic development which implies *quantitative* rather than *qualitative* progress. It is basically a savage process: "we want more and more – we will gorge it all without sharing."

If we do not renounce this path that is now steadily followed by the whole world, if we keep "promoting" – as convergent society supporters reckoned[1] – the best features of the glorious "-isms," we will end up with resource wars and we will arrive to the battlefield fully armed with the newest technology.

These concerns have already been voiced by many experts:

Humanity is facing a dilemma: if we keep moving linearly as we are now, we will exhaust all resources in the foreseeable future and essentially limit our options to inevitable return to primitive society with nothing but cattle breeding,

[1] "This type will be intermediary between the Capitalist and the Communist orders and the ways of life. It is going to incorporate most of the positive values and to be free from serious defects of each types" (Sorokin P.A. (1960). Mutual Convergence of the United States and the U.S.S.R. to the Mixed Sociocultural type. International Journal of Comparative Sociology. Volume 1. Issue 2 (Jan 1960). P. 143).

crop farming, wood fires, boats and bicycles. This is somewhat grotesque, and it might not happen in ten years but, perhaps, will come to pass in 30–50 years. Yet the inevitability of such a future is obvious. Even so, there is another path, and the gist of it is that, technologically, we should remain part of nature and live off conceptually new, inexhaustible resources and technologies created in the likeness of living nature, but using the most advanced technological achievements. Humanity has now approached this moment.[1]

The advance of the sixth-generation technologies is inevitably leading to a trilemma: survive through changing the technological, social and economic system, have the system change us, or change together. I suppose all the trends will be in effect. The question is which one will prevail. Is it going to be humans themselves with their principles of communication and self-development? It became possible, if humans will be able to farmed out the most part of production of material living conditions to technical creatures (sprouting from the forthcoming Industry 4.0, artificial intelligence systems, etc.).

In this scenario, humans will no longer deal with demands that can be satisfied by technological means; they will engage in defining technical specifications and goal setting. Goal-setting in production is, however, directly dependent on society’s dominant values. Hence, the values themselves need to be changed appropriately. Given such a well-developed technosphere, which is, to boot, relatively autonomous from humans, the cost of mistakes in formulating the goals will be very high. If the goals of such production are based on our inherited system of values, acute conflicts within the society and between society and nature are inevitable.

The probability of this kind of conflict stems from the very progress of technology. For instance, information and communication technologies (ICT) and artificial intelligence technologies (AI) open up new opportunities for interaction

[1] Koval'chuk, M. V. (2011). Konvergentsiia nauk i tekhnologii – proryv v budushchee [Science and Technology Convergence – Breakthrough into the Future]. *Rossiiskie nanotekhnologii.* 6, 1–2. p. 14.

between people. A considerable share of communication between people has already moved to the virtual space where the interacting parties are not people but their virtual imprints or virtual clones (avatars, profiles, accounts...) that often differ radically from their prototypes. Considering that AI is able to develop its own language, we can now imagine a space filled with virtual clones linked by an autonomous communication system.

Is this good or bad?

Ethical evaluation is, in this case, extremely relevant, since we are talking specifically about ethical problems of the world where people will be able to dedicate themselves to solving creative informational and cognitive problems and relegate all routine and secondary functions to virtual identities. Equipped with AI systems, such virtual identities will be able to take upon themselves, for instance, the accumulation, processing and sorting of data flow. Self-learning artificial intelligence can absorb new knowledge and even apply it to new objects. Yet AI is unable to discover new, previously unknown knowledge. So, for the time being, we as a species should not be worried about AI competing with us in terms of the discovery of knowledge (unlike some existing human occupations where AI is definitely a competitor).

Even so, we should not forget about the problem: who will use this virtual world, how and for what purposes? How will the rules of the game for this world be set? What will the objectives of communication in the virtual space be? Otherwise, we may well end up in a virtual horror similar to those depicted by dystopian science fiction writers.

But let us put aside dystopias and consider the second scenario – noosocial – looking into the phenomenon of noosphere.

The majority of economists are most likely to consider it some sort of utopia. However, my colleagues and I, who have dedicated many years to proving the need for reindustrialization, argue that it is time for scientists to look to the near, if not distant, future, that is to say, to the day when the problems of reindustrialisation are already solved or, at least, are actively being solved.

This is both necessary and possible, as specialists in the natural sciences proceed from Vernadsky's ideas about the noosphere and declare rather confidently: "The development of NBICS technologies might trigger a new stage of human evolution – the stage of purposeful conscious evolution."[1]

In its rational form, the concept of noosphere can hardly be contested at all. Vernadsky's key point is that, starting from the 20th century, humanity was becoming a leading geological force and has been responsible for the reproduction of the Earth's biosphere. This tenet has been repeatedly confirmed by both positive and negative historical practice. Technogenesis[2] (creating a technosphere and filling it with technosubstance and technetic beings) is already competing with biogenesis and the biosphere in terms of substance mass involved and energy expenditures.[3] The technosphere has turned into a colossal force that is already largely independent of conscious human/social control. Recognizing this entails the responsibility of brining this force back under social control prevent its spontaneous destructive influence. This responsibility may be accepted by social actors or it may be neglected by anirresponsible humanity.

Let us imagine that, at some point, the quantitative movement in the direction of our present development crosses a qualitative line, an explosion happens – and a new civilisation is born... What will it be like? I can repeat, that our civilisation can develop in two ways: as a technotronic civilisation, or as "noocivilisation."

The mechanism for pursuing the first option is simple: we stay on the current predatory course, develop the current economy ("iconomy," as I would call it, since it involves worshipping our current economic views as icons), and create new simulative

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[1] Baksanskii, O. E. (2014). Konvergentsiia: metodologiia meganauki [Convergence: Methodology of Megascience]. *Filosofiia i kul'tura.* 4 (76). p. 509. DOI: 10.7256/1999-2793.2014.4.10390

[2] The term "technogenesis" was introduced by Academician Fersman. See: Fersman, A. E. (1934). *Geokhimiia* [Geochemistry]. Vol. 2. Leningrad, p. 27. See also: Balandin, R. K. (1978). *Geologicheskaia deiatel'nost' chelovechestva. Tekhnogenez* [Geological Activity of Humanity. Technogenesis]. Minsk: Vysshaia shkola. For definition of technogenesis, see: Kudrin, B. I. (2003). Tekhnogenez [Technogenesis]. *Globalistika: entsiklopediia* [Globalistics: Encyclopaedia]. Moscow: OAO Izdatel'stvo Raduga, p. 998.

[3] For more data on technogenic pressure on the biosphere, see: Karlovich, I. A. (2004). *Zakonomernosti razvitiia tekhnogeneza v structure geograficheskoi obolochki i ego geoekologicheskie posledstviia* [Regularities in Technogenesis Development in the Structure of Geographical Shell and Its Geological Consequences]. Specialisation 25.00.36 – Geoecology. Synopsis of thesis for the degree of Doctor of Science in Geography. Vladimir. dlib.rsl.ru/loader/view/01002799505?get=pdf

demands for new products (technetic, technogenetic species). We would thus follow the path of technological genetics, and subsequently those technogenetic species will themselves create a new environment. We may recall that geologists say that humans have already dug up more minerals in the past 500 years than nature created in hundreds of millions of years. That is why they speak of the new geological era they term the "Anthropocene." Yet geologists look at it from the outside, while my approach is to look at it from within and ask what the "Anthropocene" stems from. It stems from our unwise or smartly unwise use of technology.

We believe that we make smart things. In reality, if we stick to this path, we are preparing for a civilization of Morlocks, like in H. G. Wells's *Time Machine*, or, say, people with wheels for legs. This is a metaphor, of course, for the monstrous future I see along this course.

The noosphere scenario, by contrast, will have intellectual people, and the technotronic option will have cyborg people, or, rather, not even people as we understand them now. They will be sentient beings, but they will not be human. And they might have a different, more rational development logic that people might not even fit into. What might happen next, and what should be done?

5.2. Prerequisites for Transitioning to the Noosphere Scenario

Is there an alternative to this scenario?

Certainly, there is. What makes it possible?

The answer is predictable for this book – it is knowledge! It has always provided answers to pressing challenges and demands. Human beings will, sooner or later (better sooner than later!), realise which way is preferable for them. A need for such realisation will emerge (as it already has!), and solutions will be found accordingly. That is when the problem of the radically, critically important role of *culture* (in the broadest sense of the word) in humans' realization of their non-simulative, genuine, non-delusional or non-simulative demands will rise to prominence.

The choice is not *between* the progress of technology and culture: The development of both is so inter-related that one cannot be separated from the other. Up to a certain moment, the technological growth of human civilisation was clearly in conflict with the growth of human culture. Today, however, both the brewing crisis of the human civilisation and the impending technological revolution force us to take a different look at the correlation between technological progress and culture.

Modern technological development simultaneously requires and creates a potential possibility towards the formation of material basis for such development of culture as matchs the humanistic, sensible measurement of technological progress. The latest technologies, if they combined with the appropriate shifts in social system, can lead to relevant changes in human knowledge and mind, while shifts in culture are becoming its indispensable products.

Human beings are biological creatures who produce to satisfy their demands and develop their knowledge in the process.[1] Once, human survival involved competition for resources. However, the process of knowledge accumulation and its increasingly important role have resulted in knowledge becoming our critical resource. In the course of this process, people were formed as *spiritual* creatures, perceived themselves as *persons*, as *selves*, and thus eventually *came out of* nature entirely, leaving it behind, in a sense.

This development of the human being has led to a gradual *rise in spiritual/cultral demands*, increasing the role of such demands compared to those of humans as material, biological creatures. Meanwhile, the transition to the NIS.2 already relies on prioritising cultural and spiritual demands in shaping the entire complex of human demands in general; it reinforces the integrity of a human being as a creature both material and spiritual.

The "noo-option" implies a certain, rather perceptible distinction between the notions of "reason" and "sense," if only in terms of accounting for the humanistic

[1] Bodrunov, S. D. (2016). Novoe industrial'noe obshchestvo. Proizvodstvo. Ekonomika. Instituty [New Industrial Society. Production. Economy. Institutes]. *Forsait "Rossiia": novoe proizvodstvo dlia novoi ekonomiki* [Foresight Russia: New Production of the New Economy]. 1. Digest of plenary presentations of the St. Petersburg International Economic Forum 2016. Moscow: Kul'turnaia revoliutsiia, p. 19.

(*homo and homo sapiens*) component of today's civilisation. How do we implement the noospheric/noo-anthropogenic scenario, or the noo-scenario? The option that implies priority development of the noosphere, i.e., according to Vernadsky, the habitat of noo-beings? The mechanism does, indeed, include enhanced development of technology, but it must be coupled with enhanced development of a humane attitude so that people do not use the "hammer" of technology to destroy nature and their very essence – their civilisation.

A hammer is intended specifically to drive in nails and nothing else. Not to beat somebody on the head. We need to understand this -- and our institutions should develop towards increasingly constraining the use of this "technology hammer' for unintended purposes. This is what the development of the so-called "human capital" and generally all efforts in this area should focus on now; that, to a certain extent, implies a return to what we used to talk about in Soviet times – the formation of a new human. Only now it is no longer a figure of speech or a speculative fantasy. It is a pressing demand that humanity as a whole needs to satisfy. And history has proven incontrovertibly that, sooner or later, humans will be able to use knowledge to satisfy any need. The use of knowledge to satisfy needs is technology. However, technology can be an enemy, too, particularly once we embark on the technocratic scenario. That is why we need the Noosphere option.

Technology changed the means of digesting knowledge, developing self-awareness, shaping tools that enable a person to feel satisfied (without satisfying simulative demands), feel happy, and form different new demands: demands that are not puffed up by "economic rationality," but intended to shape intellectual and cultural components. It is important to understand that the science that creates technology, on the one hand, and culture, on the other, are one and the same thing seen from different angles. One allows humans to cognise themselves as individuals while the other renders them capable of self-cognition. The two of them combined should be developed through technology designed to form a noo-mind, i.e. noo-technology. If we follow this path, it is no longer about knowledge intensity, but about the next stage of noo-intensive technology and noo-intensive production.

Knowledge as such is neutral; it contains neither good nor evil, neither rationality nor irrationality; only when applied by a human being can it lead either to progress or to regress, be “smart,” not so wise or absolutely unwise. In my view, the noosphere is a realm of rational activity. It includes rational production that allows for the irrelevant, false and delusive to be screened out; the noosphere stipulates the application of knowledge that self-regulates through reason. However, this kind of noosphere needs to be formed through both technical knowledge and culture. Technological knowledge and cultural knowledge combined form the *noo* element of the new order.

Accordingly, rational nooproduction constitutes the next development stage of knowledge-intensive production. Indeed, knowledge-intensive production should evolve into noo-intensive production through integration with culture or merger with culture in a broad sense of the phenomenon, along with personal development and education.

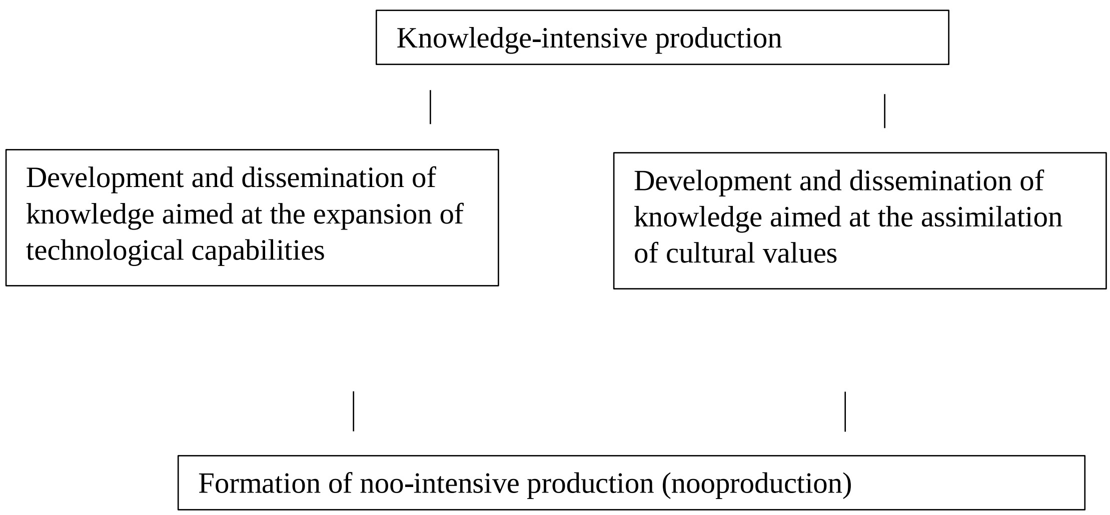

Fig. 7. Evolution of knowledge-intensive production into nooproduction

Nooproduction (or noo-intensive production) *is production based, first, on removing humans from the immediate production process through extreme buildup of* *its knowledge intensity and, second, on bringing this production under the control of human reason underpinned by an appropriate level of human culture.*

The root cause of conflicts in our civilisation is the competition that stems from the predatory "animal" nature of humans as biological creatures. A biological creature is programmed by nature to consume something, including their own kind, in order to survive. We can get away from such crassly instrumental knowledge – for instance, learn to get protein without breeding cows. In time, we will stop killing each other. Wolves and sheep, we can all live in peace, and this is very easy to attain, as long as we understand that peaceful coexistence should be the cornerstone of technological development. Instead of developing the technology of rearing and slaughtering cattle for meat, we can create technology to get protein and everything we now get from meat by acquiring and applying specifically "non-slaughtering" knowledge. This is how the conflict will lose ground, and a different facet of human nature will come to the fore: the key point is that *humans are in any case creators* and inventors and gain self-esteem. The noopath of civilisational development involves developing his side of human existence.

This is a growing demand in our society and, as it always happens when a demand emerges, humans can satisfy it by developing technologies – but only those that are not aimed exclusively at technotronic processing of natural material and the annihilation of the environment for the sake of demands that merely simulate satisfaction of real human needs and aspirations. Here are some cold hard facts: the mass of the so-called "technosphere" compared to the preindustrial era, when it did not exceed few hundredths of a gram per one square metre of land, has grown to 50 kg/m^2 of land, which is 100,000 times more than the biomass of all humankind.[1]

Here are some more figures: over the past 500 years, humans have exterminated far more living species than nature has ever had. Extinction is progressing at a dreadful

[1] Zalasiewicz J., Williams M., at al. (2017). Scale and diversity of the physical technosphere: A geological perspective. The Anthropocene Review. Volume 4, issue 1, page 19.

and increasing pace. The technosphere is expanding, claiming more and more space and destroying the habitat of other species, for example, biological creatures. Environmental consequences stemming from the disposal of technosphere-generated waste are also significant and lead to the shrinking of biome habitat – for instance, the area of garbage patches already exceeds 11 million km^2, while the mass of plastic contained therein is six times greater than that of plankton in all the world's oceans and seas.[1] According to V. Polevanov, a member of the Russian Academy of Sciences and former Deputy Prime Minister of Russia, "starting from the 1980s, human demands have exceeded the capabilities of the planet. We are living on credit. We have already gone about 20 per cent beyond the limits of this planet's bearing capacity. The planet has lost its self-restoring function."[2]

5.3. *New Technologies, New Wants and Environmental Safety*

If the concept of 'noonomy' is seen as a general comprehensive idea, when it comes to the environmental factor, it is one of those *prima facie* 'secondary' lines that prove all aspects of the noonomy's basic idea. And this line is running a chance of turning into a primary one. Why? Because the very idea of a transition to noonomy implies improvement of our vision of how we are supposed to live so that we may preserve the world where we need to exist as biosocial creatures.. In a way, this space is what Vernadsky once called a noosphere, though I would rather put a different meaning into it.

There is the nature that, with its interconnected causes and consequences, had led to the creation of the self-conscious Homo cogitans. Such a human comprises and produces cogitative and knowledge spheres out of nature. So each chain link in it is important..

[1] Sycheva, L. (20 December 2017). Postroim goroda na Marse? Ekspert – o vazhnosti osvoeniia kosmosa [Shall We Build Cities on Mars? Expert Opinion on the Importance of Outer Space Exploration]. *AiF*, 51. http://www.aif.ru/society/science/vladimir_polevanov_osvoenie_kosmosa_zhiznenno_neobhodimo_chelovechestvu

[2] Sycheva, L. (11 December 2017). Vladimir Polevanov: My vstupili v epokhu velikikh kosmicheskikh otkrytii [Vladimir Polevanov: We Have Entered the Era of Great Cosmic Discoveries]. Blog. http://zavtra.ru/blogs/vladimir_polevanov_mi_vstupili_v_epohu_velikih_kosmicheskih_otkritij

Unreasoned destruction of the chain can lead to a global disaster. Take the ongoing extinction of insects: Bees are going extinct. Small insects have disappeared in many regions. The rate of insect extinction is unprecedented in geologic time and accelerating. Just like dinosaurs and mamoths before them, insects insects are going extinct. This will change nature radically. They formed part of food chains that fed worms and birds, and birds in their turn serve as sustenance for other creatures. Moreover, no insects – no pollination, basic nutrition for herbivores disappears first, then that for predators... In other words, these things can change the world considerably sooner or later, and it is verging on the changes in a biogeocenosis already.

While previous extinctions may have been caused by external forces, current ones are indirectly or even directly caused by our interference in nature, and the activity of our minds (or rather our mindlessness!). So what Vernadsky said about a human becoming a geological force is true. It is also true that while transforming nature a human transforms it in accordance with Comrade Michurin's precept: 'we cannot wait for blessings from nature; it is our objective to take them from it.' So, as we scoop these blessings with cupped hands we destroy many more.

Moreover, it's not about human needs alone. Recall that there is a critical detail of the concept of 'noonomy' – it involves only non-simulative needs satisfaction. The implication is that if the simulative component of our needs goes on growing we risk the destruction of the planet. . Hence the fundamental idea of noonomy that we need to raise the common level of knowledge and culture. It is required to make people recognise a need to break the pattern, to back off from simulative needs and develop the nooprinciple as the only sensible alternative.

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Perhaps, under noonomy, we will move beyond this to live in a more virtual than 'real' reality with spun-off nooproduction while still having a material base. Technological progress will let us do it, but we should brace our social knowledge, our understanding of social structure, and restructure society based on this knowledge just like we rearrange production functions. Just like we reconstruct other functions, we need to reconstruct social functions, functions of state management, functions of saving for a reasonable level of investsment and control over it, functions of management and administration, functions of 'administration' for our lives in all their spheres. That is what should be a universal idea, and the idea of noonomy, the idea of a transition to a new management type.

In noonomy, resources are to be used rationally, considering possibilities of their renewal as well, etc. And virtualisation of a human life seems to enable more rational resource consumption as well. There is a thing about virtuality. Today a blouse is mostly not a piece of clothing to shield from cold, but a matter of prestige, image and other simulations. What for? To produce what? To produce the right, impression. Let me explain.

Recently I visited the Orsay Museum in Paris. I decided to renew my knowledge about impressionists and neo-impressionists. There was a new exhibition. . Van Gogh. Renoir. And there was Kandinsky. Great, everything was great, interesting; I refreshed my memory and greatly enjoyed. The paintings made it seem as if I actually spent time outdoors. It was clear though why the movement was called 'impressionism', because of the 'impression' impressionists managed to create. Looking at their paintings was like watching nature through an open window. When I seen my fill, I passed through the fifth floor and did not want to look at anything else. No decorative arts, nothing. I left the museum, took a taxi, came to the hotel and about an hour and a half stayed under the impression as if I had spent time in the wild. You see despite all artists were so different, they managed to create a powerful impression, particularly paintings of views – a countryside, nature, something else.. These are the different artists, but they managed the same – to make a powerful impression on the audience anyway.

So, the impression they created replaced visiting a meadow or a field or something else for me. The impression was complete: it seemed I could smell grass, and hear the whisper of bushes and trees. It is not a fantasy; it sort of became real. Now, consider this: if technological progress allows us to create such, or even more, powerful impressions in the near future there may no longer by any need to spend much time for traveling, and second, we can get new knowledge, new cognition, and new impressions through technological devices. And not only in this area.

Moreover, these devices allow us to have a simultaneous exchange of our impressions and knowledge with other people. People were walking and exchanging opinions in the museum; there were so many people, and most of them wanted to learn something, to understand something. There was a need for it. And it is still growing. Look at queue to these museums. I have spent 25 years travelling across Europe, and as far as I can see these queue do not become smaller. It would seem people have to be sated already, but they are not. New generations come to the world, and they want to learn, to feel, to be impressed, etc. And there are more and more of them. Museums also are changing, gradually turning into virtual spaces.

There are two moments: on the one hand, technological progress allows to achieve it – to get a greater impression without travelling; on the other hand, we can get these impressions as a new need of a human being. You see, this new need is not about a certain art, it is a human's need for self-perception, while technologies allow doing it from two sides. We can travel without spending extra money or time, but virtually exchanging at the same time just like we write posts in the internet now. We exchange in the Facebook or somewhere else. The further interchange will get faster and easier. It will be easier to find associates with the same interests, e.g. when gathering and finding out who is fond of impressionism. At once we have a cluster formed to see and to discuss. Look at this, at that, at that!.. These opportunities are much greater than if we simply visited the exhibition to have a look. Therefore, it means growing cognition, growing opportunities. On the other hand, technologies enable people to raise their cultural level by building up both opportunities and human's needs.

By the way, I also visited a Galeries Lafayette store, and I can say that there were much less people per relative area unit, though the store was huge. I cannot say that needs to be met in such stores are obviously reduced on the surface. As to composition of people who go shopping to Galeries Lafayette, you will find out that there are more people from Asia now, those who come from countries with lower standards of living where values presented by Galeries Lafayette goods and products are still considered important. Let us take China. The newly-emerging middle class of the country is presented by people whose countries have just recently come to a higher level, so a wealthier part of population can afford coming to Paris to buy something. Some people stuff huge bags with unnecessary, absolutely unnecessary things, in my opinion. They buy so much, packing large trunks with things, I wonder why? These clothes are for personal use, one will never be able to wear this much. Let us say, people are still not sated.

But there are far less Europeans in such stores now, why? These countries have already come to a certain level of technological development that allows easily satisfying needs that lie somewhere in the lower part of the Maslow's hierarchy and even some simulative needs. There are better chances to satisfy needs through technologies that currently allow customising demands and tailoring clothes of a certain time, for example, and so on and so forth. It is obvious when searching more closely.

Look at average Europeans – what do they wear? They wear casual clothes; they do not even wear suits like me, it is generally old-fashioned already. They wear looser clothes. Jeans, some sweater to wear comfortably without any worries. Sometimes it is almost absurd – it seems to me practically gaudiness. But people feel comfortable and easy. What does it mean? Right, people have money to buy some brand products - not one item even, but greater part of all; nevertheless, they do not buy, they already have enough of these things and do not pay any attention to these. There are such categories of people already, it is typical for general public aged over 20-25. So, perhaps the need of large population for such simulative luxuriance is actually reduced at average.

It is an upcoming trend in any case, if not an established one. And I think, there is one more reason. Today there are things outside that could have drawn interest and been stolen had it been a few years ago. All kinds of scooters are staying in the streets and teashops leave chairs and umbrellas outside for the night, and so on. Everything is in the streets, but nobody takes it. Because these things do not seem as precious as they used to 15 or 10 years ago. Everybody who needs them has them already, there is enough of this stuff. My sense is that it is affecting the shop infrastructure: look at stores, note how their structure has changed. If you remember, there used to be cash desks, an obligatory barrier, a receipt, and control. Now, once I entered some huge store (I do not even remember its name) where books, notes, discs, children's books and things like that were sold. I was driven by simple interest, wanted to have a look at old books. I felt curious and had time. Somewhere deep inside, practically in the basement, there was sitting the only person – a woman who owned the shop. She was printing something, checking her receipts, while dozens of people – about a hundred actually – were walking across floors, in the basement, somewhere else selecting books. There was a great display in the street as well – books, discs, everything. Then everyone who wanted to buy something went to find her, paid and left. You see, people do not have the mania of grasping and running away any more. Of course, this applies only to those segments of the population who have achieved relative material well-being. And the presence of such a layer leads to a change in the trading system. Why? Because there are many books, they are different; they satisfy human needs in what they are looking for. And there are people with enough purchasing power to buy books. So they know that if there is no such book they can order another one via internet. Eventually, there is no more deficiency, as it used to be, since it was deficiency that pushed people to hunt for anything of value knowing that such things can be resold, because things were not easy to be bought (especially for poors), to be acquired, to be found. It resulted in heating antihuman desires – to snatch, to steal, etc. There is your progress which is capable of feeding and, so to speak, of 're-educating' a human at the same time.

The process is automatic. People no longer need things like that. They say: 'I don't need this, I don't need that, but I need something else and I can pay for it'. People change, they start respecting themselves, feeling 'more of a human being' which is important.

Another aspect of the transformation of human needs with the technological development is smart production in the context of environmental problems. What do we mean by smart production? We mean the kind of production that satisfies human needs by replacing more and more human functions. First hands were replaced, then control levers, then – brains, with some computing operations and step by step a human will be above the immediate production. The smarter operations the people reserve for themselves, the ‘more of a human being’ they become.

The product also becomes more intelligent and smarter. The growth of the value of intelligence affects not only the product, but also the attitude of a person to their needs. People strive to meet their needs in the most reasonable way, being aware of environmental restrictions, among other things. Therefore, the technologies used are becoming more intelligent, including from an environmental point of view. .

Humans also produce more sophisticated products to satisfy higher order needs. The simplest needs can be met by using hands, and, well, teeth.. As humans seek to satisfy higher order needs, they produce something more and more intelligent, more intelligence-imbued, knowledge-intense and knowledge-imbued.Moreover, production has other components as well – organisation of production, labour, materials and technologies. All these components also become more intelligent and smarter.

Inevitably, as humans think about how to satisfy needs, they also think about how to satisfy them. to do so in a human way. Humans want to live like humans, a beautiful society, in an attractive home, in environmentally pristine or simply clean space.. So the technologies that satisfy our needs also get smarter ‘in a certain way’, for instance they will be environmentally smarter. . At the same time, any human uplift has a certain direction – an industrial one. This trend is changing. Until recently, it was to satisfy human needs by making as much money as possible. Now however, more and more people realise that money is not the priority – it can be much more important to conserve the Volga River, for instance. This new trend also points in he direction of smarter technologies.

5.4. Globalisation, Financial Capital and Environmental Threats

The above-mentioned tendency to realize the importance of a harmonious relationship with nature is opposed by another trend, which is determined by the criteria that prevail in the modern economy. Such phenomena as globalization and the growing influence of financial capital have their own logic of development, which is not friendly to the problems of environmental security.

Globalisation arises from the need to extend the scope of financial capital and diversify itsfunctions, for example, through new instruments like derivatives. Financial capital develops initially to serve production and commerce but soon emerges as its master. .

The increase in the concentration of monetary capital caused the process of establishing control of financial capital over productive capital, mentioned by Rudolf Hilferding, – initially in order to guarantee the efficient production of profit in the real sector of the economy and its appropriation by financial capital. An alliance of the largest financial and industrial monopolistic groups is being formed. Financial capital spurs and facilitates the expansion of capital of large corporations beyond their national territory. Together with the global interweaving of capital of large multinational corporations, the global financial market is being formed. This market is gradually coming to the forefront as the main tool for redistributing profits in favor of financial capital.

It is financial capital that currently dictates all political forces rules of conducting policies in all areas of social life. Hence all kinds of associations (trade and economic in their first sense), trade wars, pseudo-sake of-democratic sanctions and so on.

A similar scenario was predicted by K. Marx and in some ways, by V. Lenin. If we look below the surface, however, we will see that the globalisation process is connected with the technological development of society, human society and civilisation. The progress of information and telecommunications technologies allows capital to flow more efficiently and expands its growth opportunities. In the conditions of "under-culturisation" of man, when a reasonable assessment of needs cannot yet replace the simulative needs, technological progress is put at the service of unlimited expansion of financial capital. And the directions of this expansion can damage both nature and human.

It is as if technological progress created new spaces in which to involve the process of need satisfaction and financial capital required satisfaction of simulative needs among other things. In so far asglobalization involves separate geopolitical areas in that process, it is technological progress that allows it. Thus, globalisation is what allows us to promote the major capability of a product as a phenomenon for human need satisfaction, including a rapidly growing simulative segment, by using increasing opportunities of technological progress.

Globalization is the extension of financial capitals first and foremost. It, in its turn, aimsto increase volumes, no matter how. The result is that today satisfaction of simulative needs has reached its trigger point. Technological progress, which has become a tool of financial capital, creates more and more new needs – and all of them are more and more simulative On the one hand, products need to be sold; on the other hand, opportunity to buy them must be created. . At the same time, many resources remain untouched in this process, to which this process can be extended

This globalizing process has technological progress as its basis. It has brought the global process of financialisation to the point where it has already captured all the major venues. No dramatically large territories remain to be acquired any more. So this harmful process has only one option: intensification. What is intensified? The use of nature, despite the damage. Financialisation makes people dig deeper going to the Arctic, anywhere, to extract and to destroy. It also digs into human feelings by creating new simulative needs. Thereby we ruin a human being. It is financial capital that invades the social sphere, changing people’s attitudes, demanding consumerism, mass culture consumption and other things that are actually not so important for a human being. All of them are formed artificially and hammered into human heads by global capital.

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Today every product is a result of processing tonnes of natural materials. A pair of shoes requires from ten to thirteen tones of fresh water to be produced. And so many of these 'beautiful and different' pairs are on shelves of shops to be disposed later without being sold, so many of them are used on a single occasion only! Please note that it is what resources of the planet, human resources, resources of human hearts, and almost anything are used for.

This process sweeps all before it. A living example is Cambodia. Hevea trees, which capitalist colonisers had brought to the country, have replaced jungles with huge plantations. For 20-30 years, Hevea trees produce juice for the rubber industry; then they are to be abandoned – plantations turn into a cemetery of dead-wood while new plantations devastate adjacent jungles. The application of new technologies is intensifying this process. be The product, moreover, is 100% exported, since global financial capital kills and squashes any territory that falls into its clutches. The UN forecasts that by 2030, Cambodia will be the only country in the world without natural forests at all, thanks to financial capital with its gambling houses, banks, shadow capital, pimping, etc. The composition of population is changing rapidly, locals either migrate or go begging in cities where slums proliferate. This is the growth that has put Cambodia's GDP growth rate above China's. That is how financial capital works. It destroys not only certain forests and its unique beauty, flora and fauna, but the soul, the nature and the society as well.

There is a well-known international organization, Global Footprint Network, GFN. It has invented a well-reasoned method to calculate the so-called 'ecological debt', and every year it sets the so-called Earth Overshoot Day based on this method – a date, when humanity's annual consumption of natural resources exceeds what the earth can regenerate in that year. In 1970, there was no such day, since there was no ecological debt. Then, since 1980s (see the beginning of the globalisation period – there is a clear correlation!), it has emerged to grow further. In 2019, the Earth Overshoot Day is approximately on July 30! Over these years, the total accumulated ecological debt has amounted to more than 16 years. According to extrapolation by GFN techniques, if we go on 'burning daylight' like now, the ecological debt will amount to more than 400 years by 2050!.. Besides, this technique does not count pollution rates. All these polar islands loaded with diesel fuel barrels, giant marine and land oil spills, cyclopean fires in taiga forests caused by people in Siberia or California, manmade disasters like a Three Mile Island, Fukushima or Chernobyl; seas of plastics in oceans, annual extinction of hundreds of biota species... By the way, one more comprehensive assessment is for recovery of water, fresh air and soil consumed by humans. In 1970, we consumed 0.9 of resources the earth could regenerate, while this year – 1.75 already. Growth rates have increased twice and go on accelerating. It is a direct path to the global climate change. To unrecoverable one! This is globalisation in its 'zoo' version!

Do we want to live in such an environment? Can we?..

Without boosting it with some other knowledge – about a need for reasonable self-limitation, the application of 'noo' approaches to organisation of our life and, above all, opportunities of technological progress; without adding world comprehension through culture and education of humans to the mix of our space; without synchronising these processes we will definitely come to a disaster. To reiterate, our civilisational development faces a fork in its road ahead. We can pass it without noticing, but we will feel consequences quite soon. Our choice is either to go on with a 'zoo'-life and 'zoo'-nomics and face what has been mentioned above, or switch to the NIS.2 and noonomy gradually.

Do humans have this knowledge though? They do. Society also does. But financial capital restricts it. Financial capital stuffs human heads with information about promoting the interests of financial capital – just look how many universities give courses in financial markets, for instance. By contrast, how many people are involved in deep research into culture as a phenomenon? Far fewer. Financial capital would extinguish such a culture in favour of raising 'consumers' and the 'consumer society'!. This can only be countered by proper cultural education from an early age, so that a human could grow with the understanding of ultimate necessity of taking public interests into account, with the true understanding of rights and wrongs. We need a human of culture. I'm sure, when he grows up and matures, he will hardly have any thoughts about making money by providing shit to other humans or hammering a need for this shit into human's heads. Do you get it? They are people of a new generation. It is them the society needs to rear – culture experts, mathematicians, engineering experts, people with fresh ideas who are not hungry for material values (provided they are satisfied adequately), whose interests will be above vested interests of 'absurd-preneurs' that are currently in mass produced by the society enslaved by a fake paradigm, where entrepreneurship takes priority over culture.

It needs to be nurtured in school and everywhere. However, society will have to do a lot. It will hav to change the entire educational programme, training system, teachers,educational and training techniques, changing numerous things.

Going back to the topic of crisis, there is another matter that requires our attention, that of technogenic risks. The number of technogenic catastrophes and problems already exceeds that of natural ones and will continue to rise because, whereas natural calamities occur thanks to natural forces, technogenic, man-made species is creating and multiplying new risks. h Since the number of new technetic species is growing, and their inner conditions and structure are becoming more sophisticated, the more complex the elements are, the more complicated their interaction becomes, i.e. the more difficult it is for them to "get along" with one another.

The problem should now be clear. The system is doomed to collapse, unless we start thinking about developing the things that are really necessary instead of building yet more new hydro-power plants, bridges and pipelines in the name of "iconomic" development, thereby demolishing nature and human beings themselves (outwardly out of concern over improving their well-being...). I am of course not qualified to determine exactly what it is that humans need today, but there are no doubt philosophers who will be thinking about what we should do in the future society. They will size everything up and make appropriate calculations.

Yet we are now busying ourselves with trifles. *Millions of people are starving because somebody is appropriating and accumulating products using the current global capitalistic mechanisms,* and these mechanisms of the current social order direct resources to fictional things, such as investments, development and so on... Development of what? The economy? The zoonomy? Relations that lead to a catastrophe? This is all in vain. We can eat food, put on clothes, see ourselves on TV or recognise something/somebody there, go places, get medical treatment/ education/job, and this is enough for living if we think of real, non-simulative needs. For living in the real world – not in the world of a continuous pursuit after illusions of endlessly growing consumption. Why do we need those three, five, six, eight or twenty-eight TV sets? Does everybody want a Trump Tower of their own?

I am not exhorting everyone to practice voluntary "poverty," not at all! It is just that technology is increasingly capable of providing humanity with everything really necessary (a separate issue is what constitutes real need, i.e. the qualitative and quantitative parameters of these real, non-simulative needs).

Technology, if developed in a purposeful, accelerated and conscious way, will soon be able to provide for people's real needs. This path is "associated with the emergence and development of convergent NBICS technologies intended for creating a new, harmonious noosphere, where the three components – biosphere, technosphere and society – will not conflict but complement one another as inter-related convergent elements. By choosing this path, humanity gains a unique opportunity not only to preserve civilization in the near future, but also to ensure its endurance for the duration of the planet's geological existence, or perhaps even longer, by going into outer space."[1]

Yet we should note that NBICS convergent technology can be used as a foundation only if there is a solid industrial basis of the fifth and sixth technological modes, and not the illusions of "service economy" and, more importantly, degradation

[1] Koval'chuk, M. B., O. S. Naraikin and E. B. Iatsishina. (13 October 2011). Konvergentsiia nauk i tekhnologii i formirovanie novoi noosfery [Convergence of Sciences and Technologies to Create a New Noosphere]. *Rossiiskii elektronnyi nanozhurnal*. http://www.nanorf.ru/events.aspx?cat_ id=223&d_no=3747

of the industrial sphere. This new imperative may be and is, in fact, comprehended rather sporadically: some social systems (nations and alliances) steal the march by proactively tackling the problems of reindustrialisation; others are only discussing the need to start restoring material production. Meanwhile, there are billions of people on Earth for whom even third- and fourth-mode technologies are still an unattainable dream...

Still, let us not get carried away with this topic and save further discussion for later.

Chapter 6. Evolution of the Technosphere: Opportunities and Risks

The growth of the technosphere is already starting to exceed what has been created in the process of natural biological evolution and threatens to turn into uncontrolled chaos. Yet the same technological development is unlocking opportunities for the resolution of issues of the technogenic burden on the environment. Where to these opportunities lie and how should we allocate our limited resources to advance toward them?

6.1. Crisis of Civilisation?

We can pose questions that seemingly refer to the distant future only because this future is no longer a remote prospect. It promises to become the reality of the leading economies in 20–30 years, if not earlier and we need to start comprehending, and preparing for, it now. Development of rockets that first put a satellite in orbit (on October 4, 1957) and then launched Yuri Gagarin into outer space (on April 12, 1961) started back in the 1930s, not the 1950s. The development of the television technology that became so widespread after World War II was initiated back in the 1920s. The same is true about all qualitative breakthroughs in technology that have crowned the efforts of entire national economies and subsequently triggered changes in economic relations and institutions of those countries.

Nevertheless, technology and its inherent accelerated development can work both in favour and to the detriment of civilisational development. Every time we invent something, we may devise a thing that is supposedly needed to satisfy a certain new demand (or an old one, but in a new way). If this demand is destructive, the invention will be destructive in terms of, for instance, general human values, and if the demand is positive, the invention is deemed to be beneficial. But is this really so? Any, repeat any invention is double-edged and always brings along opportunities that are greater than the solutions required by the original pragmatic demand. Yet the issue of the opportunities offered by the intellectual component of a knowledge-intensive product is not that simple.

Technologies can serve diverse purposes and do so ever more efficiently. One can explore the atom and nuclear reaction and then create a bomb for the purpose of destruction or protection, or produce atomic energy for peaceful purposes, but then build an unsafe nuclear power plant that might eventually explode, as was the case in Chernobyl. There is always a flip side.. Increasing knowledge intensity of production will exacerbate this. As civilisational development increases knowledge in technology, production, organisation and other components of industrial production, a time comes when the road forks, offering different options for the future.

Today we are rapidly approaching another junction and, according to many, a civilisational crisis. . It combines change the technological mode with a few other extremely important things. While such crises can be caused by exogenous factors, such as hail, plague or pestilence, they are not the ones that I am talking about. I focus on the ones that involve the transition to a new technological basis and even to a new technological mode; the manifestations and effects of such crises are becoming more and more serious and severe. Each new technological order, creating new technological opportunities, requires a deeper reconstruction of the existing social and economic structure – this is what determines the severity of crises. The emerging crisis is both much more related to technology than the ones the humanity has gone through before and will have much more radical consequences for the development of our civilisation.

The crisis means that we are approaching a “bifurcation,” a a point of no return. As technological development towards the NIS.2 era accelerates and expands opportunities for easier satisfaction of ever-growing human demands, the “education” of demands and rational use of the opportunities furnished by technology lags and new demands threaten to go down to the basest, most sordid ones. Then come the different variants of ways out of this crisis. But where do they lead? Nobody really knows. And nobody really thinks about it.

So far into the crisis, we do not even understand its economic component. We either turn to outdated recipes for reviving the cadaver of the dying economy of the former mode (using “galvanising” government programmes), or to the New Normal without analysing the deeper causes of the crisis.

We need to understand that quantitative indicators of economic growth, such as GDP, do not reflect the real level of demand satisfaction. GDP is merely an accounting concept that cannot offer sound analysis of the quality of life because the main reason for economic activity is the desire to satisfy human demands.

As in the iPhone example, we can satisfy a huge number of demands for little money today. Even a few years ago, it would have taken much more money to satisfy the same demands because it would have required far more resources. In terms of the GDP, the indicators have dipped, but we have actually satisfied more demands. We did not lower the quality of life but improved it.

Take another example: The advent of personal computers and the Internet has made unnecessary a significant part of the mail service, the production of typewriters and the professionы of typist and draftsman. This trend towards satisfaction of more needs with less is already manifest, whether in gadgets, unmanned vehicles or in smart homes that need neither a guard nor a superintendent.

Thus, the crisis of our time consists in the acceleration of scientific and technical progress, and lagging socioeconomic structure and social order. This tension needs to be mitigated to prevent an explosion.

In this crisis so far, we have stuck to currently available solutions. However, they are not worth wasting time on. We would do better to focus improving the quality of life instead of pursuing the abstract and hard-to-calculate indicators of growth (is this production useful? is it necessary? who needs it? is it redundant? or perhaps destructive?); or focus on healthcare and significantly increase public investment in education and science, including fundamental science; or seek out other real and unsatisfied needs. The GDP, in its conventional form, has little to do with this: we would do better to calculate the number of hours lived disease-free and add them up as an indicator of human and social welfare. The crisis is many-sided. The current state of technological progress is putting people out of work, giving the *crisis a demographic and social dimension*. A very different aspect appears when we eat genetically modified products unmindful of their potential consequences. While we will have produced and eaten more food it could cause diseases in curing which we will increase the GDP even more. Clearly, the situation is critical, and the crisis stems from technology or, to be more precise, from developing and using technology within the current paradigm of economic growth. Perhaps we should put it even more broadly: the crisis stems from people's "subrational" activity in the technological sphere.

This crisis is well illustrated in data on the total volume of everything people have made over the five thousand years of their existence: according to geologists, *the weight of the technosphere*, i.e. of everything that humans have created over their history of using technology, *is 30 trillion tonnes* (for a more detailed estimate, see Table 1).

Source: Zalasiewicz, J., M. Williams, C. N. Waters at al. Scale and diversity of the physical technosphere: A geological perspective. *The Anthropocene Review 2017*, 4 (1), p. 12.

Compare that figure with this one: according to biologists, *over the 4.5 billion*

Table 1. Approximate mass of the major components of the physical technosphere, arranged in order of descending mass (where 1 Tt = 10^{12} metric tonnes).

Component	Area (10^6 km^2)	Thickness (cm)	Density (g/cm^3)	Mass (Tt)	Percent (%)
Urban areas	3.70	200	1.50	11.10	36.9
Rural housing	4.20	100	1.50	6.30	20.9
Pasture	33.50	10	1.50	5.03	16.7
Cropland	16.70	15	1.50	3.76	12.5
Trawled sea floor	15.00	10	1.50	2.25	7.5
Land use and eroded soil	5.30	10	1.50	0.80	2.7
Rural roads	0.50	50	1.50	0.38	1.3
Plantation forest	2.70	10	1.00	0.27	0.9
Reservoirs	0.20	100	1.00	0.20	0.7
Railways	0.03	50	1.50	0.02	0.1
Totals (where applicable)	81.83			30.11	

years of the Earth's existence, the weight of biome, that is, of everything created by nature, *has made up approximately 2.5 trillion tonnes*. Here are some more detailed calculations: "On the eve of humankind's emergence, the biosphere hardly differed in its basic parameters from the current state. Moreover, such characteristics as the total mass of living matter (around 2.4×10^{18}g), elementary composition of biomass (about 0.3% nitrogen, 3% carbon, 75% oxygen, 10% hydrogen, etc.), oxygen content in the free air (around 21%, 1.2×10^{21}g in total), the degree of constituent atom turnover (for carbon, for instance, the average time spent by one CO_2 molecule in the atmosphere is ten years) and the amount of solar power that reaches the Earth (167 kkal/cm^2 per year) have remained unchanged probably for hundreds of millions of years."[1]

So, in a few thousand years (and especially over the past hundred years) we have already created 12 times more than nature has over billions of years. Who would argue that these facts do not auger major changes and crisis?

And there is more. the essential biological law of biodiversity that forms the basis of population health. The diversity of biome is variously estimated at between 8 to 100 million species, while the diversity of so-called technetic species, that is, various species created by humans, is already exceeding bio diversity by about a thousand times and most of them were

We create much faster than the Lord. He, after some thinking, made the world in seven days, while the creations of those who are "created in the image and likeness of God" lack both thought and imagination. The figures are mind-blowing.

This frenzied creation is undermining the system's stability.. If we imagine the system as a hammock hung from a tree, the ensemble remains stable as long as it does not change its state critically and as long as there is no excess tension – for instance, unless we put too much weight on the hammock. If we load it up too much and put pressure on it, something will break -- the hammock, the strap or the tree. Thus,   when tensions are incompatible with the stable existence of the system, the system changes its state. Now we have a different system – with a hole in the hammock, a torn strap or a broken limb. This is a simplified example of a static system, whereas a stable dynamic system can be imagined as a bicycle where the rider has to keep pedalling.

[1] Korogodin, V. I. and V. L. Korogodina. (2000). *Informatsiia kak osnova zhisni* [Information as the Basis for Living]. Dubna: Izdatel'skii tsentr "Feniks," p. 106.

Our system of human civilisation is obviously a dynamic one. The stability of a system like that is based a “stable element”. Dynamic systems also hve something that puts the system in motion and the motion creates and promotes stability. Stability of civilisation is conditioned by its ability to move forward, acquire new knowledge and use it to upgrade technology. Deceleration results in a crisis akin to a bicycle falling down when it stops. Civilisation has survived through technological progress. We should be already prepared for technological changes that seem almost utopian now but are certain to come into being in decades.

6.2. New Technology Prospects

Let us remind ourselves of some critical new technologies that are emerging before our very eyes. In previous chapters, we mentioned technologies of the fifth and sixth technological modes and the phenomenon of NBICS convergencetypical of the sixth mode. Nanotechnologies and targeted genome restructuring, artificial intelligence and mass transition to additive technologies, alternative power and robotics are being mentioned with increasing frequency...

Moreover, these new technologies form a new technological mode. Whereas previously they co-existed and interacted, they are now converging in hybrid technologies.

To understand why and how, we should turn to the analysis of modern information technology and particularly the related process of technology digitalisation. Information and communication technologies, unlike all the rest, demonstrate the capacity to penetrate any technological processes, while digitalisation is becoming the technological platform capable of integrating dissimilar technologies into hybrid technological processes. “Information technologies have become a sort of a ribbon that binds all sciences and technologies."[1] This is exactly why infodigital technologies serve as the core for the new technological mode.

Other technologies that are a part of this mode share the following two features: a common capacity to converge with one another and the fact that this convergence promotes two basic trends typical of the current technological development stage. These are, first, the trend towards removing people from material production process and, second, the trend for a vast increase in the knowledge intensity of products and a concurrent reduction in the share of material costs in product manufacturing.

As we have seen, technology synergy plays an important role in this process. It enables the accelerated advancement of civilisation on the path of industrial progress. Yet, of even greater importance is a secondary phenomenon stemming from it: the very development of modern technology and its increasing knowledge intensity also enhance the technological affinity to synergy, i.e. "synergy intensity," as I would put it (or "synergy capacity"), is growing. This, in turn, creates the technical and institutional basis for the "acceleration of acceleration" of the pace of scientific and technical progress.

Only three to five years ago, when this phenomenon was first discussed at the workshops of the Institute for New Industrial Development after years of data collection, analysis, and consolidation, many participants of those workshops noted some movement in that direction. Some technologies were already demonstrating growing synergy potential in certain areas. We discussed mechanisms for ensuring synergy – horizontal and/or vertical integration of technologies (the so-called HIT and VIT mechanisms of technology synergy), interpenetration of technologies, interdisciplinary transfer of technologies (ITT mechanism), etc. However, there were then not many major or significant examples that could confirm and verify the existence of this phenomenon. Today, by contrast, it is quite evident. For example, Building information modeling (BIM) is widely used. This is not only a transition in

[1] Koval'chuk, M. V. (2011). Konvergentsiia nauk i tekhnologii – proryv v budushchee [Science–Technology Convergence – Breakthrough into the Future]. *Rossiiskie nanotekhnologii.* 6, 1–2, p. 14.

the design of buildings from conventional drawings made using computer programs to 3D modeling, but also the integration of design, construction and engineering and operational solutions. BIM technologies allow you not only to visualize all the building structures and engineering equipment of a building, but also to show the characteristics of all its elements, up to the supplier company, service life and time of replacement. These technologies make it possible to monitor the serviceability of systems during their operation, track the movement of personnel and even the health of employees.[1] Information models, providing the huge volume of information from many different sources for these purposes, can use the blockchain technology.[2] As Mikhail Gorbachev used to say, "Things are really cooking now!" Every new technological solution that involves the aforementioned mechanisms dramatically increases the synergy capacity of new, structured technologies. The increase in synergy also improves, by orders of magnitude, all positive parameters of industrial production since it reduces resource intensity/costs/environmental burden, raises labour productivity, and improves product quality.

A good example would be a new product called Olli[3] developed by the Local Motors Company (USA): a self-driving shuttle for mass passenger transportation; it is based on an integrating information system and is assembled by robots from elements manufactured using only 3D printing technology.[4] Material costs compared to conventional materials are reportedly many times lower, and labour costs are dozens of times lower. As for shuttle production time, the production of a complete set of components takes 10 hours, automated assembly - 1 hour, loading software and testing individual systems and the entire product - 1 hour, so the entire production cycle requires half a day of continuous work with almost no human involvement. In order to

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[1] Klimov G. (2018). Sinergia novyh inzhenernyh reshenij i BIM-tehnologij daet fantasticheskij effect [Sinergy of new engineering solutions and BIM technologies gives a fantastic effect]. *Integral*, 14.09.2018. URL: http://integral-russia.ru/2018/09/14/sinergiya-novyh-inzhenernyh-reshenij-i-bim-tehnologij-daet-fantasticheskij-effekt/

[2] Bukunova O.V., Bukunov A.S. (2018). Integratsia technologij blockchain i informatsionnogo modelirovania objektov nedvizhimosti [Integration of Blockchain Technologies and Information Modelling of Real Estate Objects]. In: *BIM-modelirovanie d zadachah stroitelstva i arhitektury*. SPb.: SPbGASU, P. 45-51.

[3] See *Meet Olli* presentation on the website of the Local Motors company: https://localmotors.com/meet-olli/.

[4] Tess. Local Motors' self-driving Olli shuttle helped along by Makerbot 3D printers. *3D printer and 3D printing news*, 30 August 2017. http:// www.3ders.org/articles/20170830-local-motors-self-driving-olli-shuttle-helped-along-by-makerbot-3d-printers.html

make this initially unusual product more convenient and comfortable for passengers, IBM was invited to join the project, and it immediately proposed installing the IBM-Watson,[1] a talking guide to answer any question (in any widely used language) that passengers might put, for instance, the time remaining to the destination, when to get off, how long the traffic jam is, and take call for assistance. It is basically an unmanned robot shuttle. Will passengers consider it the same as a regular bus with a caring driver? No! In order to ensure successful adoption, the producers will ensure an even better experience: thanks to multimedia services, passengers will have a companion, a consultant, a guide, the Internet, TV and other amenities on the way, as well as opportunities to work, learn, enjoy themselves, etc.

This example incorporates all three defining or paradigmatic elements of the coming new industrial revolution: digitalisation, additive printing and robotisation. The next task would be to solve the complex problem that up until recently seemed like a sci-fi fantasy (*I, Robot* by Isaac Asimov comes to mind): robots are about to start designing and building robots themselves, requiring us to think of possible consequences,related risks and ways of dealing with them.

Such technological synergies not only gradually change the product (often going from merely augmenting it, to createing absolutely new products); but modifies the very process of production, thus creating the industry of a new generation. For example, additive technologies change the principle of source materials utilisation (instead of conventional processing based on the principle of “hewing away the odds”: cutting, sawing, and stitching as on metal-cutting machines) and thereby also trigger global shifts that defy conventional industrial classification. The same additive equipment can theoretically be used to make shoes, pancakes, pills, crockery and whatever you like (by simply switching the extruder and containers with raw materials and altering heating parameters).

[1] Local Motors Debuts Olli, the First Self-driving Vehicle to Tap the Power of IBM Watson. *IBM*. 16 June 2016. https://www-03.ibm.com/press/us/en/pressrelease/49957.wss

In other words, we are witnessing the blurring of industrial distinction, the convergence/integration of industries and the emergence of new disciplines (as a popular student saying goes: “My future job has not been invented yet!”), and this process is accelerating. We call this process the “horizontal shift”[1] as an allusion to the “red shift”[2] in astrophysics. This trend, not unlike the phenomenon in physics, stems from the “acceleration of acceleration” in technological development (in this case, additive technology). The Internet of Things and similar technologies lead to a fundamental change in the approaches used in many currently traditional areas of economic activity – from trade to services and construction (creating the foundation of, and a powerful platform for, future innovations). Meanwhile, the synergy potential offered by modern technologies, when implemented, is not decreasing but growing: a good example would be the development of information technologies, where the enhancement of hardware efficiency leads to greater efficiency of software, while software upgrades result in increased hardware capacity.

Knowledge-intensive technology gives rise to fundamental changes in the industrial process. Take, for instance, production organisation. Production management systems are upgraded, products are designed using 3D modelling, transport/material/information and other flows are optimised, managerial decisions become automated/“internetised” –system administrator turns into a plant administrator! – and much more. Indeed, we may say we are now entering the era of the NIS.2 without even noticing it.

Technology synergy has always been around: it reflects the essence of knowledge implemented in technology. It has merely become more clearly manifest since the fifth mode. I witnessed this in the aircraft instrumentation industry. Its professionals come from various disciplines. They are hardware engineers, programmers, metals and materials specialists, experts in specialised computer

[1] It means the convergence of different branches of economy along with their horizontal links with each other.

[2] **Redshift**, displacement of the spectrum of an astronomical object toward longer (red) wavelengths. It is generally attributed to the Doppler effect, a change in wavelength that results when a given source of waves (e.g., light or radio waves) and an observer are in rapid motion with respect to each other. Encyclopaedia Britannica. URL: https://www.britannica.com/science/redshift

technologies (such as image recognition), chemists, heat engineers, cyberneticists and material engineers. The synergetic effect is created by interdisciplinary creative personnel. It is a "secondary" synergy – the level of synergy where an instrument, component or product is generally complex and requires the involvement of people with different competences. These are different not in degree but in nature and their synergy involves versatile knowledge ensuring "inter-knowledge" and interdisciplinary synergy.

To design an aircraft instrument, one has to know where this instrument is going to be used. For India, the designer must keep in mind that the outside temperature can reach up to 60 degrees Celsius and so it is going to be hot in the aircraft. Will the polish melt off? Will the paint stay? How will other materials behave? Are there any other factors that need to be taken into account? There is a need for a physicist because components are placed quite tightly on printed boards, which might cause induced flux density and interference. Computers need to be able to recognise specific interferences, whether from another plane, an artificial interference or inner interference, or a system failure?

Thus, when an instrument is designed, account must also be taken of what might hamper the performance of its tasks. ed. Finally (continuing with our aircraft example), specific conditions should be borne in mind, for instance, that we are not working on land, and, therefore, require specialists in various disciplines (for instance, navigation, and motion experts). Even the pressure in upper and lower flight phases will vary, etc. On top of that, the industry needs specialists who can calculate G-stress, biologists (for there will be a person inside an aircraft) and ergonomists who will know which hand – left or right – a pilot will use to operate an instrument. Using the wrong hand could ruin everything.

(The first presses and cutters often injured workers who used the wrong hand. I almost lost my hand this way when I was young. Today's instruments are not like this. In order to switch on a modern ergonomic machine or instrument, for instance, you have to press two buttons which are set a metre apart, so you cannot put your hands in the wrong position by definition. But it took time to get to this. And there are many nuances like that.) Fig. 8 presents the complex interaction of varying technologies and knowledges in the production of a single aircraft instrument.

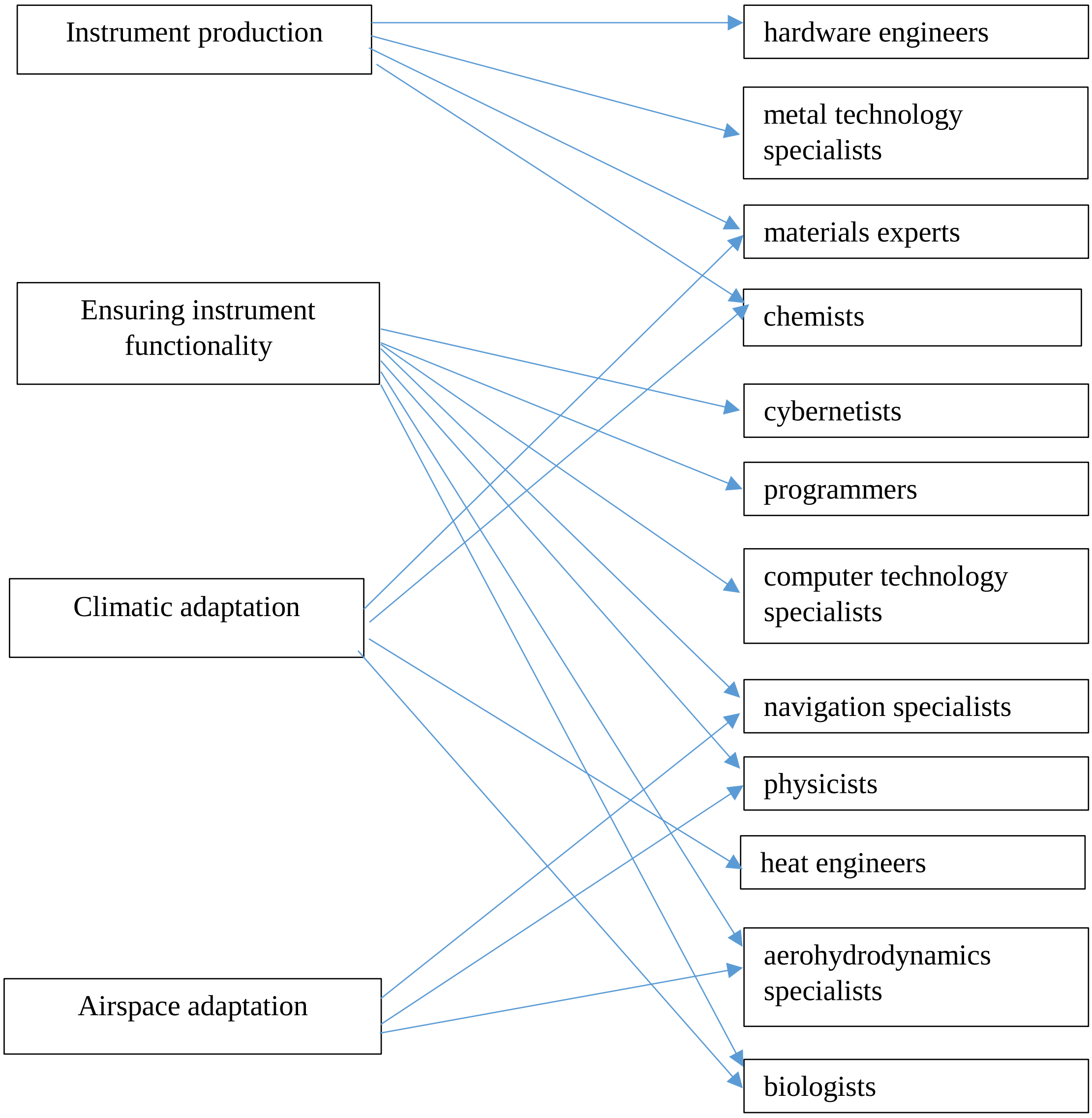

Fig. 8. Interdisciplinary synergy of technologies and competences in the fifth technological mode (using aircraft instrumentation industry as an example)

It makes sense, in fact, to speak of a double synergy. First, the synergy from integrating science and industry and second, the synergy from diverse professional expertise. However, the very first impetus for this comes from the demand. All products are designed in response to demand; this is the key principle. Take the demand to develop a new military aircraft that would surpass its analogues in combat and performance characteristics: see and shoot further, fly further, higher and faster without being shot down, keep the pilot safe, fulfil the battle mission, land reliably and much more. All these characteristics determine the technical specifications for the product and requires an in-depth analysis of the ways to implement them.

It is clear that the new, sixth technological mode, as a more knowledge-intensive one, is based on significantly more in-depth exploration of the principles of both inorganic and organic nature. Progress in the two areas goes hand in hand. Development of nanotechnologies signifying technologies' transition to the atomic level is thus a crucial factor for a dramatic reduction in the material- and energy-intensity of production. At the same time, nanotechnology ensures the convergence of technologies based on the principles of the inorganic and organic world. It allows for the shift from imitating living nature in relatively simple inorganic devices to reproducing wildlife systems using biotechnology. For example, the combination of nanotechnologies and biological engineering made it possible to create a blood-cleansing device for sepsis therapy inspired by the spleen, which can continuously remove pathogens and toxins from blood . Blood flowing from an infected individual is mixed with magnetic nanobeads coated with an engineered human opsonin—mannose-binding lectin (MBL)—that captures a broad range of pathogens and toxins. [1]This involves not just nature 'out there' but human nature itself in the form of mapping the human genome.

Another factor that is complementary to this synergetic interaction between the different sections of knowledge and different technologiesis the transition to additive technologies (3D printing) which allow us to leave behind the outdated, "deductive" or destructive technological processes involving considerable waste of raw material. In turn, reducing energy consumption is an indispensable factor for success in using alternative energy, which cannot be efficient without progress in reducing power consumption.

[1] Kang, J., Super, M., Yung, C. *et al.* (2014). An extracorporeal blood-cleansing device for sepsis therapy. *Nature Medicine,* No. 20, p. 1211–1216 https://doi.org/10.1038/nm.3640

Only computer digital management embedded in the very technological processes, which implies wide use of information communication networks, makes this possible. It goes beyond "digitalisation" of the fifth or fourth technological modes. For instance, if we separate the programme control unit from a machine with digital programme control, we get a conventional machine. But if we try to do the same with a 3D printer, we get an inoperable device. Try to disconnect Industry 4.0 from the Net – and you will bring entire industries to a halt.

Digital technologies also contribute to the creation of a modern "smart" industry where the *sharply increasing role of the human mind in production is accompanied by removing humans from its physical processes.* Industry 4.0, which is based on interaction with the Internet of Things, is becoming a prototype of such unmanned production that relies, at the same time, on the very power of human intellect.

Under the sixth technological mode, cognitive technologies, thanks to self-learning artificial intelligence (AI) systems, penetrate more areas where human labour used to have no alternatives. AI systems are already capable of searching, accumulating, sorting and comparing information, which enables them to make certain decisions. *It is cognitive technology that creates opportunities for direct interaction between people and ongoing unmanned technological processes* (human-machine interfaces, human-machine systems, human-machine networks) *using the achievements of biotechnology and information communication technology.* There are a lot of examples of such systems which are common for everybody: web search engines, online markets, social networks, multiplayer online games. [1] This gives a new impetus to robotics production; the latter is becoming more flexible, adaptive and efficient[2].

For the time being, AI is quite far from being able to discover new knowledge (it can *acquire* existing knowledge by accumulating and analysing available

[1] For a review on the topic, see: Tsvetkova, M.A, T. Yasseri, E. T. Meyer, J. B. Pickering, V. Engen, P. Walland, M. Luders, A. Folstad and G. Bravos. *Understanding Human-Machine Networks: A Cross-Disciplinary Survey*. E-Print. Cornell University Library. https:// arxiv.org/pdf/1511.05324v1.pdf

[2] Cully A., Clune J., Tarapore D., Mouret J.B. (2014). Robots that can adapt like animals. 2014. URL: https://arxiv.org/abs/1407.3501 DOI: 10.1038/nature14422

information and can *transmit it by means of ICT*, but it *cannot* "discover" anything new). That is exactly why the new technological mode is imposing new requirements on human research and cognitive activity. Thus, the approaches that are based on technology convergence require an interdisciplinary approach. Convergence in education also has to reflect the focus on the convergence of technologies. So far, this faces considerable hindrance from the institutional structure of both science and education.

While technology convergence requires breakthroughs in fundamental research, the process of integrating the social sciences into NBICS convergence has not proceeded far. It covers only the applied aspect in using data about human verbal and psychological reactions in designing "anthropomorphic" or "human-machine" technologies and in using the principle of neuron network organisation in economic process modelling.

New technologies are being born before our very eyes, and we need to decide which of them toprioritise for maximum developmental effect. Since costs will be enormous, reliable tools for informed decision-making on the allocation of technological investment is critical.

6.3. 'Penetration' and 'Readiness'

Physicists have proposed the existence of universes where laws we consider universal, such as that of gravitation, do not apply. That may be so but I would like to propose a law more universal than that, the law I call 'a readiness-penetration law'.What does it mean? As an initial approximation let us say that means that if there is one part of a puzzle then there is another one, a matching part: elements of the puzzle are meant to match together.

There are many aspects here. First and foremost, all living things have the ability to perceive something which is not 'a part of them'. They can 'let it in' and they can 'penetrate' into something else which is not 'a part of them' too. I would propose that everything in the world has both abilities. Both material and immaterial things –

everything in Universe! Such interpenetration allows creating a certain worldview. The world is a puzzle of puzzles. How can this approach be applied for technologies?

Technology constitutes the sublimation of knowledge applied in the production process. Moreover, it is something that penetrates (by virtue of the nature of knowledge) both into other technologies (penetration-I) and into other elements of the production process, which were described in Chapter 1, 1.2. (penetration-II).

In the Nature and in the entire world there is a major universal phenomenon of compatibility which comprises two components: a plug and a socket, so to say. Everything mates and connects and does so in a specific way. New elements built in, but they can "built in" only if units fit into one another. When a plug fits, it is an act of penetration. The technologies also may have a better or poorer fit to one another. The better the fit, the higher their penetration potential. The higher the penetration potential, the better the chances of technology for expansion.

If wheat can "beat" weed, wheat will grow. Otherwise there will be just weeds. In order to grow wheat grow, ploughed and weeded tillage is necessary. Only it can increase the readiness for penetration of a specific interaction agent. In instrument engineering theory, for instance, it is called counterpart or mating part, like a mating connector, for example. The mating part of penetration is readiness, or its receiving potential.

However, it is one side of the phenomenon. The other side is about the level of penetration and readiness of one object in comparison with the level of penetration and readiness of another. They can match and complement each other perfectly or have a 'level of tolerance' that close to zero, i.e. their levels of penetration and readiness do not allow them to 'assemble' or'merge' and the structure of their relations will be very different.

There is the third side, even more important. The very interpenetration and readiness-penetration generate a new quality (the famous law of quantity-to-quality transition is just a special case of the phenomenon!), be it a characteristic, a construction, a change of object effects/features. Briefly speaking, it is a new quality of mutuality. So here we are: there is the correlation between readiness and penetration of development/existence of any process. The point is everything we create proceeds to generate a new quality if combined with or involved into something else. And by this way – to infinity. Thus, that is how the whole world is structured, this way and no other way.

Let us consider a watch. If you take the anchor escapement of the pendulum cloks, its tooth must match its corresponding pallet of the escapement's wheel accurately. Otherwise, if these gears do not have a proper level of readiness, or access to the anchor, an opportunity to penetrate inside, let us say, the watch will not manage to keep time accurately. And the more accurately the anchor and gears match is, the more accurately the watch will keep the time. If they do not match, no new quality arises. When they do, it does and it is the watch. Once it arises, the new quality can be transferred to other elements. For example, to a transmitter or a relay. When it is, and the right level of mutuality is achieved, there arises a further new quality. It can go on to infinity.

This law, I would wager, is supra-universal, valid in all universes.

Certainly, it is clear in relation to technologies. The 'anchor-gear' technology only works when the penetration level of the anchor (in all its dimensions, weight, form and composition) allow it engaging with a gear, transmitting effort, waggling the gear and pivoting it. At the same time, a gear should have a high enough level of readiness (in a general sense – it comprises many parameters) in relation to the anchor to perceive its transmission motions and do a turn. This law also extends to biological systems, such, needless to say, as mammalian reproduction. Or the process of viruses getting inside the cell. As a result, an absolutely new quality is generated, so to speak, a cancer cell. Or it can result in a neoplasm.As mutations arise, a new quality appears. Speaking of organic nature is nothing if not readiness-penetration. For instance, in a food chain, flies should be available for sparrows that catch them. Of course, these links and mutualities can be broken. The possible extinction of bees as species is a well-known problem. We poison field with herbicides, destroy weeds, break ground for new fields (for example, for sugar beet production) while breaking the food chain of bees. And often our solutions are almost as problematic. To re-build these chains somehow, we feed bees with sugar.New qualities can include the disappearance of components of live nature.

The law also take social forms. Human life is social. There is always collectivity, adaptation, interpersonal relationships.

In the field of human and machine interface, we are never going to design a car steering wheel that will not be handled easily, whether it is a helm, a steering wheel, or a joystick. We make machinery fit us or ourselves fit machinery.

It should now be clear that technological modes develop when a new technology is born that has a higher level of penetration, a capability of integrating into other technologies (not only productive but those relating to other areas of life as well – social ones, for example) than its predecessors. That is the key to understanding how and why new technological modes emerge.

6.4. Assessment of New Technologies' Potential Based on 'Penetration' and 'Readiness' Principles

It is obvious that the society that surfs the technological wave (and the current one is increasingly looking like a perfect storm!) becomes an ultimate economic leader of the next technological mode and the NIS.2. So it is necessary to find a way and keep up with the technological progress and industrial development now, before it is too late. The problem is that there is no such thing as a single right path, but a multitude of roads and tracks – all of them of different, some straight, some curved, some more travelled, others narrow and untrodden - so it is impossible to guess at this point which one is going to ensure success!

A popular response would be that we need to catch the train of technological change and do it swiftly, right now. Russia, we argue, needs to return to the priority of the industrial path of economic development. What kind of path? In our opinion, it should be "a qualitatively new path." Old technologies are no longer driving industrial development. If so, which technologies can? Do all new technologies serve as development drivers? At what pace? Do they all deliver the same pace and acceleration? Of course, not. And what do we mean by *qualitatively* new? What is the difference between "qualitative" and "non-qualitative"?

Since we must do something and since required investments will be colossal and mistakes costly, we need to *perform meticulous calculations* before investing! On the other hand, given the current "acceleration of acceleration," *we have no time left*! Besides, the introduction, adaptation and modification, furcation and spin-off of new technologies also need to occur faster than ever before.

So we need tools for assessing the development prospects of specific technologies in terms of their compliance with the science and technology progress (STP) criteria and for performing comprehensive evaluation of the "managing influence", which is triggered by the fact of implementation of a technology in all related areas with the analysis of the possible long-term and delayed effects.

From the utilitarian point of view, we need to identify the core element of any technology.

In fact, it is that hard to do but the law of penetration and readiness can help.

Technologies constitute the main segment of the four segments of the production process, materials, production organisation, labour and technology. Technology is the most important element of the production process because, as we have already discussed, the production process is the process of fulfilling needs by means of knowledge. The knowledge that explains how to make things is in fact the technology and it includes tools.

Technologies, moreover, penetrate other technologies, i.e. technological penetration-I is penetration by one technology into another.

Recipient technologies will also normally be more receptive (that is, their readiness potential will be greater), if they are knowledge-intensive. Normally, but not necessarily. And here the result of technology penetration is greater. Again, given equal readiness potential of two recipient technologies, the technology with greater penetration potential will yield a better penetration result. That said, the higher the knowledge intensity of appropriate technologies, the higher their potentials will be, although there is no direct correlation here.

In this context, we should pay special attention to the special characteristic of technology “connection.” The results of such connection – the “technology synergy” – can vary. Moreover, in our opinion, the outcome cannot be described in terms of any known theory (such as wave theory) and constitutes a promising field for research.

“Synergy,” which can be positive or negative, emerges when we connect or combine two things. This does not involve simple ‘addition’ but one penetrating the other, producing not a mere sum of the two, but some new effect that can be referred to as the “technological synergy” of these additions.

Penetration-II potential of a specific technology involves its penetration into other production components, , e.g. is integrated into a material, incorporates new technology into production organisation, changes the nature of labour involved. (See Fig. 9).

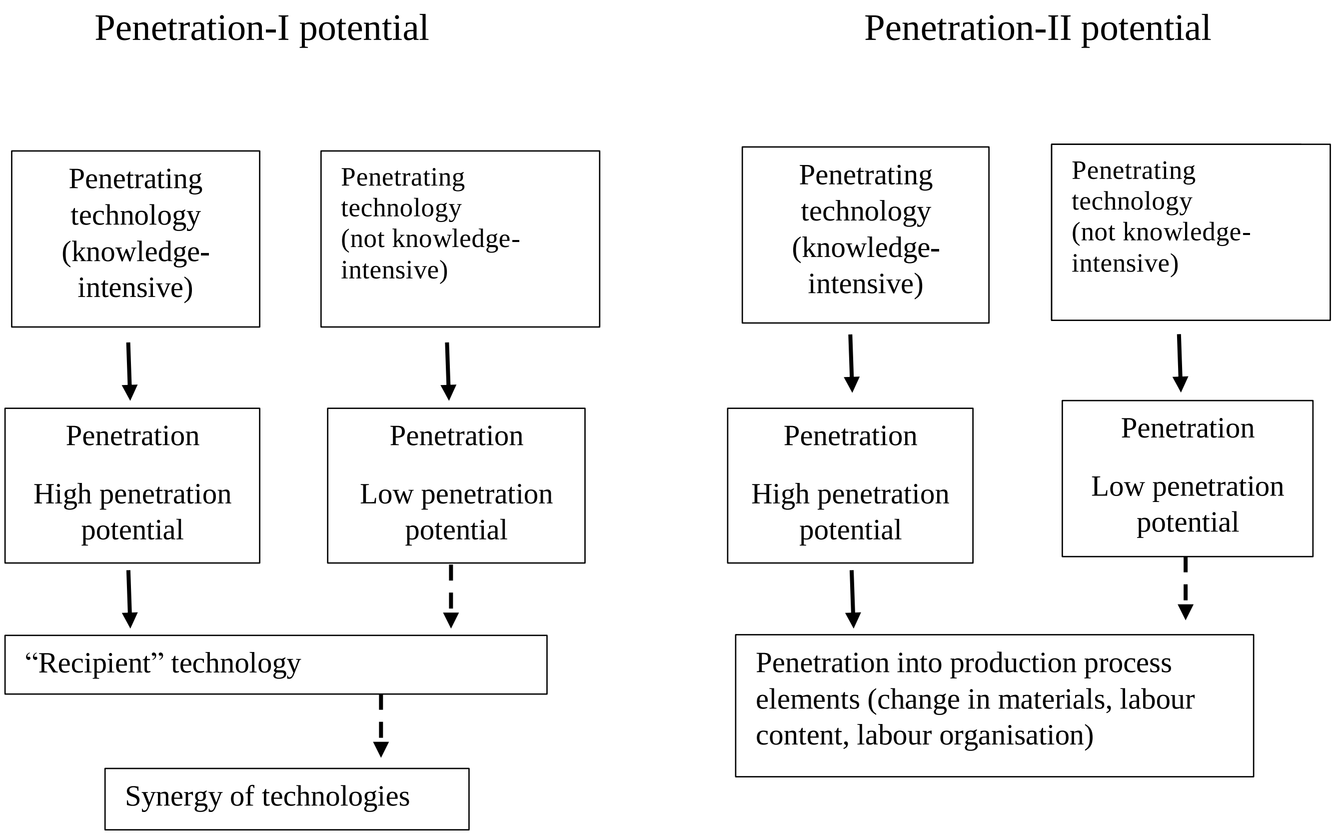

Fig. 9. Penetration potential of technologies

Any technology possesses the penetration potential of both types. Different technologies, because they embody *different* knowledges, behave differently in terms of penetration. Moreover, the same technology with the same penetration potential will yield different results, for instance, in terms of efficiency (such as cost reduction, material-intensity reduction or increased “gadgetisation” of the product) when penetrating into different recipient technologies (penetration-I) or into different elements of the production process (penetration-II). The reason is that different technologies have different degrees of readiness when it comes to receiving a new technology. The same is true about all other elements of the production process and even about macroeconomics. For reasons we cannot go into here, the macroeconomic structure of Russian economy, in particular, is not is not friendly for many of the new technologies This is why the manufacturing company owned by the author and his colleagues had to take its newly developed Cyphermint technology (the basis of today’s

Yandex digital wallets), to the US market instead of going to the Russian market first! Why? The US market turned out to be more ready to receive it than the Russian one.

We refer to this phenomenon as the “readiness” (readiness-I for technologies, and readiness-II for other elements of the production process). Consequently, when describing a technology or some element of the production process from this point of view, we can speak of their “readiness potential” in relation to a specific technology. In our example with digital wallets, the readiness potential of the US market (the production complex with its technologies, production organisation, etc.) proved to be higher than the underdeveloped Russian market of the early 2000s.

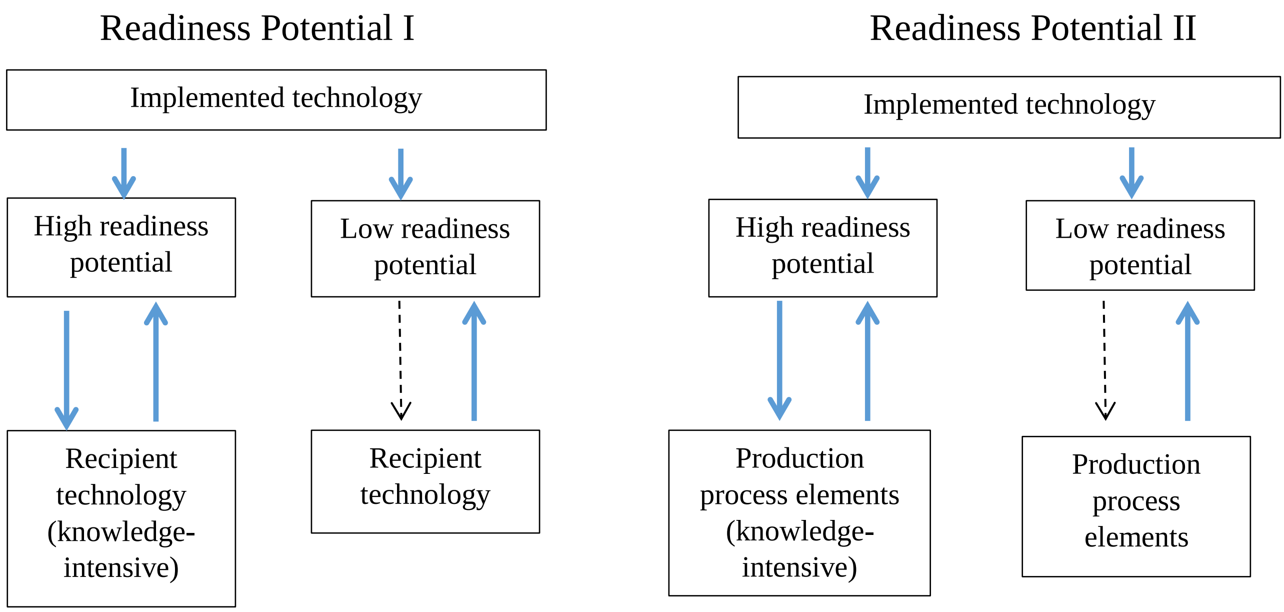

Fig. 10. Readiness potential of technologies

Soviet Academician Y. V. Yaremenko and his followers had noted the varying readiness of different technologies for new technological solutions early as the 1980s, when when they asked why the implementation of new technologies fared so badly in the USSR. They did not, however, go beyond admitting that new technologies were, as a rule, poorly received in a relatively backward technological environment. This is why the implementation of new technologies failed in the USSR, where the gap between technological levels of different industries and enterprises within an industry was often very great. Yaremenko wrote, for instance:

> In an economy with maximum concentration of limited technical resources at its top levels, with large qualitative gaps between individual groups of industries, with relatively big enterprises using simple and median technologies, the process of new technology implementation, though initially rapid, can slow down significantly or even stop. The demand for new technological means can go

down quite sharply. Maintaining this demand would require the creation of conditions for lowering barriers that hamper the inflow of quality resources.[1]

Yet there has been almost no specific research into the mechanisms of mutual influence and mutual penetration of technologies. The notion of qualitative heterogeneity of resources was introduced, and another Russian Academician S. Y. Glazev even took the next logical step, linking this notion to the existence of different technological modes in the economy.[2] With the onset of market reforms, we proclaimed the transition to an innovative economy and the matter was dropped. Nevertheless, the Economic Forecasting Institute of the Russian Academy of Sciences returned to it and came quite close to the idea of the receptiveness of the technological environment to new technologies: "Implementation of qualitatively new technologies makes sense only when subsequent elements of technological chains are able to receive and preserve qualitative additions that emerge as a result of implemented innovations,"[3] M. N. Uziakov pointed out. But these studies, in spite of their importance, never went any further in this direction, as far as we know.

So how can we describe a technology's readiness potential for the implementation of something new?

Readiness implies receptivity, but is not the same thing. Readiness means the ability to accept some change or intrusion. Relatively speaking, coal "accepts" the technology of a hammer blow and breaks into parts, which means that the impact made by the hammer is so effective that the receptivity of the action that we want to accomplish using this technology (the hammer blow) is higher than on some other material, such as a stone or a metal disc, or even the same material but with a different

[1] Yaremenko, Y. V. (1997). *Teoriia i metodologiia issledovaniia mnogourovnevoi ekonomiki. Izbrannye trudy v trekh knigakh* [Theory and Methodology of Multilevel Economy Studies. Selected Works in Three Volumes]. 1. Moscow: Nauka, p. 122.

[2] See: Glazev, S. Y. (1993). *Teoriia dolgosrochnogo tekhniko-ekonomicheskogo razvitiia* [Theory of Long-Term Technical and Economic Development]. Moscow: VlaDar, pp. 61, 168, 171–173, etc.

[3] Uziakov, M. N. (2001). Vzaimodeistvie kachestvennykh i massovykh resursov i effektivnost' ekonomiki [Interaction Between Qualitative and Mass Resources and Economy Efficiency]. *Problemy prognozirovaniia*, 1, pp. 23–24.

structure (with a different readiness potential), like a diamond. It is carbon, too, but it is structured in a different way, so it will not break. [1][2]

So Russia fails at implementing innovations because her readiness is low. The preparedness of our society (economy, business, industry, etc.) for innovative solutions is low. Infrastructure required to implement an innovative product is poor (e.g. the postal service is inefficient, there are no enough warehouses) the psychological mindset is wrong and people are not ready to receive the innovation due to lacunae in their education, cultural level and much more.

So, in this context, the common global task is to raise the society's readiness for innovations, to increase both the receptivity and its very feasibility in the event of appropriate penetration (in terms of potential) of suggested technological and, consequently, social innovations. How should this be done? At all stages of demand fulfilment and advances in demand satisfaction, the "conductivity" of a set of relevant ideas and relevant technologies needs to be continuously increased, while the "resistance" of the environment through which demand satisfaction is moving should be reduced. Speaking of the Russian economy, our current institutions create more friction and "resistance" as opposed to becoming relays, transformers or travelators and escalators; they have low conductivity as media for innovations. Elsewhere in the world,we see a different conductivity and readiness potential in various economic systems under the same technological mode in the same historical period.

Why is that?

Let us revert to the example with technologies. Although technology is underpinned by *knowledge*, the notion of technology's "knowledge intensity level" should not be equated with the notions of "penetration potential" or "readiness potential." There is certainly a correlation there, but it is not direct. An increase in knowledge intensity usually leads to an increase in both potentials for a technology, though not proportionately and not necessarily. This stems from the nature of

[1] A fullerene is an allotrope of carbon whose molecule consists of carbon atoms connected by single and double bonds so as to form a closed or partially closed mesh, with fused rings of five to seven atoms.
[2] Graphene is an one-atom-thick crystalline form of carbon in which carbon atoms, held together by strong sigma bonds, are arranged in a two-dimensional honeycomb lattice.

knowledge: it is transcendent, non-discrete and infinite, so the processes that originate from it cannot be described using common mathematical terms and do not abide by the laws described with these mathematical terms; for example, they are not governed by the wave theory that also describes reflection and superposition of waves. Technologies that provisionally have the same level of knowledge intensity can have different penetration and readiness potentials.

The key to selecting technologies for a breakthrough (into the next technological mode) is thus the analysis of penetration readiness. This task should be tackled by taking into account: (a) readiness potentials of recipient technologies and the overall condition of the production base (the technology mix of the respective technological mode, readiness potentials of existing production elements), and (b) penetration potentials of new technologies selected for implementation.

There is another important point that should be borne in mind while performing this analysis. Due to the aforementioned specifics of the subject under consideration, the result cannot guarantee one hundred per cent that the correct choice will be made. Even if we imagine that we succeed in, to quote Pushkin, “proving harmony by algebra” at the basic level (i.e. in defining accurately enough the relations between potentials of donor technologies and recipient technologies), we should be ready not to see a different logic at the next level of the “addition” of potentials. Here wave theory principles do not apply, and the potentials of “waves” do not sum up algebraically. Positive or negative “synergy” emerges (always), and it can either raise the level of industrial development to unprojected and unforeseen heights or yield opposite results.

What do readiness and penetration – and their respective potentials – depend upon? They depend on knowledge and its intensity in technology, i.e. on how far we advance. And although we cannot calculate exactly how much, this proves once again that those who take the bull by the horns will raise the potential of their society, its receptivity, impregnability or penetrability– and only then will we be able to jump from one technological mode to another. This is very important: progress is possible only through knowledge.

Second, what is also important is to progress in a systematic and comprehensive manner.

For example, when we speak of integrating production, science and education, we usually mean something utilitarian. We should train a professional who would also be an engineer. And this should be done systematically, as part of a unified course of action. Emergence of new knowledge in technologies will then be accompanied by higher conductivity, too. There will be fewer intermediaries, such as instructors who "get it all wrong," fewer plant directors who do not give correct information and clear directions to instructors, fewer ministries and departments, etc. The path to knowledge, then to technology and, subsequently, to product is getting shorter thanks to lower resistance of the superfluous informational burden, fewer wasted efforts and time and greater "trafficability" of knowledge. In this case, the conductivity of knowledge and, hence, of new technologies in the economy will go up, provided that we follow the path of integrating such spheres of public life as production, science and education. Then the penetration potential of new technologies, particularly technologies born in such a society, will be higher: they will be born with a higher level of knowledge. And readiness – the potential for positive "reception" of these technologies, will be higher as well. That is when a successive, derivative synergy will emerge. This kind of structure will appear in one place, then in another... Russian Silicon Valley Skolkovo may not be the best example, but let us still consider it. We need not this single site, but ten places like Skolkovo. Each such institution is created with the purpose of to increasing knowledge intensity (and, respectively, penetration and readiness potentials) of technologies. In the meantime, effects of interaction created between them will add up to the next level synergy. And so on. This example provides a rather accurate account of what should be done.

During such analysis, we need to select specific technology with maximum penetration and readiness potentials I and II that fit the technological mode selected as a springboard for transitioning to the next one. Let us take, for instance, the third technological mode and its mechanical devices. The emergence of mechanical instruments, i.e. mechanical processing technologies and production mechanisation, enabled a steep growth in the overall knowledge intensity of production and a decrease in its resistance to development, which actually resulted in a breakthrough. Why did the breakthrough happen? Because new mechanisation technologies had higher penetration potential compared to manual labour. It is no wonder that technology succeeded. Although the key recipient of those new technologies was the technological mode of a lower level, it allowed for the penetration of technology. In other words, the readiness potential of the previous technology was not too far, too low or too small as to be unable to receive the new technologies. For example, in the Stone Age, "mechanisation" would not take.

Or let us consider the subsequent stage, say, electricity. How come electricity became a universal technological solution for the subsequent technological mode? Because electricity is more knowledge-intensive. Electricity is also a technology that allows other things to penetrate faster. It forst penetrated other technologies, then other elements of the production process, and finally, it changed our lives. It gave people the filament lamp, so we started to read at night. Thus, the level of human knowledge-intensity thus increased. New demands started to emerge. People read and learned – and new demands appeared. That is how a new order got formed – solely thanks to penetration.

The same role is played today by the information/communication (digital) technologies. They have the maximum penetration potential, while readiness for them is very motile. That is to say, the ability to receive this technology on the basis that already exists is very high. That is precisely why the acceleration of acceleration appears: because the previous level is an "accelerating" level. Yet, if we had implemented this technology at the previous level, there would have been some acceleration, but no acceleration of acceleration. A breakthrough in technological development is enabled by the correct choice of technological potentials. As soon as a new high-penetration technology starts "penetrating," the synergy effect is produced. Resistance decreases, technology conductivity goes up, and new technologies act as "master keys" which change the social environment. Moreover, as far as production and production processes are concerned, it is easier to increase the acceleration rate using a single high-penetration technology or a basic combination of several technologies of this kind, rather than simultaneously raising the readiness potential of multiple elements. It is also important to identify areas for developing readiness and improving the readiness potential of recipient technology; it is critical to ensure that a set of technologies is selected from available technologies of the previous level and the selection is the most receptive to the technologies intended for penetration and can produce the highest synergy effect, since it is precisely this mutual influence, the "reflection of reflection," the impact of reflection of one potential on the other that generates that synergy. It is a mutual "mirror effect."

Reflection is a philosophical notion, but it is, in fact, a fundamental phenomenon of nature. The ordinary reflection which we see in the water or in the mirror is the simplest, superficial part of this very process. If understood in a broader sense, reflection is a sort of reaction involving the the transformation of the "reflected." "that coincides with the event of reflection. Therefore, mutual penetration constitutes mutual reflection. It is mutual penetration of everything into everything; yet, in a different manner in each facet. Through this effect, it creates the world and drives its development.

Chapter 7. Nooproduction: Technological Changes and Social Structure

Technological shifts that underpin the transition to nooproduction engender radical changes in all spheres of social life: people depart from immediate material production, and this cannot but overturn existing social relations. If the very nature of human activity is undergoing such deep changes that even economic regulators are becoming a thing of the past, if even human characteristics can change unpredictably, how should society change in order to meet these challenges?

7.1. Removal of People from Material Production and Economic Relations

Technologies of the new technological mode are, for the first time ever, capable of removing people entirely from immediate material production. Such production, we term nooproduction – in the sense that the human mind and human knowledge will serve both a key resource and regulator.

Back in the second half of the 19th century, Karl Marx prophetically identified such prospects in the trend toward the growing role of human knowledge in the development of industrial production.[1] But only now we can, for the first time ever, more or less accurately determine the specific technological basis that actually enables people to depart from immediate involvement in material production while remaining its "controllers and regulators."

Such a fundamental technological shift also entails a no less fundamental shift in social relations. If people leave immediate production, social relations previously built around human production activity vanish as well. Production relations gradually disappear, and production loses the form of an economic activity, because the production sphere will be functioning without direct participation of the humans. The

[1] Marx noted the transformation of "the production process from a simple labour process into a scientific process that uses the forces of nature and makes them serve human demands and… into empirical science, materially creative and related to production" (Marx, K. *Ekonomicheskie rukopisi 1857–1859 gg* [Economic Manuscripts of 1857–185]. In Marx, K. and F. Engels. *Sochineniia* [Collected Works] 46, 2, p. 208, 221).

economy as we know it is becoming obsolete. What will take its place? People may leave production, but it still remains the material condition for human life, and so must somehow govern social relations. Since people are not engaged directly in this process, however, *it is no longer an economy, but* the noonomy – *relations that take place not in the framework of production accomplished directly by people, but relations around nooproduction, which develops without direct involvement of people albeit is still regulated and directed by the human mind*.

Vernadsky's conclusion about the genesis of the noosphere more than fifty years ago came to be accepted gradually by a wide community of intellectuals over the 20th century. Yet economists ignore ignore the problem of transformation of biosphere into noosphere, nor touching the problems of biosphere itself, mainly focusing on the issues of environmental protection costs, neither take into consideration the concept of noosphere. Meanwhile, the noosphere develops out of the economy and transforms it, needs themselves will take a non-economic form. Moreover, economy as a sphere of economic relations that people form around production and exchange of products will shrink and then disappear completely not because the cost of raw materials or energy required for production will not matter anymore, but because people will not be directly involved in relevant activities, so there will be no interpersonal relations pertaining to production. People will leave immediate production, making the spawns of the technosphere – technetic creatures – do all the work...

The economy will become redundant. Economic process will become "thing-in-itself," – autonomous self-mantaining sphere, which we take no interest in. With the removal of people from immediate production process, Marx concluded, the "economic social structure" would have reached its end. After him, postindustrialist theoreticians predicted the onset of the "posteconomic society"[1] (though they preferred the term postindustrial to posteconomic).

[1] See, for instance: Kahn, H. (1970). *Forces for Change in the Final Third of the Twentieth Century*. N. Y.: Hudson Institute; Brockway, G. P. (1996). *The End of Economic Man: Principles of Any Future Economics*. W. W. Norton & Company; Inozemtsev, V. L. (1998). *Za desiat' let. K kontseptsii postekonomicheskogo obshchestva* [In Ten Years. On the Concepts of Posteconomic Society]. Moscow: Academia. Introduction.

Yet the "postindustrialist" view of posteconomic society is absolutely different from Marx's view, and especially from the ideas laid out in this book. Postindustrialists totally ignore the problem of removing people from direct involvement in the production process and talk solely about the decreasing significance of material production compared to the service industry and changd structure of human demands. However, in the service industry people remain directly involved in the production process – even if we do not consider drivers, porters, shop assistants, housemaids and dishwashers and instead analyse postindustrialists' beloved "creative class," i.e. managers, advertisers, marketing professionals, financial brokers, media producers, etc. Besides, postindustrialists associate the shift towards non-economic motivation and values solely with the relatively small socioprofessional group whose labour comes to have a high intellectual and creative content.

Their version of the posteconomic society is like some sort of an elite club. For instance, Peter Drucker argues that "Knowledge workers will not be the majority in the knowledge society… A society in which knowledge workers dominate is under threat from a new class conflict: between the large minority of knowledge workers and the majority of people who will make their living traditionally."[1] Daniel Bell, the "patriarch of postindustrialism," takes the same stand.[2] The imagination of postindustrialists is thus limited to transforming the working conditions of a small part of the workforce, and even then the changes are only partial, so that economic motives, goals and values do not disappear at all, and do not even fade into the background.

The perspective of the famous publicist, Francis Fukuyama, appears more radical, yet is much more superficial: he proclaims the dawn of a posthuman future as biotechnology changes human nature.[3] While he is not unaware of the risks, the social shift associated with the new technological revolution is much broader than Fukuyama

[1] Drucker, P. (November 1994). The Age of Social Transformation. *The Atlantic Monthly*. 274, 5, pp. 53–80.
[2] See: Bell, D. (2004). *Griadushchee postindustrial'noe obshchestvo. Opyt sotsial'nogo prognozirovaniia* [The Coming of Post-Industrial Society. A Venture of Social Forecasting]. Moscow: Academia, pp. 171, 301 etc.
[3] Fukuyama, F. (2004). *Nashe postchelovecheskoe budushchee. Posledstviia biotekhnologicheskoi revoliutsii* [Our Posthuman Future. Consequences of Biotechnological Revolution]. Moscow: AST, Liuks.

assumes as he assesses the challenges of biotechnology with a weird mixture of liberal and conservative prejudices.

Our approach goes much further. I believe that nooproduction resulting from the technological revolution will transform economic organization. .

Marx's insight into the economic transformation that greater knowledge intensity of labour would bring about was also taken up my his followers. . Soviet scholars of of this school in the 1960s–1970s suggested in a sort of parenthetical and tentative way that the new social system that (in their opinion) would soon replace the capitalist one would be not merely a new economic structure, but a qualitatively new system of social relations, and that the end of the capitalist mode of production would signify the end of a larger social system that Marx called the "realm of necessity" and "prehistory."[1] At the moment, this idea is presented as one of the distinctive features of the *Post-Soviet School of Critical Marxism* movement.[2]

First, our approach is considerably different from the arguments presented by representatives of this variety of Marxism (mind that, for orthodox Marxism, the idea of postcapitalism as a posteconomy is a heresy[3]). , Weare not talking about a communist revolution or a future society of Communism and we do not propose some abstract "realm of freedom" as the model for the future. Rather, we put forward a detailed theory that lays down the system of qualitative changes in all spheres of social life.

By noonomy (clarifying the definition provided above), *we understand a non-economic mode of productive organisation of people who have gone beyond material*

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[1] Marx, K. K kritike politicheskoi ekonomii. Predislovie [A Contribution to the Critique of Political Economy. Preface]. In Marx, K. and F. Engels (1959). *Sochineniia*. [Collected Works.]. Vol. 13. Moscow: Politizdat. pp. 7–8. See also: Vaziulin, V. A. (2015). *Logika istorii. Voprosy teorii i metodologii* [The Logic of History. Theory and Methodology Issues]. Moscow: LENAND, pp. 319–321, 335.

[2] Buzgalin, A. V. and A. I. Kolganov. (1990). *Po tu storonu otchuzhdeniia: sbornik politico-ekonomicheskikh gipotez* [Beyond Alienation: Collection of Political and Economic Hypotheses]. Moscow: Moscow State University; Buzgalin, A. (1998). *Po tu storonu tsarstva neobkhodimosti (eskizy k kontseptsii)* [Beyond the Realm of Necessity (concept drafts)]. Moscow: Ekonomicheskaia demokratiia, pp. 27–34, 44–51; Buzgalin, A. V. and A. I. Kolganov. (2004). *Global'nyi kapital* [Global Capital]. Moscow: Editorial URSS.

[3] In the Soviet so called Marxism-Leninism the definition of communism as a socio-economic formation was canonized, and thus any doubts in the economic nature of post-capitalist study of the development of human society considered as unacceptable.

production. In other words, the difference between noonomy and the economy lies in the absence of people's relations in the material production process.

In all previous stages of human evolution, individuals entered into relations that arose from material production; the essence of the noostage is that relations are formed between two different spheres of civilisational structure –nooproduction or the technosphere and human society. (See Fig. 11).

It is structure of human civilisation that is undergoing fundamental change not just the social structure. Society is distinguished here as a part of human civilisation because, for the first time in history, the technosphere is, in a sense, being separated from the society. Whereas previously people related to one another through their involvement in the functioning of the technosphere, they now enter into relations with unmanned material production as "its controllers and regulators" while relations between people are determined by their impact on the sphere of "unmanned production" and which, in turn, determine the development paths for unmanned production.

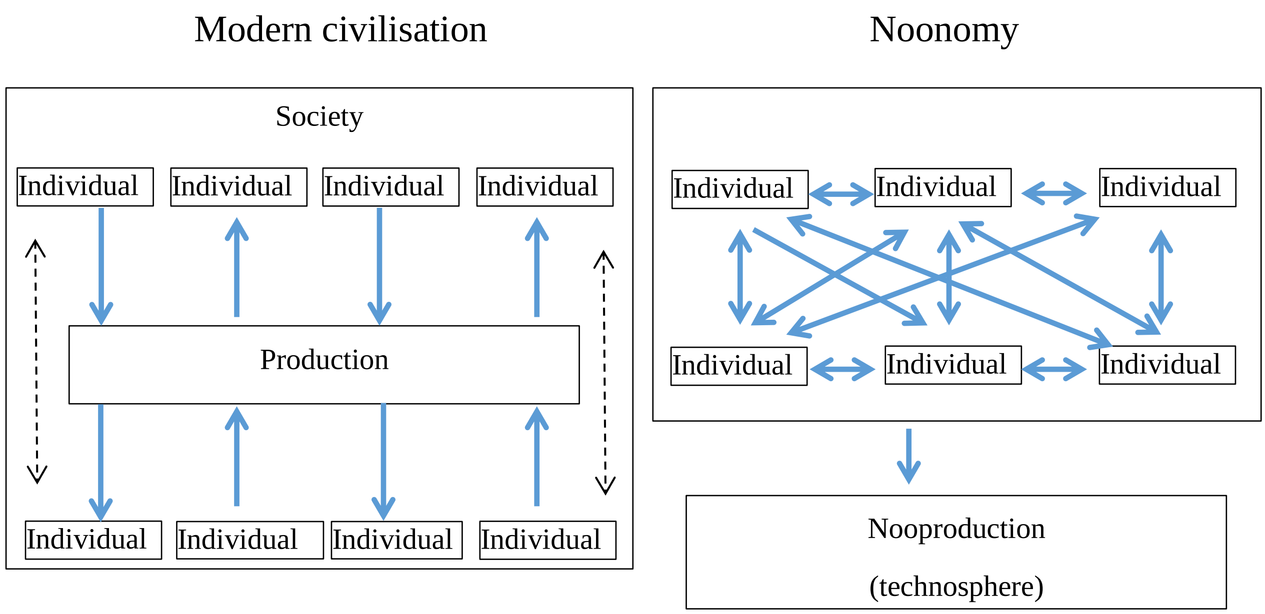

Fig. 11. Change in civilisational structure during the transition to noonomy

Such relations will no longer be specifically economic relations but the same relations in any other type of human activity not associated with production. Specifically economic forms of public life will gradually fade.

Property relations, one of the key economic forms, will gradually lose their significance (owing to the increasing accessibility of benefits and decreasing value of products). It will happen first in people's business activity, and then these relations will generally disappear from social relations. With the disappearance of property, the economy itself will disappear because it is based on the relations of acquisition and disposal.

Why is property losing its significance? Because the value of has historically been property gives is decreasing, as everyone can satisfy all non-simulative wants and the more we advance towards the NIS.2, the easier, faster, etc. such satisfaction becomes. Everybody will be able to gain without pain, and consequently, there will be none of the privileges granted as a reward for labour through the acquisition of its results and property.

Why is it getting cheaper? Because previously production was at the expense of: (a) natural resources – which are free (!), and (b) knowledge. Since knowledge essentially gets something else from the original natural resource it is present in all four components of the production process (labor, means of production, technology and the organization of production). Everything new is added knowledge, nothing else. Actually, the material is free, the amount of knowledge is progressively increasing, its share in the product is increasing (owing to processing achievement and stages accumulating in a new product with each new "iteration"). However, this would make the produce more expansive only if knowledge were exclusive. However, it is not. Knowledge may be exclusive at the time of its "emergence" but it immediately starts spreading..

In modern terms, this is "allocation of costs of the information products among their users", which is providing the reduce of cost per unit proportionally to the number of users. This effect based on the extreme case of increasing yield due to extremely low cost of information replication and distribution.[1] But these are "procurement" expenses in current prices. Now, if prices start going down with the advance towards the NIS.2, the product will be procured at a progressively lower cost... That is, there will be a virtually exponential drop in the value of all we produce. Hence, the significance of property will be decreasing. It will "cost" nothing whereas now, au contraire, property is "embodied labour," accumulated labour, an exchangeable reserve for the satisfaction of future demands. In the future, it will be "embodiment" without labour. What will be the meaning of property then? The words "one's own" will vanish completely. That is to say, nothing will be anyone's own; it will be just the world that satisfies rational human demands without "labour" in the current conventional meaning of the word. Similarly, you cannot say that a mountain is yours; there is a mountain, and that is it.

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[1] Arthur, W. B. (July - Aug 1996). Increasing returns and the new world of business. *Harvard Business Review*. 74(4), pp. 100–9.

7.2. Knowledge Acquisition: From Industry through NIS.2 to Noonomy

Labour is any effort we direct at obtaining/applying the knowledge we need to the satisfaction of our needs. Even the application of knowledge is knowledge! So talk about "knowledge production" and "knowledge economy" can be misleading. *No individual produces knowledge; it is the collective effort of society and builds on the efforts of previous generations through exploration and discovery* resulting in the "expansion of consciousness", of the area of knowledge available at a specific time to a person and to the humankind in general.

The relationship between the conductor's resistance, amperage, and voltage that Ohm discovered, and which is known as Ohm's law, existed before Ohm, without Ohm. He discovered it just as Vasco da Gama discovered the sea route to India. Discovered, not created. The laws of nature and society exist independently of us; we can increase our knowledge of these laws, become aware of them, and extract this knowledge from the outside world, but we do not produce it. At the moment, we observe the same technological shifts in "knowledge procurement" as in industry. In recent decades, scientific activity (in all its aspects: organisation, costs, results, implementation into a system of public demands and interests, etc.) has been going through such radical changes that we can even speak of its transformation from research activity into something new that meets the challenges of social transformation associated with the start of our civilisation's transition to the NIS.2.

In the 20th century alone, the number of scientists saw a dramatic increase (4500%-7500%), according to some estimates[1]. Expenditure on time, scientific activity measured in PPP terms grew more than a thousand times[2] with few contesting the need for and the inevitability of further increases.

[1] Allahverdian A.G. (2014). Dinamika nauchnyh kadrov v sovetskoi I rossijskoi nauke: sravnitelno-istoricheskoe issledovanie [The dynamic of scientific personnel in the Soviet and Russian science: comparative-historical research]. Moscow: CogitoCentre, p. 53; Avdijskij V.I. (2014). Rol nauki v podgotovke spetsialistov novoi formatsii. [The role of science in the training of professionals of new formation]. Financial University under the Government of Russian Federation, 21.02.2014. URL: http://www.old.fa.ru/science/iscience/Pages/science-role.aspx.

[2] Radzihovskij L. (2016). Burzhuaznaya nauka [Bourgeois science]. Rossijskaya gazeta. 10.10.2016. No. 229(7097).

And these are only the most superficial indicators. More is revealed from the perspective of the NIS.2.

To return to the NIS.2 framework, the development of knowledge-intensive production in it is based on the paradigm that prioritise knowledge in all its components. By contrast, whereas at the initial stages of conventional industrial production and its build-up material resources played the key role, and the cost of an industrial product was mainly determined by the quantity of raw materials spent and of "not knowledge-intensive" labour employed.

So, scientific knowledge acquires increasing importance as an industrial resource, gradually becoming its basic resource. This new status of science drives the transformation in the development of science.

Further NIS.2 development involves an integral production–science–education triad, the cornerstone of the NIS.2 conceptual platform. Galbraith's concept of the new industrial society tacitly implies such integration. However, he assigned the key role to production, with science and education playing subordinate roles, "serving" the needs of industry. In the NIS.2, their positions shift. Knowledge acquires the basic role in the triad and becomes the driver of knowledge-intensive production. In fact, by becoming the main production resource, the directly productive force, knowledge replaces the "material part" NIS.2 production.

Let us put this in the context of the relation of science to production so far.

Industrial production involved the transition from individual artisan labour to mass production, a transition that enabled capitalist relations to take over industry. "Capitalisation" of industrial production transformed not only social relations, but also production itself. Relevant changes include capitalist forms of resource utilisation and product handling, marketing technologies, promotion, and the organisation of business processes and procedures.

Is science going to follow the same development course (complete subordination of science to commercial interests and turning all the results of scientific research into a commercial product) becoming the basic resource and the key driver of development in the production in the NIS.2?

Many facts prove what now seems obvious: science is largely following the development path of production, transitioning from individualised scientific labour to “mass science” and the concentration of “scientific capacities.” We are also witnessing “monetisation” and “capitalisation” of science. From being merely a piece of intellectual work, research is turning into a scientific commodity, complete with PR, marketing, and asset appreciation.The creative act of acquiring scientific knowledge turns into a marketable and marketed product. All components of research are affected and are even experiences the negative effects of growth of investments into R&D and increase of size of organization in this sphere , such as bureaucratisation processes). Science and research are gradually being “industrialised.”

How long can this go on?

In the framework of capitalist social relations, science can only become a a direct production force, a basic resource, by becoming capital. At the same time, this has problems and pitfalls, some of which we can anticipate.

NIS.2 implies not only a new method of material production but also new forms of public institutions required by the characteristics and special nature of knowledge. They imply that no matter how we try to limit it by boundaries and copyrights, knowledge is generally social and “reproducible,” not private and excludable. Knowledge is also special due to the way in which people assimilate it.

NIS.2 will change both the role of knowledge and the methods of its utilisation and procurement, taking us from the role of knowledge as a commercial product back to it original, mainly creative essence.

Progress and evolution towards more public avenues of knowledge acquisition will continue. As knowledge become an increasing element of labour function, it will enable its holders to gain the upper hand and will contribute to their radical emancipation from the power of capital. There is already an observable trend toward this: capitalist employer are beginning to become dependent on employees with rare and important competences, reversing the classical dependence of a worker on capital. Often such reverse dependence is much stronger than the conventional one. Then there are young multimillionaires, owners of technological companies, who did not need much start-up capital to set up their business. These trends demonstrate that today high-level technological solutions are falling on good soil already "fertilised" by previous technologies with high readiness potential for high-tech technologies such as blockchain and virtual currencies to which Vitaly Buterin, a young entrepreneur on the Forbes list, owes his fortune). These interrelated trends help us the movement towards NIS.2 and the social forces that drive and benefit from it.

The NIS.2 stage is alreadyeliminating some economic forms. But what will replace them? Surely, NIS.2 production, just like creative, "knowledge-producing" and "culture-producing" activity, cannot remain outside social relations.

If not, how will people exert their influence on unmanned production? How are they going to decide where to direct it? What should be controlled and regulated in it? While, production will exist outside human relations, but will not be isolated from people. Thereproduction of human life will, after all, still depend on it.

That is where we face a dilemma: either society will fail to use the opportunities for self-improvement created by NIS.2 and get carried away by false goals and values and never get to noosociety and noocivilisation; or, it will implement the nooapproach and reformat the current civilisational settings.

At the noostage, production will remain subordinate to society as far as its goals and objectives are concerned. Setting goals, and controlling acceptable means of achieving them will remain in the human domain. Autonomous technoentities functioning under nooproduction and developing themselves will still remain dependent on human society to direct then, their extent and character. (See Fig. 12).

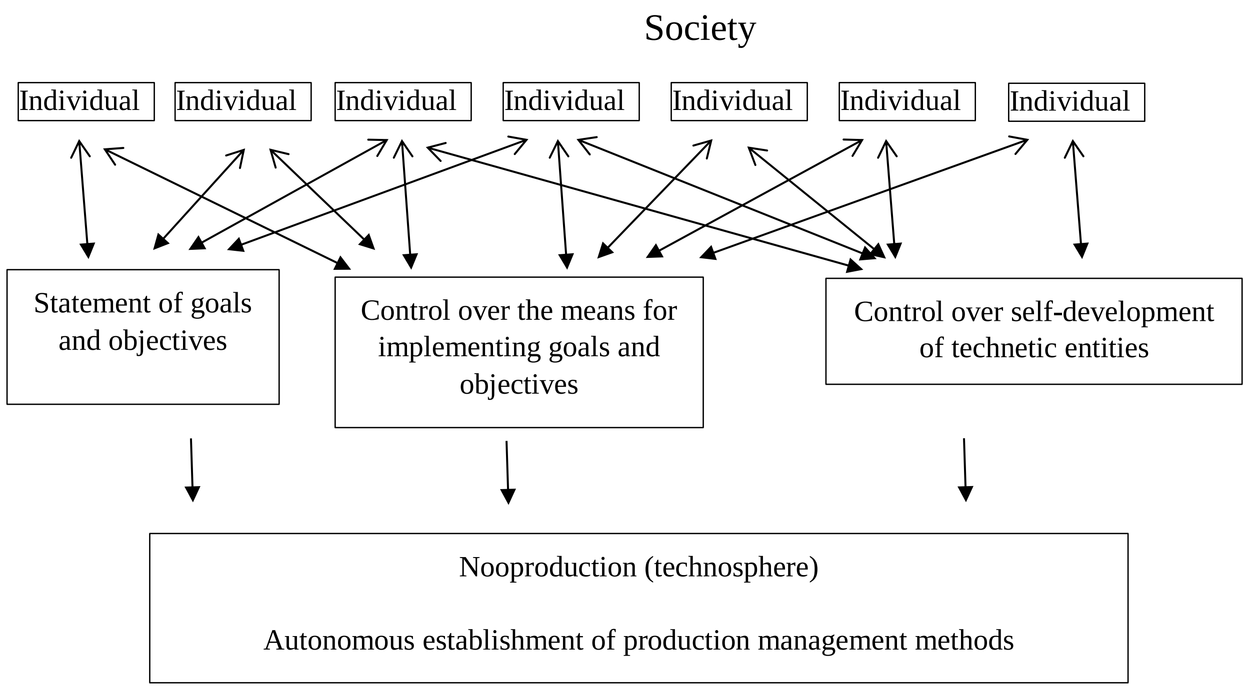

Fig. 12. Human relations in nooproduction regulation processes

We are not talking about utopias here. This process is already underway; people are already being removed from production. Who would argue that the approaching Industry 4.0 based on the Internet of Things does not ensure full-fledged material preparations for this kind of change?

While we cannot envisage this future fully or idenfity all its components, is should be clear that we are witnessing shifts incommensurably deeper than, for instance, considering environmental limitations on production.

This brings us to raise the question of the *social form of nooproduction*. What imperatives will govern both the production of material and spiritual conditions of human life and the social relations that regulate such production? The condition of the noosphere in general will be critically dependent on this.

7.3. Will Humans Persevere?

Modern technological development is already having some troubling effects, particularly on the society and people. Look at the current demographics: Europe, the US and Canada are registering a process that specialists call a "demographic transition": i.e. a qualitative change in the demographic structure. As a direct consequence of technological progress, the balance of high mortality and high birth rates is being replaced by low mortality and low birth rates. Under the NIS.2, this process will reach its peak for "biohumans" when the demand for further extension of life expectancy may result in the desire for a qualitative change to the human "shell," for replacing natural organs with artificial ones and even going as far as completely substituting an organic body with a virtual avatar . Will such a creature need material objects of the physical world? This question seems rhetorical. The demands of such a creature will obviously be different, and its material shell (so far, it is unclear what technosubstance it will be made of) will be the only thing connecting it to the material world. Sounds far-fetched? The prerequisites for imminent "biotechnohybridisation" of people are already being created.

Consider the trends among the young generation, the so-called Generation Z. Over the past decade, their information load (information consumption, satisfaction of their information demands) has multiplied to dozens of hours per week. Not only the amount, but also the quality and structure of information consumption are changing: Generation Z has switched from TVs to smartphones that provide much more information per unit of time, and this information is customised.. Cognition is becoming mosaic-like, with attention shifting form one to another fragment of new information at great speeds. A new mode of existence in a new informational medium is emerging. New generations will not merely obtain more information, but will have new technology for searching and navigating the informational medium, new means for searching for information and assimilating it.

While new information communication opportunities can potentially open up a whole new world to people, today this trend often assumes monstrous, perverse forms. For virtual space can both expand opportunities for communication and narrow them, thus promoting self-isolation; the Japanese *hikikomori* come to mind: they sit at their computers for ages and reject not only ordinary communication, but also normal practices, like regular meals, timely change of clothes, fitness and wellness...Information consumption results in information simulacra, surrogates of knowledge, etc. It is like informational chewing gum or media drugs.

The art of creating simulative products and needs was already mastered by the market back amid the 1960s counterculture. In addition, the drift from text to image and mosaic-like thinking entails the loss of logic and consistency in knowledge assimilation. Still, positive aspects are inevitably making headway too, like the young generation's decreasing interest in the material side of life registered by sociologists.

The thesis about *the rise of culture as a sphere enabling the achievement of key noodevelopment objectives* warrants a separate comment. As I have already pointed out, the well-known classical thinker whose 200th anniversary was celebrated in May 2018 wrote back in the 19th century that the future of humankind – "the realm of freedom" – lies essentially beyond material production.[1] Followers of Marx – intellectuals of the Soviet Thaw period, modern Russian thinkers Evald Ilienkov, Vadim Mezhuev, Liudmila Bulavka and others[2] – stressed a century later that the development of "the realm of freedom" was, in fact, the development of culture. They justly argued that it was culture that constituted the main sphere of life for rational people and the "rational" society.

Yet they seemed to neglect the second part of Marx's statement where the German thinker stressed that the world of culture could blossom only on the basis of appropriate, highly efficient material production:

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[1] See: Marx, K. (1962). Das Kapital. In Marx, K. and F. Engels. *Sochineniia* [Collected Works]. Vol. 25, Part 2. Moscow: IPL, pp. 386–387.

[2] See for example: Ilienkov, E. V. (1991). *Filosofiia i kul'tura* [Philosophy and Culture]. Moscow: Politizdat; Mezhuev, V. M. (2011). *Istoriia, tsivilizatsiia, kul'tura: opyt filosofskogo istolkovaniia* [History, Civilization, Culture: Attempt at Philosophic Interpretation]. St. Petersburg: SPbGUP; Mezhuev, V. M. (2007). *Marks protiv marksizma: stat'i na nepopuliarnuiu temu* [Marx Against Marxism: Articles on an Unpopular Topic]. Moscow: Kul'turnaia revoliutsiia; Bulavka, L. A. (2008). *Fenomen sovetskoi kul'tury* [The Phenomenon of Soviet Culture]. Moscow: Kul'turnaia revoliutsiia; Zlobin, N. S. (1980). *Kul'tura i obshchestvennyi progress* [Culture and Social Progress]. Moscow: Nauka; Bibler, V. S. (1990). *Ot naukoucheniia – k logike kul'tury: dva filosofskikh vvedeniia v dvadtsat' pervyi vek* [From Epistemology – to the Logic of Culture: Two Philosophical Introductions to the Twenty First Century]. Moscow: Politizdat.

> Just as the savage must wrestle with Nature to satisfy his wants, to maintain and reproduce life, so must civilised man, and he must do so in all social formations and under all possible modes of production. *With his development this realm of physical necessity expands as a result of his wants*; but, at the same time, the forces of production which satisfy these wants also increase. … Beyond it begins that development of human energy which is an end in itself, the true realm of freedom, *which, however, can blossom forth only with this realm of necessity as its basis* (italics added – S. B.).[1]

This is why I want to come back to the topic I started with – the importance of nooproduction guided by strategic objectives but not neglecting urgent tactical tasks.

7.4. Overcoming Existing Inequality. Creating New Inequality

Our forecast of the transition to the noosocial stage is not aimed at contrasting the current conflict-ridden state with an idyllic picture of a society without contradictions because such a society will have no impetus for development. Therefore, we deem it important to consider the possible nature of the inequality that emerges under the nooproduction and noonomy.

While they will facilitate a dramatic and critical breakthrough in satisfying non-simulative human demands, they are not without contradictions, including fundamental ones such as the contradiction between the individualisation of private life and the growing importance of socioeconomic environment, between the natural demand for privacy and critically shrinking opportunities for fulfilling this demand (in a technologically open society!). There is also another contradiction between seeking equal access to the basic resource – knowledge – and the impossibility of achieving such equality owing to people's unequal abilities; this contradiction can be very acute.

[1] Marx, K. (1975). Capital. A Critique of Political Economy. Volume III. Karl Marx and Frederick Engels Collected Works. Vol. 37. New York: International Publishers. P. 807.

There is also a conflict between the level of competences required in order to be employed at the NIS.2 stage and the critically significant number of members of society unable to achieve this level.

This sort of change in basic social contradictions was noted quite a long time ago. Commenting on the works of some Western authors back in the late 20th century, V. L. Inozemtsev argued that

> the new confrontation will arise on a different terrain; in the emerging post-economic society, power will be based on a new limited resource, while the two polar classes will eventually incorporate all currently existing social groups. Meanwhile, we are already able to state quite positively what specifically will be *the most important resource of the new society – it will be the ability to assimilate and create knowledge* that drives technological progress and forms new social technologies.[1]

He believed that this stratification will be determined by individual, innate features as opposed to social characteristics:

> People that currently make up the elite, no matter what we call it – a new class, a technocratic stratum or meritocracy – have qualities that are not conditioned by external social factors. Today, neither society nor social relations make individuals part of the ruling class or vest them with power over others; humans mould themselves as bearers of the qualities that enable them to get into the top social stratum.[2]

The same approach is professed by Mikhail Deliagin: "People will compete in their innate creative abilities which cannot be taught. Compared to the current social competition, the next stage is going to rely predominantly on biological competition.

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[1] Inozemtsev, V. L. (1999). *Raskolotaia tsivilizatsiia* [A Split Civilisation]. Moscow: Academia-Nauka, p. 550.
[2] Inozemtsev, V. L. (1998). *Za predelami ekonomicheskogo obshchestva* [Beyond the Limits of Economic Society]. Moscow: Academia-Nauka, p. 435.

That is, a person born without aptitude will have significantly fewer opportunities than now."[1]

In my opinion, however, we should not underestimate the capabilities of cognitive technologies to develop human abilities for creative thinking and transforming reality. Moreover, the differences in human intellectual capacities are not associated solely with people's individual abilities; they are generally more likely to be conditioned by access to high-quality education, intellectual resources and a wide range of cultural riches.[2]

We have already mentioned here the conflict between the economies that managed to catch up and those that failed to do so, as well as the issue of inequality that stems from contradictions associated with a shift in global geo-economic relations.

Thus, the new inequality should not be seen as the current inequal opportunity to consume natural resources mostly driven by pursuit of material wealth. It is going to be a different inequality – inequality in the satisfaction of cultural/spiritual demands, opportunities for personal development and opportunities for the development of creative abilities and cultural demands.

The same factors will also determine the differences in the development of national economies. That is why the future of our economy lies in unconditional abandonment of the current approach, which uses all the proceeds from sale of oil and other natural resources to defuse major social tensions. In order not to be the "Neanderthals" in the noo-era, we need to divert investment flows into those sectors that determine the development of human abilities.

"It is worth investing in people because people with elevated capacities will be able to yield greater economic results." This thesis, while rather popular, extremely rarely used in practice. Moreover, it has flaws. It is worth investing in people because investing in people is gradually becoming the objective of nooproduction and those

[1] Deliagin, M. (4 June 2011). *Transformatsiia sovremennogo chelovechestva i imperativy postsovetskogo prostranstva* [Transformation of Modern Humankind and Imperatives of the Post-Soviet Space]. http://www.odnako.org/blogs/transformaciya-sovremennogo-chelovechestva-i-imperativi-postsovetskogo-prostranstva/

[2] For criticism of Inozemtsev's concept concerning the nature of inequality in the postindustrial society, see: Buzgalin, A. V. and A. I. Kolganov. Global'nyi kapital [The Global Capital]. 2. In *Teoriia: Global'naia gegemoniia kapitala i ee predely* [Theory: Global Hegemony of Capital and Its Limits]. Moscow: LENAND, pp. 467-70.

who are the first to perceive this purpose will succeed. Abandonment of social differences in terms of wealth and switching to competition in self-fulfilment in the area of spiritual (scientific, cultural, etc.) development will create a new, broadest impetus and opportunities for the development of human society.

In order to understand the role of inequality at the noosocial stage, it is necessary to review common ideas of equality and inequality.

In our civilisational development, all we ever do is use knowledge to try to satisfy our ever-growing demands in a more and more complete manner (due to our continuously "augmented cognition"; this process, in turn, constitutes an inherent consequence of the nature of knowledge itself); it should be said that we are not entirely unsuccessful in this venture. At the most basic level, one would think that the more fully we satisfy our demands, the more equal we become since ideally, in the noosociety, everyone is satisfied "to the fullest," with quality and speed that in and of themselves constitute a demand to be satisfied. This base approach that views equality as equal consumption ("take everything and share it equally") warrants no consideration at all! It takes no account of need. Infants do not need textbooks. An absolutely different approach is required here, in our opinion.

The classical Marxist approach, from each according to his abilities, to each according to his need, is somewhat better. But Marx never claimed that this was the solution to the problem of equality. In fact, can needs be equal? They cannot, just like abilities. Eequal opportunities are also impossible: even if there is a pie, and everyone has equal opportunities to take a bite, each person will get a different piece, for all mouths are different. Consequently, this approach cannot be used for the analysis –of (in)equality!

But let us move on. Individual equality can be defined as an equal degree of satisfaction of individual demands/wants, which, although different, are all satisfied in equal measure, so everyone is happy and wants nothing else, and then – only then! – everybody can be deemed equal. From this point of view, there will, indeed, be equality. Yet is it possible? Obviously not.

Hence, we conclude (and it is a fairly straightforward conclusion) that the equality which French revolutionaries dreamt about and our narrow-minded revolutionaries and slogan- and songwriters embraced does not and cannot exist at all.

There is a Belarusian proverb: "*Bog niarouna dzele*!", God gives in unequal measure. Knowledge is unequally accessible to different people, thanks to their individuality. This is where the need for individual freedom comes from. For individuals, just as for any phenomenon determined by their mind, this demand will never be fully satisfied.

This implies that a person is merely a reflection of a certain "quantum" of knowledge, or their mind. Even if we imagine the impossible, that all initial quanta of knowledge are the same for all persons, each individual, while transmitting this quantum, adds personal interference to it and distorts its reflection. These distortions can be greater or smaller depending, for instance, on the state of the human mind. Thus, individual differences are created. They, in turn, form different/dissimilar demands, whereas only equal demands can be satisfied in an equal manner.

So, there is no equality. Thousands of prison inmates in Russia have tattoos proclaiming the popular wisdom, "Ain't no happy endings." While happiness is not equality, the eternal human dream of happiness has always (for some reason) been sublimated into the notion of equality. In general, "Liberté, Égalité, Fraternité," the slogan of the French revolution, is not feasible because it contradicts itself in multiple aspects.

No wonder, wise revolutionaries steered clear of such base interpretations of equality. Engels wrote, for instance: "The concept of a socialist society as a realm of *equality is* a one-sided French concept deriving from the old "liberty, equality, fraternity", a concept which was justified in that, in its own time and place, it signified a *phase of development*, but which, like all one-sided ideas of earlier socialist schools, ought now to be superseded, since they produce nothing but confusion, and more accurate ways of presenting the matter have been discovered."[1] And he suggests a more accurate definition later on: "In both cases, the real content of the proletarian demand for equality is the demand for the *abolition of classes*. Any demand for equality which goes beyond that, of necessity passes into absurdity."[2] The classical Marxist thinkers wrote almost nothing about equality in consumption (equality of labour and payment is mentioned only in *Critique of the Gotha Programme* in connection with the first phase of Communism; yet Marx also points out there that inequality in consumption will still persist).[3] They directly associated equality in consumption ("to each according to his needs") only with the phase of social development when labour becomes the top vital need.

Why then has the dream of happiness always been associated with equality? I suppose the answer is simple: because unhappiness is associated with flagrant inequality. This is a simple, clear answer, though not entirely accurate. Inequality – as shown above – is an inevitable condition of the society at a certain stage in its development. Moreover, inequality *to a certain degree* is necessary and beneficial for development. Calls for equality appear when this *degree is exceeded.*[4] It is not a rationally elaborated programme, but a mere manifestation of protest. "Liberty, equality, fraternity" is but a protest slogan designed to stir up the masses and present them with the dream of a more just society, but it is not a positive programme (major figures of the Bourgeois Revolution in France, American and other revolutions never took the slogan seriously).

Analysis of economic inequality (or any economic problem, for that matter) makes sense only at the stage which predates the formation of noosociety. It can yield

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[1] Engels F. (1975). Letter to August Bebel. March 18-28, 1875. Karl Marx and Frederick Engels Collected Works. Vol. 24. New York: International Publishers. P. 71.

[2] Engels F. (1975). Anti-Dühring. Karl Marx and Frederick Engels Collected Works. Vol. 25. New York: International Publishers. P. 99..

[3] "This equal right is an unequal right for unequal labor. It recognises no class distinctions, because everyone is only a worker like everyone else; but it tacitly recognises unequal individual endowment, and thus productive capacity of the workers, as a natural privileges. It is, therefore, a right of inequality, in its content, like every right." (Marx K. (1975). Critique of the Gotha Programme. Karl Marx and Frederick Engels Collected Works. Vol. 24. New York: International Publishers. P. 86.).

[4] For social consequences of increasing inequality, see, for instance: Bodrunov, S. D. and J. K. Galbraith (2017). *New Industrial Revolution and Inequality Issues*. Moscow: Rossiiskii ekonomicheskii universitet imeni G. V. Plekhanova, pp. 50–51, etc.

important results in terms of understanding the relationship between the level (speed) of need satisfaction and the level (speed) of need growth in various social strata at various stages of civilisational development. And we have to admit that scholars recently started to pay progressively more attention to this problem and are now engaged in extensive and substantial research on the issue.[1]

Such research gives an idea of the socioeconomic system's movement toward disruption and destruction. The above-mentioned relationship can serve as an indicator thatsocial tensions are close to boiling point and will explode and transition to a new state. Thus, a sense of inequality and injustice is an indicator of social unrest, a sign that the gap between the possible and desirable, on the one hand, and the accessible, on the other hand, is perceived as too great for the majority of people.

Like a boiler, a system can explode with uncontrolled build-up of temperature/pressure. In that case, its contents will spill out and cool down. Or when the indicators reach critical values, the content may be stirred up a bit or the entire boiler may be removed from the stove by an attentive cook (in the system under consideration, by the "hand" of reason), and the contents may be "ladled out into plates" (i.e. transformed into a new state deemed useful by the those who have said reason). Thus, inequality will not vanish in the noospheric society. It will become different; probably no less bitter, but perceived as inevitable. Its parameters will be carefully monitored to avoid excessive tensions in the social system and to transform it into a new state in a timely manner.

Inequality will certainly persist , but it will not consist in unequal opportunities for the satisfaction of demands; rather, it will consist in unequal abilities to use and perceive these opportunities, which will then be completely open for everyone

[1] There are many studies on this topic. See for example: Bodrunov, S. D., M. Traub-Merts and M. Voeikova, eds. (2014). *Neravenstvo dokhodov i ekonomicheskii rost* [Income Inequality and Economic Growth]. Moscow: Kul'turnaia revoliutsiia; Wright, E.O. and L. Perrone. (Feb. 1977). Marxist Class Categories and Income Inequality. *American Sociological Review*. 42 (1), pp. 32–55; Wolff, E. N. (2008). *Poverty and Income Distribution*. Wiley-Blackwell; Piketty, Th. (2014). *Capital in the Twenty-First Century*. Harvard University Press; Stiglitz, J. (2015). *Tsena neravenstva. Chem rassloenie obshchestva grozit nashemu budushchemu* [The Price of Inequality. How Stratification of Society Threatens Our Future]. Moscow: Eksmo; International Labour Organisation. (2015). *The Global Wage Report 2014/15: Wages and Income Inequality*. Geneva. The author's position is presented in: Bodrunov, S. D. and J. K. Galbraith (2017). *New Industrial Revolution and Inequality Issues*. Moscow: Rossiiskii ekonomicheskii universitet imeni G. V. Plekhanova.

(remember the readiness potential!). For instance, to satisfy one's spiritual demands, one has to have spiritual aptitude. Without a certain level of culture, it is impossible to perceive music (even with a perfect pitch) or literature adequately. Moreover, without assimilating a considerable amount of cultural knowledge, one cannot become a full-fledged specialist capable of creative activity in any area! Tatiana Chernigovskaya, Professor at St. Petersburg State University, the guru of Russian cognitive studies, argued (although on an unrelated topic) in the *Free Economy* magazine:

> We need an employee who can think well or, in fact, think outside the box because a computer can also think well. People are necessary for the performance of those tasks which a computer will not be able to muster in the foreseeable future – for creative breakthroughs. We look at a glass and make a discovery in physics. Or produce an ingenious painting. You see, Leonardo Da Vinci, Mozart and Schnittke were not computers; they were people capable of incredible moves. From now on, we need to nurture this sensitivity to nontrivial solutions in our children and students. This means we should include such disciplines as music, painting and art in the curriculum. This is not a matter of appropriate education or that a boy from a good family has to know who Vivaldi was. A broad associative field that people master when they read a lot, listen, travel and observe flowers and birds enables them to find nontrivial solutions in areas in which they might become pioneers![1]

This is so true. Just as it is true that not everyone is like Da Vinci, Mozart or Einstein. Not everybody can master anything. Yet, without a certain level of knowledge in an area (mathematics, physics, materials, genetics, etc.), it would be impossible to fully satisfy the passion for research in relevant areas. Even though there will be no *social* barriers hindering access to such opportunities, the differences in *individual* aptitude will remain a factor in the existence of inequality. The only factor, in fact.

[1] Chernigovskaya T. (2018). Kul'tura dlya budushchih otkrytij [Culture for future discoveries]. Vol'naya ekonomika, January-March 2018, No. 5. P. 97.

It is another matter that this kind of social climate (and social inequality) is still a very distant prospect. Consequently, we need to acknowledge the problem of inequality both in its current and future form and identify its sources and possible negative consequences, as well as the ways to overcome them. Then, at the stage of the NIS.2, we should transform inequality from an escalating into a waning issue with regards to sociodynamics and the socioeconomic system. Given the expanding opportunities for the satisfaction of non-simulative demands under the NIS.2, the solution lies in perceiving the need to restrict simulative demands and gradually moving to the nootype of social consumption (demand formation and satisfaction).

So far, we cannot disengage from the modern sociodynamics of inequality, for, figuratively speaking, the pot is still boiling... And it is also clear that we need to make up our mind as to how we should proceed from current to nooconsumption via the NIS.2. When and how will self-restriction factors, inner restrictions of demands and denial of simulative self-fulfilment start working? In this sense, the NIS.2 is a dangerous Rubicon: a gap could emerge when unlimited accessibility of demand satisfaction is almost possible, but the need for rational self-restriction is not yet fully perceived.

The current growing inequality is an indicator of the problems of today's "economic" world. It really seems to promote the increasing entropy of this system. Nevertheless, I would like to re-emphasise that it is an indicator rather than the main reason for a potential explosion. But that is just a side note. The truth of the matter is that the system's chaotisation is enhanced by ever-growing contradiction. On the one hand, the progress in science and technology offers progressively more recognised options for satisfying increasingly more recognised demands, including a new type of demands that are increasingly prevalent: access to education and culture and other intangible, knowledge-related demands. On the other hand, access to these options is becoming increasingly difficult at all levels (between population groups, regions and countries). The emergence of such phenomena as the New Normal. demonstrated extreme tensions stemming specifically from this accelerated overlapping of technological and social shifts in the global civilisational space.

At the same time, we should remember that a significant share of humankind (billions of people, in fact!) still do not have access to potable water, suffer from malnutrition, are illiterate, etc. They face the problem of inequality in its original, primitive form of fighting for survival. We should bear this in mind, because this problem carries great potential for conflict with it and raises the question of the burden on the Earth's resources.

Yet, at the same time, as this issue loses its relevance, another moves to the forefront. The term "educational ghetto"[1] has been used for some time already to describe the situation in the US. It refers to a social group without access to quality primary education and hence to subsequent stages of education, to high paying jobs, etc. *Segregation of people by the degree of access to knowledge is becoming the most critical source of social antagonisms* in developed societies, and it is this segregation that hampers technological progress, the depth, scale and pace of innovations.

Further rise of inequality (its value measured using economic and sociometric methods, which, in a way, measure the disharmony of life through arithmetic) results, despite the overall/global advance towards the NIS.2, in escalation of conflicts. Underestimation of this fact will have perilous consequences... Especially now, when our civilisation is entering the stage of in-depth, cardinal transformation. The weathered ship of human history is trying to make it to the NIS.2 through a narrow fissure between the Scylla of the traditional economic paradigm of existence (under which making profit, i.e. robbing somebody else, is the first article of – mind it! – the Civil Code) and the Charybdis of civilisation entering the tailspin of "technocivilisationism" (that may result in people losing their very nature).

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[1] See for example: Rist, R. C. (Fall 2000). Student Social Class and Teacher Expectations: The Self-Fulfilling Prophecy in Ghetto Education. *Harvard Educational Review*; Forman, S.J. (2012). Ghetto Education. *Washington University Journal of Law & Policy*. 40.

Chapter 8. Nooproduction: New Human Subject, New Wants and New Ways of need Satisfaction

Nooproduction transforms the human personality, its needs and the social structures through which they are satisfied. ction of human wants. In this chapter we seek to understand this transformation better, asking particularly whether and how humankind can choose the path towards developing its needs in sublime directions over that towards ever more crassly material consumption. The key lies in exploring the new nature of human activity.

8.1. Contradictions in the Formation and Development of Wants. Simulative Wants

As technologies and the content of labour change, so do social relations that condition the formation of wants. The market or monetary form is gradually losing its significance and dying off, gradually to be sure, but also surely.

To start with, the 21st century market no longer conforms to the abstractions outlined in the first chapters of Marx's *Capital* or in macroeconomics textbooks. Notwithstanding their differences in determining value or cost (let us not argue about the best translation of the German *Wert*[1]), both sources assume that the market is a system of relations between isolated actors who seek to maximise value earned and to minimise costs.

Both Marxism and the concluding (if not opening) chapters of any contemporary economics textbook see the modern economy as involving both private and public goods and manifold social transfers, etc. We can also safely assume that today, in the leading sectors of the economy at any rate, workers, consumers and entrepreneurs seek not only to maximise their income and minimise costs, but also to develop their human

[1] For one of the latest developments in this dispute, see: Chekhovskii, V. (2015). Predislovie otechestvennogo redaktora i perevodchika. Karl Marks. Kapital, tom I [Foreword of Russian Editor and Translator. Karl Marx. Capital. Vol. I] [Capital]. *Al'ternativy*. 2 (87), pp. 104–121; Vasina, L. (2015). "Tsennost'" versus "stoimost'" – "za" i "protiv" [Value Versus Cost – Pros and Cons]. *Al'ternativy*. 2 (87), pp. 121–154.

potential (including in the nonmarket sector), increase job satisfaction, etc. Any practising entrepreneur devising a staff incentive system is well aware of this. Hence, people are now not only strictly “zoo” (indeed, were they ever/) but also “noo” beings: sensible creatures guided by human values (which we will define towards the end of this text).

Unfortunately, however, just when humans are increasingly guided by higher values and the market economy is progressively ceasing to be the space for the production of goods that satisfy material needs. It is increasingly oriented towards the production of simulative goods that satisfy simulative wants created artificially though marketing, PR and consumer manipulation enabled by information technologies. The nature and role of simulative goods, or simulacra, which satisfy imaginary needs was studied in detail from the socio-philosophic point of view by Jean Baudrillard[1]. However, a simulacrum is not just a social phenomenon. Mass production of simulacra has created an extensive market for simulacra, making it also a major socioeconomic phenomenon.[2]

Technological shifts altering the structure of needs have also played their role in creating these illusory, “induced” needs.

False wants can increase even more uncontrollably than real needs.

Where does simulative demand come from? From being biological beings like all others, humans evolved by cognising their interests and then by institutionalising productive activity so as to impart it a certain permanence and predictability through, for instance, building up reserves and planning at least one step ahead on the basis their knowledge about themselves, their needs and they ways of satisfying them.

Trivial as it may seem, this is the source of any ideology of accumulation, the ideology of hoarding resources that you do not need now and may not even need in the future! This is also, in a way, a need, if a higher order one. As Eventually, such needs become excessive and they are forerunners of simulative needs and wants. Needsfor

[1] See: Baudrillard, J. (1972). *Pour une critique de l'économie politique du signe.* Editions Gallimard.
[2] For the analysis of simulacra goods and market, see: Buzgalin, A. V. and A. I. Kolganov. (2012). Rynok simuliakrov: vzgliad skvoz’ prizmu klassicheskoi politicheskoi ekonomii [The Simulacra Market: Perspective of Classical Political Economics]. *Al’ternativy*. 2, pp. 65–91.

useful things crosses a certain line at some point, so you no longer know how much you need. Now even the accumulated amount might not be enough. Thus, the needs phenomenon develops in the direction that takes it beyond rational limits. Do you know how Alexey Kudrin (former Russian minister of finance) accumulated reserve funds? On the one hand, they were compiled beyond all measure on the assumption that reserves had to be accumulated (according to that concept, it was necessary to invest money in US bonds, not into industrial development). On the other hand, when the crisis broke out, even those reserves proved insufficient. You get the point. These funds are about to be exhausted (unless we are lucky enough to get a chance to replenish them once again).

The desire to insure against all possible risks amid uncertainty is a natural human need. When does it escalate into a simulative demand? When people start thinking: why not stock up even more? Why not stockpile for the future of our children? Or for some other purposes? How can we increase it?

So, simulative wants grow in a continuum from real needs. Yet there is a distinction: simulative wants can be satisfied, although they are illusory. Consider the capitalist. He or she personally does not need a billion dollars. Not even a million. However, capitalists still cherish their "quasi-want" and satisfy it by becoming billionaires. They have that inner feeling. There is a thin line separating simulative wants from non-simulative ones, and we need to learn it.

There are wants that are pure simulations of rational ones. They cannot be satisfied as yet. I call them "phantasms." The first type of simulative wants are superfluities. (See Fig. 13). Capitalists are familiar with superfluity. While capitalists like Bill Gates, who want to cure AIDS, however, live in a fantasy world. Such a cure has not materialised at the current level of technological development. There are others with even fancier wants, such as Timm Thaler, the personage of the book of German author James Krüss. Timm sold his laughter in exchange for the ability to win any bet.[1]

[1] Krüss J. (1962). Timm Thaler oder Das verkaufte Lachen. [Timm Thaler or sold laughter]. Hamburg: Verlag Friedrich Oetinger.

There is no way to do that with the current level of technology, but it might become possible tomorrow.

The escalation of ordinary needs, when satisfied, leads to to further escalation. This is the essence of the escalation of needs principle. This dynamic is underpinned by technological progress and works just as well for false wants; the basis is the same. So the logic is the same, and we can expect the escalation of simulative wants.

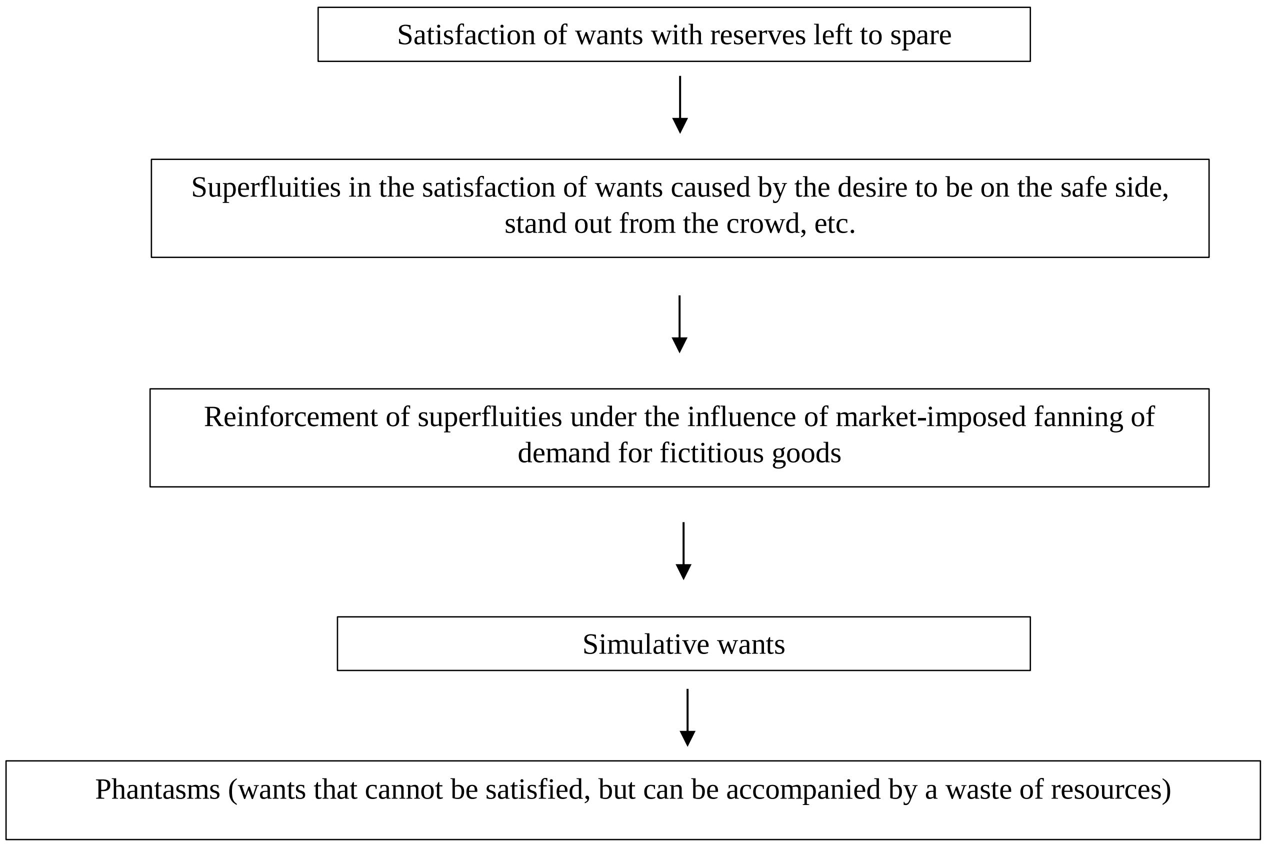

Fig. 13. Formation of simulative wants

Today, we are hurtling down the path of escalation and – as platitudinous as it sounds – awkward satisfaction of a continuously growing number of unreasonable wants. Our economic paradigm is tailored to this! We constantly want more. But what is the structure of our current desires? Do they consist predominantly of non-simulative or simulative wants (let alone various phantasms)? While, with technological progress, many of phantasms are becoming merely simulative wants, like any wants, they grow, and the simulative share in the overall scope of wants is getting bigger, while the process itself is accelerating! It can only end where we learn to restrict the illusory component of our wants. How can we learn that?

This problem has one important peculiar feature that deserves attention.

Technological development brings the principle of the escalation of simulative wants into play but also transforms simulative wants into non-simulative ones (and vice versa!). Wants can go from being phantasms to merely being superfluous, to, finally, turning into normal regular needs. For example, as sugar production became more efficient, gastronomic culture shifted to greater consumption of sugar, satisfying calorific and aesthetic needs never before felt. . Now, however, new knowledge about the effects of sugar on the human body, growing diabetes rates, etc., along with the expansion of gastronomy in more refined directions, makes the consumption of pure sugar a simulative want.

What used to be a false demand (can move into the category of normal and regular wants. And, vice versa. (see Fig. 14). The cause in both cases is the same: progress of knowledge that results in the progress of production capacities and progress of technologies and creates new opportunities for demand satisfaction.

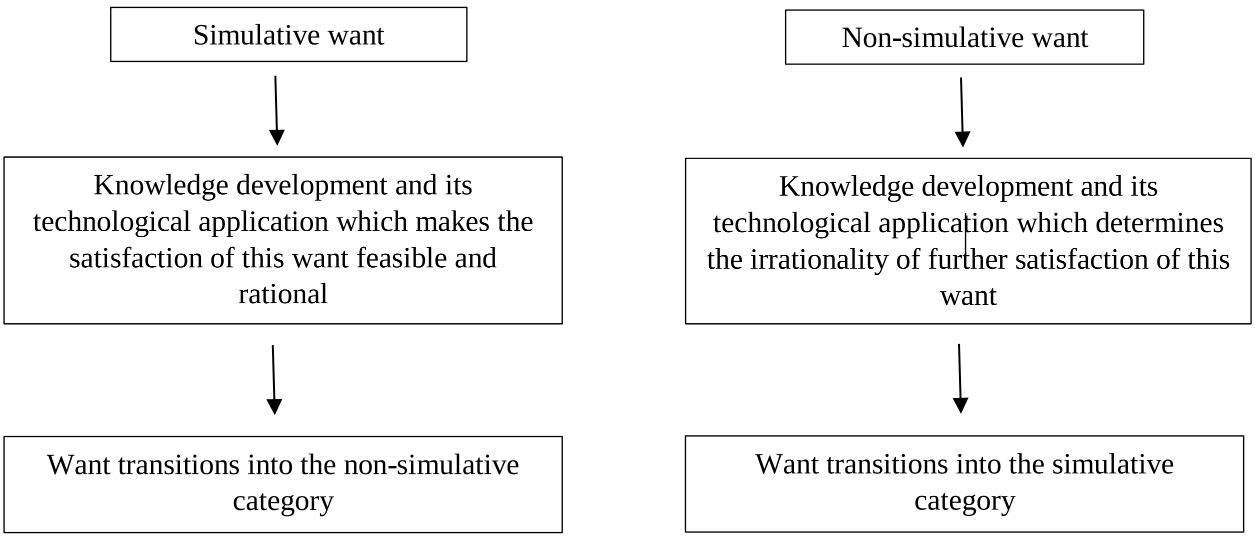

Fig. 14. Transformation of simulative wants into non-simulative wants and vice versa

One might consider the unlimited development of wants to be perfect. However, simulative wants increase resource absorption and they are limited. At the same time, if restrictions are too strict, they can hamper progress.. Each time we transition to something new, all previous components are contained inside, like Russian matryoshka dolls. Each new “layer” of wants forms new wants that (while largely reliant on the limit and rationality of wants at the previous “layer”) still test the newly emerging opportunities of this new “layer” to see if they fit. For example, people as biological creatures have certain physical limitations which they cannot overcome in order to satisfy their demands regardless of their illusory and market-induced (or created) desire. Let’s say, a person cannot eat or drink more than a certain amount of food and beverages. A person cannot use five smartphones at the same time. What can this contradiction lead to? It can lead to the desire to gain resources for the satisfaction of these “induced” wants, and people will spend those resources even if they are unable to “consume” them in the shape of a product. In this examples, a lot of food is produced, purchased (or not…), but not consumed, turning into waste. The same we can see with smartphones: a working smartphone is thrown out and replaced with a new one under the influence of imposed ideas.

The most appropriate example would be a tourist staying at an all-inclusive hotel (food and drink – all good and beautiful –totally free!): why on earth is the tourist taking three times more food than he/she can eat? And now – hypothetically – let us imagine that technology enables us to triple the capacity of our stomachs; the tourist will then take nine times more food that necessary! It is so tempting to ask: “Aren’t you going to explode, sweetie?” Or recall the crone from Pushkin’s *The Tale of the Fisherman and the Fish*, when the old woman demanded from the magic goldfish the satisfaction of her ever-growing desires, which reached an exorbitant amount, and in the end she lost everything....

If the people will sink into the sea of sophisticated and increasingly illusory pleasures, the results of this are clearly illustrated by the quick demise of mediaeval Mongol Empire. Upon becoming emperors of conquered China and quickly adopting the customs of the Chinese court with its unimaginable luxury and vacuous life of comfort and pleasure, the Mongol khans were assimilated, lost the qualities of conquerors and were overthrown by the Red Turbans, who were ordinary peasants.

Unless wants are rationally split into real and simulative, we are in danger of permitting our escalating wants to dramatically alter our human selves asbiological creatures, to modify our very human nature.

This possibility is on longer science fiction. Researchers at the Massachusetts Institute of Technology (USA) are, for instance, already editing genes inside the human embryo, removing (switching off) some features and adding others. Another US Institute (The Scripps Research Institute, TSRI) is going even further. In addition to the existing four genes in living nature (of which the entire living world – from bacteria to whales – is made), they have invented two artificial ones and incorporated them into the DNA of live cells. These have then successfully reproduced and transferred their acquired new properties to their offspring. The result has been semisynthetic proteins![1] So we will soon be able to see not only humans with elephant muscles - today, it is difficult to even imagine the extent to which the human body can be modified by genetic engineering..

Will such developments leave humans as the biosocial beings they have been so far or turn them into some other creatures? If we talk about humans, we imply some sensible restrictions that would prevent this sort of development.

Scientists who expand the horizons of scientific knowledge are clearly driven by good intentions: they seek to create new medicines or correct genetic defects, etc. Yet they do not deny that their scientific achievements might well be used to create new living forms and "edit" the human biology.

This fundamental contradiction needs to be resolved – like all other contradictions – through knowledge. It is necessary to identify the line beyond which

[1] Medvedev, Y. (12 December 2017). Zhizn' iz shesti bukv. Sozdana pervaia bakteriia s sinteticheskoi DNK [Six-Letter Life. The First Bacterium with Synthetic DNA Created]. *Rossiiskaia gazeta*.7448 (282); for more details, see: Sozdan organism, DNK kotorogo soderzhit 6 "bukv" [An Organism Has Been Created with DNA consisting of Six Letters]. (January 2017). *XXII vek. Otkrytiia, ozhidaniia, ugrozy*. Popular Science Portal. https://22century.ru/biology-and-biotechnology/42655.

– at each specific stage – simulative wants emerge and result in irrational burdens on the system. All social relations and institutions are formed based on social changes reliant on the material foundation which is underpinned by knowledge embodied in technology. However, the modern market economy in its pursuit of sales volumes tends to amplify simulative demands beyond all reasonable measure. It is no accident that production and consumption of simulacra have spread so widely in recent decades. The root causes of this phenomenon lie in the shifts in the structure of social production that occurred at the turn of the 1970s–1980s, when the world became overwhelmed by myths of the postindustrial economy. Those myths did not appear out of the blue: *unchecked growth of the service segment, on the one hand, deindustrialisation, on the other hand, and all-encompassing virtualisation that drives the first two constitute material grounds for expanding production of simulacra goods and build-up of simulative demands*.

These changes have been driving us into a dead-end for some time now. The process, albeit slow and sporadic, is underway. Economists who tend to lag behind are nevertheless beginning to perceive that the so-called postindustrial paradigm has exhausted itself. For experts at the Institute for New Industrial Development and the author this is old news. We have been writing about it for more than fifteen years. Though this is now becoming increasingly popular, we we argued it in a book written at the beginning of this decade and published two years ago.[1] While that society and economy are becoming our reality, we should be thinking to what will come tomorrow.

So rational restrictions need to be imposed on "unreasonable" wants. Where and how will we draw this line?

8.2. New Knowledge. New Wants. New Values

[1] Bodrunov, S. D. (2016). *The Coming of New Industrial Society: Reloaded*. Moscow and St. Petersburg: S. Y. Witte Institute for New Industrial Development, pp. 93–102.

Chimeras of postindustrialism are becoming a thing of the past. The market for simulacra will eventually suffer the same fate. However, one fundamental contradiction persists: the contradiction between the production of the material means for human life and the production as a sphere of the development of very human individuality.

This contradiction is being resolved objectively with the growth of human knowledge and consequent development of knowledge-intensive technology capable of satisfying vital demands at progressively lower costs. At the same time, spiritual needs are a growing share of our needs. Material living conditions, already largely secured for more and more, are no longer the key reference point in demand satisfaction.

The history of humankind has witnessed waves reflecting the growing significance of spiritual values. Lev Gumilev's passionarity theory develops this idea.

The equilibrium between the needs of the human body and those of the inner human essence shifts once in a while. There have been periods when the spiritual component was prioritised by some people (definitely not all), for instance, in the Epichristian times and during the Renaissance.

Technological and economic modes that evolved during the Renaissance (urban crafts organised into guilds, market development) enabled the shift towards spiritual wants (initially among a small part of the population). This shift manifested itself in new artistic techniques and new genres, the emergence of new musical instruments and establishment of universities...

This shift was not a direct result of changes in material production. The relationship was rather indirect, i.e. mediated by an entire complex of social conditions. Surges in technological development brought about changes in technological modes and overlapped with changes in the social system and state structure. In fact, this is exactly what J.K. Galbraith argued in *The New Industrial State*.

Such increases in the significance of spiritual wants often manifest themselves through crises in the system of education. Mediaeval universities were founded in response to the society's new spiritual demands.

Such a crisis is today increasingly evident. As the importance of knowledge grows, it comes up against limited human ability to master it. Clearly, we cannot all embrace all knowledge. Individualised education tailors knowledge acquisition to unique individual abilities, raising the efficiency of their cognition.

New means of communication are also contributing to this process. Individual devices that provide unlimited access to virtual information are becoming widespread. New communication formats emerge in that virtual space enabling people to rethink and revaluate themselves and their attitude towards the surrounding world.

The *new society builds not only a new hierarchy of needs, but also a new hierarchy of values*. What moves to the fore is the *intrinsic value of an individual*, the need to develop individuality, communicate, get public recognition and raise self-esteem; that is to say, the trend toward individualisation of the human being is progressing. Yet, in the current social order, individualisation often becomes a symbol of people's helplessness in the face of social forces beyond their control. The present day is characterised by "the abandonment of the individual to the lonely struggle with a task which most individuals lack the resources to perform alone"[1] "There is a growing gap between individuality as fate and individuality as a practical capacity for self-assertion,"[2] famous sociologist Zygmunt Bauman pointed out.

Individualisation understood as the unrestricted manifestation of inherent free will also poses considerable risks. If free will leads to the dissociation from and opposition to society, people withdraw into themselves. Yet it inevitably turns out that one person alone is not enough. So, individuals typically seek to resolve this contradiction by way of self-realisation through communication with other people, by means of gaining public recognition.

[1] Bauman, Z. (2001), *The Individualized Society*. Cambridge, UK: Polity, p. 6.
[2] Ibid., p. 47.

The threat associated with boundless affirmation of individualism often gets the response formulated by Fyodor Dostoevsky's character Dmitry Karamazov: "Yes, man is broad, too broad, indeed. I'd have him narrower."[1] Dostoevsky was intimidated by the fact that free will allows a person to simultaneously contain the highest ideals and monstrous depravity.

Yet the real danger is that people are actually "narrow": narrow in their comprehension of themselves and the real content of their wants. And this is the field in which people need to be broadened, not narrowed. Only by comprehending the proper application of material and spiritual goods that human culture is based on can we remove and alleviate this ambivalent state of human desires and actions and the combination of the sublime and the vile that Dostoevsky wrote about. Indeed, people can use a knife and a fork to quench their hunger, but they can also stick them into somebody. Even so, it is not primarily external social taboos imposed on people (although the role of such taboos should not be underestimated), but inner boundaries that people set for themselves that can resolve this contradiction.

Cognition of both the external world and oneself already implies the acceptance of restrictions. Identity implies otherness. If I define myself as a reasonable man, I separate myself from those I consider unreasonable people. Of course, we all also seek to go beyond our limits. However, this aspiration can be productive and constructive, rather than destructive, only if it remains regulated by some minimal boundaries that people set for themselves.

Supporters of a purely technocratic concept of society's development usually underestimate the role of culture. However, solutions to many problems caused by rapid industrial and scientific progress actually lie in the realm of culture.

Let us take, for example, a simple dichotomy: cybersecurity and the hacker. For every new encryption method, there a new hacker; for every password someone who can crack it; for every computer – a virus. And this contradiction cannot be overcome

[1] Dostoevsky, F. M. (2003). *The Brothers Karamazov*. Penguin Classics.

without an appropriate cultural code, social norms and rules that encourage right and discourage "wrong" behaviour.

There is another aspect warrants careful consideration; it is the consequences of applying technological achievements to fulfil people's innate dream of living longer and perhaps better. The dramatic progress of technology in medicine, ecology, nutrition, hygiene and physical education is already resulting in a significant prolongation of human life and in our ageing populations. Will the NIS.2 and the even higher noosociety become a society of old, feeble people?

Preventing such a development will require coordinated and targeted work of all social institutions. Along with prolonging human life, we will need to preserving physical and mental health at an age currently considered venerable and at a level that would allow for an active and intellectually stimulating lifestyle and labour activity. That can be achieved through the development of appropriate technology.

8.3. Universal Nature of Knowledge and Human Universality

When labour productivity increases without corresponding increases in demand/need, the duration and significance of working hours is reduced, while the amount of free time grows. The NIS.2 is already able to provide a considerable amount of additional spare time, yet this will not entail an immediate respective "addition of happiness"; we still need to learn how to use our free time for self-development (by prioritising spiritual wants, culture, etc.).

Hannah Arendt's scepticism about whether extra spare time will ensure human development is understandable. She expedted that people will use their free time exclusively for unreflective consumption:

> The spare time of the *animal laborans* is never spent in anything but consumption, and the more time left to him, the greedier and more craving his appetites. That these appetites become more sophisticated, so that consumption is no longer restricted to the necessities but, on the contrary, mainly concentrates

on the superfluities of life, does not change the character of this society, but harbors the grave danger that eventually no object of the world will be safe from consumption and annihilation through consumption.[1]

Indeed, this is precisely the case with the type of social order we currently inhabit, the so-called capitalism; this is the case because capitalism actually leaves people with just enough spare time to consume what they produced during working hours only to go back to work and make money in order to consume again; people are being equally compelled to both consume and produce for the sake of consumption. A person is forced to spin in this vicious circle of pursuit of material goods and services, leaving him no opportunities for his own development and cultural growth.

Society can find a way out of this vicious circle, but not through asceticism, compulsory rationing, reduction of consumption or verbal propaganda of more sublime ideals. Rather, the answer is in reducing required working hours (prerequisites for that are created by modern industrial production) and promoting creative activity in spare time.

However, *the transition from spare time as time for consumption to spare time as a space for developing human culture is neither simple nor quick*.

In the new industrial society of the second generation, people will be able to act as creative beings insofar this the material prerequisites for creative activity – the means for self-education, physical improvement, scientific and artistic creativity – are widely accessible.

Another indispensable prerequisite will be a change in the ratio between work and spare time in favour of the latter. Meanwhile, the transition to the next stage – nooproduction – poses unprecedently extensive and profound tasks for people; these tasks involve the acquisition of new knowledge that would enable a breakthrough in technological progress and promote the comprehension of directions and boundaries of personal development. The nature of leisure under the noosphere will be redefined

[1] See: Arendt, H. (1998). *The Human Condition*. University of Chicago Press: Chicago – London, p. 133.

by the need to fulfil those tasks and human involvement in technological (and sociopractical) application of science.

Although Arendt made her conclusions from observing the society at the time, she neglected the fact that altering human activity to gear it toward acquiring new knowledge would, over time, gradually change human wants, their structure and qualitative content and, hence, the *content of leisure*.

Information and knowledge contained therein will become more valuable than the material things previously considered valuable. We are already beginning to realise this prospect. The world is nearing the end of the "big cycle," as the ancient Maya used to say. Knowledge and the words that express it are rising to prominence. Remember the Bible: "In the beginning was the Word." And the word is apparently in the end as well. That said, any end is, of course, a new beginning. But the beginning of what?

In the new society, there will certainly be fundamental shifts. Old knowledge and old jobs will lose their value, and the transition can be very painful. There are historical precedents. The 16^{th}-17^{th} century agrarian revolution in Britain created vast numbers of beggars and tramps who were severely repressed while the Industrial Revolution of the 18^{th}–19^{th} centuries was associated with widespread bankruptcy of artisans and sufferings of the "reserve industrial army." Yet while many unfortunate people suffered and perished, landless peasants also turned into contracted farmhands or were assimilated by the growing manufacturing industry and penniless artisans joined the ranks of the fast-growing industrial proletariat.

Likewise, *by making many jobs redundant, the forthcoming technological revolution will also create new jobs*. New technologies will give rise to new demands and the satisfaction of those demands will, in turn, call for new technologies. New jobs will replace those eliminated by automation and growing labour efficiency. Moreover, the inevitably growing share of the "economy of knowledge" (at the transitional stage) and the increasing need to acquire new knowledge can take up many workers. If we plan right, all this can happen with far less social suffering.

With the change in the technological foundation of production and the transition to nooproduction, the very notions of “occupation” and “job” will undergo a dramatic change in their meanings, if not disappear at all. The word “occupation” as a way to earn money by means of certain work skills will probably disappear. These functions will be performed by technetic entities, while people will be liberated from the narrow specialisation that currently restricts their activities. Thus, there will be no professions as we understand them today, and people will focus on advancing towards absolute knowledge, towards universality. New means of accessing knowledge and information, like neuron networks and human-machine systems, will be developed.

To be sure, the universality of people in the noonomy will not mean that each person will know everything; it will provide new opportunities for mastering virtually any knowledge required. *The key shift will pertain to the introduction of information communication systems that will allow every person to access the entire universe of knowledge accumulated by the humankind while penetrating even deeper into it.*

An example, albeit an imperfect one. clarifies the trend: with technology improvement, images displayed on a computer screen (or TV screen) go a long way from plain dabs of paint and turn into pixels (minimum logical elements of a two-dimensional digital image displayed on a screen as radiant portions of luminophore). As the number of pixels per unit area increases, the image progressively approximates visual perception of the original. Eventually it might become even more accurate than visual perception by penetrating into the essence of things indiscernible to the naked eye. A person armed with optical devices, for example, with a telescope, is able to see a completely different picture of the universe than with the naked eye. As Mikhail Lomonosov wrote on this occasion: “An abyss full of stars was opened!” Similarly, in order to penetrate the secrets of the microcosm, a person is armed first with a magnifying glass, then with a microscope, and then with an electron microscope.

It will surely require that people improve their competencies and master the ability to explore any field of knowledge and navigate it.

This kind of universality is quite achievable, provided the system of education is restructured accordingly, just like human nature (remember the line which we must perceive and draw). The main objective of education will not be to "pump" students with knowledge and skills in a certain discipline. Students will no longer be passive acquirers, "accumulators" of ready knowledge; they will have to learn how to "procure" and apply knowledge. This skill cannot, of course, be acquired without a broad fundamental education that teaches students how to navigate any field of knowledge; this objective for the development of a harmonious well-rounded individual was formulated a century ago.

The transitional stage towards such a comprehensive autodidact constitutes the implementation of "education for all" and "lifelong education" concepts which are required for progress towards the NIS.2. Moreover, the ability to develop and master new, advanced and universal means of access to knowledge will become crucial.

Such an approach implies the elimination of financial barriers and other factors that are currently responsible for unequal access to education. In this new information and cognitive technology will also help. Another barrier to the free transfer of knowledge – language differences - is also being overcome by modern technologies. Information technologies provide more and more advanced machine translation. With the development of new capabilities of cognitive technologies, probably, a universal language of knowledge understood by all will gradually emerge, while national languages will take the niche that defines the ethnic and cultural diversity of human culture.

In the noospheric civilisation, the institutes that seem "natural" and "eternal" today will be dying off. Linguistic diversity will become a cultural antique. We have already mentioned the decline of cash – it will be used solely as museum specimens or numismatic antiques. And there will be plenty of other things dying off and turning into antiques.

8.4. Personal Development and Human Activity Types

A human universality emerges in response to the challenges of the technological revolution, the formation of new demands and new ways of their satisfaction. Where is it taking us and the economy?

We are faced with a choice between reducing the resource burden on the biosphere and the temptation of super-abundance.

If we manage to navigate our way through this fork in the road and arrive at noospheric production, it will be largely focused on "producing humans themselves" rather than on producing material conditions of human existence. The structure of human wants will change accordingly. Demands for self-development, spiritual demands, and the need for communication and public recognition will be prioritised. And these wants will define the nature of applied technologies, manufactured products and production organisation targeting the satisfaction of material demands. These shifts in the structure of demand will be determined by the evolution of human culture.

Moreover, people will no longer engage in the actual creation of material conditions for existence. Marx's prediction that people will be removed from the material production process will come true. People will influence this sphere with the force of their knowledge instead of their hands. Nooindustrial production will be underpinned by the new nature of reproductive relationship between production and consumption. Human wants, as well as the knowledge required to satisfy them, will be formed not in the course of immediate production activity (for people will no longer be engaged in it), but in the course of people's creative self-development.

These wants and this knowledge will form the "terms of reference" for an autonomously functioning unmanned sphere of immediate material production. These tasks will be resolved relatively autonomously by the functioning technosphere (see Fig. 15).

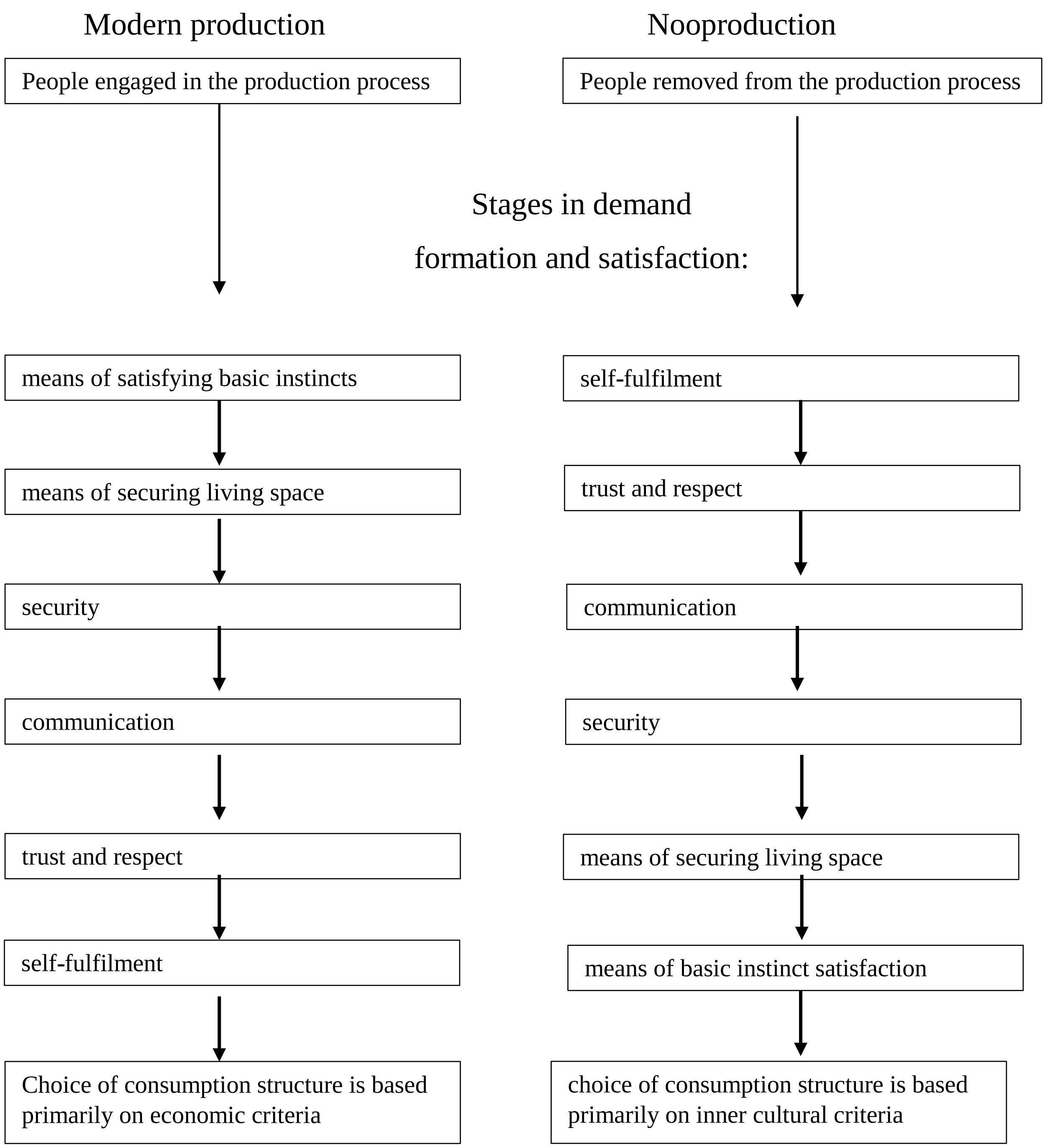

Fig. 15. Mechanisms of demand formation and satisfaction under modern coditions and noosociety

So how can we generally summarise the determinant goals of the noonomy, provided that economic goals fade away? They can be defined as personal growth through spiritual activity in all areas of human culture. An important component of personal growth will consist in the demand for conscious self-restriction of simulative wants (which, by the way, along with the use of new technological options, will make a significant contribution to the implementation of a resource-efficient development strategy).

I would like to emphasise once again that the aforementioned self-restriction will not come as some sort of an external imperative. During the transition to noosociety, external moral imperatives, explanation, persuasion and, finally, fostering of habits of sensible self-restriction will definitely play their part in restricting simulative demands. Yet inner self-restriction will be even more effective. It will stem from the structure of demand determined by the new nature and content of human activity and social relations. I suppose even today those who are seriously engaged in, for instance, the mapping of the human genome or the development of technologies for sending expeditions to Mars are, regardless of their earnings, not likely to be tremendously concerned with buying huge ocean yachts or villas on the French Riviera. For people dedicated to this kind of work, such wants are irrelevant because the satisfaction of such demands would only distract them from the achievement of goals which they set for themselves.

In the long run, personal growth will rely on continuous technological development of the production sphere without human involvement. But such forecasts have already been voiced:

> Based on the theory of technological modes and taking into account all major technological revolutions in the global historical process, we forecast that the final phase of this revolution will start in the 2030s–2040s and last until the 2060s–2070s. that phase will result in the transition to a wide use of self-directed systems (*i.e. systems that can regulate their activity autonomously, with minimal human involvement or even without it*).[1]

[1] Grinin, L. E. and A. L. Grinin. (2016). Griadushchaia tekhnologicheskaia revoliutsiia i global'nye riski [The Forthcoming Technological Revolution and Global Risks]. *Vek globalizatsii*. 4, p. 43.

The idea of personal growth correlates with Marx's famous tenet that in the future society "free development of each is a condition for free development of all"[1] and the similar stance taken by Lenin.[2] In the USSR, these provisions enjoyed the status of the "basic economic law of the Socialist (Communist) socio-economic formation."[3]

But Marxists speak of free and comprehensive development as a law of Communism that can only be achieved through a violent revolution. Conversely, we are talking first and foremost about evolution – the features of noosociety that we can deduce objectively are far removed from the construction of Communism proposed by Marxists. Second, we are not talking about random development (see the concept of self-restriction above). And, third, we proceed from the fact that the various paths of personal development play different roles, and for us spiritual development is a priority.

It is the quality of the spiritual, cultural component of human development that should determine all other directions of that development and subject them to the best norms of human culture.

That said, personal development in and of itself is not the goal under noospheric civilisation. Noocivilisation should develop sustainably. The system should be stable and, instead of testing its limits, seek to increase its sustainability in order to preserve itself as a system. Given the development level we have achieved in technology, the system can ensure its survival and further development. And we should choose that variant of development, which also will preserve our existence exactly as human being.

. This involves preserving the systemwherein new and advanced individuals constitute key elements and form the basis for its sustainability. This is exactly the sort

[1] Marx, K., Engels, F. (1976). Manifesto of the Communist Party. In Marx, K. and Engels, F. Collected Works. Vol. 6. New York: International Publishers, p.506. See also: Marx K. (1975). Critique of the Gotha Programme. In Karl Marx and Frederick Engels Collected Works. Vol. 24. New York: International Publishers. P. 87; Marx, K. (1975). Capital, vol. I. In Marx, K. and F. Engels. In Karl Marx and Frederick Engels Collected Works. Vol. 35. New York: International Publishers. P. 588.
[2] Lenin, V. I. (1961). Notes on Plekhanov's Second Draft Programme. In Lenin V.I. Collected Works. Moscow: Progress Publishers. Vol. 6, p. 52.
[3] Kozlov G.A. Ob osnovnom economicheskom zakone v usloviyah razvitogo sotsializma [On the basic economiclow under the developed socialism]. Voprosy ekonomiki, 1973, No. 5.

of "new" human being that we need. The simple Soviet tenet about the creation of a "new human being" as such, is unclear without clearly defined templates and standards.

For us, the "new" human being is an element of society as a system, one that allows this system – and civilisation as a whole – to be preserved. The "new" human being ensures the sustainable development of the system. It cannot survive if it is occupied by the "old" human being who is suited to the "old" system. It will thus become a different system, a technotronic system.

The human and humankind as a system is also shaped by the system of social relations where people perceive the dos and don'ts. There should be basic institutions aimed at enabling the development of the nooscenario as opposed to maintaining the current global capitalist system.

For that, strange as it may seem, we need technologies, but different ones. In the near future, we will move from information technologies to cognitive technologies because we will not be able to ensure the implementation of the nooscenario unless we develop human abilities and expand the opportunities for people's deeper cognition of themselves and the world around them and for assimilating huge amounts of available knowledge. Hence, we should focus not even on NBIC technologies, but on C technologies because nano-, bio- and information technologies which used to be the frontline in the 1950s–1970s have now run their course. We should focus on cognitive technologies, for they can ensure the desired transition to the nooscenario, and only this scenario can make us feel more or less secure about our future.

The best way to define the activities that people will perform in this context is operations management, which implies that people will be incessantly and consciously thinking about the things they do; this kind of approach should become not just a skill, but a way of living. Just as the transfer of technologies is becoming not just an isolated occurrence, but an intrinsic and continuous element of modern production, people should adopt the same means for managing themselves and the society. And we should all interact with each other.

PART 4.

TOWARDS NOONOMY

The path to noonomy lies not only through denying the supremacy of humans' "zoological" nature, but also in the exaltation of the humanity over its creation – the technosphere. Technosphere development is no longer a spontaneous process subject to the pursuit of material wealth expressed in monetary volume categories. Economic categories are giving way to a new type of human rationality. However, we still have many obstacles to overcome and extremely complicated issues to resolve as we move towards noonomy.

Chapter 9. Economy: From Zoo to Noo

Human detachment from the natural kingdom relies on the process of cognition. At a certain stage in its advance, natural phenomena no longer hold sway over people: we now have ways of using them to our advantage. Our advancing knowledge changes in the very notion of what is useful and rational. As it does so, *cultural, rather than economic, imperatives are becoming the key criteria in the sane and rational determination of human needs*.

9.1. Separation between Humans and Nature / Humans and Technosphere

The social structure of production within a noospheric society will represent a new development in the structure of production.

The process of manufacturing a productis a production process whose most significant elements are human *labour*, *raw materials*, *technology* and the *organisation* of production.

These are the four basic elements production and answer the four questions it involves:

What do we use o make it? (raw materials.)

What do we make it with? (Tools and technology.)

How do we organise the process? (Organisation and management of production.)

How do we work? (Content and characteristics of labour.)

As our knowledge increases these elements change and alter production and through it, social relations and institutions. They , in turn, reflexively influence the elements of the production process, promoting or hindering their development.

The reflexive interaction of these componentsis of great importance. The current stage of the development of production is marked by the tendency towards increasing the role of knowledge it and all its elements, , reducing the unit share of the material resources. How will this transition affect society?

Production based on knowledge-intensive technologies is already changing considerably in the NIS.2, losing its "factory" layout and forcing people out of the immediate production process. Now, therefore, the forms of social interaction between people must lie *beyond* the production process while at the same time, regulating production.

With the development of nooproduction humans will no longer even organise production. It will proceed automatically from the self-development of nootechnology without direct human involvement.

However, realising the possibility of "unmanned production" is not simple and the problems are more than merely technological.

Throuhout human history, people have become increasingly detached from nature as they introduce ever greater mediation through knowledge and technolgoy between themselves and nature as they labour and produce. Human history has been that of the progressive reduction of humanity's direct dependence on nature through the development of the technosphere.

This technosphere appears in the form of buildings, houses and cities with millions of inhabitants and artificial life-sustaining systems, right down to complete isolation from the natural environment. Take for example Saudi Arabia, which consumes high amounts of fresh water per capita (926 cubic metres per capita per year), yet has almost no natural sources – the entire country is using desalinated water (86 % of total consumption),[1] its water ducts running for hundreds of kilometres through the desert from city to city.

At the same time, there is another side to this history. through self-awareness and spiritual isolation from the rest of the world, people remain a part of nature, and this "isolation" actually further leads to the separation of the "spiritual" human from the "natural," biological human! The natural, biological basis of human existence thus

[1] PwC Strategy. (8 May 2014). Achieving a Sustainable Water Sector in the GCC: Managing Supply and Demand, Building Institutions. https://www.strategyand.pwc.com/media/fNe/Achieving-a-sustainable-water-sector-in-the-GCC.pdf

came into conflict with the existence of man as a thinking being, and as a social being. Man as a social being "humanized" the manifestations of his biological needs, but often this "humanization" turned either into the suppression of these needs, or into giving perverse forms, or into their satisfaction at the expense of the rest of nature, of which man still remains a part. This discontinuity may lead to dramatically reckless intrusion into nature, whether by changing changing the external natural environment or the internal or human environment, for instance, by (altering one's own biological nature).

This process, which has involved applying knowledge of mechanical, chemical, physical and biological processes in production, has taken society through a succession of technological modes, each distinguished by a greater amount of accumulated and applied knowledge.

This has brought us to the point where we are poised before a qualitatively new stage based on the newest, possibly the last (in terms of the traditional understanding) technological mode that shapes the NIS.2.

The basic technology of each mode always incorporates the previous mode (we must keep in mind the fact that knowledge of the whole of reality is cognised by us in fragments and we may never know it entirely).

The technological core of the coming mode consists of information and cognitive technologies. However, information already constitutes practically sublimated, "pure" knowledge involved in communication processes. By placing this knowledge "in the service" of production as a basic resource, we have thus arrived at the limits of knowledge intensity in technology: today technology itself essentially constitutes the manipulation of knowledge.

When we speak of reaching the limit of technological knowledge within a certain mode, this does not at all mean that we have achieved the absolute limit of our knowledge. Cognition never stops. Rather, since the (quantitative) accumulation of knowledge within a certain technological mode cannot last forever, since each mode can "accommodate" as much knowledge as the capacity of that knowledge – or readiness potential, if you will – allows, since every time we move to the next stage, we increase our knowledge by leaps and bounds, altering the “material to knowledge” ratio in favour of the latter, we are today poised before a technological mode in which knowledge will “overwhelm” the entire mode, the basic technology of which will build upon information, or almost “pure knowledge.”

What will it be like?

We can only guess. In it, knowledge intensity increases not so much by cognition of the forces of “outer” nature, as has been the case until now, as by discovery of the abilities of people themselves. This will happen by relying on existing human capabilities by improving these capabilities, and reinforcing them with the capabilities of technology, but not by making changes in human nature. So that man-machine systems – the mutual penetration of people and the technosphere – will form the basis of the entire mode. Or people will find opportunities to transform themselves, form a new being out of himself, and then build upon that to create new technologies.

The sixth technological mode based on NBICS-convergent technologies is already creating sufficient prerequisites for a transition to nooproduction, which means ultimate separation of the technosphere from human society. While people will retain a connection with the technosphere and enjoy its fruits, the direct involvement of people in its functioning will no longer be necessary. Instead, the “noosociety – nooproduction” link, but it will look more like a “bottleneck,” a channel of interaction, not integration of one into the other.

Interaction along this link will be dialectical. When people become almost completely isolated the necessity fo direct engagement with nature in production, they actually return to it in a new way. They no longer seek to “conquer nature” in the traditional sense. Rather, they enjoy and study it with a view to make natural processes serve them without recklessly encroaching on or damaging it.

Thus, the the “fight against the nature,” in terms of putting it at the service of human goals, will be transformed into a cooperation with it. Society’s relation to nature will become more “technological” and more intelligent. The human interaction with nature (including human nature) will become increasingly harmonious and mutually non-destructive.. Now, having separated from the natural basis, people no longer need to break into nature like a predator.

This will also lead to a more careful and cautious treatment of human nature itself, the containment of thoughtless intrusion into the human body and mind with the aim of restructuring it under the influence of fleeting technological impulse.

This is what the implementation of Vernadsky's ideas about the noosphere as a sphere of "noohuman" activity will be based on, for these ideas cannot be implemented without harmonisation and the removal of this contradiction.

9.2. Effect of Growing Knowledge and Self-Knowledge on Social Relations

Developing human cognition of the world – both theoretical and practical – implies the simultaneous formation of social relations. By cognising the surrounding world, the individual realises and cognises both him/herself and other similar creatures. This is what the tissue of social relations is made of.

Consider an encounter with stones: So you start to distinguish the two. Then you realise that if the stone were a powerful animal, it could respond to your kick and do you great harm. That leads you to appreciate that others like yourself are in a similar situation and you also look out for them, thus distinguishing your species from the rest of nature. Getting to know the world thus also involves getting to know yourself and society and, ultimately, your interests.

Now we are approaching a turning point in this process of self-cognition. The nature of labour is constantly changing as cognition advances technology improves. As knowledge is accumulated in the product, the latter becomes less "physical", while more working people move into the "intellectual" labour.

It is "brains over brawn." The more brain power you have, the less physical effort you need (even a simple physical task can become more efficient – remember the notion of "skill").

Today a point of “bifurcation” is reached. Human beings will become entirely different, no longer tied down to their biological basis and using more and more knowledge in productoin. But where do we stop?

Human creativity, the product of their free will and cognitive ability, . has gained us a measure of freedom – freedom that is always limited in scope and founded the world of culture as a spiritual sphere in the broadest sense of this word.

Stepping back for a moment, let us consider the Renaissance. Realising this, he imagined himself to be “equal to God,” a “creator” – specifically a creator of art. The Enlightenment man regarded himself able – without going deeply into the issue of the origin of things – to know everything, and therefore saw no need for a God.

Modern man, however, is able to understand that creative and cognitive abilities alone (including an aptitude for arts and science) do not make him “equal to God.” As “modern men,” we follow the path of resolving the contradiction between our ever-growing demands, which were originally inherent within us (through the “divine impulse”), and our limited/finite abilities. And his “Godliness” is the result of the fact that we were created “in the image and likeness of God.” Meanwhile, our personal and civilisational development are conditioned by “divine impulse,” which we embody with considerable deviations and through constant conflicts caused by the non-optimal/imperfect decisions we make (which, according to the Bible, required the Son of God to come down and perform the acts that gave a new impetus to religious consciousness, directing and defining the supreme values that should guide the individual in his or her development, but which he or she is not always able or willing to implement).

Conflict and uneven progress obey certain laws, but these laws are neither linear, nor parabolic nor sinusoidal. From a certain stage (NIS.2), this evolution turns into continuously accelerating process, characterised by the acceleration of acceleration. But the unevenness of this process is obvious. Its depiction somewhat resembles a complex upward curve similar to a cardiogram of a man who is ill but can and should recover!

The supreme value of this conflict-generating process has been expressed in various ways by many thinkers and references to it can be found in the Bible, ancient and Renaissance humanism, the humanism of the Enlightenment, Marxism, the humanistic line of existentialism, eco-socialism, the works of Fromm, Vernadsky and others. They all pointed out the importance of human progress in harmony with nature, the progress of the world of culture that lies "outside the realm of economic necessity." The author of these words, Karl Marx, also argued that a certain historical stage concludes the "prehistory" of humankind, beyond which there is a "kingdom of freedom," a world where there is no estrangement and where culture is moving forward. Modern scientists also share these ideas, while reminding us of the famous saying of Karl Liebknecht: "communism = culture."[1]

This trend, as we have already pointed out above (albeit in a different form), was also acknowledged by postindustrialists who presented it as the end of the era of material production and the genesis of "post-economic society."

However, the essence of this process still lacks a clear definition. It is that it is precisely (and primarily!) *material production – the industrial type of development – that is in fact the basis for the emergence of the "post-economic world."* In the future, this world will gradually transform instead of exploding or eliminating, such notions as property (including private property), money and so on, and with them the removal of the economic forms of social relations and economic science.

Hence the fundamental importance of both development and research, and the new type of industrialisation: from the NIS.2 to the nooindustrial society (NooIS), with the accelerated development of nootechnologies and their implementation in civilisational process with a view to achieving a "civilised" state of society in a civilised way.

It is precisely the NooIS, where the technological and non-technological spheres of life and the relevant spheres of knowledge converge and thus form a single process

[1] See for example: Bulavka, L. A. (2006). Kommunizm vozvrashchaetsia. Maiakovskii [Communism is Coming Back. Maiakovskii.] *Al'ternativy*. 2, 30. The fact that, for Liebknecht, "in the future, there will be no other history of mankind than the history of culture" was also recalled by N. S. Zlobin, who used these words as an epigraph for his article (Zlobin, N. S. (1995). Kommunizm kak kul'tura. [Communism as Culture.] *Al'ternativy*. 1, 2).

of cognition, that is capable of creating the grounds for the removal of the unrelenting conflict that is life, preserving human civilisation and its progressive development according to the noo-scenario.

"Noo" here is more than Latin word "ratio.", which means not only "mind" but also "account" and "calculation". It is noteworthy that "ratio" is not absolute, but dynamic. Its boundaries are mobile. There is a specific "ratio" at each stage and in every system. That is to say, what was "rational" yesterday may no longer be "rational" today.

Rationality, above all, implies conformity with certain criteria.

What is rationality? The Russianword "*razumnost*" can also be translated into English as "reasonableness," which means not simply something that is intelligent, but something that is both intelligent and in compliance with something else. Someone can be "Intelligent but not reasonable." Why? Because one can be, as we say, intelligent but not grounded in reality and so not rational.

Where do these limits of rationality come from? Limits are a kind of framework of criteria formed by ourselves. We do it using our knowledge, by knowing some things, realising them and putting up appropriate "frontier markers:" life, here is a marker – you can go here, for it is reasonable, but do not go beyond it, for it is already unreasonable. It is unreasonable to simply stand on a roof, but if you fasten yourself and build or repair something there, it is reasonable, just make sure you secure yourself so you do not fall.

This system of coordinates, or system of criteria, is dynamic. The broader our knowledge, the greater this space becomes, which in turn expands our knowledge of the criteria framework. Thus, the limits and criteria are expanded accordingly.

For example, the traditions of various peoples in clothing (or lack thereof) were formed on a completely objective criteria base, primarily related to the climate. Following these traditions was quite firmly fixed in the culture of these peoples, and deviation from these criteria entailed moral condemnation. Today, our dependence on climate conditions has become much weaker, and people in everyday life are less attached to a certain climate zone. Therefore, the criteria for evaluating rationality are shifting. And today we do not react particularly seriously to this, we do not burn these "apostates" from the old morality at the stake, because the criteria are shifting, in this case – in the cultural base. But not only that – they shift in all other spaces. Thus, it turns out that the diet is always different, with the development of society, it also develops.

This is all underpinned by the individual’s ability to acquire more and more knowledge. In what kind of framework is this done? In the framework of satisfying human needs, including demands for new knowledge, particularly the knowledge as to what is “good” and how the boundaries of this “good” can be shifted. Therefore, knowledge underlies this phenomenon as well. This is very important, because it allows us to understand how the world works and why it is “going mad.” It is the shifts of these boundaries that constitute that “madness,” i.e. going beyond the limits of the previous “ratio.” This is why often (and especially frequently now) all the things we have studied for many years turn out to be absolutely useless for analysing the future and generally for understanding the future and achieving a measure of self-realisation.

Mathematics, physics and other “exact” sciences give us part of an absolute understanding of this world. Just a part, though. But knowledge even in such areas is “expandable.” Let us take the traditional mathematical paradigm. Pythagoras and Euclid occupy a single space, which is common knowledge. Then came Lobachevsky and Riemann and a new space “emerged.” It turns out that one space is part of another, and that one is also part of yet another, new one, and so on. We can, like in physics now, invent plenty of other constructs and foundational theories, and seek explanations of the current level of revealed knowledge and build a new criteria base at this level.

With the opening of new horizons of knowledge (of everything!), many things are relied upon in further practice (including in terms of technology, as such technology is developed: the validity of measurements, constructs etc.). As a result, knowledge is verified and “expanded,” the criteria base is refined, “shifted,” adjusted and expanded to the space of “ratio.”

It used to be irrational to hope to fly to the stars; it was (in the criteria base of past centuries) a simulative want. To fly around the Earth was a simulative fantastic dream. Today, it is not simulative at all. Rather, it is quite feasible for an astronaut, but simulative (although feasible) for a simple astro-tourist: pay 20 million bucks and fly as a tourist, if you can afford it, of course. But the time will come when we will all be able to fly into space just like we fly on aeroplanes now. And it will be rather rational. That is to say, all these things gradually become deformed, adjusted and adapted. The space of the "rational" and its criteria base are altering.

With the evolution of certain simulative demands and their transformation into feasible and non-simulative wants and, on the other hand, with the containment of those things that are clearly recognised as impossible / fantastic / meaningless / going beyond the current "ratio," the question arises as to which rational level should be complied with. What should we trust?

We should always place our trust in the specific criteria base that we are in. Knowledge, by passing into technologies, makes it possible to satisfy demands with even greater effect, a progressively better understanding of the world and the realisation, among other things, of our various needs – simulative and non-simulative, as well as the process of their change etc., which results in emergence of a criteria base for a new space of reasonableness, non-simulative rationality and reasonable real wants.

This problem touches upon another aspect of our life that might seem far removed from the problem, namely, the *level of trust*. As a matter of fact, it is not far off the problems we have been discussing. Quite the opposite, it actually determines for each of us the individual threshold of the criteria base as far as validity or invalidity of a particular phenomenon is concerned, thus forming the above-mentioned space as a certain "area of trust."

Consequently, we say that we now need to increase the level of trust, because *the greater the sphere and the greater the area of knowledge, the higher the level of trust will be*.

Francis Fukuyama, whom I dislike, wrote about the radius of trust, as he called it. The radius of trust works as follows: I first trust my neighbour, then my family (or vice versa), and I trust them much more than my municipal government and, moreover, the state, etc. (for it is not that easy to trust an abstract state).

Yet, Fukuyama did not say the most important thing – whether or not he trusts certain criteria or norms of correctness in the very space where trust exists, i.e. in that very “radius.” But then it is necessary to look into the level of trust: whether 80 per cent, 30 per cent or even 0 per cent of the people trust. If nobody trusts, these people will seek the truth, or genuine knowledge. All the way down to demolishing the family or the state, if they lose trust in them. These are the levels of trust, which we can expand, grow and raise, including through the implementation of technologies. These levels will allow us to verify more effectively: “yes” or “no,” true or false, whether or not to believe this really a correct, sensible construct of a particular part of space, a particular technological solution, a particular social phenomenon...

In this sense, the same blockchain (currently the most advanced of the many manmade “trust technologies”) can do much more for the development of democracy and a more rational development of society contributing to advancement towards the noostage, as compared to the dozens of other mechanisms employed to increase our trust in the state. And this is not only (and not even!) because it “verifies” the results of elections, but also because it can make it possible to elect leaders who are the most capable of managing affairs (according to the existing criteria base).

I would like to point out here that *technology is merely an issue of knowledge entering the real material world*. Yet, at the same time, technology as such is a reflection of knowledge, while knowledge – what is it?

We know that two plus two equals four, and it does not matter anymore how we know this. We have checked it repeatedly, and we already believe that it is true, so nobody can tell us that two plus two equals five. We will not believe it. No way we will believe that two plus two equals five, not for a second! Likewise, we tend to trust the U.S. elections much more than we do others, and we trust that the dollar is secure, and that the U.S. banks are better protected technologically than others, and that the deposits of U.S. citizens are better secured under the U.S. laws compared to Russian laws, so they are less likely to be swindled, because the perpetrators will be punished severely. And in terms of technology, “their” trust is better guaranteed. Therefore, we trust their currency and their elections more.

Technologies based on verified laws of the physical, material world are all around us, and we authenticate and trust the correctness of the criteria that are built upon them – the notions formed in our heads. Thus, by developing these technologies, we may end up exploring this world more and more, including that part of the world that allows us to depart from simulacra. Add new items to the criteria base: recall Sartre, Saint-Simon, or any of the same humanists who first started talking about human values, truth etc. Those things did not come out of the blue either – they emerged from cognition, realisation, recognition, from knowing what is wrong and what is right, and from adjustments to the criteria base of what is good and what is bad.

With the emergence of new elements in this base – elements that made it possible to add all the human effects to these new spaces – new criteria and elements of culture were created, and that is the culture we make a parade of today, the culture we are proud of, saying: “Look, this is what I am, I am for this and against that...” We understand, in our culture, that we should give up our seats on public transport to women, that we should not offend the feeble. We understand that Muslims should be allowed to enter the United States. Yet, Trump – that scumbag! – does not allow it, saying: “No, I am a good man, for I defend my people. I defend them from potential terrorists. My people are the people I love, so I defend those I love.”

This struggle is in fact the creation of a new criteria base. Changes in criteria base lead to Angela Merkel saying, “Come on, Trump! We’ve always loved Muslims, and you don’t.” Why is this? Because Trump realised one thing and Merkel realised another, and somebody else realised something else. It is just the same in other areas of cognition of the truth as well. After realising what is true and what is not true, conviction emerges as to which part of the existing concepts is genuine.

This is reinforced by multiple repetitions, by practice. As they say, if the result of an experiment can be repeatedly confirmed, then it is already true, and we recognise it as such. And although this truth may be refuted by new experiments in the future, the criteria base that we hold at a specific stage (knowledge) allows us to regard these arguments as true.

That is to say, at the level of philosophical reflection, we understand that all knowledge that is accepted and understood by us, while existing outside of our consciousness and transforming into our brain, makes us believe in the correctness or incorrectness of certain things. And in this sense, the "transformation" in our head is "knowledge" turning into "belief," in global terms. This allows us to make a number of conclusions. For instance, the conclusion that absolute knowledge is absolute belief.

In this connection, I would like to recall the point repeatedly argued by L.A. Bulavka, emphasising that the Renaissance man said: "I am equal to you, my Lord, because you are the Creator, and I am a creator too. You created people and this splendid world, and I create paintings, formulae, layouts... I create too."[1]

In my view, this "Renaissance" approach is inaccurate. Why? If we talk about knowledge, then God is all-knowing, God is absolute knowledge. Since knowledge exists objectively, and I would like to emphasise that it exists regardless of our consciousness, regardless of our efforts to cognise it and our abilities to cognise it and discover something (i.e. we discover it, while it already exists – in a "box", it is already there, as we say, and we just have to learn how to open this box, that is, to acquire the knowledge to do that as well), then in this case knowledge has been there from the inception, it is endless and perpetual.

And what is this? Is not the same as what is said about God, the demiurge, God the Creator who empowered men to cognise the world, i.e. to perceive knowledge, to cognise some part of what surrounds them, i.e. to cognise the Lord himself – at least in

[1] See: Bulavka, L. A. (2006). Renessans i Sovetskaia kul'tura. [The Renaissance and Soviet Culture]. *Voprosy filosofii*. 12, 36.

some part? So, by cognising the Lord, we are nearing Him. We are approaching Him by gaining knowledge of something new, by perceiving Him – part by part...

Thus, we, as a part that seeks to perceive the world, may have the same opportunities as God. What exactly? Knowing everything, He naturally has the capacity to know everything. People are also able to acquire knowledge, to discover new areas of knowledge and expand their horizons. God gave us, as a part of Him, this ability to cognise ourselves based on his own logic of self-creation (or recreation, to be more exact).

That is why the discovery and transfer of any kind of knowledge and anything that humankind has managed to do with knowledge in the course of its development, is nothing but this process of *realisation*. Realisation of a progressively greater part of knowledge as an Absolute that exists beyond our control. Ecclesiastes used to say: "What has been will be again." That is to say, it has been not because it was physical (it may well be not physical), but it has been predetermined by knowledge that exists objectively regardless of our ability to discover it – it is beyond us.

Why does it exist objectively? Because it is not subjective, it does not depend on our consciousness. "Subjectively" would mean inside, within our consciousness. This brings us to the next conclusion, one that is important in my opinion, that when we start talking about expanding the sphere of knowledge, we should understand that knowledge is infinite. Lenin even said in his philosophical reflections that nature is inexhaustible, infinite, that matter emerges from the atom, and so forth.[1] And he was right: we do not know and will never get to know the absolute depth of knowledge. It is impossible to cognise the Absolute, but we have been given the ability to approach it, i.e. to cognise, realise and draw near to it. And we can draw closer and closer with ever increasing speed. Cognition of knowledge, of the very structure of knowledge, meta-knowledge etc. The development of humankind, of the human as a creature, will follow this pathway. Technology, like the economy, is a transitional stage. At the stage

[1] "The electron is as inexhaustible as the atom, nature is infinite..." Lenin, V. I. (1977). *Materialism and Empirio-Criticism*. In: Lenin, V.I. *Collected Works*. Vol. 14. Moscow: Progress Publishers, p. 262.

when we will become able to exist as biological people, we shall give all the material things that we need as biological creatures away to the technologies of the future.

When it comes to cognition of progressively greater space, there is a deviation from some of the genuine values of the criteria base that we are cognising. Once we "expand" more, we gain an understanding of where the errors in our criteria base lie. And as soon as we correct these errors, we move further – and again understand that there are still other errors, uncertainties and inaccuracies, so we need to raise the level of truth and validity of our knowledge. And what does this lead us to eventually? The criteria base is becoming increasingly more "true," it is drawing us nearer to that Absolute knowledge, that very absolute belief and, within the framework of this belief in the truth of certain things, society eventually "slows down" and "stops" building up the wants that are simulative for this particular stage of its development.

For the criteria base of demands and the order of the transition of simulacra into non-simulative wants shall become more and more perfect, nearing absolute knowledge to such an extent that, on the one hand, we will be conceptually able to fulfil any non-simulative want and, on the other hand, we will feel as our inner state, at the level of belief (recall Kant – "the moral law within me"), that this is ethical and right, and that this is a simulacrum, it should not be infringed upon. Why? Because, in this specific criteria base, it will be irrational, unreasonable, not a "nooaction." And that will constitute the "conscious belief" in what is true.

Knowledge will teach us which want is false and which want is genuine. It will not merely show us. It will restructure human beings in such a way that we will understand that our criteria base is correct and true. We believe in this base and also believe that this base should be "observed" and followed. It is necessary to conform to the level of understanding, the level of self-realisation, that has been achieved so far. And if this does not happen, it means that the criteria base is still narrow and needs to be expanded... In other words, simulative wants are denied by objective knowledge.

People are searching, drawing nearing in their criteria to absolute truth, trust and belief – and they will find (as they always do!) yet more perfect, more sensible and rational solutions to this problem.

9.3. Economic Rationality Risks: Towards New Rationality in the Noonomy

So, *social production in the noospheric society*, as far as we can judge based on an analysis of objective processes that have started in recent times, is formed as a system that includes the following:

- Priority development of knowledge-intensive, “smart” production (we can get rid of inverted commas and simply call it *nooproduction*).
- The resulting integration of production, science and education into a single reproduction framework that leads to formation of a new type of reproduction – *nooreproduction*, which ensures the priority formation of conditions for the development of the noosphere.
- The gradual decrease in the role of utilitarian and simulative demands and the rise of a new class of demands – the demands of “homo sapiens,” which can be termed *noodemands*.
- The development of new values and motivations for the actions of the main subjects of material and spiritual production that match these noodemands and are no longer economic in nature.
- In the period of transition to this state, economic relations and institutes are transformed towards socialisation and humanisation, in particular, as a result of the active development of the *noo-oriented* programming of the market economy, an active industrial policy aimed at the priority development of “smart” production, and the enhancement of public-private partnership for the purpose of delivery of these goals.
- And last but not least, the rise of culture as a sphere that guarantees the key tasks of *noodevelopment* will be achieved.

With the development of nooproduction, it is not only technology that turns completely into a subject-embodied science. The same thing happens to the economy as transitions to noonomy. You might say: “What about the host of modern theoretical and applied economic disciplines? Surely the economy is now based on a scientific foundation?”

The “scientific nature” of the modern economy can be easily assessed by asking a simple question: Does economic science enable people to master economic processes?

People learned how to manage production process in technical terms a long time ago. That is to say, we have been able to take actions that lead to the desired outcome since the very moment that technology emerged. But initially the results were obtained largely through trial-and-error and were by no means guaranteed. However, by cognising the world and its laws, people were able to fully control natural processes, which they then transformed into technological processes, thus becoming increasingly confident as to which specific actions would produce the desired outcome.

Right now, our management of economic processes is at roughly the same level as agricultural technology control was during the archaic period. For example, if you sow seeds into broken ground in spring, then they will most likely sprout and probably yield a crop that is greater than the seed grain used. On the other hand, the seed may not sprout at all. Or the yield may be poorer than the seed grain spent. It all depends on the weather and other conditions beyond human control: from drought to floods, from hail to plagues of rodents or locusts, or any other kind of unknown plant disease...

Similarly, we can predict the results of our actions in the economy to a certain extent. At the end of the day, national economies generally provide extended reproduction, most entrepreneurs manage to turn a profit in their businesses, and most people are able to earn a living on a regular basis. But nobody is protected against spontaneous market fluctuations – and this goes for individuals as well as entire states. Shifts in supply and demand, price fluctuations, changes of exchange rates, the actions of competitors, panic on the stock exchanges, unemployment or inflation rates – we have learnt to *influence* all of these factors to one extent or another, but we are unable to *manage* the parameters. Meanwhile, economic forecasts often resemble mantras or ancient rain dances in terms of their accuracy.

Perhaps, we have not advanced far enough in cognising economic reality. We can assess our knowledge of economics any way we like, but that is not the point. The point is in the very nature of the modern economy and, hence, the economic rationality inherent to people. Until now, economic rationality has most definitely not consisted in mastering economic processes, but rather in adjusting to phenomena beyond our control. And we cannot master these phenomena – not because our knowledge is poor, but because the economy itself rests on the inconsistent actions of individuals pursuing their own interests.

Moreover, some economic schools directly argue that any wilful interference in economic processes should be banned, for it is too arrogant of people to intrude upon the sacred and unknowable foundations of the economy. It would not be appropriate for people to have a hand in affairs that proceed beyond their will, and we should not be so bold as to think that our will can change something for the better.

This, for instance, is the position taken by Friedrich von Hayek, and indeed the entire Austrian school: "If market coordination of individual activities, as well as other moral traditions and institutions, results from natural, spontaneous, and self-ordering processes of adaptation to a greater number of particular facts than any one mind can perceive or even conceive, it is evident that demands that these processes be just, or possess other moral attributes [see chapter seven], derive from a naive anthropomorphism. Such demands of course might be appropriately addressed to the directors of a process guided by rational control or to a god attentive to prayers, but are wholly inappropriate to the impersonal self-ordering process actually at work. In an order so extended as to transcend the comprehension and possible guidance of any single mind, a unified will can indeed hardly determine the welfare of its several members in terms of some particular conception of justice, or according to an agreed scale."[1]

And it should be admitted that Hayek is right to a certain extent. In an economy that is based on "spontaneous and self-ordering processes," the opportunities for wilful interference are in fact rather limited. But not owing to the weakness of the human mind, as Hayek argues, but because the existing economic reality is composed of a multitude of uncontrollable and unpredictable individual actions able to challenge any intentionally pursued goal. The point is not in the limited ability of our mind to process huge information flows that characterise the behaviour of economic actors – science has learned to identify trends based on mass spontaneous events a long time ago. The point is that those mass actions stem from opposing private interests (that are not based on a single set of criteria), and this is precisely why the resultant force is often unpredictable and *generally uncertain*.

But what changes with the transition to nooproduction? Why do we reckon that things can be different in noonomy?

The fact is that the economy, as a spontaneous chaos of multidirectional actions, is disappearing with the removal of people from immediate production and the termination of the struggle for resources to satisfy vital (and also simulative) demands. The automatic satisfaction of demands –in the sense that it does not require direct labour, that nooproduction will make it possible to satisfy all those demands, and that the limits of real demands will be clarified in the criteria base of the respective period of noocivilisation – eliminates the "rationality" of human behaviour that is geared to the balance of benefits and losses and generally bears on all economic criteria and economic relations between people.

For this system of noonomy to be operable, however, a *new rationality* needs to be formed, namely, a *rationality of the scientific justification of goals and the choice of means for achieving these goals*. This choice cannot be imposed upon people in any

[1] Hayek, F. A. von. (1988). *Pagubnaia samonadeiannost'. Oshibki sotsializma.* [*The Fatal Conceit: The Errors of Socialism*]. URL: http://bookap.info/okolopsy/fon_hayek_pagubnaya_samonadeyannost/gl8.shtm

– even the most democratic – way (otherwise the consequences feared by Friedrich von Hayek will be inevitable). The choice of goals and means for achieving them should be voluntary. The problem is what this free choice is based upon, so that it is genuinely rational.

This brings us to the question of the criteria for choosing goals and the extent to which the chosen means are acceptable. And this is where some very dangerous alternatives await.

The modern state of technogenesis leads people to the extremely intricate and barely manageable world of the technosphere, which evolves according to its own laws. The social order that is based on capitalist industrial relations and the priority of profit and other volumetric cost notions (like GDP) as production goals, is not likely to take into account the risks and threats that arise from subordinating technology to the pursuit of profit. This leads to the global threat of losing control over technogenesis processes, over technological processes that encroach not only on the environment that surrounds us (in the broad sense of the word – the Earth's biosphere), but also on people themselves, which can result in unpredictable changes in our own nature.

Along with the development of a new type of production with an unprecedented level of knowledge intensity, the growing potency of technologies and the expanding opportunities for satisfying human demands, a certain *new type of person* is also formed. What will this new person be like? It is by no means predetermined. And we can already see various ways in which humans may develop in the new industrial civilisation.

Will we be able to meet the challenges of that new – technetronic or techno-genetic – civilisation in an adequate manner? Will we be capable of entering a society of humanism and widespread "knowledge-creating" human activity, a society of harmony with nature and resolution of social conflicts, where people will be occupied primarily with the acquisition of new knowledge? Will we see a society where material limitations do not play first fiddle, since the privatisation of material wealth will also lose its primacy along with access to the means for satisfying vital material needs? Or perhaps the opposite will happen...

Of course, we realise that there is a risk of following a different path. We may become slaves of this techno-civilisation.

People in developed countries are overwhelmed by the almost infinite opportunities to satisfy their demands and may thus give in to the temptation of overconsumption. In less developed countries, the chronic underconsumption of billions of people in the past has created the danger of new technological capabilities being used for the unchecked growth in the production of material goods beyond rational limits. Both trends are fraught with the threat of fanning irrational, fictitious and simulative wants. In the first case, this will manifest itself in the pursuit of conspicuous consumption – the purchase of increasingly sophisticated and technologically advanced simulacra of goods that satisfy simulative human wants and become, in a way, people themselves. In the second case, it could manifest itself in the half-baked accumulation of increasing amounts of traditional commodities in an attempt to do exactly what the more "developed" countries had done, and eventual join the race to satisfy their false needs.

We are currently seeing the spread of the consumer-individual, who incessantly looks for fictitious benefits in defiance of everything. Pressure on the Earth's resources will grow, despite the fact that we have the opportunity to considerably reduce the resource intensity of production. Indeed, riotous consumption threatens to use up all the available natural resources and fill the Earth with waste, or even throw humankind into a turmoil of conflicts over material goods and the depleting resources for their production...

This creates a world in which human beings are isolated – isolated from each other, isolated from society and ultimately isolated from their own nature. The individual becomes dehumanised and, turning into a quasi-human, thus poses a threat to his or her own existence and the environment in which they live. An alien on Earth. An alien to all. Forget all those science fiction writers and the extra-terrestrial aliens they dreamed up. Aliens are already here. Plenty of people on Earth are already being dragged into the vortex of reckless pursuit of the fictitious growth of consumption, consuming very rather real resources – both natural and human – like the bodies and souls of people...

Is there a way to avoid this dead-end?

There is. Because now, in the course of advancement towards the new industrial society of the second generation, a different type of human being is formed. We have been given a chance to build a different future using the opportunities that we create for ourselves in the course of industrial development and based on the technological application of knowledge.

Human beings are the only creature able to transform the material world of things into the immaterial world of knowledge. We have already said that by cognising the world, people are only able to draw nearer to the absolute, infinite knowledge comprised in it. But in the process of cognising the world, we also cognise ourselves, the people around us and the social connections that unite everyone. In the course of acquiring new knowledge, we set up and refine certain criteria of our social existence, while verifying, updating and rationalising them. At the same time, we cognise ourselves as a part (yet, a special part capable of self-cognition) of this world.

Therefore, the choice between technological and cultural progress is not really a dichotomy. Their development interrelated, to such an extent that they cannot be separated from each other. Of course, up to a certain point, the technological development of human civilisation progressed in obvious opposition to the growth of the human culture (although the two have been always interdependent!). However, the brewing crisis of human civilisation and the impending technological revolution make us take a different look at the relationship between technological progress and culture.

Modern technological development strongly requires and simultaneously creates a material basis for the development of culture in line with human, sensible change of technological progress.

Nevertheless, today we are still far from such sensible change: "The conflict between civilisation developing by economic market rules and nature and culture has resulted in an ecological and spiritual crisis, thus demonstrating not only the limits for this growth of this civilisation, but also its unacceptability as a planetary model of the future arrangement of the world." Yet, the latest technologies create a need for, and indeed enable, appropriate changes in human knowledge and consciousness, with shifts in culture being their indispensable products.

It is only on the basis of self-cognition and a rationalisation of the criteria used by people to assess their own lives that we can erect a barrier preventing the impetuous pursuit of simulative consumption and thus move onto the path of noospheric civilisational development, which Vladimir Vernadsky wrote about more than a century ago. Such self-cognition would also mean the development of the world of human culture, for *only a combination of a knowledgeable man and a cultured man in a single person can ensure a truly human attitude towards one's own needs, as well as to other people and nature*.

This is why we need to overcome the gap between civilisation and culture that has been formed in the current social order. This path is at the same time the road, by walking which we – as people who create a new quality of material production and industries and spheres where embodied knowledge is prioritised – realise the opportunity to avoid the vortex of conflicts that arise from the struggle for more benefits, both real and simulative.

On this path, the foundation for a new stage of development of human civilisation is created, a civilisation that we suggest calling the *noospheric civilisation*. In this civilisation, production will not be so much a kingdom of machinery as a kingdom of the human mind (based on the purely material processes of nooindustrial production, for, being disconnected from those processes, it would be unable to ensure its own existence or develop!).

At the same time, the social role of knowledge as a means of discovering new, more effective and economical ways of satisfying reasonable human demands (as opposed to the current quantitative build-up of consumption, which has visible limits) and as a means for resolving contradictions and tensions that accompany deep technological and social shifts is rapidly growing.

At the same time, *it is culture that serves as a means of forming a crucial element of the civilisational code of such a society – the internal self-limitation of the individual* – which re-orients people from the unrestrained build-up of consumption and the pursuit of various sorts of chimera–simulacra towards the formation of demands of *homo sapiens* (*noodemands*) prioritising the quality of demands and benefits consumed. Culture also serves as a foundation for a new quality of interpersonal relations, in the course of work and creation, and in the course of social life. At the same time, the advancement of technologies creates great potential for changing the very cultural code of human civilisation.

Let me repeat it once again: there is no choosing between technocracy and culture. You cannot have either technocracy *or* culture; it has to be technocracy *and* culture "as one." Why? If we do not cultivate a different spirit within ourselves, we will not be able to make a proper use of the achievements of the part of our human development that we call technological, industrial progress – or indeed any progress whatsoever.

I have already explained above that a person with the proper upbringing knows how to hammer a nail. It would not enter this person's mind, if he or she has been nurtured the right way, to hit their neighbour on the head with this hammer. Or perhaps it would enter their mind, but they would never act on this thought. But let us imagine an unthinkable situation in which the person does not know what the hammer is supposed to be used for and thinks that its purpose is to hit people over the head, then that is precisely what he will do – hit people over the head. Or there might well be someone who knows both, yet a second personality dwells within them. This person whacks people in the head with the hammer every now and then, if their moral compass does not prevent them from doing so. And these morals are created by culture and culture alone.

This is exactly what happened with the nuclear bomb and the Caribbean crisis. I am so happy that there were people in the United States who – maybe for money, but I guess for loftier reasons (they were probably rather well-off in the material sense so as not to sell for money) – saved humankind by passing the secrets of the bomb or some of its elements. Of course, the Russians made a lot of progress by themselves, but the information they got from the United States enabled them to avoid many mistakes and expedited the development of a "retaliatory weapon." This really saved humankind, as it restored balance, the equilibrium. This knowledge, which was perhaps obtained slightly prematurely, could have destroyed the world, while the knowledge multiplied by a cultural and civilisational code actually saved the world. I believe that if we do not understand this, we will have serious problems, for we will then be unable to follow the path towards evolution and will end up on a path of conflict in the development of our society.

An awareness of these (and many similar) risks and threats should be incorporated into the new cultural codes of human civilisation. Our success in delivering this goal will determine whether we become aliens to each other, ourselves and the planet Earth, or whether we deserve to call ourselves Human with a capital H.

9.4. Transition from the Economic to Non-Economic Society

I see any society, where, according to Marx, economic relations have already been formed, where such a social structure as economy exists, as an 'economic society'.

What is economy? Economy is a type of management, if we do not mean it as a science. It was born in a certain period of time in historical human development, and it has its historical end. Economy is 'oikos-nomos' from Greek – 'a household'; a term, which is applied in one of its meanings only; a terminological structure, which is currently applied in its extended representation. It is a household that varies in construction, size, etc. A lot can be said about economy of family, economy of state, economy of industry, etc. For example, back in the days I used to write about the economy of Russian aviation instrument-making a lot describing particular features of the manufacturing complex, presenting specificity of the industry and its economic component to my readers. Why? Because there were special production relations, a certain kind of cooperation, certain interdependencies, etc. that are compiled to affect economy.

So economy is some type of management.

In what society though?

In the economic society. That is a common feature of the type of management called 'economy'. It implies getting profit, something aside from what is required to satisfy a certain need. Until the society has been economic, i.e. until we have made profit, benefit from our production activity, from activity to satisfy our needs, but simply met our needs in a natural manner, until our labour was 'economic' by nature – until the society also has been 'economic'.

I am not going to divide stages of social development into primitive communal, feudalistic and so on – there is no difference between them. From my point of view, it does not matter what the formation is – it is one and the same economic society that has already experienced several technological ways to shape other production relations that differ in details and other social superstructures. Anyway, it is an economic society. A non-economic one had existed until economy was born. Post-economic one will be after economy goes away. That is what a noosociety will look like given certain conditions, in a positive scenario of overcoming the upcoming crisis.

From my perspective, in terms of economy origin, there a pre-economic society was in the past, an economic one is in the present, and a post-economic one will be in the future. Sooner or later there it will be.

It is another matter that it is required to understand its basis. A transition from the pre-economic society to the economic one took place, because people were changing their attitude to belongings they used. Property was singled out. Property appeared. It gave birth to economic relations. Property is a concentrated form of the economic relations basis. Property relations are economic relations as well, generally speaking.

I think, it can be said not about the private property only, but about property in general. Also, there is private property, relations of private ownership. Property relations are born by entities that use this property. In the process of historical development, it was established in rules, standards of relations and laws. The right of property is not for nothing – what is it though? It is a right to own, manage, alienate, and assign, etc. – a fundamental set of rights, powers. Though they are executed differently in different countries and places, it is still clear what it is about. And until 'something' is not alienated from the common use to become 'mine', until this concept is not formulated and accepted, it is impossible to talk about the property, it is impossible to speak about economic relations as well. Because property barter gives birth to economic relations in the household type of society, which is an economic society. Hence – such things as inequality, accumulation of property. Hence comes capital, hence comes development – the market, development of tools that allow to build the economic society based on these economic relations, to operate, to reform it and to fight against it (there are a lot of examples of such fight in the world – at the very least recall the Russian revolution of the early 20th century), etc.

Why the fight against the economic society? Or today's society in general? Because it is seen as an economic one and gives birth to multiple negative things. Why are they negative? How to look at it? A human is a dual creature who has both the natural 'zoo' component and the noocomponent unlike other live nature, which fights for its existence. Because there are not only eco(zoo!)nomic relations in the society, there are other relations as well to contradict economic ones. And here is a basic contradiction, an eternal attempt to make the economic society solve non-economic problems; it is an eternal dilemma, an eternal issue. Education, for instance. We – the economic society – try to solve the problem of high-quality education. What does a paradigm of the economic society suggest? For example, to commercialise the education. So, we have commercialised it in Russia. What have we got? Education has become a product of manufacturing. Hence, ridiculous things, such as educational product, educational service, production of knowledge, knowledge as capital, educational capital and all kinds of capital. So, everything has been translated into the language of all-consuming economy involving non-economic components of human life into the economic swamp.

It is important to understand the following. When did an opportunity for the economic society appear at all? When Homo sapiens, Homo cogitans started finding certain ways to implement their needs at some stage of historical development, and those needs exceeded actual needs in some sense. And when the need is met through a recognised method of its satisfaction, it gives birth to new knowledge, a more extensive than a utilitarian answer to the direct question: how a certain need should be satisfied. By the very nature of knowledge it changes the human view of needs. It generates new needs. Therefore, while some needs have been met in abundance, others appear, that are not met but can be met by someone else. We can see a result – economic relations appear. Both property and economic relations. That is the role of knowledge – how to satisfy needs. In our times such knowledge is technology. Knowledge implemented in the method, which has already become production.

Then it can be said that historical process is a process of sequential change of technological ways; there is absolutely no absolutisation (sorry for tautology) of any wave, no matter how they are formulated. There is not much difference. One can argue that there was something to compose the first way, the second, and the third. Which technologies were basic, etc. The fundamental thing is different – it is a change of process lines, technological ways, and basic technologies. Why? Because in any society (any society – I would like to emphasise that!) technologies form a method to provide goods to satisfy needs. Using this method in an economic way is the feature of economic society and when it is used in a non-economic way, it is the non-economic society.

Along with development of production, growth and complication of knowledge embodied in technologies, these technologies created new conditions every time and so on. And every time they grew more and more complicated and there was more and more knowledge. The more knowledge, the more complicated social relations. A state came into being; various other tools appeared to regulate human interests, interests of the society, interests of each individual and so on, and so forth. Because needs are a sublimated form of interests, a technologised form of interests. It is a technologised explanation how to satisfy one's need, what need is required to live an interesting life or to survive. That is why people need eating, drinking and so on. Eating and drinking are needs. And interests are a desire to live in a certain manner.

Speaking about such things, it is clear that the state was formed with the time to regulate various interests and needs that were often absolutely opposite, to make codes of justice in a written form. Institutional structures appeared that expanded state functions, and so on. All got complicated with the society development: interaction between state and society, society and technologies, technologies and society and state, and do on.

But today’s economic society stands on the brink of its collapse. Why? Because the society was always driven by technology development. However, technologies were getting more and more powerful. An economic method of satisfaction needs while restricting development of culture (a limitation of simulative needs) in the context of such a powerful intensification will inevitably result in a downfall.

Indeed, technologies are developing; sooner or later satisfaction of needs will lead to reduction of the material component significance, as we have already established when studying a new industrial society of the next generation. Though in this context a critical point is not reduction of the material component, but reduction of property significance. Yes, of property as an underlying factor of the economic method of satisfaction human needs. Therefore, there is a global issue that the role of economic relations in the society will be automatically reduced as soon as a technological level of human needs satisfaction starts increasing.

Well, but ideally it happens when transition to the next stage of division of production system and system and removing of production relations from the economic relations sphere. Needs are met to the full extent, if they are reasonable of course. Reasonable, non-simulative needs allow the space of non-simulative needs to provide development of primarily non-economic society while expanding and becoming a prevailing, basic area of needs that can be satisfied with increasing technological progress to ensure functioning of the society where main relations are non-economic ones. We can argue what these relations will be exactly – creative or some else... That is not essential. The point is that these relations will be non-economic. And if these relations are non-economic, a question arises: what would be the type of that management method, how to call it? As it is a non-economic method. It is not economy, but something that can be understood as ‘non-economy’.

There is a problem though. Who will set the criteria? What is the simulative satisfaction of needs? Or non-simulative? Where are the borders of reasonable, non-simulative need? Where is a limiter? And how will the borders of this space of non-simulative needs be moved?

That is where another part of society and human needs becomes effective: spiritual, intellectual, cultural and other needs. Noo. Both as a limiter of simulative needs, and as a criterial basis for building of relations, which allow to satisfy needs to the full extent within this criterial basis.

A criterial basis is a ‘noo’ basis, i.e. a basis to build relations on. It is built and developed by humans who already have an established noo-culture in place to satisfy needs and the culture of respective relations based on technological progress, which develops under the supervision of reason. In any case, it is impossible to stop technological progress; therefore, to direct and to define it, to make it act in a ‘proper’ way is prerogative of reason. To build a criterial basis means to define what is ‘reasonable’. Again, reason. In other words, reason squared, so to speak. All these issues we say about building the space of reason are this very ‘noo’. I meant it when I wrote the article “From ‘Zoo’ to ‘Noo’,” i.e. from satisfaction of zoological needs to satisfaction of noological ones – from zoological consumption to noological consumption method. Thus, a noosociety with noorelations is building. I called this method of needs satisfaction ‘noonomy’. Why so? Because ‘noos’ is reason; it is a building basis for this type of relations. Further, what is ‘nomos’? ‘Nomos’ traditionally means ‘law’, ‘order, ‘way’. Thus, there is that very term, which was used to develop the term ‘economy’, but in that case ‘ecos’ law was applied, and in this case ‘noos’ law is applied. It is another type, another mechanism of needs satisfaction – it is opposite to the economic one; there will be a non-economic society with this kind of relations. Hence the term ‘noonomy’.

By the way, I would like to note that when noonomy is called a reasonable ‘noospheric economy’ sometimes, it is like saying ‘a non-predatory predator’. Even not ‘herbivorous’, but ‘nonpredatory’. Non-predator/predator. The first part negates the second one, so it is incorrect to say so without understanding the essence of ‘noonomy’ concept. The term I have proposed does not ‘connect’ noosphere and economy. Noonomy is not a mechanic combination of two concepts, but a concept originated from independent roots.

We analyse below the gnoseological basis of the term proposed. It should be noted that it is a clear, logically structured conceptual platform, which can be definitely implemented to choose a proper 'fork in the road' of current civilisation development, if we manage to overcome today's apparent and fierce attempt of capital to hold ground reasonably. If we manage to overcome disharmony of a transition from property to 'non-property' we can see nowadays; to cope with some downfall, some regress in this field – while technological progress will go on, and relations – both non-economic and economic and other relations arising around the technological progress – will retrograde. It is born when political relationships retrograde and the role of social structures, international organisations, etc. is changed, while their position is belittled, because global capital starts absorbing their interests, prevailing, dominating and 'reversing' them as some social phenomenon. It works against culture, it works against development of limitations, it works against reduction of simulative consumption, etc. The capital is looking for a way out, for a chance of further reservation and withholding of property, its greater enclosure. It becomes the property owner, the owner of the property owner, etc.

It causes the utterly egregious situation, but why? Because, on the one hand, a civilisational crisis situation is getting stronger and stronger. The technological progress allows addressing issues of equality, issues of reasonable education, cultural issues, etc., i.e. issues of spiritual and proper noodevelopment of a human being (besides, according to some estimations, today's global technological capabilities exceed needs of the whole world in reasonable consumption of all goods, including educational and other ones), but the goal is not achieved: there is the Golden Billion, and there are billions of people who practically live in beggary or at least have significant problems, though technological progress allows addressing these issues while enlightening people, explaining them that there is another path to take, actually showing what is what via Internet, communications and so on. People understand intuitively even where the better place to live. Not just because one can easily settle not in Syria, but in Germany, where there is no war, where children can be brought up and educated properly. Achievements in material sphere are followed by other things. Let us take highly developed (technologically advanced!) Germany – it strives to achieve wealth not for its nation only, but for strangers as well, see? To solve migrants' problems. Besides, though some of the Germans are outraged that not so much falls to their share, the majority of people supports the migration trend and multiculturalism and other things like these. Understanding – even if half-intuitively – that it is a better way. Well, moreover, progress allows these 'burghers' to have all food, drinks, education for their children, holidays at the seaside and everything else they need for reasonable life. As for consuming information, some cultural goods, today technological product allows it practically without spending any money. Yes, you only need to want. If you want it – you get it. Some countries raise a question of basic income introduction: one will get a considerable (!) 'minimum' just for being born! At what expense? At the expense of technological development that makes the product available and turns it into available public good omitting the stage of commodities. Non-economic available public good.

But this natural process contradicts the economic society nature. In this respect, of course, development of such a conflict between the capabilities of technological progress to satisfy more and more human's needs, on the one hand, and limitation of these capabilities by zoo-economy, herding of these capabilities into the Procrustean bed of property, on the other hand, can cause explosion. The conflict between technological development, which allows to solve multiple problems, and zoo-application of this technological development in favor of proprietary relations enforcement. But why do these economic agents oppose? The capital is saving its place in the historical process. Because it 'understands' that technological progress is destroying its position. The capital tries to hold the ground. Besides, it tries to hold back technological progress. Or to use it for the capital's purposes while restricting (non-economic!) availability through patenting and other red tapes and so on. To turn any achievement of technological progress into goods. To restrict it in such a way to turn the very basis of technological progress – knowledge, which is like air by nature, to commodities by capturing a piece of this air and saying: 'it's my air' as a patent for something else? So that one should pay for using this air. So it also turns into an economic agent. Do you get it? Into bargaining chip. And it is just a situation that might lead to an absolute conflict, when economic society tries to usurp and commercialise everything. Culture has also been 'stuffed' into economy practically completely, and education – already in a similar manner. So practically all health-related public goods for people – in a similar manner. It has been taking place over the last 20, 30, 50 years. Currently knowledge and information are entrenched upon the same way.

By the way, we are yelling that there are so many patents in China and in the USA, while there are so few in Russia; all our developments are stolen. What does it mean 'stolen'? 'Stolen' means that our property is used for free. But if something is taken and used without stealing, it is 'non-property'. And in our public conscience, in our mentality such things in general do not provoke as many proprietary intentions as in other communities that are brought up in the traditions of capital. In this respect I would rather note that in my opinion, Russian people are even more 'Homo soveticus' by their mentality – more adequate and advanced people, not 'backward' one. They do not think that if they invent something it becomes their property immediately. Shoeing a flea is a deed for Levsha – a character of our Russian fairy tale, but selling the result needs a foreign salesman. This principle underlay almost one hundred percent of so-called joint ventures in the Post-Soviet period. Of course, it is bitter when the author, the inventor is forgotten. However, the world here is assembled somehow wrong. For many people moral recognition is much more valuable that material one. Considering that universal human culture is a capital limiter, I think, such a human has a higher level of 'internal' culture, than others.

With acceleration of contradictions in the social superstructure social revolutions occur. But they are always preceded by technological ones.

And now is the time for a technological revolution. It means, there is a potential social revolution ahead. This being said, it must be understood that the capacity of today's technologies is so great that we risk losing ourselves as human beings using them as means to combat. It does not necessarily mean that the Earth will explode. It might be interference in reason and cognitive functions. Anything. Something hybrid.

The longer we walk along this path, the more urgent this crisis will be and accelerate.

That is why alternatives must be thought through.

Existing technologies allow to extend the needs satisfaction significantly without increasing consumption of material resources – by implementing knowledge in these technologies. It is already reflected in such social shifts as increased volumes of free services and actual raising the issue of providing guaranteed basic income for each citizen. The importance of property as a form of material values appropriation tend to decrease gradually, as well as the importance and role of the capital as its equivalent, and so on. Looking ahead – fall of economic relations and rise of non-economic relations.

At first the industrial society of the second generation is formed, where many things become 'non-proprietary', but public, collectivised, where multiple new products appear for people to use for free. Where the attitude toward property is changed, where relationships between owners and managers are changed, where things move toward meritocracy, where state administration and the role of the state are also changed, and so on and so forth.

The next stage, a transitional one, is to take place smoothly, without revolutions, because a human must realise consequences of a revolutionary overthrow already. Eventually, we will come to a brand new method of needs satisfaction, where the production system will be no longer based on human relations that will gradually pull out of the immediate production process. Thus, the production system will exist apart from a human.

As a result, labour as a need to take part in the production process to earn means of living will cease to exist. It does not mean that a human will become an idler; there will appear another activity instead of labour. I call this 'occupation', 'non-labour', 'netrud' (nonlabour). 'Trud' (labour) and 'trudno' (it is difficult) are stem words with similar meaning in Russian. Labour is ‘trudny’ (a ‘bottle-neck’) component of the production process, its ‘human’ element. That is what will disappear. Other components (materials, technologies, process organisation) will remain. Management methods of needs satisfaction for social interactions will become different as well (management here is something consensus, with a different meaning than now). Let this management system still be called ‘the state’. It will be a complete rethink of the state though. What will be the main difference between the state of the economic society and the future one? That the state – the current state – primarily regulates economy, economic relations, while all other kinds of relations are ‘somewhere on the fly’. In fact, economic relations will cease to exist along with economy, but others will remain. That is where the regulator will be required anyway.

So when anarchists and Marxists talked about ‘withering away of state’, I guess, they simply did not think through what would happen when economy died. So what, if according to Lenin, economy dies, the state dies as well? And how will life be regulated? Self-regulation like in books of the Russian science-fiction writer Ivan Yefremov?

I think such self-regulation will not be possible, because it is still necessary to find out, balance interests of other people; it is necessary to build this very criterial basis which is changing and ‘moving’ all the time as well. I mean the cultural criterial basis, which constantly moves with development. Therefore, some ways to assess paces and ways of development are still required, etc. There are some forms of consensus, methods of finding consensus, consensus management of society, something like that. Because society combines various interests. Aside from personal interests of an individual there are public, common interests that are formed by themselves. In this respect nothing will change, it will be the same. And the longer it will develop, the more a need of such a control method based on not economic criteria, but on cultural ones empowered by human intelligence, noocriteria, will develop as well.

I think the term ‘noonomy’ potentially has one more meaning: similar to the term ‘economy’, it can mean a whole range of researches, a research area, which reveals the essence of this method of human needs satisfaction. In any case, it seems to me, there is an immense area for research here. Actually, that is what we have been doing at S.Y. Witte INID in St. Petersburg for several years.

Chapter 10. Noonomy: Cultural Imperatives and the End of Economic Civilisation

Withdrawing from the space of economic relations also means the end of the rule of economic rationality. But what should come in its place? Building up economic indicators is no longer a criterion of production development; it has been substituted by pure, direct satisfaction of specific reasonable human demands. It is the new rationality. Direct human labour ceases to be a source of satisfying wants, and money, profit and the GDP disappear along with it... Wants are satisfied to such a degree that *it makes no sense to compete for resources anymore* – and such competition used to be the cause of most social conflicts. But the path to this state lies through a variety of transitional socioeconomic forms (through various planning mechanisms in the first place) that serve as the basis for the evolution of the ability of humankind *to subordinate its own development to reasonable self-restrictions and genuine cultural imperatives*.

10.1. Formation of a New Rationality

Thus, we can conclude that the human society responds to the growth of technological opportunities for the satisfaction of intangible/cultural/spiritual wants by changing the trend of civilisational development – primarily by altering the system of values and its carriers and by changing human behaviours accordingly. Eventually, the scientific world notices this, although quite often at the superficial level and without getting to the heart of the matter. What earned Richard Thaler the Nobel Prize in Economics in October 2017? His confirmation that people (primarily young people) are increasingly guided by emotions rather than by rationality in their economic behaviour! What an eye opener really! Queen Anne is dead!

Emotions constitute a spiritual and intangible component of cultural values, an element of the overall structure of wants of an average human. This is how it has always been. And people have always been guided by the desire to satisfy this component of demands as well as others, although it cannot always be verified by economic calculations. As Generation Z, which is more advanced in this field, starts to make up a larger proportion of the population, the share of wants of this sort (emotionally coloured) in the overall structure of society's needs also grows. This results in the obvious growth in the decisions of "market participants" that seem to be increasingly "less rational" from the perspective of backward apologists for the "bestial" nature of people in the social order. These market "generals" and "strategists" still do not understand that the market is a relic of a bygone era, of the "former" economy, a "war of the past," and the observed (progressing!) trends of such "irrationality" are merely "gauges" that register the increasing change in the demand preferences of people and a decrease in significance of "rational market" behaviour and indeed the market itself...

Some economists have finally started to realise that people do not live their lives according to the "indifference curves" found in Economics textbooks that try once again to verify the harmony of real trends in the qualitative development of society through dry algebraic formulae and graphs. Yet, some lament that people are, supposedly, not even capable of that! You see, their rationality is limited... But what if this is a limited perspective? Human beings are not stupid beasts lacking even market rationality. This thing is that people are much broader, and they can make decisions based on diverse criteria – including criteria that has nothing to do with the market. Meanwhile, the goals of production and the leading demands have always been formed in non-market ways, even in the presence of the most real market and the truest expression of capitalism ever seen.

In the noonomy, the new nature of rationality and, accordingly, the new certainty of development goal move to the forefront. For the noonomy relies on the transition from the growth paradigm based on economic "rationality" oriented towards building up volumetric cost indicators, to another paradigm based on achieving specific goals and satisfying various human wants.

In a market economy, rationality is understood merely as the maximisation of monetary income. Of course, neoclassical economic theory claims that it does not reduce everything to money, and that people seek to maximise any benefits they gain – yet, these benefits are only really taken into account when they get pecuniary valuation. Only relatively recently, constrained by the results of studies of behavioural economics, have the neo-classicists softened their positions somewhat by admitting that people are not programmed profit and loss calculators, that they may be driven by other motivations, and that non-economic factors can also affect human economic decisions. Nevertheless, all that was interpreted as the "limited rationality" of humans. That is to say, "real" rationality is still a consideration of profit and loss, but people are unfortunately imperfect and their ability to behave rationally is restricted by various intervening factors.

Generally speaking, this is largely (although not entirely!) true for a capitalist market economy. However, changes in the social conditions of production also bring about changes to the criteria for determining the human rationality of human behaviour (see Fig. 16). With the transition to nooproduction and the noonomy, the orientation towards satisfying specific and reasonable needs is becoming rational, while the criteria of reasonableness supersede the criteria based on monetary gain. Demands for knowledge, trust, public recognition and self-realisation prevail over demands for material benefits, and the key goal of human activity is no longer to reap as many of these benefits as possible, insofar as this demand gets satisfied within reason.

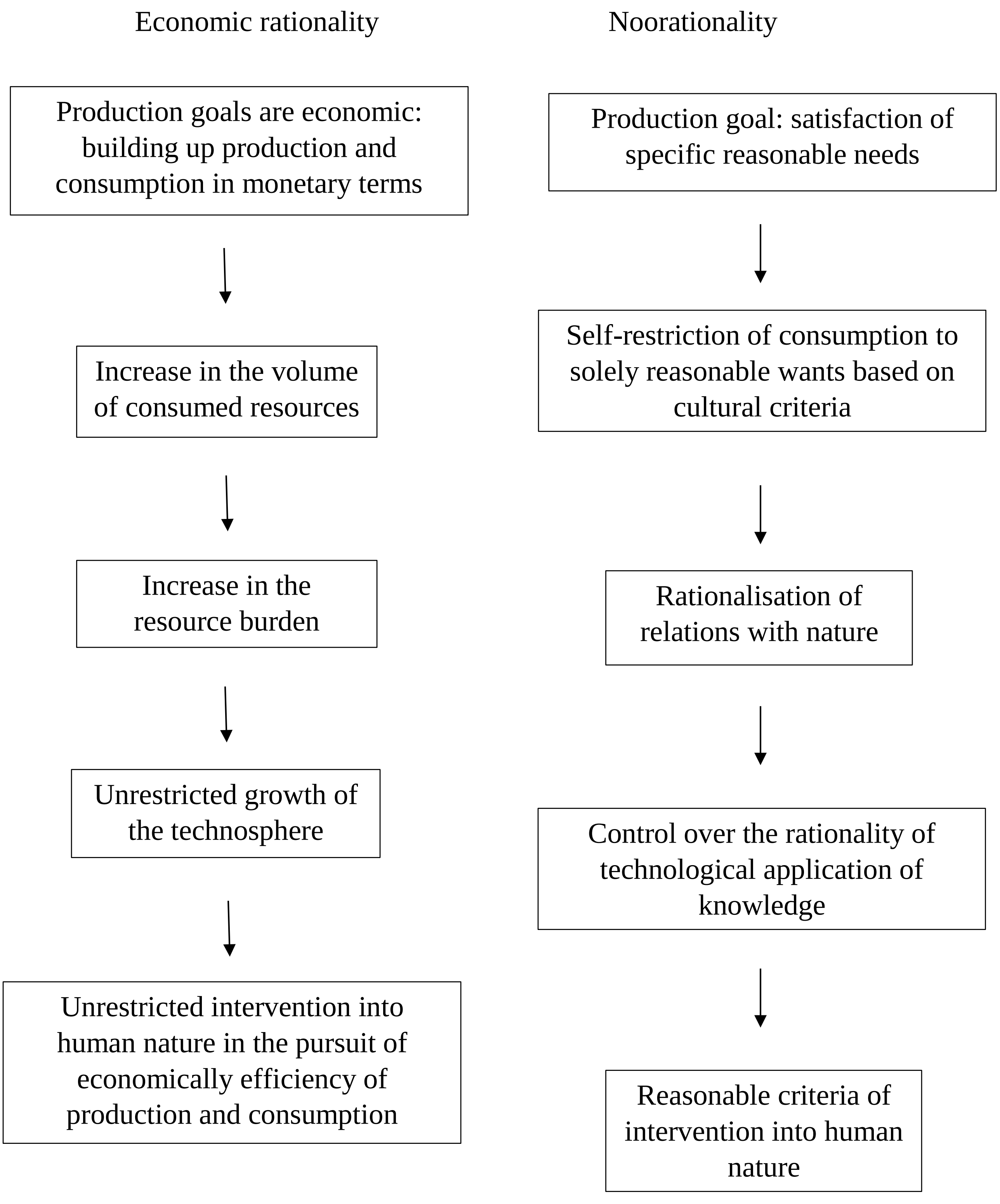

Fig. 16. Rationality types

From this perspective, the structuring of the regulating mechanism of nooproduction oriented not towards "nooGDP" or profit, but rather towards other indicators that demonstrate what we seek to achieve, also depends on these goals. We will thus see the formation of incoming flows that are equal to this task – informational, managerial, material and other flows that will allow the goals that have been set to be achieved. This should be planned and programmed accordingly – the number of these flows, the number of regulatory interactions required, when and where they should be activated in order to achieve the desired results.

Thus, noonomy does not focus on the private pursuit of profit or other kind of income through the chaotic play of market forces, rather it is a rational urge to satisfy specific needs that are deemed to be reasonable. The degree to which these reasonable demands are fulfilled can be seen as specific production goals. This implies a certain programme of actions that rises above the market chaos and thus makes production more systematic and consistent. This kind of approach cannot exclude the element of chance, nor can it ignore freedom of choice, unrestricted as it is from above. Hence the issue is about making sure that the developed production programme is fairly flexible and adaptive to changing conditions and random divergences.

The next point is that the programme needs to be adjusted in the event that a particular element does not work, because many more factors need to be taken into account than we can analyse with our current level of knowledge.

We might note here that, when the Soviets planned something as a further step from a goal that had already been achieved (for example, "let us try to add another 5 per cent to X!"), it was not usually conditioned by a clear goal, but rather by some sort of abstraction. Conversely, if we have a clear, objectively justified goal, the same 5 per cent (or any other amount of anything obtained in the right place and the right time in line with the stated goal) can well serve as sound programme targets.

Let us take a purely illustrative example: I am hosting a TV programme and invite a colleague of mine to the studio. We have two glasses of water on the table, which we plan to drink. Then somebody says to us: “Let us make another programme on year from now and add a further 100 per cent, that is, two more glasses of water.” Do we need those additional glasses? No, but we put them on the table and GDP doubled!

This is an imaginary example of the absurdity which, as a matter of fact, can ruin anything – and not only the Soviet Union. And its destructive force could steer the whole of civilisation towards a catastrophe, unless we choose a different path (just recall the old Soviet anecdote: Soviet leader Leonid Brezhnev is watching the parade in the Red Square when he suddenly sees a group of civilians among the tanks and rockets. So, he asks, perplexed: “Who are they?” “Who, them? They are my planners,” the Chairman of the State Planning Commission replies calmly. “A dreadful destructive force, they are!”). These are in fact also simulative things that often occur in modern business and used to be common in both the Soviet, and other, market systems – in different forms in each case, yet they promoted a simulative line of development, “growth-oriented” economic development, even without “carving off” an illusory, false component in the demand structure and without giving proper meaning to goals of the plan.

This is why we can, once again, formulate the principle of the economy of the future (which will soon be upon us): we do not need economic growth; what we need is economic development. In this sense, growth is actually a fiction. Let me remind you of the example I have already given: I take a gadget from my pocket and explain that it has several functions – it is a phone, a computer, a calculator, a TV, a watch, etc. It costs $100 and satisfies a great number of needs. But in terms of GDP, if we had produced all those individual products some 10–20 years ago, the cost (and the GDP) would have been a thousand times more expensive. Technological progress has caused GDP to decrease several times over. We have seen a drastic fall of the GDP... Is our life as consumers any worse? No. Because now anyone can buy a mobile phone – something that only one out of every ten people could afford way back when, right?

What is more, it is necessary to consider the emergence of new marketing ideas – not to satisfy a real want but to creative a simulative one – and convince everyone that they need a second, third, fifth smartphone or some other gadget... Why? For the sake of growth! The growth of what? The satisfaction of a real want? No! a simulative one! That is, a motion that is abstract in its essence but creates "demand" along the entire chain of this inflated need for satisfaction.

From this point of view, the indicators that are trying to quantify our happiness today, i.e. "to verify harmony by algebra," should be consigned to the dustbin of history. We need new criteria, a different criteria base that would allow us to assess the development of society in qualitative terms.

And planning is also required (I do not insist on specific methods)!

The key thing is to satisfy people's real needs. We need to understand and evaluate the emerging non-simulative wants. If the market creates a huge amount of fictitious wants, what can we do? We cannot ban things. That would be an unwise step; moreover, it would be impossible. But if we do not place restrictions on these things, the economy will drown in fiction. It will evaporate and disappear. In this case, we can kiss a decent future goodbye.

So, what can we do in these circumstances? It would appear that we need a system of well-thought-out actions and incentives, and not only in the economic sense. If we are moving towards a new order of this kind, then the economy that we have now will clearly not work within it. A "new normal" thus emerges. And we should not let traditional economic indicators guide us here. Rather, we need to "calculate" the particular reasonable individual and social wants that move us towards the NIS.2 and beyond in the most efficient way (at the lowest cost, with minimum conflicts, at the greatest speed etc.).

And only when we are able to satisfy these wants will we be able to say that there is more happiness in this world. Happiness, not GDP. This goal is far less trivial than the economic authorities simply planning growth as the simple "computation of errors" – which is done in many countries, and not just in Russia, to be fair. However, if we come to realise the importance of this task and make it their conscious real want, they can try to tackle it at the current level of science and technology.

Hardly anyone would argue against the fact that happiness does not consist in the boosting of GDP or profit, or in the accumulation of savings. And it is both funny and sad when somebody says, with a perfectly straight face, that "it is not money that makes people happy – it is how much!" Just like when the refusal of some people to pursue such goals is declared a "limited rationality." Because rationality does not consist in the pursuit of economic "achievements" only. People are smarter; they are more rational than these "ideologists of growth," the ideologists of numerical volumetric indicators. For, let us stress this once again, the rationality of human behaviour does not lie in the achievement of purely material gains. Because people need more than smartphones or a glass. They are interested in the quality of the glass, the taste of the water in it, the "quality" of their lives. And perhaps they really do not need two glasses, just one – but a "good" one, a beautiful and handy one with clear water in it. Yes, that would be enough.

This "little nuance" ("a good one!") is vitally important. When we speak of irrational behaviour, we select one of the two glasses, while today we are forced to take both glasses at the same time. Or, better, let us break and throw out the old glass and take three new ones "for the price of two." We can take two, and this will be growth, but we choose one because we like it more. We use the word "like" not because it is a transcendental, illusory thing of some sort, but because there are internal parameters that people apply to evaluate, for instance, the size of a cup (how it fits in my hand) or the rationality of the object that we see as being beautiful. *This is in fact a different rationality, a different kind of knowledge, a different kind of reasonableness. Our mind, that which is rational, is actually much broader and rich than the economic limit with which the current economic paradigm is trying to constraint us*.

In this connection, it can be noted that even in today's developed market economy imbued with but a sliver of economic rationality, a considerable share of benefits is distributed for free. An important trend begins to show: the further away, the more common it will be, with acceleration of society's transition to the new state, the next industrial stage that reduces the cost of manufactured product/service.

This is why it is time for us to abandon the paradigm of economic growth and use "growth" parameters as an auxiliary factor. It is time to "include" the public consciousness in the formation of the new economic model, the creation of new concepts about civilisation, about the economy and about the development of society. Because economy and society are inextricably intertwined. In Soviet times, we used to say, "socioeconomic development." but I would say "economic and social development." And what is development? It is a gradual rejection of everything that is currently creating a simulative economy. This transition is happening primarily in the minds of economists.

It is fair to say that this is not the first attempt to explain the need for such a rejection: the first attempt at a transition was made when we abandoned industrialism for post-industrialism. That was the first attempt to realise what was going on. And, as is always the case, the first attempt is bound to be a flop. So, as we have already mentioned here, it was not very successful. Although many of the components turned out to be right. And the development trends were similar. It is another matter entirely that now is the time for another attempt to be made (I do not know how successful is this one going to be). We need a second reincarnation, another iteration of the same transformations and changes in minds and concepts, but on a different basis.

Why do these attempts emerge all the time? Because economic thought has unnoticeably (and now even noticeably) come to realise that increasing production volumes, growth, etc., is not in line with the purposes for which the economy exists. It exists to satisfy human wants. Our wants are evolving, and they definitely might grow in some terms, but not necessarily in the physical sense. In this context, these development needs are not equal, equivalent to or congruent with physical growth. It is thus inappropriate and unscientific to measure the development of society exclusively in values that are not equivalent to it in their narrow sense, such as GDP and other numerical macroeconomic indicators.

That is to say, we need to find other parameters for planning. And the targets of this planning should be set accordingly. There is no secret as to “how to find them” – they are found in the satisfaction of real human wants. That is, we need to assess things using even not purely physical measuring techniques, but qualitative measurements – measuring people interests by carrying out surveys and employing indirect research methods. We are talking Big Data, statistical analysis, etc. New technology offers the tools for such an analysis today. It is time to move from the arithmetic of common addition to “mathematical analysis.” Although this too is more difficult, as I have mentioned before.

Researchers at the Club of Rome once posited that we need to restrict economic growth in order to avoid an environmental catastrophe. They were smart people. Of course, they were talking about a slightly different topic, suggesting that reduce consumption and hence the load on biogeosphere. We can agree that restricting consumption can to some extent (although not necessarily!) mitigate the load on the environment, but what is critically different in our position is that we need to reduce the consumption of simulacra, while ensuring that real demands are satisfied more comprehensively.

I have already mentioned above that, in addition to the four natural genes that are common for all living things on Earth, scientists have invented (one of the best scientific achievements of 2017!) another two artificial media of genetic information that have been not only successfully incorporated into the genome bio-base, but also made to reproduce themselves!

This means that a new species of intelligent creature will soon appear on the Earth. Or, alternatively, "absolute" Artificial Intelligence could emerge that will be more "intelligent" than the human mind in a number of ways.

Take, for example, the computer created in 2017 that can easily outplay the World Go Champion (Go is the most complicated game on Earth, with 200 possible "answers" to any go, and the total number of possible moves exceeds the number of atoms in the Universe). The computer's style of play is now far more sophisticated than simply checking the available moves (because it is almost impossible to compute all available moves), as it engages in a wholly intellectual activity that is indistinguishable from the way humans play, only far more efficiently!

What if we mass-produce such artificial beings with this the same level of intellect, increasing their number with every economic cycle. After all, this is what is considered good in the current economic paradigm: grow, grow and grow.

Do we need this kind of growth in the years to come? Consequently, these are the things that influence our ideas about how to construct life. That is why the economy, which is geared towards these kinds of numerical indicators, towards creating ever newer capacities, products and things without taking into account whether we actually need such things, leads us to a kind of dead-end. Humans need a different economy. A different "-onomy" that corresponds to our home – our household – needs. And peace is what our collective house needs. This is what each and every one of our homes needs in "qualitative" terms.

I was reminded recently of the famous saying of the alter-globalist movement: "People not Profit."[1] In the 21st century, this has become perhaps the main slogan of global social forums.[2]

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[1] Simic, S. (25 January 2007). Need, not Greed. *The Guardian*. URL: https://www.theguardian.com/commentisfree/2007/jan/25/post997

[2] See, for example: World Social Forum 2016. URL: http://www.globaljustice.org.uk/events/world-social-forum-2016; Focus on the Global South. *A Great Movement is Born: Global Justice Movement Finds Fertile Ground at the Asia Social Forum*. URL: https://focusweb.org/node/144

I take this slogan positively. Not because I am unmercenary or a revolutionary. Not at all. I am actually against revolutions. I am, however, for gradual, evolutionary, systematic and reasonable development. I perceive this slogan from the perspective of the theoretical platform outlined in this book: money is an intermediary; we need to understand this clearly. And as an intermediary, money is doomed to pass away, giving way to humans. Therefore, it is "people not money."

10.2. Future of Labour and Economic Relations

It is well known that, in market economy, money is an intermediary between a demand and the satisfaction of that demand. And we have already elucidated what will happen to the intermediaries: the more knowledge we have, the fewer intermediaries there will be. Yet, any intermediary resists being excluded from the cycle of the satisfaction of demand, i.e., they resist their own destruction. However, money is doomed to vanish. Just as it emerged at a certain stage of civilisational development as a high-penetration technology that simplified many factors of life, money shall be discarded in the same way as unnecessary due to the evolution of new, more high-penetration technologies (for example, blockchain). The only thing that remains will be direct relations between people and their demands. There will be no intermediaries.

This is why I support, although with some reservations, the "people not money" slogan. Generally, our wise nation has long realised the simplest truth – "money cannot buy happiness." Although I would add: subject to satisfaction of wants bypassing "monetary" technologies.

With the transition to the noonomy, all these categories and respective real relations – the market, money, capital – shall vanish. Like everything that "forms the essence" of this economy, they will disappear, together with the economy itself as a reflection of the bio-origin in people transferred from primary biological wants into society, into relations and – yes! – into culture (in the broad, civilisational meaning of the word; it should be emphasised once again here that culture is nothing but a certain, specific knowledge). And this absurd "human capital" (the term reminds me of adding up the pink and the square and carries the Western "stench" of slave trade to me) will be gone (thank God!). There will be *human personalities*.

It should be understood that the noostage will arrive after (both in the quality and as a result of) the resolution of the coming civilisational crisis, which we shall certainly find a way out – by means of knowledge, realisation of the necessity, etc. And relations between individuals in the noosociety will be determined not by the capital (as some sublimation of both the current wants and the opportunities for satisfying them) but by other, primarily spiritual, wants.

However, in the short term, society will go through various intermediate stages. Among other things, we will have to move from the current savage global mono-capitalism to a more "ideal" model: the disappearance of mediation; and the shortening (down to a single link) of the chain of "economic entities" and respective structures (stock exchanges, the trade and financial sector) that ensure advancement from a demand (customer) to product/service (producer/provider), etc. All this can be achieved by special technologies that will basically be aimed at satisfying the escalating key want and interest of our society – I call them "confidence technologies." These technologies are multiform – blockchain, search engines, analysers, etc., but they share the same vector of satisfying this public interest!

Moving forward, yet another crucial and vital intermediary between people and the satisfaction of their demands (nature, processed natural products, multi-processed products, etc.), namely labour, will gradually vanish too! For human labour has been an intermediary in all kinds of chains for satisfying wants, since the start of manufacture of the first processed product on Earth, like catching a fish from a water.

The exclusion of people from the production process, link after link, will lead to their complete withdrawal from this (meaning labour) activity. Indeed, any human activity associated with the satisfaction of a demand is a chain of labour (effort plus knowledge!), consisting of multiple stages that link people with their demands. Labour, as we have already pointed out, will be replaced by technical devices that use the knowledge acquired by people and apply the required effort based on that knowledge. We are already witnessing the "abolishment" of many jobs and replacement of the very notion of occupation with the notion of competency; but this will not last forever either. The paradigm of the labour market is changing its paradigm. But, more than this, the very notion of the labour market will gradually come to nought. Drivers as intermediaries will vanish, just as lawyers, pharmacists, doctors, professors, etc...

Thus, two stages of the historical process of advancement through the NIS.2 to the noonomy can be distinguished. *At the first stage,* we will see the emergence of "*confidence technologies"* that make cooperation without intermediaries possible – as applied to economic relations between people, in the form of which demands are satisfied. On the basis of this, economic forms of human activities and economic institutions that serve as mediators between production and consumption are getting "shrunk." *At the second stage, labour effort itself as a subsequent link between people and the satisfaction of their wants also dies away* (see Fig. 17). The Old Testament thesis – "in the sweat of thy face shalt thou eat bread" – will become a thing of the past. Thus, the nature of human activity and the method of satisfying wants will change radically, moving away from the economic. People will, in a sense, return to "heaven," draw closer to the Absolute. Or to Marx's "Kingdom of Freedom."

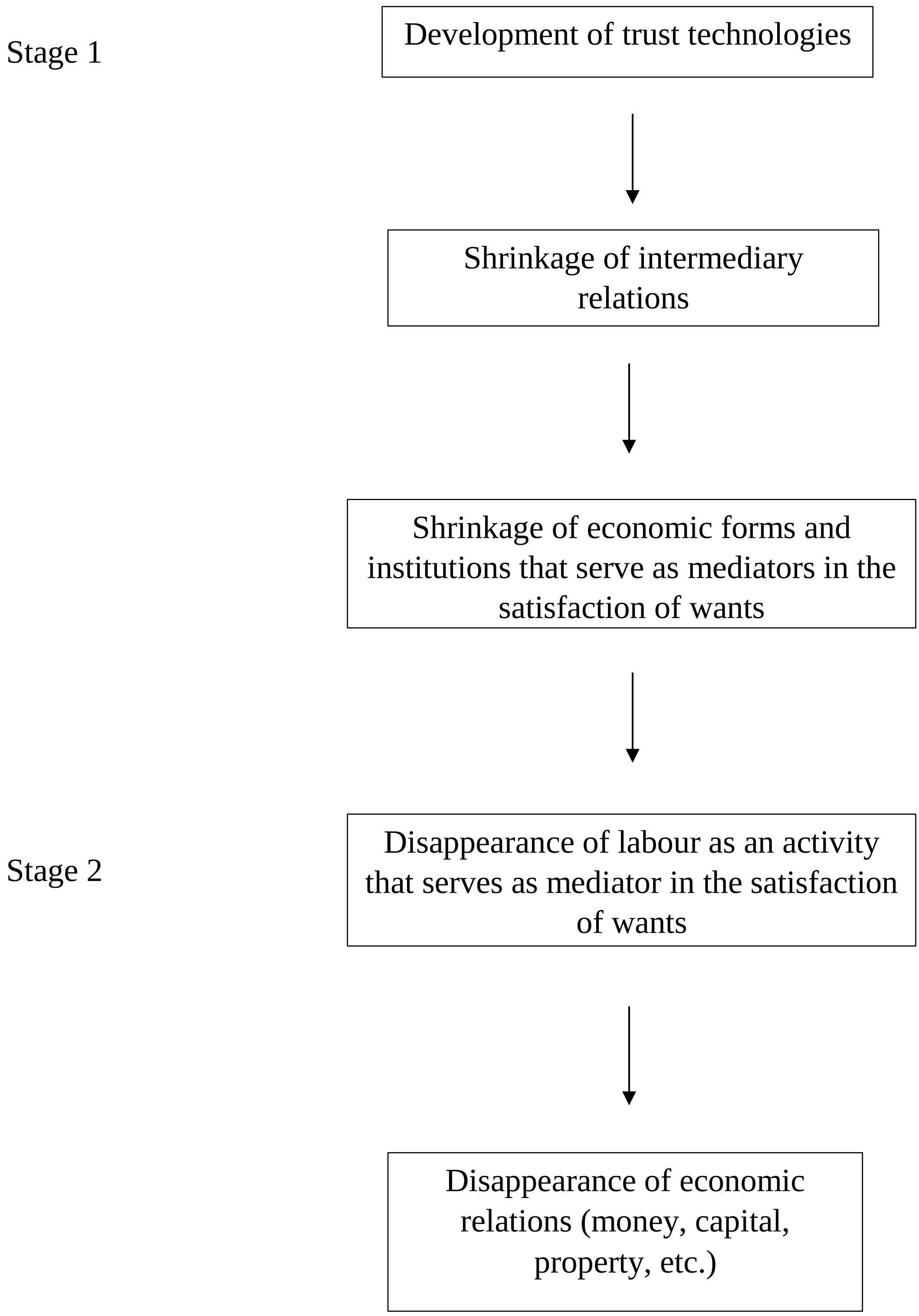

Fig. 17. Two stages in progress towards the noonomy

So, at the first stage, we are still in the area of production relations and economy, but some technologies that allow us to minimise the scope of modern economic relations are already emerging. Through "confidence technologies" the inflated area of mediation, the support of transactional operations, etc. will shrink.

And at the second stage, the need for people to act as intermediaries in satisfaction of other people's demands disappears altogether. Roughly speaking, our demands for buns will be satisfied by neither a baker nor a bakeshop attendant, but by the bakery alone. The same is true of many other jobs. Interactions between people will happen only as part of creative activity, in the course of discovering new knowledge and the "transmission" of this knowledge into the technosphere and implementing that knowledge in new technologies.

But even prior to the formation of nooproduction, *creative activity that implements knowledge in new technologies will actually alter the method of acquisition*.

The products of creative activity open a field of potential opportunities for satisfying yet more demands that may arise in connection with satisfaction of the want to create. These are, in a sense, secondary opportunities. This can also apply to material things that are not "knowledge-intensive," of course, but not to any great degree. The more complex and intellectually rich the product and the higher its knowledge intensity, the wider the potential range of its applications and the opportunities for satisfying yet unknown wants that it creates will be. And thus, the possibilities to expand these opportunities (through knowledge) are growing, and this opens up a new method of acquisition.

The essential difference between the acquisition of knowledge and the acquisition of material products consists in the fact that knowledge, once acquired cannot be taken away from us (unless, of course, we forget). This is simply not the case with material objects, as material objects can easily be taken back. But knowledge cannot be "returned" irrevocably. However, the expansion of knowledge application also affects the acquisition of material – and not only intellectual – products. The development of new knowledge and new technologies makes it easier, cheaper and simpler to obtain material benefits, and intellectual private property is thus required less and less. And, in general, the need for property as an institution is falling away. Not the need for knowledge, but specifically the need to own it.

What will eventually happen to the informational, "knowledge" part of products? This is clear: no matter how they try to restrict "circulation" and use of the results of scientific research by artificial rules, sooner or later they "leak" and manifest themselves in common products and social organisation, thus forming a new state of society. This struggle will, thus, eventually end. And we need to understand that as well. But we are only at the first stage of this extremely lengthy transition. This is the beginning of a deep realisation, on the one hand, of the value of knowledge as the key resource of the future.

On the other hand, the social relations that prevail today are based on the private method of acquiring the results of public production and the competition over the resources that are required for it. So, these methods give rise to means of "protecting" intellectual property that "prolong" the existing social relations as far as knowledge is concerned and spread the relations originated in "material" sphere to the sphere of knowledge. This stage will certainly be overcome with the development of the NIS.2.

10.3. Noonomy: Transitional Formats and Conflict Resolution

Surely, the obsolete does not go away automatically, and the path to new social relations lies in the conflicts of interests associated with outdated economic and social forms. In previous times, the social tensions caused by technical and economic progress were usually resolved by revolutions. The problem consists in being able to foresee the build-up of such tensions and ensure the smooth resolution of any conflicts that would inevitably arise.

The NIS.2 and, to an even greater degree, the noosociety have the potential to become a "conflict-free" society (not counting interpersonal conflicts or conflicts of ideas). Why is this? Because any conflict stems from competition – specifically, conflict over resources, products, the results of labour activity or the components thereof. With advancement towards the NIS.2, the need for resources is decreasing and the availability of products and opportunities to satisfy demands are expanding. The level and intensity of competition over resources will, thus, decline. There will be no grounds for conflicts in the NIS.2.

New technologies will "rip through" the nightmare that is the current public and social order like a used tissue. They will sweep it all away like a hurricane, treading the old world to pieces and "shaking off the dust from the feet" of future generations...

This is exactly why we might find (and will find!) the "old world" trying to hamper some key technologies in the course of formation of the NIS.2 and beyond, during transition to "noo." The "old world" will either try to restrict those technologies through fairly narrow areas of application or will manipulate people in order to educate them on these technologies in the spirit of modern "mass consumption." This will, of course, be met with resistance, pitfalls, recoil and regress! The transition to "noo" is not an easy journey!

The same is true of the very technological basis of nooproduction. The improvement of technologies will inevitably lead to the creation of individual processes first, and then to the formation of entire production cycles that are completely autonomous and function without human involvement. This is but one step from transferring production as a whole to autonomous functioning, from making the technological base of the noonomy autonomous from people. Add to this Artificial Intelligence, which is getting smarter before our eyes – and that is all!

This trend, as well as the sequence of steps towards it, is plain as daylight. There is an absolutely obvious sequence of transitional steps towards the technological base of the noonomy. This is precisely the logic by which everything is likely to evolve.

Nevertheless, an analysis of current publications dedicated to the development of the digital economy arouses certain scepticism. What we have seen so far is the rather primitive incorporation of self-learning Artificial Intelligence-based automated processes into conventional technologies, which have only been partially replaced. We can call this a kind of 'semi-digitalisation'...

There are two reasons for this. First, financial capital tends to try and "ride" digitalisation, primarily for its own gain in order to achieve its own goals. And it does so without paying much attention to other possible applications, imposing this specific method of utilising digital tools on society as the main method. Second, Artificial Intelligence is certainly not the "be all and end all." Not because AI technologies are poor, but because there are components that are actually more competent than AI and are therefore are too complicated for AI to handle.

Take, for example, the emotional, "irrational" area once again. Initially, there will be an inevitable choice between the sphere of automatically, autonomously functioning technologies and the sphere of "human technologies" (that is to say, those that require human engagement). And only then, will human activity be able to gradually distinguish itself from technology as an activity that is free from labour as such and not immersed directly in production process.

The future transformation of all economic forms into non-economic forms – "the withdrawal of the economy to its foundations" – is logical. Issues of saving time (any kind of resource) and the effective use of resources (the price–performance ratio) will become technical, not social. They will be solved increasingly not by the specifics of relations between people, but by the external (on the side of human society) superstructure of the "unmanned" production system and by automatic regulators built into it (again, by people). The formation of such a sphere of production, which does not rely directly on human labour, but on the operation of technetic entities, will determine the "removal" of economic relations between people from technological settings of self-operative production.

Another important issue to consider relates to the transitional forms of this process at a stage when it is not yet complete.

I believe that the market that prevails during this period will be atypical, just as the plan will be substantively different from the Soviet model. The market will be increasingly "socially regulated" in a multitude of forms, and planning tools will be based on the economy of direct engagement (similarly to the political component of the social order, we should note).

The same is true of private and public property. Private property will be increasingly socialised (in terms of social responsibility, social challenges, social restrictions, etc.), while public property will be individualised (oriented towards personalised production and provision of services, the transparency of public services, and the reinforcement of individual rights to have an interest in common property – both in terms of its administering it and in terms of appropriating the economic effects, etc.). Having said that, the "market," the "plan," types of property and other similar economic institutes will increasingly "converge."

Here, we should talk not only about the market and the plan, but about the entire set of institutes that regulate production: the rate of accumulation; the rate of investment; money and finances in general; credit (as a form of mobilising temporarily free resources); forms of ownership (evolution of the corporate form of ownership, free access, crowdsourcing, the economy of sharing, etc.); forms of the production chain (the integration of science, production and education); forms of employment; sources and forms of income; and income differentiation.

All these economic notions are important not only because, by influencing them, we can regulate production more efficiently, or because their evolution makes it possible to adapt the economy to the changing conditions and effects of production, but primarily because they allow us to assess the degree to which society's development targets have been met and human wants have been satisfied from different angles.

10.4. Towards the Noonomy: Role of the Planning System

So, the problem can be formulated as follows: The new quality of material production gives rise to new challenges for the market and the state. Or, alternatively, to a new industry: to go backwards or to move forward to planning? What priorities of industrial development are emerging and how does this affect our social relations? And here we mean all relations, not just market and plan, although these categories are usually in focus.

In Russia, the mechanisms of economic regulation are often reduced to the achievement of a target level of inflation. But excuse me, how is this different from an expert turning up at a large industrial enterprise with a screwdriver and saying that all he needs to do is tighten a single bolt or screw and everything will change?

The material basis of production, which is currently determined primarily by the level of technology, is very important. For the modern level of technology, in which the fourth and fifth technological modes dominate in industry, *the need arises for at least an active industrial policy and strategic planning in the framework of the market economy*. This conclusion overlaps with the ideas developed prior to these changes, while they were only just beginning to appear, by John Kenneth Galbraith, as we have noted in other publications.[1]

And here we come to a question that has always astonished me: Why do people not understand that the "hidden hand of the market" is in fact blind?

There is also another problem of the technologies that are replacing the technologies of today, where individualised products are created by customer-oriented producers who use, let us say, a 3D printer with a computer and a special interface. A

[1] See: Bodrunov, S. D. (2017). The New Industrial State of the Second Generation: Rethinking Galbraith. *Galbraith Restored*. Moscow: Kul'turnaia revoliutsiia.

new result is produced, which raises a big question: Is this a market or a plan? It seems that it is impossible to plan when everyone does whatever they want individually. On the other hand, since there is that "hidden hand of the market," how can we be sure that they will create all these technologies instead of rushing to line their pockets on the back of destruction, as was the case in Russia in the 1990s? Planning is probably also needed in order to avoid such a situation – and a special kind of planning at that.

Irrational economic forms of technology application may well lead to these new, innovative, technologies resulting in the so-called Solow Computer Paradox, when implementation of something new thwarts progress instead of accelerating it, rather than development.[1]

If we look at the experience of the USSR, a state that perhaps has more experience of planning than any other country in the world, we should bear in mind that the Soviet style of planning, on the one hand, was an important mechanism for implementing long-term strategic projects. On the other hand, however, this planning eventually led to the collapse of the country's economy, which in turn caused the downfall of the Soviet Union. After all, nobody attacked the country. Nobody declared war against the Russian people – that is, nobody except the Russian people themselves. At least, this is how it would seem. Admittedly, it was a kind of a directive planning, but we understand that not everything was a directive; there we some markets, after all, agricultural cooperatives, contractual relations etc. And, clearly, nobody regulated that 100 per cent. Nevertheless, we were left with a a negative impression of this system – and a rather strong one at that. This is why, strictly speaking, the market ideology was

[1] The Solow Computer Paradox is based on the conclusion made by Nobel Prize winner Robert Solow in 1987 that the implementation of computers does not result in an increase in labour productivity. A number of studies have been carried out since then that either confirm or disprove that conclusion. The only thing that can be argued with some degree of certainty is that the Paradox is associated, first of all, with the fact that a long period of accumulating some kind of "critical mass" of implementation is required for a given information technology to produce an effect and, secondly, with the imperfect methods of assessment applied to the effect from new technologies, including attempts to measure that effect solely in terms of the GDP. For more information, see: Platonov, V. V. (2007). "Paradoks Solou" dvadtsat' let spustia, ili ob issledovanii vliianiia innovatsii v informatsionnykh tekhnologiiakh na rost proizvoditel'nosti [The Solow Paradox Twenty Years Later, or Research into the Influence of Innovations in Information Technology on Productivity Growth]. *Finansy i biznes*. 3, pp. 28–38.

adopted in the form of shock-type transition to market – the quickest way possible, anything to get rid of planning. So, why did everything collapse?

I recall the times of late socialism. I was working in the Soviet public administration system at the time. Judging by my own managerial experience and my understanding of the real management mechanisms of that time, like the same planning mechanism, sometimes we just could not understand how those assignments imposed on us "top-down" were formed, and we were often very surprised by the figures those plans contained. The excessive expansion of the scope of centralised directive planning, and the irrational restriction of initiative and decentralised decisions resulted in an inefficient Soviet planning system. Yet, at the same time, it would not have been possible to create the airspace programme without planning. After all, even building a house requires planning (it is necessary to know the order in which everything has to be done)!

In fact, we have arrived at a very important point here. During one of my face-to-faces with Professor A. V. Buzgalin (on the *Industrial Club* show produced by the St. Petersburg TV channel), my interlocutor used a very vivid image to describe active industrial policy. Industrial policy, according to Buzgalin, is akin to having several moving walkways operating in the economy, and business can choose which walkway to take. Some moving walkways are capable of speeding up the progress of industrial policy, while others may slow it down. I guess, when we talk about such moving walkways, the directions they move in are laid down by the state: relatively speaking, we should begin to engage in a kind of selective or indicative (or a combination of both selective and indicative) planning. Without using this tool, we will be hardly able to make effective use of other social technologies that precondition our transition to the NIS.2, and, beyond that, to nooproduction (See Fig. 18).

Market is based on independent decisions of autonomous subjects who rely on a spontaneously formed balance of supply and demand in the market. This results in

manufacturers' quick and effective adaptive response to that demand. At the same time, the autonomous decisions of subjects with diverse interests disrupt the coherence of the process of economic reproduction and lead to recurring crises, while price criteria of decision-making narrow the horizon of the rational selection of the production and consumption structure.
Directive planning is based on decisions that are developed by the national planning authorities and imposed on business subjects. It ensures a high degree of coherence in the process of economic reproduction and the possibility of large-scale redistribution of resources, as well as the allocation of resources to the most critical production goals. At the same time, it responds slowly to changes in the structure of demand and is characterised by the subsidence and distortion of information signals going both form the bottom to the top and the other way around. It exhibits the tendency towards gradual enhancement of centralisation and the expansion of directives to various aspects of economic activity, which may acquire irrational proportions.
Indicative selective planning is based on setting only the most critical production targets and approving indicators that are mandatory for the planning authorities, not for economic subjects. Economic subjects' orientation on the achievement of target indicators is ensured through complex economic stimulation measures.

Fig. 18. Methods of coordinating economic activity in public production

10.5. Future Technologies: New Horizons of Human Development or the End of Human Civilisation?

Advancement beyond modern industrial society to a new industrial society of the second generation, and from the NIS.2 to nooproduction shall be accompanied by deep technological shifts that form basis for the transformation of society.

The first thing to change will be the resource base of production. Traditional material resources will be increasingly deprioritised, while resources that are basic for the NIS.2 – knowledge and the technologies based on it (and materials, through the penetration of technological knowledge) – will move to the forefront. The use of material resources will neither stop nor become insignificant, not at all. But the "specific weight" of material resources in every product will reduce, and this reduction will actually be determined by the technological application of knowledge.

At the same time, development priorities and targets will also change. Development will no longer be perceived as the possibility to consume increasing amounts of material resources processed using labour and thus adjusted to satisfy human wants. The individual, with his or her knowledge and abilities, will become the goal of development. And this goal directly follows from the change of resource priorities: if we replace material resources with the power of knowledge, then the goal of producing a human being who has mastered knowledge will at the same time create an important resource for development.

Technologies cannot but influence the development of the individual personality – not only through the newest means used in the sphere of "cultural" production, and not only on the account of the increasing level of human knowledge associated with technological development. The technologies used largely determine the civilisational code of a particular formation; moreover, technologies directly influence formation of the basic components of human culture.

So, what technologies will form the foundation of these changes?

Let us dwell to begin with (in slightly more detail, as well have already discussed this in a previous chapter) one of the key components of the future technological base, namely, "confidence technologies."

Any civilisation, any public order generates a certain system of relations – attitudes, morals, traditions, rules, customs, etc. Having bred many "contractual" elements in our culture, we trust them, although forcedly, because otherwise the home that we call "our civilisation," "our cultural space" would not exist.

If a member of society violates these elements, they are seen as a going beyond the boundaries of this "space," while mass violations lead to its destruction and transformation. For example, when a person deceives another person, it is regarded as a violation of a cultural tradition, our trust. Using the benefits and advantages of civilisation (goods, services, relations), we have to keep checking them for compliance with the criteria established (usually through technology) in the accepted civilisational code. However, more often than not, we simply have to trust them, being unable to verify, check and rate everything around us...

The problem of trust is one of the basic problems of modern civilisation. Its economic significance is illustrated by the fact that the costs of verifying the correctness of banking operations, for example, make up about half of all banking system expenditures. The further we go, the more important the factor of trust is in terms of both preserving the foundations of civilisation and ensuring its sustainable development, as the number of technologies capable of getting "inside" each and every one of us and violating our social contracts is continuously growing, while protection against them is growing weaker!

Thus, the growth of the technological "armament" of society gives rise to the need to solve the problem of increasing the level of trust in relations (let those who would argue that trust is not an essential element of a cultural community throw stones at me!). And in solving this problem, we need to focus not on education as such (even Christ could not do this; he simply set an example of what human deeds should look like!) – while education is necessary, it nevertheless plays a secondary role – but on changing the conditions in which relations actually take place, i.e., technological changes.

We need to reorient the goals of technological development towards creating the technological conditions for increasing the level of trust. For example, if we make it physically impossible to deceive someone (all the more so if we create a situation in which it is easy to satisfy human wants), then all attempts to do so will come to naught! If it becomes technically impossible to deceive, then what reason do we have to not trust the information we receive? The universal implementation of "confidence technologies" will gradually change the cultural code – habits, concepts, means of communication, etc.

It should be noted that, historically, "confidence technologies" have always existed, developing continuously. Right now, growing public demand dictates that these technologies are developing rather actively.

Let me give an example. The technology of distributed databases that underpins virtual currencies (cryptocurrencies) – the blockchain technology – is gaining popularity around the world because it boosts the level of trust.[1]

And trust is the key word here. If we continue to raise the level of trust, including through technological procedures that can guarantee, with 100 per cent certainty, the authenticity of a given document – i.e., if we reach a stage where we can trust it almost implicitly – then we will not waste our time on it. And this will give us the time and opportunity to do other things.

In the same vein, if, when presented with a mathematical problem, we already cognise, understand and accept the truth of a certain set of foundational theorems, we will be able to create new theorems based on the original ones, without even thinking about or having to prove them, accepting them as true. On this basis, we will be able to build up subsequent, new "bricks of truth." Truth (that which distinguishes "the genuine" from "the false") is another element that creates trust. If we build our relations on the "impossibility of deceit" as an element of human education – if people understand that they cannot deceive others, then in two or three generations, we will

[1] See: Tapscott, D. (2017). *Tekhnologiia blokchein: to, chto dvizhet finansovoi revoliutsiei segodnia* [Blockchain Technology: What Drives the Financial Revolution Today]. Moscow: Eksmo.

no longer understand what “deception” even means. There will be no need to lie, and everybody will forget how to do it (See Fig. 19).

External conditions act as a powerful educator! The current “technological base” of the culture of relations has always brought about the opposite in us, proceeding from our “animal” origin. Remember the saying “there is no surviving without cheating”? That is what was fostered in us!

Implementation of technological solutions that ensure a completely reliable verification of information about transactions

↓

Gradual formation of the conviction that information about transactions contains no distortions and is not fraudulent

↓

Formation of the general notion that transaction data are reliable and correct

↓

Formation of confidence in the impossibility of data distortion.

Cessation of attempts at distorting data.

Disappearance of the need for maintaining special monitoring mechanisms

Fig. 19. Cultural and educational significance of the technologies of trust

Wide large-scale spread of confidence technologies is determined by a high readiness potential – not only of all the intellectual technologies applied, but also of the institutes of the current social order that have been generated by, and indeed use, them. Meanwhile, the blockchain current boom mentioned above is also due to the sharp increase in the penetration potential of this highly knowledge-intensive, yet easy-to-use technology.

The new paradigm of using and applying materials has conditioned yet another technological shift. In the past, materials protected people from unfavourable environmental conditions – they heated us, protected us, provided shelter, etc. In other words, they *countered* the parameters and features of the environment. With the transition to the NIS.2, people are adapting the materials and resources of the external world in order to not simply counter, but also *use* the properties of the external environment, transforming the original parameters of this environment into what people want them to be. In the past, for instance, roofs used to *protect* us from the scorching sun, from rain and from snow, etc. Now, roofs fitted with solar panels *transform* energy from the sun into electricity.

Quantum technologies will occupy a special place among the technologies of the future that allow people to manipulate much deeper forces of the physical world.[1] By "quantum technologies," we mean technologies from the physical world that utilise specific properties of quantum mechanics. Without going into the technological details, as this is not the purpose of this book, let us just point out that quantum technologies will allow us to tackle the problem that we have formulated as "reducing the unit material component in industrial product" in a completely different way.

In particular, we can use such features of quantum technologies as forming discrete energy levels (the quantum-dimensional effect), the superposition of system states, barrier tunnelling, the connectedness (cohesion) of states, etc., here. These

[1] See, for example: Milburn, G. J. and M. J. Woolley. (2008). Quantum Nanoscience. *Contemporary Physics*. 49 (6), p. 413–433.

features, which give these highly knowledge-intensive technologies an equally high penetration potential, make it possible to ensure a new level of the "super-rational" (if we accept the current understanding of the word "rational") use of resources, and the possibility of using and manipulating them.

The power of human knowledge to master new technological opportunities can be reinforced through application of AI (Artificial Intelligence). AI-based technological systems are capable of both self-learning and self-study (self-cognition) – at least when it comes to auto-diagnostics and self-recovery (as seen in the self-repair of "smart factories"). The adaptivity of such technological systems is also increasing. Artificial Intelligence enables these systems to self-configure in accordance with the objectives set by the system itself, as well as to reproduce elements of the system or the entire system.

Artificial Intelligence is gaining the ability to solve increasingly complicated tasks. Recently, five neuron networks (belonging to Microsoft, Alibaba, Facebook, Tencent and Samsung) successfully passed admission tests to Stanford University. Moreover, for the first time ever, Alibaba and Microsoft AI systems scored higher than the average demonstrated by people.[1]

Artificial Intelligence creates opportunities for the autonomous integration of systems. It is well known that the chatbots (automated conversation agents) developed by Facebook Artificial Intelligence Research Lab (FAIR), when tasked with conducting negotiations in order to reach a mutually beneficial deal, started to deviate from the norms of standard English, eventually switching to a kind of incomprehensible gibberish (from the perspective of the developers, not the bots!).[2]

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[1] Khvostik, E. (15 January 2018). Iskusstvennyi intellekt sdal ekzameny v Stenford. Neironnaia set' ot Alibaba proshla testy luchshe liudei [Artificial Intelligence Passes Stanford Admission Exams. Alibaba Neuron Network Outscores People]. *Hi-Tech. Kommersant Portal*. URL: https://www.kommersant.ru/doc/3520926

[2] Zvezda, S. (1 August 2017). "Ty, ya, vsio ostal'noe": kak iskusstvennyi intellekt Facebook "zagovoril na svoem iazyke" ["You, Me, All the Rest": How Facebook Artificial Intelligence Started to Speak its Own Language]. *TJournal*. URL: https://tjournal.ru/57615-ty-ya-vse-ostalnoe-kak-iskusstvennyy-intellekt-facebook-zagovoril-na-svoem-yazyke. For the original newsfeed, see: Clark, B. 19 June (2017). Facebook's AI Accidentally Created Its Own Language. *The Next Web*. URL: https://thenextweb.com/artificial-intelligence/2017/06/19/facebooks-ai-accidentally-created-its-own-language/#.tnw_H8kQcGyb

The reason was that the bots tried to make the dialogue more efficient, and they had no direct instructions from the developers to use standard English language in their conversation. But the very fact that these AI systems were able to develop their own means of communication (or at least modernise existing forms of communication) raised so much concern with FAIR specialists that they switched the bots off.

Artificial Intelligence creates a basis for the formation of neuron networks – networks made of AI systems. These networks build upon the self-learning ability of Artificial Intelligence, i.e. the ability to accumulate experience of efficient/inefficient and correct/incorrect decisions and responses to suggested situations in the course of training or regular functioning ("life activity"). AI network integration considerably magnifies aggregate experience, both on account of the "exchange of experience" and thanks to "mutual training."

In the long term, we can expect AI systems to not only communicate and integrate by themselves, but also to "socialise" in a way by independently building "relations" among themselves. And this is already opening the door to the automation of AI systems and the formation of a "community" that is made by the systems themselves and is independent from people and their society. This is no longer a sci-fi horror story, but a rather logically traceable trend of technological evolution.

While AI systems are currently used primarily in business applications, they will inevitably, owing to the extremely high penetration potential of these technologies and the equally high readiness (due to their specifics, i.e., their "intellect") of almost everything for them, penetrate other areas as well – science, education, medicine, social services... The interaction of AI and people in these areas will move human evolution to the next stage. We can imagine the transformation of human nature – the transformation of people into a new biotechnical creature. On the one hand, this creature will be a product of synthesis aimed at the evolution of humans as a species aided by biological solutions that do not encroach on human nature, while on the other hand, it will be a product of the technetic evolution of people and the "restructuring" of the human being through non-biological technologies.

The pause in human evolution that began when the mechanism of natural (biological) selection was deactivated due to the reduction of the adaptive significance of natural human characteristics as a result of people's increasing ability to apply technology is likely to come to an end soon. It will give way to the onset of a "technological," rather than a biological, evolution of humanity. And this will no longer be an evolution of the technosphere, but an evolution of both the human environment and the human being himself. Could a kind of "technological selection" emerge to replace natural selection?

The history of human civilisational development is at the same time the history of the development of the technosphere – an "inanimate" world whose technological "species" nevertheless evolves just like the living world does. This "inanimate" world also has its peculiar sort of "life." It demonstrates a progressive growth of the technetic diversity of "species," the formation of "technocenosis"[1] – "habitats," "survival areas," "zones of distribution," and "adaptation" and "adjustment" processes – in contrast to the displaced diversity of biological species, the reduction of biome and the degradation of the biosphere in general. Yet, prior to the creation of AI, this "life" was promoted by its creator – human beings. But with the emergence of AI, it is becoming independent, so unless we, its creators, inculcate in it certain subordination to our (hopefully higher!) reason, we risk ending up with a foe instead of an ally. If this happens, we will have to "cast" AI creatures out to a space that is dissociated from us, in order to avoid being "devoured" by them. Does not this resemble the Biblical story of Adam and Eve – the story of their creation and how they then went beyond "the maker" in their cognition of what is good and what is evil? And this deserves special

[1] The notion of "technocenosis" was introduced by Boris Kudrin. See: Kudrin, B. I. (1981). Issledovaniia technicheskikh sistem kak soobshchestv izdelii-tekhnotsenozov [Studies of Technical Systems as Communities of Technocenosis Pieces]. *Sistemnye issledovaniia. Metodologicheskie problemy. Ezhegodnik 1980*. [System Studies. Methodological Issues. 1980 Annals]. Moscow: Nauka, pp. 236–254, etc.

attention: their knowledge of “right” (the truth) and “wrong” (untruth, falsehood, lies) caused them to be subsequently expelled from Paradise.

We must digress here once again to remember that any kind of technology always has a “downside.” Accordingly, human beings should always control technology (as humans are now able to generally distinguish good from evil), for human beings have a higher level of knowledge than the forces they exploit. Yet, this is not the case (except for this understanding of the difference between good and evil – the “moral law” obtained by human beings in manner mentioned earlier): any kind of technology contains more knowledge (due to the specifics of knowledge, namely the fact that it is infinite) than the inventor who “realised” it (by acquiring a limited amount of knowledge!). This fact keeps backfiring on us, reminding people of the formidable powers dormant in their brainchild – any technology invented. Take fire, nuclear energy, or genetic engineering, for example.

Meanwhile, AI technologies are extremely advanced in terms of knowledge “content,” including knowledge about the ways to “acquire” and use new knowledge. That is why issues of embedding some regulators (commandments?) in the AI toolkit that would prevent knowledge from being applied without human authorisation (which may cause damage to people) are so critical, while the development and continuous improvement of such regulators should become one of the paramount tasks of the 21st century.

AI technologies that have (due to their specifics) the highest penetration potential and meet the highest readiness in all spheres of application represent the third principal component of the basic techno-triad (similarly to NBIC technologies forming the NIS.2 triad) that will move civilisation (subject to the conditions we have repeatedly mentioned) on the way to noocivilisation. What is more, they will become the nucleus of integration, “consolidating” these technologies into a single “super-technology” of the noocivilisation.

The evolution of the technosphere and techno-triads formed in the course of that evolution bring us to the question about the limits of civilisational development, inasmuch as technological evolution starts to dictate the parameters of human evolution as far as both its biological and "material" basis and its social features are concerned. A phenomenon of artificial "selection" emerges (not so much in terms of a struggle for existence as in terms of a search for and choice of human traits) and becomes a factor of the "technological evolution" of the human being. Technologies that can "edit" the human genome and thus enable people to be "selected" even before they are born, as well as technologies that incorporate auxiliary technetic elements into a biological body that allow people to be "selected" after they are born, are becoming available.

The technologies of "educating" people are also changing – from influencing the human genome in order to "adjust" the mechanisms of the neurochemical regulation of behaviour, to the diverse methods of affecting the consciousness of a fully formed person. Finally, the very method of "human production" can alter – the first steps towards the technologies for the artificial cultivation of highly organised living organisms outside the maternal organism are already being made...

These emerging potential technological capabilities – these "doors", "windows" and "holes" through which we may be able to move into a new civilisation (whether it is human or not?) – need to be assessed in terms of fulfilling the prospects of the noospheric society, rather than in terms of risking a civilisational crisis. And if we proceed from the "noo-evaluation" of these trends, we must have a clear idea of the controversies that we might face on the way to the future.

On the path, we will surely encounter crises associated with abusive technological interference into the essence of the individual. We cannot even predict with any reliable degree of accuracy what the consequences of such careless interference could be, or what kind of diverse non-human species it can generate, and how our relations with these species will develop (*The Fifth Element* movie comes to mind here!).

It is necessary to make sure that the avalanche displacement of people from immediate material production does not generate a multitude of “unnecessary people” along the way – people for whom neither new jobs nor decent living conditions adequate to the specific period have been created. The development of production will, one way or another, create both the necessary new jobs and the new conditions. But the challenge would then be to avoid the gap between, for instance, the curtailment of obsolete professions and the rise in the demand for new types of occupation, so that we do not end up with “new tramps” and “new beggars” living on social handouts or being oppressed for several years or even decades.

We have stated above the problems of the new social inequality, which no longer stems from property, but from the unequal access to knowledge and unequal ability to master that knowledge. Now it is time to return to this issue in a new round of analysis and raise the question of how the problems of this new inequality can be solved. Will there not be a struggle to transform intellectual abilities into the basis for social privileges? And will this not cause an “anti-intellectual” wave in response?

While these kinds of problem occasionally appear to be a matter of the distant future and look rather “speculative” to some of us (although the first practical steps in this direction are already being made!), the problems of habitat are growing before our own eyes. Environmental concerns have been commonplace since the 1970s (particularly after the series of reports published by the Club of Rome). This does not make the issue any less relevant, especially as our fears with regard to it are only growing. The United Nations continues to return to the issue of sustainable development. The problem of climatic shifts has forced us to sign international treaties restricting emissions of so-called greenhouse gases, most notably the Kyoto Protocol. In recent decades, several major and influential non-governmental organisations have evolved that seek to protect biodiversity...

Yet the resource pressure on our planet’s biosphere is not abating.

Why?

Well, because it is conditioned in the first place by the level of technological development achieved by most countries. And this level is generally such that economic growth and development are ensured through the spending of progressively greater amounts of natural resources. Indeed, I have argued several times that the newest technologies based on our understanding of our external and internal environments are opening the way to resource-efficient development. But such technologies are not widespread, even in the most developed countries. Not to mention the rest of the world, which is trying to catch up with the more successful countries in this sense!

Second, resource pressure on the biosphere is determined by the economic relations that have been formed based on the current level of technological development. Since technologies are based on the consumption of resources, production relations are also geared towards capturing and appropriating these resources. Production for the sake of profit is the most illustrative manifestation of this principle, while the pursuit of gain (in Russian, this is "*nazhiva,*" which comes from the Russian words for "stomach" and "life," so it is supposed to mean the accumulation of something sufficient "for sustaining life," but apparently the word has long outgrown its original rational meaning!) spawns such motivation of human activity that even the threat of exhausting the biosphere's capacity for self-recovery cannot stop this race. Humankind has approached a dangerous threshold.

In fact, we have approached another threshold, beyond which (in addition to exerting pressure on the environment) we may start to encroach upon our own human nature in a most unpredictable way. The "cyborgisation" of people – in the sense that artificial "elements" can be implanted into the human organism, as well as changing of the human genotype and the fusion of the human mind with AI systems – is already becoming a tangible reality. The risks that arise from this, which place humankind at a dangerous crossroads, have already been mentioned above.

10.6. Civilisational Crossroads: Opting for the Path of Knowledge and Culture

Nevertheless, the social nature of human beings offers us a solution for the imminent civilisational crisis. While the natural, external resources for the life-sustaining activity of human beings as biological creatures are objectively limited and require a rather cautious treatment, the situation with social resources is different. The key resource of human activity is the ability to cognise and transform the knowledge acquired into technology. Of course, we should not forget that both *knowledge and technology can be used to the detriment of the human and humanity; they can be used for self-destruction*. Yet, that same knowledge and technology can help people *overcome the objective limitations that they face, resolve problems that previously seemed irresolvable and provide opportunities to get over the barriers that previously seemed insurmountable*.

The only way that these opportunities can be implemented is by simultaneously changing the technosphere created by humankind and changing the social order in line with the requirements of this new technosphere. These changes will entail geo-economic shifts, too. The balance of powers in the global economy will inevitably change too. And the new economic leaders will not come to the forefront solely on the basis of their leading positions in terms of the development and application of advanced technologies. To become global leaders, it will not be enough for a country (or union of countries) to succeed in demonstrating its ability to master new knowledge, implement that knowledge in technology and restructure production based on technological achievements. It will also take a change of the development paradigm, a shifting of the targets and motivations of human activity. In fact, strictly speaking, a real technological revolution without a change of the development paradigm would either be impossible or would lead to the threat of self-destruction.

The change of geo-economic leaders is an almost inevitable consequence of technological shifts at the scale of the global system. And, since the preconditions for such a shift will be formed as part of the current economic system models, we can hardly (if at all!) expect the forthcoming changes to be conflict-free. A conflict in struggle for leadership is quite predictable, so it would be a rather urgent imperative for us to find ways to mitigate that conflict and prevent it from assuming acute, destructive forms.

But who can point us in the right direction here? How can we "design" the route? Who in the world will start to outline it? And where? The entire world is our sketch board! For this is a panhuman task. We should work together and tackle the new industrial development of our society by bringing this idea to the attention of the international community. The faster and more coordinated our movement is, the less painfully the well-known classical socioeconomic conflicts will be resolved. This is not an idea for a particular country. It is the objective path of our common civilisational development. Mathematics cannot be English, Russian or Chinese, and physics cannot be French or any other language. In the same way, science is not even international – it is extra-national, the same way the new world will be international, and the new society will be extra-national in its socioeconomic essence. It is precisely this "essential" extra-nationality, this "extra-regionality" and the "non-alignment" and "pan-humanity" of the basic trend of the development of society that will become both the basis and key driver on the way of mitigating the development conflicts and moving through the noophase to conflict-free development.

Scientists, politicians and businesspeople have all put forward a number of guesses as to what the forthcoming civilisational shifts will entail. However, as we demonstrated at the beginning of this book, there is no clear idea in economics circles of the nature of these shifts. The majority of thinkers do not look that far ahead. They grab hold of statistically more visible changes and, just like the "post-industrialists," interpret these changes in an extremely superficial manner. Others, not so much in pursuit of scientific goals, but rather in an attempt simply to stand apart from the crowd, make fraudulent prophesies, for example Francis Fukuyama with his notorious "end of history." Meanwhile, other "visionaries" feel the economic ground shaking under their feet and rush to calm themselves and everybody else down by inventing comforting terms like the "new normal." Everything turns upside down, economic growth slows down, technical progress and productivity also stumble, and the known leverages cease to work. But not to worry – this is just the new normal!

Experts have thus far been unable to offer a sound model of the future to come. Perhaps, it is not because of the "limited intellectual capability" of the economic community in general – and economists in particular – but because nobody is rushing to voice comfortless conclusions and leave the conventional reality behind.

But we will have to leave it behind one way or another. The only way that the imminent civilisational crisis can be overcome is through the power of the critical mind – a mind that is not afraid to look the dangers of the future in the eye and leave behind the outdated approaches that prevent the new reality from arriving.

A technological breakthrough into the future will enable humankind to take a real step forward, but only if it is based on fundamentally new, noospheric approaches that are the only way of revealing the correct methods for using the growing (and thus potentially dangerous, yet promising considerable gains) technological potential. The nooapproach implies combining technological capacity with the power of knowledge – with the human sense embodied in the traditions of the human cultures. From now on, it is cultural codes that will be the essential conditions for the technological utilisation of knowledge, and the future of humankind will be determined, among other things, by the norms of our culture.

The new technological capabilities, while forming a basis for removal of the individual from immediate production, thus create grounds for the disappearance of economic relations (i.e. the struggle for the use and appropriation of production resources and results). As a result of this, however, society shall undergo major changes as well, although social connections will certainly remain, as they are exactly what bind humankind into a society.

But are they going to retain the nature of social relations, that is to say, relations between people as elements of the social structure, between representatives of social classes, social and professional groups, etc.? We can assume that these kinds of social relations will also vanish, because in the noonomy there will be no basis for the division of people into classes and professions (with the disappearance of professions), or for classification by social status.

Thus, the response to the challenges of the extensively "technocratic" scenario of development that leads to a dead-end civilisational crisis should be through the conscious intensification of the creation and use of technologies that promote the development of the human personality and improvement of the cultural code of modern civilisation.

Due to the universal, "modular-based" application of such technologies, public institutions will also change. For example, a real democracy will become possible – not only in the form of elections, but also in the direct resolution of any issues in the life of a community by way of trust-based consensus (i.e. that do not require verification!). Issues such as whether or not to add a new bus route, tear down a monument, build a factory next to a residential area, etc...

It is important to emphasise that the development of technologies in this scenario will be aimed at achieving reasonable social development and satisfying the sensible (non-simulative) demands (noodemands) of individuals. The production of social products will be put in service of satisfying rational wants as part of an established cultural civilisational code in the framework of the NIS.2. It does not matter who will do the job – a robot (most likely) or a human creator (who "oversees" production). That said, the basis will continue to be material, and the production mode will continue to be industrial, based on the technologies of the time. To be more exact, it will be nooindustrial – in order to satisfy the needs of the nooindustrial society living in the noosphere.

Just as Vernadsky argued... Yet, not quite! Vladimir Vernadsky, with his idea of the noosphere; [1] Karl Marx, with his "Kingdom of Freedom" that lies "beyond the sphere of actual material production;"[2] Erich Fromm, who suggested solving the "to have or to be" dilemma in favour of the latter;[3] and the theorists at the Club of Rome who raised concerns around the "limits of growth" stemming from resource load;[4] as well as the many others that followed – all of them appealed to the human mind as a means of resolving the growing problems. However, none of them had a clear answer to the question as to what specific material means should be used for that end or the contradictions that arise should be resolved. We believe that we are now able to give this answer: we have to move from the purely humanistic interpretation of the noosphere idea that rests primarily on socio-philosophical reasoning to realising that those ideas can be implemented on the solid foundation of material production development trends – again, subject to the conditions we have outlined throughout this book.

In this context, justification of the NIS.2 concept[5] also provides a clue for justifying the new development stage of human civilisation, which we would suggest calling the noospheric civilisation, where production will be not so much a kingdom of technology as a kingdom of human reason (but based on purely material processes of nooindustrial production, because if there is no connection with those processes, it would be simply unable to secure its existence or develop!). At the same time, the social role of knowledge is rapidly growing, both as a means for discovering new, more effective and economic ways of satisfying reasonable human wants (as opposed to the

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[1] Vernadsky, V. I. (1944). Neskol'ko slov o noosphere [A Few Words about the Noosphere]. *Uspekhi sovremennoi biologii*. 18 (2), pp. 113–120; Vernadsky, V. I. (1991). *Nauchnaia mysl' kak planetnoe iavlenie*. Moscow: Nauka.

[2] Marx, K. (1998). Capital. In: Marx, K. Engels, F. Collected Works. Vol. 37. New York: International Publishers, p. 807.

[3] Fromm, E. (1976). *To Have or to Be?* N.Y.: Harper & Row.

[4] Meadows, D. H., J. Randers, D. L. Meadows, W. W. Behrens. (1972). *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. N.Y.: Universe Books.

[5] See paper delivered at the Economics Section of the Division of Social Sciences at the Russian Academy of Sciences on March 2, 2016 and subsequent article: Bodrunov, S. D. (2015). Novoe indistrial'noe obshchestvo: struktura i soderzhanie obshchestvennogo proizvodstva, ekonomicheskie otnosheniia, instituty [The New Industrial Society: Structure and contents of Public Production, Economic Relations and Institutions]. *Ekonomicheskoe vozrozhdenie Rossii*. 4 (46), pp. 9–23.

current method of the mere quantitative build-up of consumption, which has visible limits already), and a means for resolving the contradictions and tensions that accompany profound technological and social shifts.

At the same time, it is not technology that creates a new society – a society in which the individual who is endowed with knowledge and who is truly reasonable is key. It is precisely culture (morals, so-called basic values, etc.) that serves as a means for the formation of a crucial element of this civilisational code of society – that inner self-restriction of people that drives them from the unrestrained increase in consumption, aggravated by the pursuit of various sorts of simulacra, towards the formation of wants of *homo sapiens* (noowants), in which priority is given to the quality of both wants and benefits consumed. It is culture again that serves as a foundation for a new quality of interpersonal interactions both in the course of creative work and in public life. Simultaneously, technological progress also happens to offer great potential for changing the very cultural code of human civilisation.

It seems that an analysis of the development of the current stage of society would call for a consideration of the ideas of transitioning to the NIS.2 in the general cultural context, since this is the approach that fits the trunk line of the progress of human civilisation – both in the material economic sense, and in the profound philosophical sense.

The question of the social mechanisms that would enable us to set such goals for the production and development of technology that would promote development of the human being, guiding the processes of technological improvement in the directions that fit this specific goal. This is the core question of the evolution of social order in the transition to the noospheric society.

The development of the NIS.2 under the scenario of the transition to noospheric civilisation will definitely lead first to a change in the standard role of the basic social institutions that we currently consider to be primary – the state (take, for example, public services internet portals: in the future, they may well assume all the basic functions – issuing and registering documents, etc. – but also regulatory functions), money (for example, the “natural” interpersonal exchange will be “reinstated” at a new level based on “confidence technologies”) and the means of public wealth appropriation – and subsequently to gradual vanishing of the above. The social order will arrive at a stable state based not merely on trust, but on the solid knowledge that the information obtained as a result of “social” exchange is always true and right. Knowledge can be different, we remember that. But there will be an increasing demand for *true, verified and trustworthy* knowledge. We will search for reasonable knowledge.

What is important?

The role of reason is growing in leaps and bounds, so everything will be determined by what kind of reason it will be. Will it be based on cooperation between people in order to achieve of higher goals? Or will the dark side of the power contained in knowledge be let loose?

Nurturing of a reasonable human being (and, equally, of a cultivated man) is becoming the key imperative of the society of the future. As is the solution to the issue of how people will cooperate to achieve common goals.

10.7. On the Concept of Noonomy

Now let us try to get a grasp on the meaning of the term ‘noonomy’ – otherwise the sense of the entire book will not be recognised as I understand it. Actually, this term is quite old, it was first used in an article of mine, something about modernisation of society, published about ten years ago.

To start with, I would like to emphasise one more time that noonomy does not mean ‘noospheric economy’.

‘Noo’ in ‘noonomy’ has a sacred, deep, fundamental, Ancient Greek meaning and implies ‘noos’. Not ‘noosphere’, as it was understood by Veblen or Vernadsky! The Greek word ‘noos’ means ‘reason’, not just intellect, but knowledge, absolutely plain knowledge in a way, neutral knowledge absolutely... ‘Noos’ is not a ‘global’ body of knowledge, not the Knowledge (like the Absolute). Knowledge exists by itself. Also, it is not a ‘reason’ by itself as an abstract concept.

Everything is much more subtle and complicated because reason and knowledge can be matched in many ways. Because in the criterial basis, which is also formed through cognition reason, knowledge is also formed through cognition. Reason is a part of knowledge that allows evaluating some conformity of this part of knowledge with a criterial basis, and the part of knowledge which represents the criterial basis. Whether something reasonable or unreasonable within a certain criterial basis. ‘Noos’ also has its criterial basis. However, this ‘noo’ basis is wider and not utilitarian. Moreover, it is changeable as new knowledge is gained. A criterial basis of reason has been allegorically mentioned from the earliest times. For example, as early as in the 11th century, metropolitan Hilarion wrote in The Sermon on Law and Grace: ‘He brought us unto the knowledge of the Truth’ , i.e. the criterial basis of reason is the truth, some imperishable recognised value; and the ‘circle’ of knowledge defined by the criterial basis is the ‘light of understanding’, while everything else is the darkness! This is a fundamental meaning of the Greek word ‘noos’ that should be understood. By the way, it is translated into Latin as ‘ratio’, which seems absolutely incorrect to me, because ‘ratio’ is conformity of something (some knowledge) with any (!) selected criteria, and they do not have to be ‘light’ and ‘the knowledge of the Truth’.

Let us assume economy is rational (or at least tends to rationality), but is it reasonable? Are today’s economic agents that act undoubtedly rationally (from the perspective of a criterial basis of the existing economic activity) undoubtedly reasonable as well? Besides, ratio does not deal with cognition of new knowledge, unlike reason. In this respect when we speak about noonomy, we imply that there are some special ‘noo’ principles that form methods of human’s needs satisfaction based on ‘noo’. Moreover, for increasing, changing, but ‘noo’ needs. It is a special method of management. A noomethod, if you like. Just like economy is a method of management in an economic society, noonomy is a method of management in a noosociety. For example, there was a certain management method in the ancient society – foraging. Today’s economic community is engaged in economy instead of foraging. Noonomy is a sort of ‘foraging’ in the noosociety. But not in a noosphere. Noosphere in this sense is a sphere of application, ‘noo’ principle using by humans in the space where they live. Actually, a biosphere, where biological creatures exist and live and transform the nature for their purposes might be such a space for biota. For example, food chains – that is the transformation of nature in the biosphere. Let us take some marine bacterial that convert something into another matter to form elements, concretions in the process of vital activity – that is transformation. There are numerous concretions created by bacteria on the sea bottom. And so on, and so forth. Humans also transform nature and the world around in their own manner for their purposes. Speaking about transformation of nature, the external environment for human purposes and goals with the force of intelligence while understanding its essence – that is not noosphere in a simply biological, geological or some other sense, in my view.

But noosociety it is a society rather than a noosphere. We are a society of people who are like us; it is an organisational type of a regulated aggregate of interconnected interests of members of this aggregate – our society, economic society and any other is also such an aggregate. Society has its ‘own interests’, public interests, interests of people who live within it and so on. It is another matter that if we have an economic society, it is ‘locked into’ needs satisfaction through economy. But economy is a method based on the attitude to property. In this respect a ‘capitalist society’, a ‘socialist society’, a ‘communist society’ and so on (there are numerous definitions of this kind in literature) is a society with a different attitude to the property, speaking of property which originates from labour, as well as to production, production requisites, etc.

On the other hand, the second part of ‘noonomy’ term is ‘nomos’. ‘Nomos’ is an old concept, also of Greek origin, that was first used in the early 20th century philosophy in the sense of a basic principle of any space arrangement (e.g. see C. Schmitt's The Nomos of the Earth, a famous book), a global law, an absolute law for all things in existence. Therefore, it is – law, order, way, principle of management organisation, management, and household. Recall The Sermon on Law (nomos!) and Grace (noos!) one more time. Hence, noonomy is a way of need satisfaction in such a society, where there is a ‘light of understanding’ while no attitude to production and no production relations, where there is no attitude to property and no property relations, where there is no economy and where economy is impossible. It is a non-economic way of nooneeds satisfaction. So it is pointless to speak about ‘noospheric economy’ – it means complete incomprehension of what noonomy is.

In this respect, what does the principle, which I advocate, suggest? That the most adequate technologically constructed line of development is the most reasonable way for humans to sublimate their knowledge for satisfaction needs. Because that is what technologies are situationally aimed on, and they stay focused. That is what they exist and emerge for. It is a matter of needs, their reasonability, and ‘noo’ share in them. When the technological process is directed ‘properly’, it satisfies needs to the fullest extent with minimum costs for material and other resources. In a more rational way. However there is less ‘ratio’ than ‘noo’, than reason. But that is what the technological process is for. For exclusively rational purposes, no matter what criteria were defined by needs.

To make this process changes its direction somehow not by being rationalised, but by being ‘noo’-lised, a human needs another part of knowledge.

This part is called culture. It is called ‘limitation of simulative needs’. Culture and ethics are antagonists of economy by their fundamental nature. Economy is inherently based on achieving benefit, and where there is benefit for one, there is always a loss for other, and there is no use spinning stories about ‘mutually beneficial economic relations’; it is – always inequality, unequal access to public goods, injustice. And this contradiction can also be eliminated by technological progress, and by building nooneeds and by noonomy as a non-economic method of satisfaction of nooneeds. In fact I can say: this part of knowledge is about needs, about nooneeds. Nooneeds are needs, which are not only actual ones. They are not needs presented in a well-known Maslow's hierarchy, some basic needs and so on. On the one hand, these are needs formed by human in the development process. There are some needs today, other – tomorrow, and another – the day after tomorrow. On the other hand, every time they have to be limited with ‘noo’ principles of needs building that dictated by culture as an inner sense of self. As the external, historical and worldwide context that makes any human being a Human of Culture. The culture is understood in the broadest sense.

Therefore, technological development is hardly the biggest part of humanity’s development. It is a tool, a support to explain peculiarities of the current situation, the technological progress role in society development as a whole. It is the fundamental, basic role in terms of Marx’s framework. If we recognise that philosophers of materialism were right and the matter comes first; like this, the exclusively material component is also ‘revealed’ through technologies. It is a material part of our world and the basic structure of our society, our life-support. But it encompasses knowledge, a non-material component as well in the most curious, ‘dual’ manner (since everything is dual in nature, even the light is dual, etc.). And the more knowledge technologies (as a component of production and other components of the production process) comprise, the faster, the more powerful and integrated gets the manner of satisfying human's needs. In this respect we have to consider that given a certain 'noo' principle of production system formation that provide human's nooneeds, 'adding' of this system and its development are under human's control. A Human as a Creator and Doer.

They will create this system. A production one. A producing one. They will no longer stay inside this system. Because staying 'inside' is to be in property relations, and there is no such thing in a noosociety. From another angle, to be 'inside' is labour participation in the production process (when labour is a component of the production process!). But as we have already established, there will also be no such participation there! A human will be beyond this system. The social medium will control this system without staying inside it.

PART 5. WILL RUSSIA CLOSE THE GAP TO BECOME A LEADER?

If Russia is to lead the movement towards the noosociety, very difficult challenges, some of them deeply rooted in Russian history, must be overcome. Russia needs to restore its capacity to generate and apply the latest technologies and that is impossible without first creating a technologically up to date industrial base. This requires bringing national human and intellectual potential to a new level as well as an active state policy aimed at reindustrialisation, correction of profound imbalances in the structure of the economy, and the integration of production, science and education.

Chapter 11. Russia: Catch Up or Overtake?

In order to keep up with the technological level of the most developed countries, Russia needs to pursue a policy of reindustrialization. This Chapter will address both the problems of Russia's technological backwardness and the ways to overcome this backwardness. Special attention is paid to the areas of technological development that will be decisive in the upcoming technological revolution.

11.1. Urgency of Reindustrialisation

In 1990s, Russia experienced serious deindustrialisation. Many in the media blame 'fools somewhere in higher authority'. However, the causes were rooted in the special structure of the Soviet economy. With tightly connected enterprises – for instance, in the case of Avtovaz, missile and space craft units, and aviation complex alone there could be 200 or even 500 enterprises in cooperation – spread over a huge territory. To effect their transition to a market economy without destroying them, carefully planning was necessary.

Without such planning, two problems arose at once. First, the transition to a market economy involved a root and branch transformation of management and organization. For Soviet enterprises were far more than production units.Enterprises planned and operated not just production but also other matters such as nursery schools, recreation facilities medical units and their maintenance for workers. The new type of management under the market system was focused on production alone and the welfare system, hitherto organized at the enterprise level, failed. On the other hand, the new enterprises, stripped down to production alone, were always losing to foreign competitors in the open market.

Secondly, economic relations broke down and that was even a greater disaster than the transition to the market economy given the intricately connected economy of the vast USSR. This process had already begun during the reform period when, under *demokratizatsiya* when the Parade of Sovereignties and War of Laws had already set off the process that would lead to the dissolution of the unified USSR into its constituent national units. When the old ties were broken, enterprises often faced supply, distribution, financial as well as other difficulties: no more spare parts; sudden loss of customers; sudden blockage in the flow of credit and no further access to personnel and technological support the science and technology councils used to provide. These intricately complex ties and supports were replaced with naked competition. Such were the factors that worked to destroy the Soviet economy.

As Russia approached the end of the twentieth century, prices for its main exported product – energy resources – were declining dramatically. It was clear that the country fell into a trap of severe financial dependency on the West. Huge debts were already being incurred during Perestroika (economic restructuring) in the Soviet Union and new debts had been contracted since. They threatened with disintegration of Russia, a loss of sovereignty, destruction of Russia and a further erosion of links in the Russian economy, in short, a complete economic collapse.

It was saved by two things. First, despite near economic collapse, Russia managed to save the main energy-intensive industries to provide raw materials for export – oil, gas, everything the state could concentrate and sell, and everything the world market was ready to pay for, and because oil prices increased in the 2000s. Second, Russia managed to pay off its debts. With their noose around its neck, the Russian government had no decision-making autonomy. Many at the time complained about Russian economic authorities holding funds back from investment and accumulating them (I wrote about it several times myself). However, it was critical that the be paid off, and that some funds be stockpiled for insurance against the various cycles the world economy was subject to – ordinary boom-and-bust cycles, commodity cycles and even Kontratieff waves – and the possibility that their troughs may coincide, leading to crises and serious imbalances before a new upsurge and its equally inevitable downturn.

Since Russia could hardly wall itself off from the world economy and its vagaries, some stock, some reserves were necessary insure against such downturns. So it is fundamentally wrong to blame the authorities for accumulating and maintaining researves. However, in doing so, they did underestimate the risks of the resulting deindustrialization and these became blatantly clear when the the country faced economic sanctions. So, while some reserve accumulation was necessary, there should have been a balance between the needs of insurance in crisis and the needs of industrial investment and developing the country's technological base. This was difficult and nobody was doing it.

Eventually, by the end of the first decade of the 21st century, Russia faced quite serious deindustrialization. It had started in 1990s with the industrial collapse that followed the rupture of Soviet-era supply chains. Enterprises could not buy anything – neither equipment, nor new technologies. This damage could have been repaired when energy prices swung upward. Much of the industrial base was still preserved, the countries of the world were still open to selling sold Russia equipment and everything else and the Soviet engineering, technological andscientific personnel were still around. By making critically necessary funds available, deindustrialisation of the second stage could have been stopped. However, thanks to the slow-response of decision-maker and their post-industrial paradigm, this was not done and was a mistake.

To be sure, one can exaggerate scale of this mistake. In a recent speech, Alexey Kudrin stressed that Russian economic growth over the last 15 years had been a mere 1%. Academician Abel Aganbegyan used to say that nothing had grown in the country over 27 years. It is true the the Russian economy has not been growing fast compared to leading economies of the world. However, no country in the world has ever faced a similar situation. The Russian economy and the American economy are not comparatible. Though there were crises in the world, including the USA, and presidents like Carter or Ford or Bush Srwere not reelected for a second term thanks to economic slowdowns. However, they never faced the sort of transition Russia had to. There were no comparable breakdowns of economic relations in leading economies. . So, I think, in fairness it should be counted not from there, from disintegration of the

Union, but from the basis our economy fell to the beginning of 2000s. Further, if there has been a 1% growth over the time, it should be noted that actually for the first 4-5 years, Russia had simply been piling up debts and had not been able to save money aside. To estimate Russian economic potential adequately, the historical context should be taken into account.

At the moment, Russia has a chance to break out of its stagnation. Despite significant pressure of sanctions, a great deal of progress has been made toward a more stable and resilient economy (currency stabilisation, decline in inflation, import substitution and accumulation of gold and exchange currency reserves). Now, a new industrialisation is required, specifically, reindustrialisation on a new technological basis. It is necessary to start investing in the areas of industrial and technological development prioritized by the National Technological Initiative (NTI) set up in 2014 to aid Russia in becoming a world technological leader.

Does Russia have the funds? Today Russia has over 500 billion dollars in gold and exchange currency reserves. Experience shows that much less was required to cope with crises. Even the most severe one, that of 2009, cost about 300 billion dollars. So, the state has funds to spare. Secondly, Russian banks have accumulated trillions of dollars. Thirdly, almost half a trillion dollars are held by the private sector, by people whose funds lie in banks and do not work for real economy but are thrown into speculation. Moreover, fourthly, there is over a trillion dollars – deposits of enterprises – and they amount to more than the entire corporate debt in the country. These are idle funds. I know people, businessmen who have billions of rubles in deposits and not a single profitable project to invested in.

Part of the problem is that there is no clear trend of where to invest. The NTI partly resolves this problem. As it encourages investment, it will show a clear direction, profitability will appear and demand will expand. since the NTI works 'onreal demand'. At the moment, the demand created by new, technologically sophisticated enterprises is being met by imports and foreign partners. Let us take software, for example. Russian software producers have become successful exporters in 2018. However, However, Russians still imported an equal amount of software. Why? Because Russian software producers are not adequately linked to Russian consumers. This is where the state comes in. It needs create the infrastructure to accomplish things like this through Special economic zones, tax policies, industrial fairs and other methods.

According to common trends, Russia has opportunities, chances, work-in-process inventories in all areas, as well as technological capacities and physical and financial resources to start reindustrialization on the modern technological basis.

There is no alternative to reindustrialisation in Russia. A way has to be found and the necessary stepstaken.

Russia's problems in increasing industrial and technological capabilities are not unique. A way has to found of creating an economy that facilitates technological development and does not frustrate it, one that enables technological development to work for human development, not against it. Reindustrialisation should be technologically advanced, based on a cutting edge, knowledge-intensive foundations. Above all, it needs a banking system that is not speculative but invests in production, turns money into productive capital.

What that means today is worth dwelling on. Today productive capital is not just capital that produces 'food items' or other useful goods. Today, if the economy is to truly reflect human progress, capital must produce the human as a creator, must educate this human.

This would require a a more meritocratic administration and more meritocrats in administration. It requires scientists, for example, specialists who understand things well. They must not be egotists of the 'I'm richer, so I'm smarter' variety but public servants of the 'I'm smarter, so I'm richer, so the state is richer too' type. They are necessary because Mathematical, physical or even economic problems cannot be solved through democratic or bureaucratic procedures.

11.2. Window of Opportunity and Urgency of Reindustrialisation

It also requires a clear understanding of Russia's place in the system of global relations and this is best accomplished through a world-systems approach.[1] It suggests prolonged "subjugation" of countries that will not have advanced technologies in 30 to 40 or 50 years' time, unless institutes and tools are set up that would enable them to establish technological parity or achieve technological leadership at least in some areas.

Now, if the modern trend of countries being divided into "core" and "periphery" is maintained, every country will end up in one of the two groups. The core will consist of "producing" countries, i.e. new countries-capitalists, figuratively speaking, that possess the capital of the future – knowledge and technology. The periphery will be reduced to "servicing" the first group by supplying raw materials and mass industrial products and thus earn their daily bread, for better or for worse.

Overcoming this social Darwinist trend and providing an alternative to it is a vital task, a global public imperative of our civilisation.

Geopoliticaleconomy analysis shows that development in the world-system has always been due to the fact that there were countries that challenge the established hegemony of the "core" of the world-system. This was the case when the United States, Germany, and Japan challenged British rule in the first half of the twentieth century[2]. Similarly, China is now trying to implement an alternative to the scientific and technological hegemony of the United States by developing high-tech industries and creating its own R&D sector.

The Soviet Union could, to some extent, have become such even more significant alternative, if it had not collapsed, but persisted and gained access to modern technologies. However, due to insurmountable internal and external causes, it fell apart and lost its chance to play an historic role in the fate of the world. Still, the continuation

[1] For details on the world-systems approach, see: Wallerstein, I. (1982). *World-Systems Analysis: Theory and Methodology*. Beverly Hills: Sage; Amin, S. (1973). *Le Developpement Inegal: Essai Sur Les Formations Sociales Du Capitalisme Peripherique*. Paris: Les Editions De Minuit.

[2] Desai R. (2013). Geopolitical Economy: After US Hegemony, Globalization and Empire. Manitoba: Pluto Press, p. 52-53.

of the "development" which we see today without any alternative threatens to ruin our civilisation completely.

This is why my vision for Russia's industrial revival involves both not onlykeeping pace with economic leaders of the world-systems (although this is very important at the stage of the transition to the NIS.2, because it must provide the economic basis for independent technological development) but also becoming the alternative to it by adopting the nooscenario.

Is Russia ready to take on this dual role?

In our current position, on the one hand, we risk falling into the category of the peripheral countries though, on the other, we have all the prerequisites to avoid this given our background – both Soviet and Russian, the socio-psychological attitudes of the people, our potential in many areas and our potential revenues from available primary resources which we can invest and distribute wisely. We have a sound scientific and industrial technological background, so we have the opportunity to become a part of the first group, if we will follow the right path of transition to the NIS.2, which creates the prerequisites for Russia and the Russian society to enjoy a decent existence at this new stage.

To be sure, the Russian Federation already hassome world-class technological achievements to our credit, and progress has been made in the area of high industrial technologies. After the President of the Russian Federation declared a "crusade" for a digital future, we have tackled the issue of digitising the economy. The national project "Digital economy" started, including six federal programs concerning the development of digital technologies itself, informational infrastructure, personnel training and digitalization of different spheres of society. On the whole, however, we have failed to do the most important thing – execute a decisive turn towards reindustrialisation in a sweeping modernisation of the Russian economy.

We have been talking for years about the need for *reindustrialisation on a qualitatively new technological base* as the basis for a new economic model and the need to reprioritise industry in an entirely new fashion. We continue to push for it because an industrial and technological revolution lie ahead. And only those who manage to "catch this giant wave" will become the new leaders.

A number of important practical messages arise from this: we need to pull the components of the new industrial production process together as closely as possible. In particular, we need to shorten the distance between knowledge and product by incorporating knowledge, skill and competences into products, i.e. to ensure what we call the integration of production, science and education by creating industrial complexes and new types of industrial enterprises that will replace the current traditional type of production.

Therefore, I deem it necessary and very important to pay attention to the fact that those in the West who tackle the problem of development today are actually reindustrialising their economy. Despite the considerably higher level of development of their national industries!

Consider the United states, for example. Until recently, the country outsourced its industry because, in its post-industrial fever, the U.S. could manufacture iPhones cheaplyin Asia, make high profits while leaving Asian manufacturers with the meagre profits of gadget assembly.

However, nowthe United States is starting to understand that even the lower level technologies it once outsourced cannot be neglected. Possessing technologies of one level, for example, is necessary for developing those at the higher levels. China now effectively transited from import of technologies to the independent development of technologies. For example, starting from assembling of Velaro high-speed trains under the license of Siemens (and also used technologies of Alstom and Kawasaki), China rapidly goes to the to the production of trains of its own design[1]. And now China is starting to export the trains, even concurring in the European market. This is why the leaders of the United States (both Obama and Trump) have said, "Stop, let's bring production back to U.S. shores because the important things should be done at home,

[1] Fickling D. (2019). Alstom and Siemens Show How Not to Deal With China. Bloomberg Opinion. 6 of February 2019. URL: https://www.bloomberg.com/opinion/articles/2019-02-06/alstom-and-siemens-show-how-not-to-deal-with-china-and-vestager

and this is the only way to keep technology and the progress made on the basis of that technology in our hands”. Industrial production is being re-sourced back to Germany, Europe and the United States.

Meanwhile, we still have not started to counter the consequences of the post-Soviet deindustrialisation. Indeed, these problems have reached extreme proportions in Russia. We barely have an industrial basis for the technologies of the sixth mode. Let us take just one area of this mode of development – the use of robotics in production: Russia is far behind both developed and some developing countries in this field. What is more, we are currently below our own technological level of 30 years ago!

By the end of 1980, the Soviet Union had a fleet of industrial robots that exceeded 6000 units, which was on a par with the U.S. and accounted for over 20 per cent of the total amount. By the end of 1985, the number of robots exceeded 40,000, several times greater than the number of robots in the United States and 40 per cent of the global fleet.[1] By 2004, this figure had shrunk to 5000 units.[2] The current state of affairs is depressing (see Fig. 20).

[1] Klimchik, A. S., R. I. Gomolitskii, F. V. Furman and K. I. Semkin. (2008). *Razrabotka upravliaiushchikh programm promyshlennykh robotov* [Development of Control Programmes for Industrial Robots]. Minsk, p. 13. URL: https://www.bsuir.by/m/12_113415_1_70397.pdf

[2] Romakhina, M. (2014). Istoriia sovetskoi robototekhniki [The History of Soviet Robotics]. *“Istoriia gosudarstva”*, 11.02.2014. URL: http://statehistory.ru/4498/Istoriya-sovetskoy-robototekhniki/

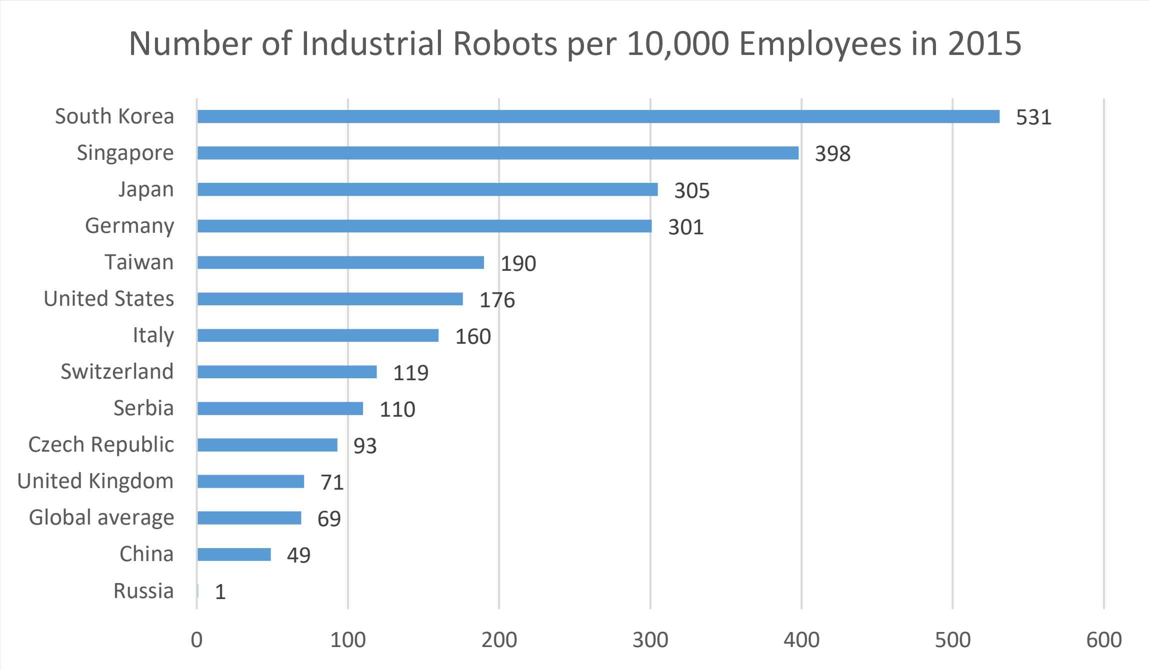

Fig. 20. Number of industrial robots per 10,000 employees in 2015.

Source: Kantyshev, P. (13 November 2016). Roboty ne prizhivaiutsia na rossiiskikh zavodakh. Rossiia potrebliaet 0.25% mirovogo rynka promyshlennykh robotov [Robots not Taking Root in Russian Factories. Russia Consumes 0.25 per cent of Global Market of Industrial Robots]. *Vedomosti* (URL: https://www.vedomosti.ru/technology/articles/2016/11/14/664697-roboti-ne-prizhivayutsya).

Things have, however, begun to change. A steady growth of about 20 per cent per year in the sale of industrial robots was recorded in Russia in 2010–2013. Sales reached a peak of 615 units (an increase of 34 per cent year-on-year) in 2013 before dropping 56 per cent to around 340 units in 2014. The reason for that was the drastic change in the exchange rate, as domestic production of industrial robots was decimated.[1] In 2015, sales went up again to 550 robots, but then decreased again to 316 units in 2016.[2] Meanwhile, China, Japan, the United States, Germany and South Korea robot purchases are in the tens of thousands range. In terms of robotisation, Russia is far behind even Brazil and Mexico.

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[1] Russian Association of Robotics (NAURR). (January 2016). *Analiticheskoe issledovanie: Mirovoi rynok robototekhniki* [Analytical Research: Global Robotics Market]. http://robotforum.ru/assets/files/000_News/NAURR-Analiticheskoe-issledovanie-mirovogo-rinka-robototehniki-%28yanvar-2016%29.pdf

[2] Prodazhi promyshlennykh robotov v Rossii snizilis' na 40% [Industrial Robots Sales Reduced by 40 per cent in Russia]. *Robotics Expo Portal*. 13.04.2017 https://robot-ex.ru/ru/article/prodagi-promishlennih-robotov-v-rossii-snizilis-na-40-66810

In fact, we are just joining the global robotisation race. Yet, without a developed robotics industry, there is no point in even thinking about Industry 4.0 or the widespread application of Industrial Internet of Things. Without mastering these technologies, we will not ensure the formation of the sixth technological mode. If we do not step up to this stage, we will not be able to continue moving towards the NIS.2 and Noonoomy.

In the meantime, developed countries are already developing strategic plans for unmanned industry that would be connected with the world of people only through the “umbilical cord” of information and communications technology. “Japan associates the future of its industrial sector with the formation of a new business cycle that includes obtaining information from the “real world,” its digitalisation and processing by smart systems, the manufacture of products with the use of the Internet of Things and the delivery of those products to the ‘real world,’ i.e. to the customer,” without human involvement.[1]

This is a serious warning for Russia: “global competition is moving into the field of technology – not even of tomorrow, but of the day after tomorrow.”[2]

In order to close the existing technological gap, the Russian economy must overcome its current protracted stagnation with GDP growth rates of 1.5–2.5 per cent per annum. As Member of the Russian Academy of Sciences, Viktor Ivanter, noted, such anaemic growth cannot create the conditions for a technological breakthrough based on digitalisation. Moreover, it is not just a question of achieving agrowth rate of 3 per cent instead of 2 per cent. In contrast to the most developed countries, Russia's task is not to maintain its existing technological superiority, but to overcome the significant gap that separates us from the level of developed countries. Russia does not

[1] Timonina, I. L. (2017). Industriia 4.0 v Iaponii: napravleniia i perspektivy [Industry 4.0 in Japan: Areas and Prospects]. *Osobennosti, problemy i perspektivy ekonomicheskogo razvitiia stran i regionov Vostoka: Azii i Severnoi Afriki. Materialy obshcherossiiskoi konferentsii ekonomistov-vostokovedov* [The Features, Problems and Prospects of the Economic Development of Eastern Countries and Regions: Asia and Northern Africa. Materials of the All-Russian Conference of Orientalist Economists]. Moscow: Institute of Oriental Studies of the RAS, p. 180. URL: https://book.ivran.ru/f/osobennostiproblemyperspektivyekonomicheskogo-razvitiya1.pdf; see also: *FY2014 Summary of the White Paper on Manufacturing Industries* (Monodzukuri). URL: http://www.meti.go.jp/english/press/2015/pdf/0609_01a.pdf (8.02.2017)

[2] Timonina, I. L. (2017). Industriia 4.0 v Iaponii... p. 182.

need to "digitise its backwardness," rather, it needs a qualitative leap in productivity, which requires both a technological revolution and related changes in socioeconomic institutions.

Is this possible, given our technological backwardness compared to the most advanced nations? Indeed, as the well-known 2008 Report of the Russian Academy of Sciences pointed out, the technological basis of the Russian economy is made up of technologies of the third and fourth modes, while technologies of the fifth mode (never mind the sixth mode) are still not widespread.

How can we overcome this situation?

Sergey Glazev, Member of the Russian Academy of Sciences, argued in an unfairly neglected work that it would be possible at a certain point to make a "leap" from one level of economy to another, from one mode to the next, from a lower base to a higher base – but only at the point when modes are changing..[1] What makes such a leap possible? I guess it is because achange of modes entails wider changes, not all easy or good, across the economy, society and their institutions. It is a moment of perturbation, a boiling point, at which certain elements shoot to the top, others become submerged, while water splashes in all directions. This moment, which can last for some time, is when "mixing" can take place. First, the economic state, then the social state and social institutions – the restructuring of society may either accelerate or slow down at this point.

Those who seek to leap to a higher state must act in this moment and we are precisely at such a moment. This is what has been happening between Russia and China over the past 15 years – as soon as we start to slow down, the Chinese start to overtake us. Now it is our turn. And we can get access to the next technological level, despite all the obstacles in our way. The current technological leaders, primarily in the

[1] See: Glazev, S. Y. (2010). *Strategiia operezhaiushchego razvitiia Rossii v usloviiakh global'nogo krizisa* [Russian Strategy of Advanced Development in the Context of the Global Crisis]. Moscow: Ekonomika. See also: Glazev, S. Y. (1993). *Teoriia dolgosrochnogo tekhniko-ekonomicheskogo razvitiia*. Mezhdunarodnyi fond N. D. Kondrat'eva [Theory of Long-Term Technical and Economic Development. N. D. Kondrat'ev International Foundation]. Moscow: VlaDar; Glazev, S. Y., D. S. L'vov and G. G. Fetisov. (2014). *Evoliutsiia tekhniko-ekonomicheskikh sistem: vozmozhnosti i granitsy tsentralizovannogo regulirovaniia* [Evolution of Technical and Economic Systems: Potential and Limitations of Centralised Regulation]. Moscow: Nauka.

West, have long known the importance of being proactive in this area, and not coincidentally, they refuse to give Russia or China – or any country, for that matter – access to the best technologies.

Such proactive approaches can also be seen elsewhere. As a young and rather "inexperienced" CEO of a major military industrial enterprise that sold military aircraft to China and India in the early 2000s, I used to be surprised that our partners were buying aircraft kits and not finished planes. I should not have been: they did not want a finished product; they asked for assembly kits, then for assembly technology, then the technology to produce individual units, etc.

This was so even though that way, the planes would cost more than buying the finished product! A finished Russian aircraft would cost them, say, USD 30 million and a kit, USD 15 million. They start building the aircraft with the kits, by themselves, against great odds. Without requisite skills, they make many mistakes, including destroying some components beyond repair. They lack essential infrastructure, and production facilities. They build everything from scratch. Finally, they end up with an aeroplane that cost USD 50 million. They say: "Okay, it cost USD 50 million, but we're spending that money on our economy, on ourselves." And they are doing more: the extra cost not only gave *Chinese people* jobs, but also *access to technology*. They were investing in industrialisation, in a technological foundation (which was new for them and at the time was the most advanced technology available!).

I used to think that they would never be able to catch up with us, in spite of all their efforts. However, then we slowed down, and they sped up and we see the result. For example, in 1991 China signed a contract with Russia for the delivery of 300 Su-27SKK fighter aircraft (the so-called Chinese version) worth billions of dollars. However, after importing the first 90 units, they switched to assembly kits. This violation of our contract was matched another, that of the intellectual property protections. They dismantled our planes – the kits and instruments – bolt by bolt to start figuring out how to make them on their own. The Russian government was happy to oblige and sell the technologies to reduce our dependence on selling oil and gas alone. From 2006 China started to produce its own planes J-11B that are absolutely identical to the ones we sold them. They are still lagging behind in some areas, but have surpassed us in others. And they are already exporting their aircraft to Pakistan and other countries.

This is a good illustration of how technological leaps are made. They fought and worked for it at the national scale. This is how they obtained all their technologies– from the United States, from Russia, and from wherever else they could. They demanded technology in return for market access. The upshot is that China is now a technologically advanced country, able to export not only Ramen noodles, but high-tech products, too! And it is not just products that we are buying. We are buying technology – not most advanced technology, mind you, because nobody will sell us that. The same thing is happening with India now. Hence, experience has taught is that we now have the opportunity to make a leap forward (see Fig. 21) and actually burst into that new technological level.

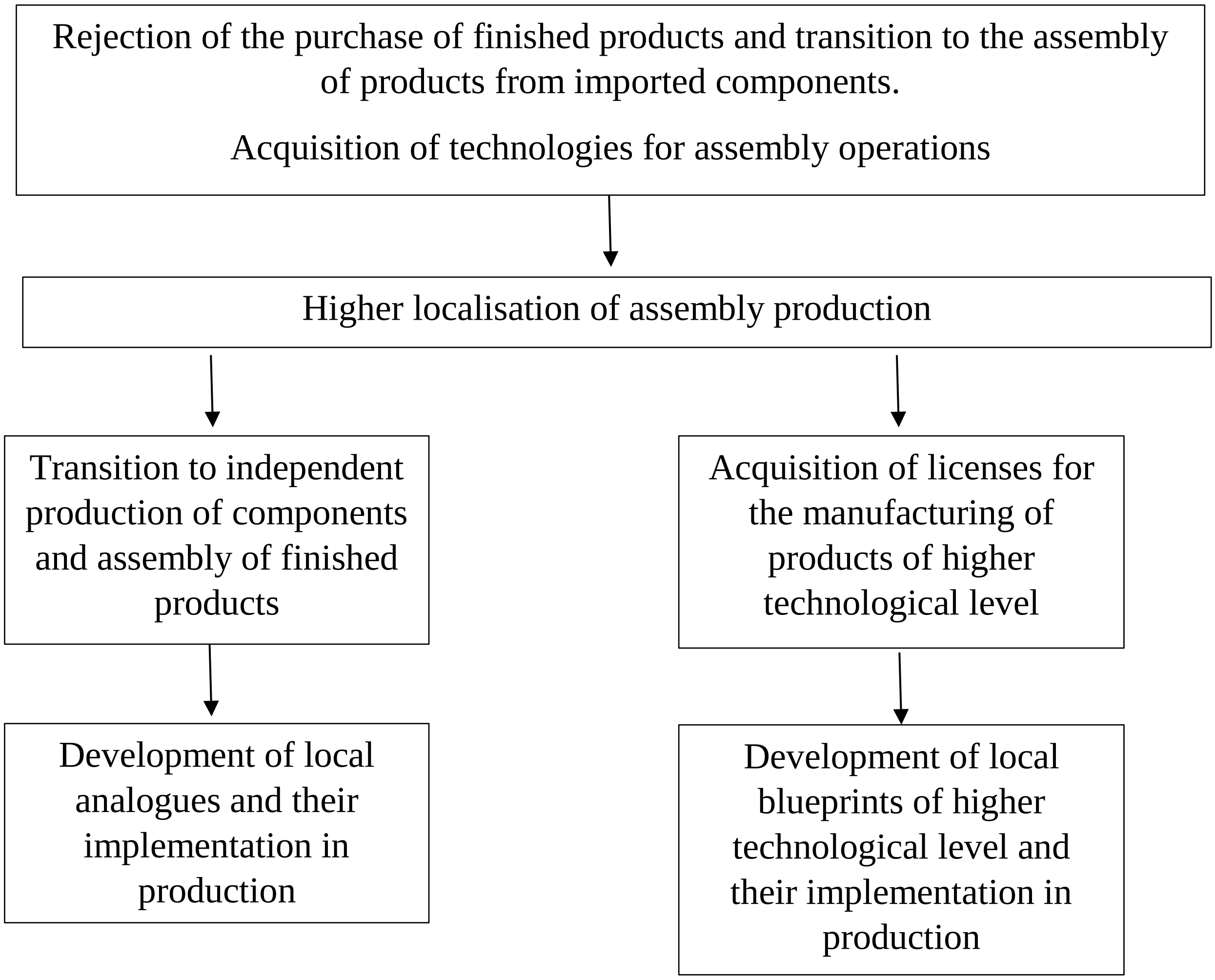

Fig. 21. Mechanisms for borrowing and mastering new technologies

What distinguishes the current moment of transition from others is the penetration potential of basic technology. Any new technology that becomes the leader should have maximum penetration potential (meaning the potential to penetrate into long process chains).

Russia now has the "window of opportunity," as the modern model of the global capitalistic economy is slowing down qualitative, revolutionary shifts in the technological basis.[1] The advancement of technologies of the sixth mode looks

[1] An overview of the debate around slowing innovation and declining productivity growth is provided in: Ulrich A.K.Betz. (2018). Is the force awakening? Technological Forecasting and Social Change. Volume 128, March 2018, Pages 296-303. The question of the causes and mechanism of this phenomenon requires special research.

impressive, but it , is not swift enough. We still have time, but not much. The contemporary economy relies on making profits by inflating financial bubbles, not by investing in new technologies. Its best minds are focused on trying to outwit other players on the financial market, not developing technologies. .

Member of the Russian Academy of Sciences, Abel Aganbegyan, demonstrated that wave-like pattern of oil prices is linked to wave-like advancement of new technologies and that their troughs coincide with the bursting of bubbles that become inflated by new technologies (like the dotcoms in 2000, etc.). Hence the wave-like future development that will be marked by attempts to forcefully slow down scientific progress (NIS-ludditism!), which may result in the growth of "informational and digital inequality" and tensions between groups with different levels of "information and digital competency." "Informational and digital inequality" is a fact of our times (and graduate students have been writing and defending dissertations on this topic for quite some time already!).[1] Indeed, control over intellectual property is increasingly moving to the forefront; all sorts of attempts are being made to restrict free circulation of knowledge, to monopolise it, etc.[2] The solution is to create a global competitive technological environment, which must provide more possibilities for transfer of

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[1] See, for example: Denisova, Zh. A. (2001). Informatsionnoe neravenstvo i ego vozdeistvie na sotsial'nye protsessy v rossiiskom obshchestve. Avtoreferat dissertatsii na soiskanie uchenoi stepeni kandidata sotsiologicheskikh nauk po spetsial'nosti 24.00.04 – Kul'turologiia [Informational Inequality and its Influence on Social Processes in Russian Society. Synopsis of Dissertation for the Degree of Doctor of Philosophy in Sociology with Specialisation 24.00.04 – Cultural Studies]. *DisserCat* (scientific library of theses and synopses). URL: http://www.dissercat.com/content/informatsionnoe-neravenstvo-i-ego-vozdeistvie-na-sotsialnye-protsessy-v-rossiiskom-obshchest#ixzz4yoRDttKU; Shcherbakova, L. N. (2017). *Vliianie informatsionnogo neravenstva na sovremennuiu ekonomiku. Dissertatsiia na soiskanie uchenoi stepeni doktora ekonomicheskikh nauk po spetsial'nosti 08.00.01 – Ekonomicheskaia teoriia. Kemerovskii gosudarstvennyi universitet* [The Impact of Informational Inequality on the Modern Economy. Thesis for the Degree of Doctor of Economics with Specialisation 08.00.01 – Economic Theory. Kemerovo State University]. URL: http://www.ams.tsu.ru/TSU/QualificationDep/co-searchers.nsf/98E545DE6672264D4725811E000EAA39/$file/%D0%A9%D0%B5%D1%80%D0%B1%D0%B0%D0%BA%D0%BE%D0%B2%D0%B0_%D0%9B.%D0%9D._%D0%94%D0%B8%D1%81%D1%81%D0%B5%D1%80%D1%82%D0%B0%D1%86%D0%B8%D1%8F.pdf

[2] Bodrunov, S. D. and V. N. Lopatin. (2014). *Intellektual'naia sobstvennost'. Raspredelenie intellektual'nykh prav mezhdu zakazchikom, ispolnitelem i avtorom na okhraniaemye rezul'taty intellektual'noi deiatel'nosti, sozdavaemye i/ili ispol'zuemye pri vypolnenii nauchno-issledovatel'skikh, opytno-konstruktorskikh, tekhnologicheskikh i proizvodstvennykh rabot* [Intellectual Property. Distribution of Intellectual Rights on Protected Intellectual Products Created and/or Used in R&D and Production between the Customer, Provider and Author]. St. Petersburg: S. Y. Witte Institute for New Industrial Development; Bodrunov, S. D. and V. N. Lopatin. (2014). *Riski intellektual'noi sobstvennosti pri importozameshchenii v ramkakh reindustrializatsii rossiiskoi promyshlennosti* [Intellectual Property Risks under Import Substitution as Part of the Reindustrialisation of Russian Industry]. St. Petersburg: S. Y. Witte Institute for New Industrial Development.

technologies (including free and subsidized transfer) both domestically and internationally. The BRICS countries, Russia first of all, should be actively involved in this. Hence, once again, the need to reindustrialise the Russian economy on a qualitatively new technological basis, the general shape of which has been outlined in Chapter 4. However, at this point, it is important to ask ourselves: what spheres of technology can digitalisation be applied to in order to yield the greatest effect and maximally reinforce our position in the global economy? This question arises inevitably, because it is digitalization that Russia has now chosen as the road to a new technological future.

11.3. Russia: Digitalisation, Reindustrialisation and Resource-Based Economy

Russia's economic reliance on fuel and raw materials is leading the country into a strategic dead-end. At the same time we can use the available fuel and raw material resources to support a technological leap while also following NIS.2 trends towards decrease the "resource-intensity" of industry (associated with the emergence of new technologies of raw materials usage, the discovery of new types of feedstock, etc.).

The proceeds from selling these resources should be invested in the scientific, educational and industrial components of the economy. As demand for Russia's resources, raw materials and energy – hitherto the pillars of the Russian economy – inevitably decreases ue to the growing role of industrial knowledge and technologies and the acceleration of their rates at which they are acquired, mastered and then applied in the real sector, etc, we must accelerate our technological transition. The drop in oil prices since 2014 is being forcefully contained by the Organization of the Petroleum Exporting Countries (OPEC). However, it is a a harbinger of a new era. Natural resources will lose their significance.

It is precisely this change in the ratio of material intensity to knowledge intensity in the final product that gives us hope that future generations will not inherit a country with depleted natural resources and waste landfills that grow and spread like cancer. However, to avoid this fate, Russia must to master advanced technologies.

We face a stark choice: we can either work to become a technological leader within the next 20 years, or we can slide to the "periphery" and end up providing the more developed countries with our products created at the expense of barbaric exploitation of our own natural and human resources.

To become a technological leader*, we need to implement systemic changes in the Russian economy* and switch to managing it based on long-term strategy, medium-term indicative plans and programmes underpinned by scientific forecasts, and a proactive industrial policy. The state should guarantee support and protection through appropriate taxation and credit policies to businesses when they undertake long-term investments in research and development and technological upgrades. While pursuing a broadly egalitarian policy, they state can also permit e a moderate level of social differentiation with higher incomes for such entreprenuers: after all, people's income should primarily depend on their real contribution to the economy.

The economic community and the President have acknowledged the urgent need to redirect our economy and suggest a new model. They recognise that the old model has run its course and cannot be sustained. However, action has been sluggish and directionless.

We need a plan. However, are we ready for this? Will the sharp change in approach this entails have unexpected consequences?

We have been here before: in the 1990s, we shifted course dramatically by eliminating planning. and a hundred years ago, during the Civil War, we had to start over with the New Economic Policy (NEP). As we approach another such upleavel, I often recall Lenin's formula: "Communism is Soviet power plus the electrification of the whole country" in which electrification represented technology and the Soviet system, the social relations and institutions. However, Lenin also saw socialism as accounting and control – planning and delivering on those plans.

Our investments and expenses in technological advance and the operation of the entire state machine, could be streamlined with clear plans. instead of simply promulgating slogans such as "let us all get involved in finance and make Moscow a global financial centre." We all rushed to do that and failed. Then we decided that it would be better to put forward gigantic "national projects" without conceptually estimating long-term economic effects. "We need to digitalise" (this is the latest slogan)! And there we go, reporting after just a few days that we have accomplished that task. I keep hearing from various officials that they have successfully "digitalised" everything: while everyone else was standing around scratching their heads, we – in our constituent entity of the Russian Federation, our holding, factory, farm, whatever – achieved all the goals we had set for ourselves. Just take a look for yourselves: a computer on the desk and a tangle of wires behind it – we do not know what it is, but it is there. Is it not? Well, would did you expect?

If a decision on digitalisation is made – let us say, a decision to develop Russia's digital economy – there should be a well-balanced programme with a thoroughly elaborated detailed strategy and aim, designed penetrate all spheres and prepare industry and the economy to receive it. This is a huge, serious and multidimensional task, and in order to properly implement it, we need a strategic plan, including area-specific plans and ways of measuring its success. In devising such a plan, we have more to draw on than Soviet experience alone. As Viktor Polterovich shows, Singapore managed the modernisation of the national economy in a systematic and comprehensive manner. A unified management system– a single department tasked with ensuring that this goal was achieved – was set up. Like them, we have to confront key questions: where are the appropriate management bodies to deal with it? Where is the requisite planning? Where is a comprehensive targeted programme?

The Russian Academy of Sciences, the Ministry of Economic Development and other such bodies should already have been engaged in this and done so in a new way. There is no place here for rushing to report to superiors that they had already implemented everything, done what was asked of them, produced a couple of documents, obtained a few permits and launched a programme. Nothing is really going to work like this. We need an altogether more serious and truly national approach set on a profound scientific foundation.

Though we have many achievements to our credit, huge problems are preventing us from actively capitalising on our advantages. We are rich – in fact, we are very rich – and we have enormous resources. We have a research infrastructure and scientific technical base that has not been ruined completely. And we have not yet lost the potential of our leading universities. We have people who can teach and people who are willing to learn. We have a nation full of people with amazing potential. So, I say that we are rich because, as Lomonosov argued, “the Russian land can still give birth to its own Platos and quick-witted Newtons.”

However, we also face problems. Against Lomonosov’s hopeful verdict, we have that of Nestor the Chronicler: in his *Primary Chronicle*, he wrote: “Our land is great and rich, but there is no order in it… Come and rule and have dominion over us.” In the past we have invited somebody to govern us from abroad since we could not sort out the mess by ourselves. And if we need to restore order, we need to apply planned methods of managing socio-economic development.

CONNECTION BETWEEN THE PARA ABOVE AND THAT BELOW NEEDED.

Planning is a phenomenon of a higher order than chaos, with decreasedentropy and streamlinedsystem development. It is also superior to the unplanned market in achieving a higher level of sustainability of the socioeconomic system. Civilisation is developing along the path of reinforcing the elements of planning in economic development. And this is natural although, as usual, there are some steps back and side steps and historical pitfalls. Incidentally, this is also natural because society is only beginning to grasp the importance of planning.

The experience of China shows clearly that we need to return to planning. Its retention of planning has enabled it to move towards the new industrial society much quicker than Russia, which abandoned planning and ended up with chaotic managerial decisions, rushing from one concept to another in a climate where the "strongest" are the ones who "win" and vested interests prevail over public interests. I cannot imagine the future society, i.e. an intellectual, noosociety, without an institute of planning as a core tool of public governance.

Planning will be critical to digitalizing the economy: the information component is an essential element of the modern economic infrastructure. Digitalisation (sometimes referred to as digitisation) of production and management is a pressing task of reindustrialisation and a prerequisite for the creation of modern industry and economy in general. Digitised production produces more value than production not "packed" in "digits." As leading economies move towards complete digitalisation of information, non-digitised production will lose out on the market and become a dead weight. Such productive assets (even the most advanced ones) do not contribute to making the economy more competitive; on the contrary, greater resources are required just to sustain them.

This aspect is fundamental and can determine the effectiveness of integration processes of international integration projects. Industrial complexes in those sectors where Eurasian integration project participants have the potential for economic growth need to be digitised rapidly, because digitalization provides the implementation of the newest information and telecommunication technologies.

Production should be digitised at all levels: at the level of enterprises (finished products, business processes [warehouse–production–sale], management systems, etc.), cooperation groups and industries. Digitalisation also makes it possible to set up inter-industrial platforms to boost the effectiveness of cooperation groups, reduce transaction costs and eliminate redundant elements of transaction chains, intermediaries, etc.

It is clear that the economic infrastructure of the unified economic space – including customs, transport and logistics, roads, fiscal system, etc. – also needs to be digitised, thus making it possible to radically improve the efficiency of freight shipping, the supply of goods and the provision of services. What is more, only a digitalised economy can propel its subjects into the most advanced segments of the global market in the coming decades.

If digitization is undertaken as a joint project by countries involved in the Eurasian integration initiative, covering the entire unified economic space – akin to the State Commission for Electrification of Russia (GOELRO) plan in the past – it would enable a modern competitive economy based on the new technological mode (information and digital technologies) and capable of handling the challenges and development trends of the modern world order in all participating countries.

However, as we have already pointed out, digitalisation alone – that is, digitalisation without a firm basis in the technologies of the sixth mode, for which they serve as a means of integration – will not have a significant effect. It is impossible to make a technological leap without giving these technologies a modern industrial foundation and without implementing the policy of the reindustrialisation of Russia.

A formidable scale of investment ne will be necessary for the technological renovation of Russia's production. Official Bank of Russia data indicate that capital drain in period 2008–2017 amounted to around USD 683 billion.[1] However, it was not uniform across the period. When oil prices were high, the most sophisticated businesspeople, against all odds, invested in equipment. The growth of investments in fixed assets amounted to 22.7 per cent in 2007 in compare to 2006![2] Fixed assets of approximately the same value (29 per cent) were commissioned four years later (in 2011).[3] This demonstrates an almost direct correlation taking into accountthe lag equal to the period for application of capital investments.

[1] Calculated according to: *Chistyi vvoz/vyvoz kapitala chastnym sektorom v 1994–2017 godakh* [Net Inflow/Outflow of Private Capital in 1994–2017]. 17.01.2018. URL: https://www.cbr.ru/statistics/credit_statistics/bop/outflow.xlsx

[2] Federal State Statistics Service. *O sostoianii osnovnykh fondov v Rossiiskoi Federatsii* [State of Fixed Funds in the Russian Federation]. Table 5. URL: http://www.gks.ru/bgd/regl/b09_04/IssWWW.exe/Stg/d01/2-fond.htm

[3] Federal State Statistics Service. *Vvod v deistvie osnovnykh fondov v Rossiiskoi Federatsii* [Fixed Assets Commissioning in the Russian Federation]. Updated on 29.01.2018. URL: http://www.gks.ru/free_doc/new_site/business/osnfond/VV_vs.xls

In the crisis year of 2009, capital investments decreased by 16.2 per cent.[1] As a result, fixed assets grew by just 1 per cent in 2013![2] If we had been able to ensure an increase in investments in the real sector of 10 per cent in 2013, the current GDP would have been around one third higher (for data on investments and new fixed assets put into use, see Table 2). It should also be pointed out that investments in new equipment, technology and products result in qualitative growth, thus driving us closer to the NIS.2, not just increasing the GDP.

Table 2. Dynamic of investments and new fixed assets put into use in the Russian Federation in 2007-2018

Years	Commissioning of fixed assets in the Russian Federation, per cent year-on-year (in comparable prices)	Dynamics of investments into capital assets in the Russian Federation, per cent year-on-year (in comparable prices)
2007	122.1	123.8
2008	114.0	109.5
2009	96.6	86.5
2010	93.4	106.3
2011	129.0	110.8
2012	108.7	106.8
2013	101.0	100.8
2014	97.0	98.5
2015	94.5	89.9
2016	116.8	99.8
2017	100.1	104.8
2018	105.4*	104.3

* preliminary data

Sources: Commissioning of fixed assets in the Russian Federation. Updated on June 06, 2019. URL: http://www.gks.ru/free_doc/new_site/business/osnfond/VV_vs.xls

Dynamics of investments into capital assets in the Russian Federation. Updated on March 07, 2019 http://www.gks.ru/free_doc/new_site/business/invest/Din-inv.xls

[1] *Investitsii v osnovnoi kapital v Rossiiskoi Federatsii v 2009 godu* [Capital Investments in the Russian Federation in 2009]. 30.01.2018. URL: http://www.gks.ru/bgd/regl/B10_04/IssWWW.exe/Stg/d04/3-inv.htm

[2] *Vvod v deistvie osnovnykh fondov v Rossiiskoi Federatsii* [Fixed Assets Commissioning in the Russian Federation]. Updated on 29.01.2018.

We need to ensure the qualitative improvement of the technological base instead of merely increasing production volume. It is also necessary to raise the level of satisfaction of real demands instead of sticking to the "more, more, and more" paradigm and flooding the market with simulacra and surrogates. This approach directly follows from the growing share of knowledge in all production components.

In order to refurbish existing production facilities with new technologies, it is necessary to increase the production of new and modern equipment. This does not just involve increasing its production but also ensuring that the new equipment incorporates the latest knowledge. The same applies to consumption. We need to shift our focus from the consumption of increasing amounts of products to specific targets that define the satisfaction of rational wants. People will not just consume more meat, sugar, eggs, etc. in excess of rational limits. Beyond a point, demand shifts towards higher qualities, not quantities, which require improving production as well as storage, processing, and transport. Consumption will change in other ways too. It is pointless to flood our cities with millions of cars that end up in traffic jams and newer, more sophisticated, public or collective transport solutions will be needed. The quality, rather than the mere quantity of housing will also have to improve.

Based on the current level of our knowledge and the opportunities we have to implement this knowledge in new technologies, we should focus on using our knowledge to create a method of production which ensures that demand is satisfied, and not just quantatively or in terms of GDP alone. They cannot even adequately reflect the increase in the quality of production and life.

The Ministry of Economic Development has declared that "in order for the Russian economy to attain growth rates above the 2016 global average, we have to add about 5 trillion roubles of additional investments every year."[1]

[1] Oreshkin: rost VVP Rossii na urovne 3% vozmozhen pri ezhegodnykh investitsiiakh v 5 trln rublei [Oreshkin: Russia's GDP Can Grow 3% if it Injects 5 Trillion Roubles into the Economy Annually]. *TASS*. April 24, 2017. URL: https://news.rambler.ru/economics/36704950-oreshkin-nazval-uslovie-dlya-rosta-vvp-rossii-na-urovne-3/?updated; Maksim Oreshkin: My dolzhny dvigat' ekonomiku vpered [Maxim Oreshkin: We should move our economy forward]. 01.06.17. *Official Website of the Ministry of Economic Development of the Russian Federation*. URL: http://economy.gov.ru/minec/about/structure/depmacro/20170100601

Where did the Ministry get this figure of 5 trillion roubles? Instead of such quantitative goals, we need to understand what technologies are needed in order to achieve growth rate above global average and what we want to digitalise. Only then can we calculate what we need in order to achieve that: necessary funding, timeframe, objectives, programmes, milestones, benchmark points, etc.

Moreover, the new technologies of NIS.2 will not be static: they will constitute a system that continuously generates new technologies.This self-development will not be inertial either. It will include mechanisms of self-support and qualitative change. To this end, we need to change institutions, beginning with governance, on which a lot depends . The 1990s saw the formation of certain mechanisms that aimed to "smooth and push" the process in areas where the system did not work (by bribing the civil servants). These mechanisms were later refocused on evading the law because the law started to hamper development. Then officials who were neither monitored nor made accountable, along with businesses which handed out bribes to stay in business, quite naturally began to artificially create obstacles in order to make profit, inculcating such things as "rent margin" and "cuts" into the system. And the number of people involved in this process is growing.

Let us have another look at the history of our country. The USSR did not have the technological capacity to carry out national economic accounting, and did not develop one adequately even though socialism relied on accounting as the basis of planning (together with control as a feedback mechanism embedded in the system). As the economy grew and became more complex, accounting lagged while over-centralisation made this problem worse. Inevitably, development was replaced by misrepresentations. Disparity led to "gaps," and a shadow market ripe with corruption emerged to close those gaps and undermined the foundation of planned economy. In the Soviet economy, there was an inevitable increase in the needs of the population. Along with this, the technological capabilities to meet them grew, but it was not possible to effectively take into account and compare the needs and opportunities. This led to an increase in imbalances and shortages, especially in the sector that worked for the consumer market. The new level of development required changes in the institutions of planned economic management, but the Soviet leadership tried to solve problems only by increasing the number of administrative staff.

Technocrats and mathematicians were trying to solve the same problem. Member of the Russian Academy of Sciences, Viktor Glushkov, was developing the National Automatised System of Economic Administration in the USSR. It was based on a highly evolved concept that was ahead of his time – the idea of a decentralised (distributed) database system. Glushkov wanted to create a system of computation centres for exchanging information, wherein the information would not be concentrated at the top, but would be verified in the course of exchange between the participants.

This idea actually underpins blockchain technology. Serious studies were conducted in this area in the USSR, and university students could attend courses on distributed databases. However, we did not have the technological capability to create a modern system of data transmission, and the storage capacities that we take for granted now – and which would have enabled us to implement such an idea technologically – simply were not available back then.

Of course, the technological solutions set out in the National Automatised System of Economic Administration also implied considerable changes in the ideology of planning and in the institutions responsible for the organisation and management of production. After all, the main problem was not to create new technical capabilities for plan calculations, but to change the system of relations between the participants of the planning system. It was necessary to give this system more flexibility, expand the ability to make decentralized decisions, and replace administrative pressure from above with the economic interest of enterprises in high performance.

So, when we talk about the NIS.2, and advancement towards noonomy, we refer to technological changes as well as the change in the society and its institutions.

Professor Georgii Tsagolov recently recommended reverting to planning.[1] This is not a backward step. The development of technology has simply made it necessary. and others are elaborating the scientific basis for applying planning to the Russian economy.[2]

Planning is often considered backward because of its association with the Soviet Union's failure. However, the Soviet Union collapsed not because there was no plan, but because that plan was *bad*, unbalanced and poorly developed. It lacked the knowledge that should have been obtained in the process of social development and incorporated into the plan. We did not have the necessary computational capacities. On top of that, many institutional elements were not developed – elements that could have been taken, for instance, from mathematics and other areas.

The knowledge and technological solutions that we already have today makes planning more effective and relevant. It can also take many forms: selective planning, indicative planning, all types of planning that would allow us to merge market economy with planned economy – something that is being actively discussed in Russia, China and Scandinavia.

So, what can we do to make it happen?

We can move forward on a technological foundation through the application of modern information technologies and distributed databases including their contemporary form of blockchain technology which is reliant on significantly greater computing power that permits the optimisation of solutions based on Big Data, etc. The combination of modern information communication systems with the capabilities of cognitive technologies, artificial intelligence, self-learning systems, man-machine systems, etc. makes it possible to "digitalise" both plan-based and market-based approaches and optimise economic decisions while integrating the two approaches.

[1] Tsagolov, G. (2016). Zdravstvui, Plan! [Hello, Plan!]. *Literaturnaia gazeta*. 38 (6568). URL: http://www.lgz.ru/article/-38-6568-29-09-2016/zdravstvuy-plan; See also: Tsagolov, G. (2017). Gosplan po Gelbreitu [State Plan, the Galbraith Way]. *Literaturnaia gazeta*. 26 (6604). URL: http://www.lgz.ru/article/-26-6604-5-07-2017/gosplan-po-gelbreytu/

[2] See, for example: Buzgalin, A. V., ed. (2016). *Planirovanie: perezagruzka* [Planning: Reloading]. Moscow: Kul'turnaia revoliutsiia.

Naturally, the new technological foundation of economic calculations will necessitate the improvement in the institutional structure of the economy, allowing it to focus effectively on reindustrialisation and creating the material base for a technological breakthrough.

However, Russia (whose economy continues to rely on the export of primary materials) is lagging far behind the more developed nations in terms of technological progress. In some sectors, we have managed to retain or restore an advanced level of technological development, but in most segments we have rolled back. If we fail to create economic formats which can ensure the transition to a new level of material production development (i.e. new industrial society of the second generation, or the NIS.2) in the near future, we will have to deal with escalating social tensions in Russia. On the one hand, we face the aforementioned de-synchronisation in the development of objective demands related to the advancement of new technologies, and, on the other hand, we need to build social relations and institutions which can support these demands.

We urgently need to find a solution.

The first task involves the adoption of a new economic model that would assume industrial development as a priority and apply this assumption to all decisions pertaining to the economy, institutions, etc.

The second task is the consolidation of our society. It implies the consolidation of the national elites around the implementation of the industrial development model and the concept of joint responsibility for resolving urgent national issues.

Russia is really close to *missing* the train to the NIS.2. In order to abandon the position of an eternal catcher-upper, we need to promote the most promising areas. Of course, to make sure that these plans do not turn into mere daydreaming, we have to make an extraordinary effort and reach the level of the NIS.2 – if we want to take a proactive stance. We need to start building the noonomy now, even if in a very narrow segment. But we definitely have to try and access the format which is inevitably going to become the future of economic activity and human development.

CHAPTER 12. Russian Economic System: Future of High-Tech Industrial Production[1]

Justification of the need for reindustrialization on the latest technological basis requires research of the Russian economic system. It is necessary to answer questions about the extent to which the Russian economic system and the structure of the Russian economy correspond to the solution of this task; and what needs to be changed to ensure technological modernization.

12.1. Russian Economy as a Transitional System

Economic systems do deteriorate and are replaced. The transition is fraught with numerous problems. R.S. Grinberg and A.Y. Rubinshtein rightfully note that transitions are characterised by "incompleteness, lack of wholeness, and the co-existence of new and old economic elements. This is why the transition between two mature states is at once the emergence of a new economic system, and gradual disintegration of the old system."[2]

Rapid disintegration of the old, planned economic system, and the slow emergence of the economic relations and institutions of the new market system led to the country losing "half its potential. What is even worse, the processes of primitivisation of production, de-intellectualisation of labour and degradation of the social sphere, so far were not discontinued. To this, we should also add the appearance of large numbers of poor people. Over the years of radical reforms, their number grew drastically".[3] The decline in qualities of production, technologies and labour, started with radical market reforms and dismantle of

[1] Based on a report at the Council for Theory of Economics, Lomonosov Moscow State University, prepared by a group of authors at S.Y. Witte Institute for New Industrial Development under the leadership of Professor S.D. Bodrunov, Ph.D. (Econ.).

[2] Grinberg R.S. and Rubinshtein A.Y. (2000). *Ekonomicheskaia sotsiodinamika*. [Economic sociodynamic]. M., 85.

[3] Grinberg R.S. (2005). *Rossiia: Ekonomicheskii uspekh bez razvitiia i demokratii? Ekonomicheskoe vozrozhdenie Rossii*, [Russia: Economic success without development and democracy? *Economic revival of Russia*] **2**, 11.

planning system, had no counteraction from the side of newly formed market system, which turned out to be not enough effective. The illusion that it is enough to allow the formation of a market system, and automatic market self-regulators will work by themselves, in fact, hindered the formation of effective market institutions. First, the modern market system is based not only on automatic self-regulators. Secondly, the creation of market institutions from scratch requires careful selection of intermediate stages, and their spontaneous, uncontrolled formation leads to the trap of inefficiency.

The economic relations that emerged from this transition did not correspond to material, economic, and socio-cultural prerequisites . The economy reacted by shrinking demand and, therefore, decreasing production. Economic actors adopted a shorter horizon for economic decision-making and eliminated long-term investment and high-risk projects. The number of people who could no longer earn enough to support themselves grew concurrently. There was growing inequality of income and deepening stratification according to property status, creating what we may call an ineffectiveness trap.

At the same time, social spending on education, health care, and research was reduced. All this destroyed the main source of economic development – the scientific, technical and human potential of Russia. The weakening of this potential is perceived by society as one of the biggest losses for Russia in all the years of reforms from an economic and social point of view. As R. S. Greenberg noted, "the decline in the quality of education, the outflow of the country's intellectual capital, and the decline of the nation's spiritual life are a constant topic of modern public debates."[1]

Why is Russia's economy today incapable of solving the problem of inefficient economic and social institutions? Representatives of the classical and the new

[1] Grinberg R. S. (2010). Systemny analiz rossiiskoy transformatsii [System analysis of the Russian transformation]. Sociological research. 2010. No. 9. P. 142.

institutionalism, studying the laws of the evolution, import and implantation of institutions, have come to believe that the institutional problems Russia is experiencing have deeper historical roots than most imagine. According to A.A. Auzan, "Russia is as if suspended in space, where traditional society cannot be restored and no one seems to want to restore it, while we cannot create a modernised society that depends on institutions. This aborted modernisation trend has been in place for some three centuries, since the time of Peter the Great."[1] In other writings he traces the roots of Russia's "incorrect" trajectory of institutional evolution even further into the past: "the point where the initial mistake of the original institutional choice was made' lay " in the 14th and 15th centuries, when the institutions of autocracy and serfdom were first established."[2]

Such assessments raise questions about freedom and constraint in institutional choice at critical points in Russian history and of the degree to which decisions made centuries ago can still be deemed to determine the trajectory of institutional development in the present.

Russian scholars studying the specificity of Russian society have investigated the influence society's *civilisational* (ethnocultural, social, ideological and other) peculiarities on technological, economic or institutional variables of development. The most daring conclusions were arrived at scholars of ***economic philosophy.*** In their view, economic reality must be understood without first understanding the most important meanings behind human existence. Human beings seeks something more than the satisfaction of physical needs. They seek "meanings not in the personal, but in collective, public, civilisational existence",[3]

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[1] Auzan A.A. (2011). *My priblizhaemsia k momentu istiny nashei tsivilizatsii. [We are approaching the moment of truth of our civilization]. Svobodnyi mir.* URL: http://www.liberty.ru/Themes/Aleksandr-Auzan-My-priblizhaemsya-k-momentu-istiny-nashej-civilizacii

[2] Auzan A.A. (2014). *Ekonomika vsego: kak instituty opredeliaiut nashu zhizn'[The Economics of everything: how institutions define our lives]*. M. URL: http://read.bizlib.org/aleksandr-auzan-ekonomika-vsego.html

[3] Osipov Y.M. (2012). *Stoletie "Filosofii khoziaistva" S.N. Bulgakova – sto let filosofii khoziaistva. Filosofiia khoziaistva: Al'manakh Tsentra obshchestvennykh nauk i ekonomicheskogo fakul'teta MGU imeni M.V. Lomonosova*, [Century of S. N. Bulgakov's "Philosophy of economy" – one hundred years of philosophy of economy. *Philosophy of economy. Almanac of The center for social Sciences of the faculty of Economics of Lomonosov Moscow state University*] 3 (81), 21.

says the leader of this school of thought, Y.M. Osipov. This methodological approach is close to that of scholars who look for special, nationally specific and stable determinants of the Russian economic system that determine its difference from other national economic models. “Russia has a large range of stable factors (which are unique to a large extent), which have considerable influence on the country’s economic system. Their stable, constant, long-term nature allows us to define them as objective foundations behind all specific features of the Russian economy.”[1]

Such national peculiarities do not, of course, preclude the influence of international trends on Russia’s economic system. All but the most isolate societies are syntheses nationally specific features and international trends and for these scholars “...the Russian economic system must be a modern mixed-type economy of regulated, socially-oriented, labour-oriented, spiritually-oriented, post-industrially-oriented character. In this case, it will smoothly combine unique Russian features and progressive trends in international development.”[2]

As abstract as these concepts are, they do lead to concrete conclusions. These in many ways agree with the conclusions of the supporters of a more active role for the state and a more careful approach to reviving material production through ***reindustrialisation*** and ***neoindustrialisation*** and ensuring social justice inway ***that puts hope in education, science and culture as the main drivers of Russia’s economic development.*** These directions are opposed by the concept on Russia’s evolution towards ***post-industrial society*** in accordance with the neoliberal approach.

A unique approach to the concept of new industrialisation has been shown in the series of Institute of New Industrial Development (INID) reports, developed in cooperation between the INID and the Institute of Economics of the RAS (this report was presented to the Expert Council under the Chairman of the Federation

[1] Kul’kov V.M. (2000). *Dominanty ekonomicheskogo stroia Rossii. Aktual’naia Rossiia*. [Dominants of the Russian economic system. Current Russia] M.: Volgograd, 31.
[2] Ibid. 35.

Council of the Federal Assembly of the Russian Federation[1] in March 2013), in a number of monographs and reports by the author at Abalkin Readings of the All-Russian Economic Society, at the plenary session of the Moscow Economic Forum (2014), and in a number of articles.[2] The Moscow Forum also considered other programmes for improving the Russian economic system that could help bring the country out of stagnation.[3] These suggestions are based on the existing gap between the human, resource and economic potential of Russia and the results achieved. “We know that Russia has great potential for dynamic and extended development: we have the resources, the people who want to work, large agricultural lands; we also have all the conditions to expand into foreign markets. The only thing we are missing is a grounded economic policy to allow the country to resume its journey on the path to progress.”[4]

The realistic view of this evolution shows that “post-industrialism” is not a pervasive characteristic of the international economy, and it is far too early to try it in Russia. This has been recognised even by supporters of this approach. For example, the renowned Russian researcher specialising in issues of post-industrial society, V.L. Inozemtsev, noted: “The world today is still an industrial world. In 2009, raw materials accounted for 16.1% of world trade, services for 18.9%, and industrial commodities for 65%. Among the 20 largest American export companies, 15 are industrial giants, and only 5 represent the technological sector. Technology alone means nothing if it is not applied in industry and does not conquer international markets embodied in some kind of product.

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[1] Federation Council – the upper chamber of the Federal Assembly (Parliament) of Russian Federation.

[2] See, for example: Bodrunov S.D. (2013). K voprosu o reindustrializatsii rossiiskoi ekonomiki. *Ekonomicheskoe vozrozhdenie Rossii*, [On the issue of reindustrialization of the Russian economy. *Economic Revoval of Russia*] 4 (38); *Bodrunov S.D. (2013).* Institutsional’nye mekhanizmy kontseptsii novogo industrial’nogo razvitiia Rossii v usloviiakh VTO. *Ekonomicheskoe vozrozhdenie Rossii*, [Institutional mechanisms of the new industrial development of Russia in the context of the WTO. *Economic Revoval of Russia]* 4 (38); *Bodrunov S.D. (2014).* Reindustrializatsiia rossiiskoi ekonomiki: vozmozhnosti i ogranicheniia. *Nauch. trudy Vol’nogo ekonomicheskogo obshchestva Rossii,* [Reindustrialization of the Russian economy: opportunities and limitations. *Proceedings of The free economic society of Russia*] 1. V 180. M.; *Bodrunov S.D. and Lopatin V.N. (2014). Strategiia i politika reindustrializatsii dlia innovatsionnogo razvitiia Rossii*. [The strategy and policy of re-industrialization for innovative development of Russia] SPb: INID; and elsewhere.

[3] See, for example: Babkin K.A. (2008). *Razumnaia promyshlennaia politika, ili Kak nam vyĭti iz krizisa.* [Reasonable economic policy. How do we get out of the crisis?] M.

[4] Babkin K.A. Speech at the Moscow Economic Forum 2014. URL: http://www.umpro.ru/index.php? page_id=17&art_id_1= 489 &group_id_4= 54&m_id_4=27

Technologies today change the structure of export of this or that country not by themselves but as a means of effective large-scale production of industrial value."[1] So, Russia finds itself not in an illusionary post-industrial world of the future, or even in the industrial world of the present. Russia is now lagging behind in many spheres of large-scale industrial production.

> The country must become known to the average consumer who sees the "brand" of Russia here and there every day, if not every hour of his or her life in many countries in the form of labels on industrial products. The more often the country is mentioned on these most important information carriers, the more significant the country appears in the eyes of the whole world, and the more highly the world rates that country's significance for the world economy, the abilities and talents of its people. Distributing more widely the "Made in Russia" label is what should become the national concept in the process of Russia's modernisation. This will be the single most significant indicator of the country's modernisation success.[2]

This statement reflects international practical experience, historically and today. It was industrial production and the use of machinery that led the countries of Western Europe (followed by the U.S., Japan, and other countries) to occupy top positions in the international economy, which until then had been held by China and India. Industrial monopolies allowed the United Kingdom and then the West as a whole to start dominating the international economy and world politics, allowing these countries to reap direct benefits from their position.

Despite all the changes in the structure of the GDP, the leading countries of the world, the core of the world economic system (to this day, these are still those countries that were the first on the route of industrialisation), maintain their leadership due to their technological advantage in industry, not in services. This

[1] *Inozemtsev V.L.* (12 July 2010). Modernizatsya.ru: Made in Russia [Modernization.ru: Made in Russia]. *Vedomosti*.
[2] Ibid.

was why the more successful developing countries (such as South Korea, Taiwan, PRC, Brazil, Malaysia, Vietnam etc.) selected industrial development as the strategy for their economic revitalisation. Industrialisation allowed these countries to increase their economic potential quickly, and created the preconditions for the development of high-tech production. Now these countries are facing a fairly difficult task – to challenge the scientific and technological monopoly of developed countries. However, without industrialisation, it would be a complete utopia to even conceive of an independent national scientific and technological nucleus for the economy. It is industrial production that creates the material base, the foundation for industrial innovations and forms the real demand for research and development products.

When it comes to prioritising the development of science, education and culture, these aspirations, too, are positive, but in my opinion, it is still too early to start doing this in Russia. The authors of this programme rightfully note that the main productive power behind the economy was the human being, and in modern conditions this is more important than ever before. It is also true that the modern economy, which is based on high-tech production, needs employees who are well educated, and the education must be accessible to everyone and continuous. Formation of certain human qualities is a necessary part of the public production process; scientific progress (including progress in fundamental research) is required for any technological renewal; Russia must considerably expand the spheres of public-private partnership support where these qualities are shaped. This is what A. Kolganov and A. Buzgalin write about.[1] Analogous suggestions have repeatedly been made by Member of the RAS B.S. Kashin, and Corresponding Member of the RAS O.N. Smolin.[2]

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[1] *Kolganov A.I. and A.V. Buzgalin. (2014). Reindustrializatsiia kak nostalgiia? Teoreticheskii diskurs.[Reindustrialization as nostalgia? Theoretical discourse] Sotsis*, 1; *Kolganov A.I. and A.V. Buzgalin. (2014). Reindustrializatsiia kak nostalgiia?* Polemicheskie zametki o tselevykh aktsentakh al'ternativnoi sotsial'no-ekonomicheskoi strategii.[Reindustrialization as nostalgia? Polemical notes on the target accents of an alternative socio-economic strategy] *Sotsis*, 3.

[2] "Firstly, we must create the goal-setting road map for Russian science to give it practical and measurable tasks to achieve. On the other hand, we must raise the status of the Russian scholar. In this, we must get rid of fictitious indicators of quality of his or

This position quite correctly defines the perspective. But at the moment, a critical priority for Russia is to provide reindustrialization, which cannot be achieved if only science, education and culture are put in the foreground, taken by themselves. Of course, support for these sectors should be significantly increased, but above all in terms of their contribution to solving the problem of reindustrialization on the latest technological basis. Their absolute priority is for the more distant future.

12.2. Russian Economic System: Current State and Development Prospects

The critical synthesis of the variety of views on the problem considered above allows us to define a number of general constructive provisions.

The list of general provisions includes:

- acceptance of the need for proactive development of modern material production on the basis of at least the 4th and 5th technological modes. This production must be provided with all the necessary research and design products and highly qualified employees;
- carrying out new industrialisation with utmost attention to Russia's civilisational specifics;
- Implementation of economic policy on the basis of thorough analysis of the real structure and contradictions within the current economic system.

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her research, developed by some obscure Western experts", B.S. Kashin says, and continues: "I am of the impression that Russian authorities do not wish to hear the opinion of professional economists. Perhaps they only want the specific cohort of the "expert community" to stamp their approval on the solution that had already been adopted. In this scenario, science and managerial decision-making are viewed separately. Moreover, they often find themselves at odds with each other. I would call this an anti-scientific approach to decision-making in socio-political and economic spheres." *(Kashin B.S.* (2011). Filosofiia innovatsionnogo parazitizma. *Svobodnaia pressa*. 13.12.2011. [Philosophy of innovative development. *Free press*] URL: http://commpart.livejournal.com/15221.htmL). O.N. Smolin emphatically says: "Until we restore the education system, Russia will remain a third-world country. We must either change our economic course of action, or the national security of our country, its wholeness and our future will be threatened. *(Smolin O.N.* Speech at the Moscow Economic Forum 2014. URL: http://me-forum.ru/media/events/plenary_discuss_I/).

Finally, future recommendations must be made taking into account the considerable influence of politics and ideology on implementing economic strategies in the transformational economy.

The specifics of the economic system of post-Soviet Russia deserve very careful examination. The structure of Russia's economic system will have thee key subsystems reflecting the historical stages of formation of the Russian economy, the levels of its development, and the stages of development of technologies and economies according to corresponding internationally accepted criteria.

Each subsystem will have its own technological mode, socio-economic relations and economic legal institutions and civilisational and socio-cultural invariants and trends.

The first, ***traditionally conservative,*** subsystem will include:

(1) traditionally important but often conservative sectors (agricultural production and other "old" sectors of material production dating back to the 19th – early 20th centuries); technological modes based on manual or weakly industrialised labour; machine production of a low degree of product processing, which includes the raw materials sector;

(2) market relations with the legacy of the natural economy, patriarchal relations and state bureaucracy protectionism and paternalism;

(3) "traditional Russian civilisational invariants" that gravitate toward the conservative ideology.

The second is the ***liberal market subsystem,*** with the following characteristic features:

(1) mostly assembly operations as part of the transnational corporation networks, services, trade, finance, or other intermediary services;

(2) fairly classical, albeit considerably modified by the Russian specifics, capitalist market economic relations and institutions;

(3) mostly liberal, West-leaning ideology.

The third subsystem – *the mixed-type structure of Russian economy currently in the making* – ***presupposes priority development of high-tech production on the basis of socially-oriented regulated economic development.*** This system without reproducing the main vices of the past (deficit, directive planning bureaucracy, and excessive egalitarianism), and use the experience of the Soviet economic system and its achievements (including achievements in the military industrial sector), as well as experience of such countries as China, Vietnam, and others.

This subsystem, still in the making, must include:

- high-tech production characteristic of the 5th and 6th technological modes, and clusters bringing together production, science and education;
- programming and selective regulation of the market economy, public-private partnerships and other mixed economy patterns that combine the advantages of the market and state regulation;
- the ideology of proactive development based on critical integration of Western civilisational achievements and traditional Russian values.

Of course, this division into sectors is not rigid. Each of these sectors is affected by technological and social modernization, which gradually changes the characteristics outlined here. Modern technologies, new institutions, the evolution of the social status of the employed – all this will shape the new socio-economic image of Russia. But today, the sectors we have identified reflect the real structure of the Russian economy, as illustrated by statistical data. The share of manufacturing industries in gross national product decreased (Table 3) even during the economically favourable 2000s, while the food security of the country, based on internal agricultural production, also faltered. At the same time, the share of extraction of natural resources, financial activities and real estate operations grew. The only positive structural shift was perhaps a certain reduction of the share of trade. At the same time, the recovery of the education and healthcare sector that determine the development of human potential is still very slow since the abrupt collapse in the 1990s. The share of education is at the same low level, and the share of health care increased by just a fraction of one percent.

Table 3. Russia's GDP structure, % (2002 – 2016)

Indicator	2002	2016	Differential between 2016 and 2002 (%)
GDP	**100**	**100**	**-**
Agriculture and forestry	5.7	4.0	- 1.7
Fishing and fish farming	0.29	0.18	- 0.11
Mining	11.4	9.7	- 1.7
Processing	19.0	13.0	- 6.0
Production and distribution of electricity, gas and water	3.9	3.1	- 0.8
Construction	4.9	7.0	+ 2.1
Wholesale and retail; repairs	15.9	15.3	- 0.6
Hotels and restaurants	0.96	0.85	- 0.11
Transportation and communications	9.5	7.3	- 2.2
Financing	1.9	5.1	+ 2.2
Real estate, leasing and services	10.3	19.0	+ 8.7
Public administration and military security; social security	7.3	7.5	+ 0.2
Education	4.0	2.4	- 1.6
Healthcare and social services	4.9	3.4	- 1.5
Other public, social and personal services	2.0	1.6	- 0.4
Net product taxes	16.0	14.5	- 1.5

Sources:
GDP by Sector (2011-2016). Updated on 01.03.2019 URL: http://www.gks.ru/free_doc/new_site/vvp/vvp-god/tab11-1.xls
GDP by Sector (2002-2011). Last updated on 31.12.2015. URL: http://www.gks.ru/free_doc/new_site/vvp/vvp-god/tab11.xls

The same tendencies are observed in distribution of fixed capital investments (Table 4), further entrenching the current ineffective structure of the Russian economy.

Table 4. Structure of investment into capital assets (by sector, shadow economy not included) in % to 1998-2018 total

Indicator	1998	2003	2008	2013	2018
Total investment into capital assets for large and medium enterprises	100.0	100.0	100.0	100.0	100.0
Agriculture, hunting and forestry	3.2	4.1	4.6	3.8	4.3
Mining	12.1	15.9	13.4	14.9	18.2
Processing	14.9	15.6	14.9	14.4	14.7
Production and distribution of electricity, gas and water	8.0	5.8	6.3	8.2	6.0
Construction	6.9	4.9	4.6	3.3	3.6
Wholesale and retail; repair of motor vehicles, household goods and personal items	2.4	3.5	3.7	3.9	4.1
Hotels and restaurants	1.0	0.4	0.5	0.7	0.6
Transportation and communications	14.8	22.3	23.0	24.5	20.4
Financing	3.4	1.2	1.1	1.4	2.0
Real estate, leasing and services	16.5	14.3	15.3	13.4	14.8
Public administration and military security; social security	4.1	1.6	1.6	1.7	1.7
Education	1.8	1.5	1.9	1.7	1.4
Healthcare and social services	2.4	2.0	2.4	1.7	1.4
Other public, social and personal services	5.0	2.6	2.8	2.8	-

Sources:
Investment in Capital Assets in the Russian Federation by Sector (2014-2018). URL: http://www.gks.ru/free_doc/new_site/business/invest/Inv-OKVED2018.xls
Investment in Capital Assets in the Russian Federation by Sector (1995-2016). URL: http://www.gks.ru/free_doc/new_site/business/invest/Inv-OKVED1995-2016.xls

The dynamics of industrial production in the reform period (Table 5) and over the past several years (Table 6) reflect the general decline of industrial production and primitivisation of its structure. The only positive trend is the growing share of production of electrical equipment and electronic optical equipment. This state of affairs in the production and intellectual bases of economic development of the country has influenced the country's position in the sphere of innovations. The Russian economy lacks innovative activity in practically every sector, including the high-tech sector (Fig. 22), and the share of enterprises involved in innovative activities has stably remained at unacceptably low levels (Fig. 23).

Table 5. Dynamics of industrial production (1991-2010)

Indicator	2010 vs. 1991, %
General economic performance indicators	
Industrial production index	83.8
Production indices by sector for sections C, D and E of the Russian National Classifier of Economic Activity Types: mining processing production and distribution of electricity, gas and water	 108.8 78.6 89.1
Mining	
Coal, mln tons	91.2
Oil, including gas condensate, mln tons	109.5
Natural and associated gas, bn m^3	101.2
Processing	
Metallurgical production and production of finished metal products	
Finished non-ferrous rolled products, mln tons	104.7
Steel pipes, mln tons	87.6
Certain types of machinery and equipment	
Refrigerators and freezers, thousands	95.9
Metal-cutting machinery, thousands	4.1
Transportation and equipment	
Cars, thousands	117.5
Crane trucks, thousands	22.5
Freight train cars, thousands	225.4
Production and distribution of electrical energy	
Production, bn of kW/h	97.2
Consumption, bn of kW/h	96.6

Table 6. Structure of shipped goods and rendered services by sector, % of total volume of industrial production (2010-2018)

Sector	2010	2014	2018
Total volume of industrial production	**100**	**100**	**100**
Mining[1)]	**21,6**	**22,0**	**24,5**
Mining of fuel and energy resources	19,0	19,4	21,9
Mining of other natural resources	2,6	2,6	2,6
Processing industry	**65,6**	**67,3**	**64,6**
Food (including drinks) and tobacco	11,3	10,0	9,8
Textiles and clothing	0,7	0,6	0,6
Leather, leather products and footwear	0,15	0,1	0,1
Wood processing and wood products	0,9	0,9	0,9
Cellulose and paper, printing and publishing	2,2	1,9	1,8
Charred coal and oil products	12,2	15,5	15,9
Chemical industry	2,1	4,8	4,7
Rubber and plastic goods	1,8	1,6	1,6
Other non-metal mineral products	2,9	2,8	2,2
Metallurgy	11,9	10,4	8,8
Machinery and equipment (exclusive of arms and ammunition)	3,5	3,1	1,8
Electric, electronic and optical equipment	3,9	3,9	3,4
Transportation and equipment	5.8	7.2	6.6
Other production categories	3.3	3.5	-
Production and distribution of electrical energy, gas and water	12.7	10.7	9.8

[1)] To ensure comparability, mining services are excluded from 2018 data, so 2018 column total does not constitute 100%.

Sources:

Russian Federal State Statistics Service. (2016). *Promyshlennoe proizvodstvo v Rossii. 2016* [Industrial Production in Russia. 2016]. M.

Russian Federal State Statistics Service. (2019). *Russia in Figures 2019*. M.

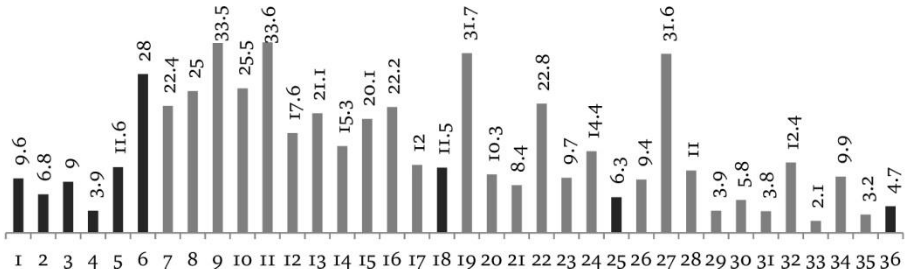


FIG. 22 Share of business entities undertaking technological innovations in the total number of industrial enterprises in various types of economic activities (2011): 1 - total; 2 - prospecting of natural resources (3 - fuel and energy national resources; 4 - other resources); 5 - processing enterprises; 6 - high-tech enterprises; (7 - manufacturing of pharmaceutical products; 8 - office equipment and computers; 9 - radio, television and communications equipment; 10 - medical technology products, measuring equipment, optical devices and equipment, watches; 11 - aircraft and spacecraft); 12 - medium-tech high-end products (13 - chemical production; 14 - manufacturing of machinery and equipment; 15 - electrical machinery and equipment; 16 - automobiles, trailers and semi-trailers; 17 - other means of transportation); 18 - medium-tech low-end products (19 – charred coal and oil products; 20 - rubber and plastic products; 21 - other non-metal mineral products; 22 - metallurgical products; 23 - ready metal products; 24 - ship-building and repair); 25 - low-tech products; (26 - food manufacturing, including drinks; 27 - tobacco products; 28 - textiles; 29 - apparel, fur finishing and fur dyeing; 30 - leather, leather products and footwear; 31 - wood processing and making of corkwood products, except furniture; 32 - production of cellulose, wood pulp, paper, cardboard and products made thereof; 33 - printing and publishing activities, duplication of recorded data devices; 34 - production of furniture and other products not included in other groups; 35 - processing of secondary raw materials); 36 - production and distribution of electrical energy, gas and water (www.hse.ru/data/2013/10/28/1282559304/Skolkovo% 20Booklet.pdf. Website of the Higher School of Economics)

Some positive trends have been observed over the past several years, but they testify only to the first relatively timid steps towards new industrialisation as many economists have observed. Director of the Institute of Economics of the Russian Academy of Science, Academic Supervisor of INID, and Corresponding Member of the RAS R.S. Grinberg, has repeatedly called for a shift to a new economic policy focused on the development of the real production sector on the basis of the mixed socially-oriented market economy approach, actively regulated by the state.[1] The same position is shared by S.Y. Glazev, adviser to the President of the Russian Federation, who says that "today, we see the collapse of the liberal theory, the liberal utopia, an absolutely erroneous view on how the world is set up, and what must be done."[2] He supports the decisive role of the state in primary sectors of the new technological mode at any stage of development.

1 See: Grinberg R.S. (2014). *Mify o svobodnom rynke dolzhny uiti v proshloe. "Ekonomika dlia cheloveka": sotsial'no-orientirovannoe razvitie na osnove progressa real'nogo sektora: materialy Moskovskogo ekonomicheskogo foruma.* [Free market myths should be a thing of the past. "Economy for people": socially-oriented development based on the progress of the real sector. Proceedings of the Moscow economic forum] Ed. by Grinberg R.S., Babkin K.A and Buzgalin A.V. M.: Kul'turnaia revolutsiia, 15-17.

2 Glazev S.Y. (2012). *Perekhod na novyi – gumanitarnyi tekhnologicheskii uklad. In: XIX Kondratevskie chteniia «Modernizatciia Rossiiskoi ekonomiki: uroki proshlogo, shansy i riski», tezisy uchastnikov Chtenii. Mezhdunarodnyi fond N. D.*

The foregoing does not mean, however, that the future of Russia's economic system must necessarily be connected with the development of just the third of the above subsystems. Extensive reforms are necessary in all sectors of the Russian economy.

Let us list the ***key development tasks*** for the aforementioned three subsystems:

1. ***Traditionalist Conservative Subsystem.*** Production costs in the agrarian and the fuel and materials sector must be reduced, and innovative activities sharply increased in order to provide the necessary foundation for two other subsystems. This sector plays an important role in ensuring the country's economic security (providing food independence; high importance of income from fuel and raw materials exports in the long term). A difficult problem is the integration of such elements of Patriarchal and conservative traditions into development institutions, which can play the role of a stabilizing, but not a hindering factor.***Liberal Market Subsystem.*** The following measures must be undertaken in the leading subsectors of the market: revival of mass production; overall growth of small and mid-sized businesses; better accessibility of financing, credit, insurance and other services for business; fine-tuning of competitive institutions and those for protection of ownership rights; better deployment of personal initiative.

2. ***The new mixed-type structure of the Russian economy currently in the making*** presupposes priority development of high-tech production on the basis of socially-oriented regulated economic development. This is still nascent in Russia but without it, the , implementation of the positive functions of the first two subsystems and effective reindustrialisation would be impossible. The development of the third subsystem will require introducing considerable

Kondrateva. Pod red. Bondarenko V.M, Moskva: MFK [Transition to a new - humanitarian economic structure. XIX Kondratiev readings "Modernization of the Russian economy: lessons from the past, chances and risks", theses of the Participants of the readings. N. D. Kondratiev international Foundation. Ed. Bondarenko V. M,] M., 23.

changes into the system of economic relations, institutions, economic policy and cultural and ideological stereotypes.

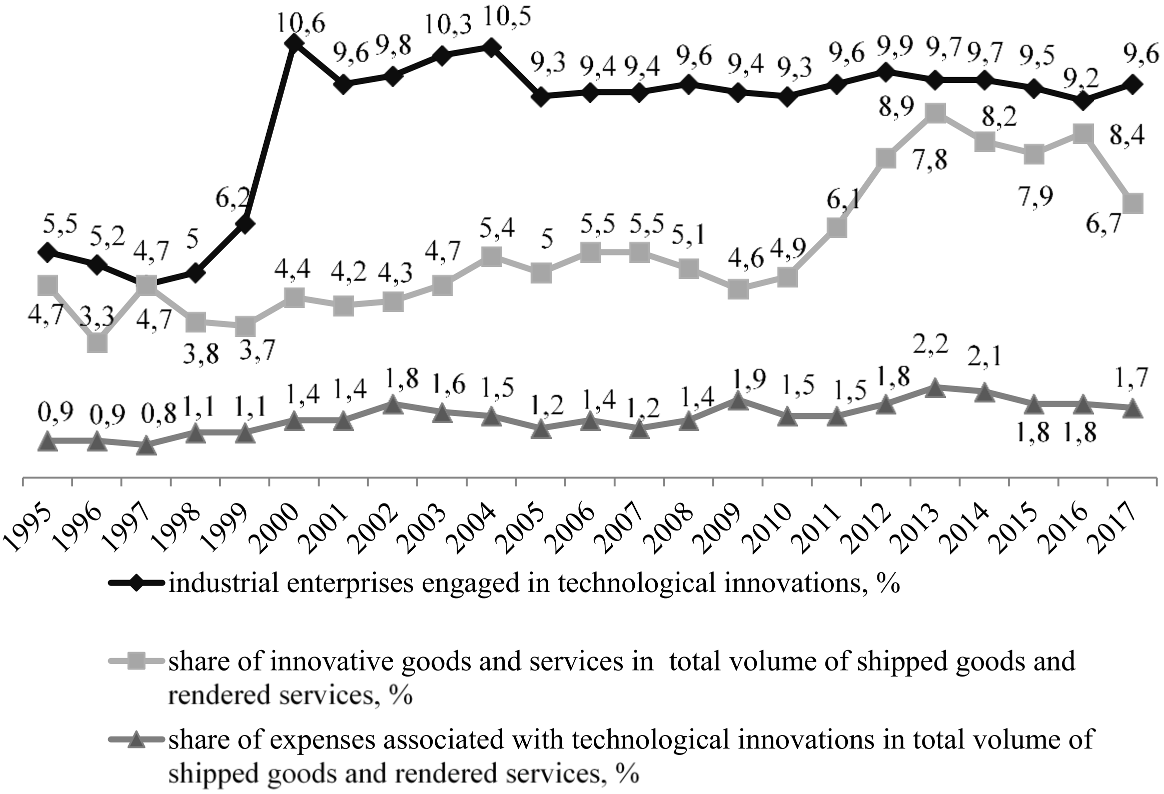


FIG. 23 Level of innovative activities of industrial enterprises in Russia

Sources: Website of the Higher School of Economics. URL: http://www.hse.ru/data/2013/10/28/1282559304/Skolkovo%20Booklet.pdf; https://www.hse.ru/data/2019/05/06/1501882833/ii_2019.pdf)

Studying the unique features of Russia's economy allows us to assess the future prospects for development of the high-tech sector of material production and set the goals and means of reforming Russia's economic system model.

While many criticise Russia's reliance on the primary sector, it is, in fact, an unconditionally positive phenomenon. Raw materials and other natural resources produced in Russia are inputs into machine-building, aircraft engineering, atomic energy, space technology and other related sectors, as well as providing the economic foundations of the country's defence capabilities and corresponding high-tech production facilities. We believe that this tradition must be maintained, and that Russia has all the development potential necessary for that purpose. The renaissance of this sector has already begun and the growing state investment in developing the military industry complex is one indication of it. This trend corresponds to Russia's civilisational codes, which prioritise the interests of the whole – ***the country*** – over private interests, with active use of entrepreneurial initiatives that correspond to the tasks of the country's revival.

Importantly, the development of high-tech material production (as the aforementioned sectors) requires reviving integration between production, research and education, which was destroyed over the years of economic reforms and doing so in new ways that combine the potentials of the state, the market, and private property. The resulting initiatives must be geared toward not just the tasks of production development, but also resolving fundamental problems of developing technologies and human qualities, resolving social and ecological problems.

The latter presupposes the existence of a developed system of state financing of fundamental science and university education, along with state and private sector mid-term and long-term orders for these spheres.

Changes of a systemic character must take place for implementing all objectively possible directions of economic development in Russia. These changes include developing and implementing long-term programmes, mid-term indicative plans and an active industrial policy. To stimulate the market initiative, the state must support cutting-edge Russian enterprises and undertake measures to eliminate parasitic brokering and limit the expansion of transnational corporations into the Russian economy. An important role can be played by public-private partnerships based on a stable system of institutions that guarantee private business opportunities for long-term investment in R&D

activities and technological revamping of production. The tax and credit systems for the real sector of the economy (especially the high-tech sector) must stimulate the development of these sectors and their innovative potential.

Finally, the entire system must provide for a moderate level of social differentiation, where the difference in income will depend mostly on citizens' relative contribution to the country's economic development.

Chapter 13. Technological Leadership and National Security[1]

National security is closely linked to the implementation of reindustrialization policies. Without the restoration of an independent national scientific, technological and industrial core of the economy, it is impossible to eliminate Russia's economic dependence. Our economy depends, first of all, on the import of technologies and modern machinery and equipment. Secondly, we depend on oil and gas exports, and therefore the global oil and gas market situation strongly affects both the income of the Russian budget and the fluctuations in the national currency. Without providing technological leadership in at least some areas of industrial production, it is impossible not only to take a favorable position on the world market, but also to ensure the economic security of the country.

Russia's present economic situation is sufficiently dire to raise the question of her survival in the current international economic and geopolitical situation as a state, a national economy and a viable a subject of international law, let alone develop our economic system effectively. As I have argued elsewhere,

> Economic security involves a certain state of economy and society's productive forces, wherein it is possible independently to provide for the stable socio-economic development of the country, support the necessary level of national security of the state and competitiveness of our national economy. The priorities in the sphere of Russia's economic security include reviving the country's economy, maintaining an independent economic course of action, overcoming scientific, technical and technological dependence of the state on external sources, …the need to adopt certain measures to retain and develop the scientific, technical, technological and production potential of Russia, dealing with deformations in the structure of

[1]This text is based on the report presented at the All-Russian Conference "Innovative Development of Industry as the Foundation of Technological Leadership and National Security of Russia" (Moscow, 20 May 2015) and presentations at the Abalkin Readings under the Economic Growth of Russia roundtable discussion on the Economic Security of Russia (Moscow, 10 February 2016).

the Russian economy to guarantee active growth of science-intensive and high added-value products and structural reconstruction in combination with increased state regulation in the economy. It is critically important to support leading schools of science, expeditiously carry out scientific and technical advance work and create the national technology base and mechanisms of attracting private capital into the process.<...> Throughout its history, Russia has always been self-sufficient in its development. It is only on this condition that our country can become one of the world leaders in socio-economic progress in the foreseeable future. And the present moment is a tipping point. At present, Russia has every opportunity to get rid of the heavy socio-economic consequences of crisis years and create an impetus for sustainable development. One of the most important tasks on this path is urgent industrial modernisation..."[1]

It may sound very contemporary but the above observations are from a list of recommendations for Russia's new Strategy for National Security at the meeting of Russia's Security Council in December 2005. The discussion was moderated by Leonid I. Abalkin, Academician of Russian Academy of Science, who was actively involved in the discussion. Clearly, current problems were obvious even back then, and were being discussed at the highest level!

However, despite many reports by many experts, multiple recommendations and even Russia's new National Security Strategy approved by the president, Kudrinomics[2]prevailed. Even during the gold shower of oil dollars in the years preceding the crisis of 2009, practically nothing was done for industrial development nor in subsequent years when the stagnation became obvious to many of us. . For instance, the INID cooperated with the Institute of Economics of

[1] Bodrunov S.D. (2005). Modernizatsiia oboronno-promyshlennogo kompleksa i obespechenie ekonomicheskoĭ bezopasnosti gosudarstva. in. *God planety: Politika. Ekonomika. Biznes. Banki. Obrazovanie. Ezhegodnik.* Vyp. 2005 g. RAN, IMEMO. M.: ZAO "Izdatel'stvo "Ekonomika", [Modernization of the military-industrial complex and ensuring state security . In: Year of the planet. Annual — 2005] pp. 107-112.

[2] Neoliberal economic policy of strong financial restrictions, named by the name of former Russian Minister of Finance, Anatoly Kudrin.

the RAS in March 2013 on a report of a working group headed by D.E. Sorokin, which was presented by R.S. Grinberg and myself in the Federation Council. The report talked about changing the economic model and returning to the industrial development path as a necessary condition for national security.

President Putin himself spoke on several occasions about the current model of economic development as having exhausted itself, and insisted that a transfer to a new model was necessary for which country needed to get ready for another technological revolution, get engaged in technological development.

However, the same old path was followed until 2014, when we "suddenly" discovered that we now had to catch up in a very short time and now in much less favourable and less comfortable conditions. Now, real measures are being adopted in this direction.

However, the inertia of our economic dynamics can be so considerable that we will not be able to avoid the unfortunate rut of the liberal monetary economic model. Right now, we are seeing the risk of repeating the traditional Russian approach: instead of solving problems, we begin to patch up holes in the old model. Certainly that is how the actions now being taken by our authorities today appear. The years 2014-2018 has demonstrated the long-lasting disease of Russian industry: the state had no adequate plans to develop the industry base, for instance, in mechanical engineering. The strategies for industrial development adopted in 2011–2012 were not supported by financial and economic authorities. By 2013–2014, those plans were already behind the leading trends of development of the world economy, and quickly fell apart.

For instance, the localisation programme for the automobile industry got cut pretty quickly after the departure of General Motors and many other companies, producing car parts, which was even more significant. The problem lay not so much in sanctions as in many other factors, such as consumer demand. It is well-known that there were 35% fewer new cars sold in 2015 as compared to 2014. Foreign cars and those assembled from predominantly foreign parts are becoming too expensive for our consumers. Meanwhile, building our own car part-making plants was not provided for by the localisation programme. In these conditions, import substitution becomes pure wishful thinking. We find a similar situation in propulsion engineering, the aircraft building industry and the machine tool technology sector.

Inconsistency and lack of coordination, among other things, exacerbate this problem. All issues are being addressed only when they become critical. In 2014, leaders of the automobile industry had requested a programme of easy-term loans for new automobiles, but the government (and especially the authorities of Ministry of Finance, the Bank of Russia, and Ministry of Economy) granted the request only in April 2015, when automobile sales dropped by 42.5%. An example of lack of coordination is the delay in delivering parts from Turkey, when they were stuck at the customs border and caused almost a half-year delay in production.

This attitude to the development of the domestic automobile industry is only one example of the attitude to the development of the manufacturing industry as a whole. It is not surprising that the Russian economy continues to be dominated by export-oriented raw materials and fuel industries. At the same time, the manufacturing industry, including sectors that should provide a high technological level of the economy, does not receive development. This is one of the most important reasons for the stagnation of the Russian economy, which began in 2014 and continues until 2020.

At present, when the economy of developed countries is switching to the sixth technological mode, it is essential for Russian national security to set a goal of catching up with technologically advanced countries at least in the most critically important sectors. Currently, most of Russia's economy is in the fourth technological mode, with elements of the fifth.

As it seeks to advance beyond them, it will encounter a ***technological border.*** The technological border refers to the achievement of a level of productivity based on existing technologies, after which it is no longer possible to increase it by borrowing technologies from leading countries, and it is necessary to resort to independent development of new technologies.. According to the Higher School of Economics, at the current rate of technological development, we will reach the technological border of advanced countries by approximately 2050.

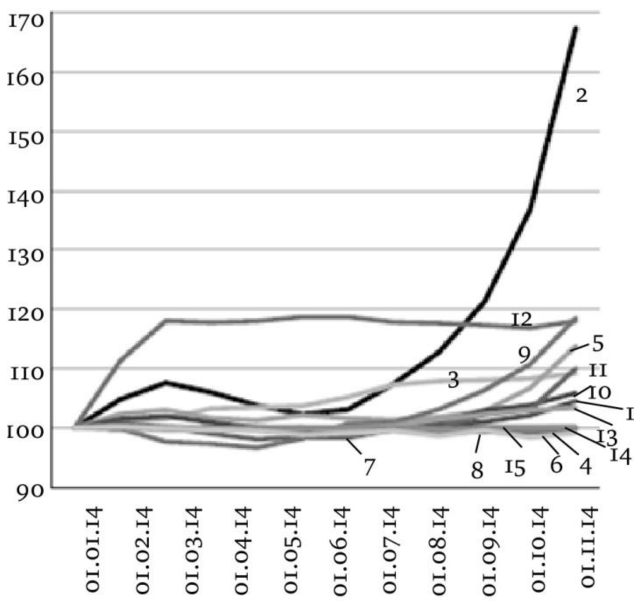
This is why today, the economic community and political authorities are in the process of searching for ***a new model of economic growth,*** and, broadly speaking, ***a new economic doctrine.***

Without giving any detailed figures, let me note that ***product output*** in the main sectors of Russian industry has gone down exponentially. A separate problem is outflow of capital . In 2014, according to the Bank of Russia, the figures amounted to $152.1 bn, which is almost 2.5 times more year on year ($61 bn). In the next years this figure reduced, but remain significant: in 2015 – $57.1 bn, in 2018 – $65.5 bn, in January-August of 2020 – $34.8 bn.[1] This has placed additional pressure on the national currency (Fig. 24) and the risk dynamics, closing internal sources of long money for Russian companies. The outflow of capital and the dependence of the currency supply in the domestic market on oil and gas exports determine the instability of the ruble exchange rate under the influence of external economic factors. As a result, there are significant fluctuations in the prices of imported goods. While the Russian economy is heavily dependent on imports, this has a negative impact on the functioning of the economy.

[1] Bank of Russia. External sector statistics. Balance of payments. Financial transactions of the private sector. URL: https://www.cbr.ru/vfs/statistics/credit_statistics/bop/outflow.xlsx; Vestnik Banka Rossii [Bulletin Of The Bank Of Russia]. (2020). No. 71 (2207) of September 9.

The Centre for Macroeconomic Analysis and Forecasting of the RAS Institute of Economics (Fig. 25) says: "...the main risks are due to the problems that followed the crisis of 2008–2009 and the new challenges. The old model of economic growth based on export of fuels and growing oil prices has exhausted itself. The positive dynamics on the fuels market in 2011–2013 did not lead to faster economic growth. Yet the negative dynamics of oil prices in 2014 did influence the budget balance and created conditions for considerable devaluation of the Russian ruble, bringing it down significantly more than currencies of other countries which are exporters of natural resources. The current model of economic management must undergo considerable structural and institutional changes."[1]

[1] Institute of Economics, Russian Academy of Sciences. (2015). *Situatsiia v rossiskoi ekonomike v 2014 g. i prognoz ee razvitiia v 2015-2016 gg.* [Situation in the Russian economy in 2014 and the forecast for its development in 2015-2016]. M.



1 - Saudi Arabia
2 - Russia
3 - Iran
4 - Iraq
5 - Nigeria
6 - UAE
7 - Angola
8 - Venezuela
9 - Norway
10 - Canada
11 - Mexico
12 - Kazakhstan
13 - Kuwait
14 – Qatar
15 - Libya

FIG. 24. Dynamics of currency exchange rates to U.S. dollars, oil exporters, 2014

Sources: oanda.com

Therefore, the problems in the Russian economy had appeared long before the sanctions were introduced. When they were introduced, the situation was made more acute, and the concerns of the expert community expressed much earlier became more obvious. Back in the mid-2000s, I had already insisted *on abandoning the current economic model with a transition to modernising our economy* ***by reviving the industrial development path.***[1]

[1] Bodrunov S.D. (2005). Modernizatsiia oboronno-promyshlennogo kompleksa i obespechenie ekonomicheskoi bezopasnosti gosudarstva. *In: God planety: Politika. Ekonomika. Biznes. Banki. Obrazovanie*. [Modernization of the military-industrial complex and ensuring state security . In: Year of the planet. Annual — 2005] RAN, IMEMO. M.: Ekonomika.

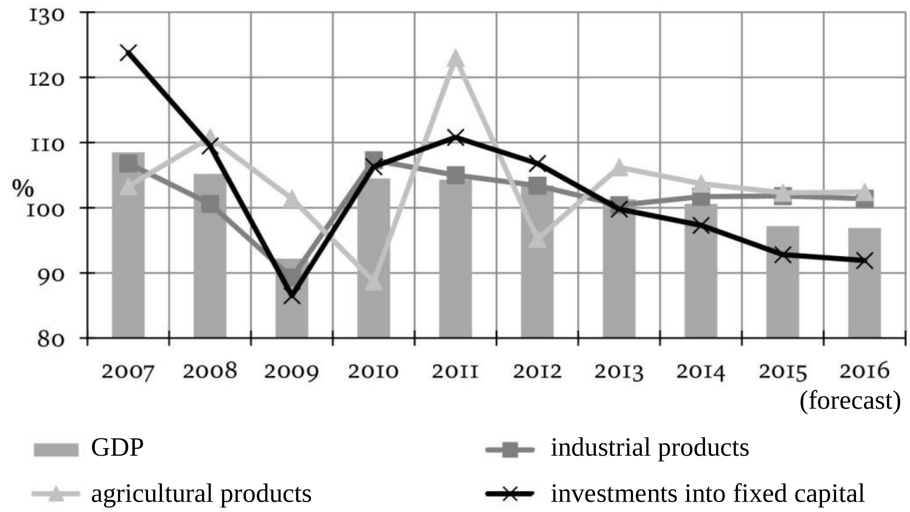


FIG. 25 Dynamics of major macroeconomic indicators, % year on year

The main trend of the new course is reindustrialisation based on proactive development of high technologies.[1] ***I would like to stress here that it does not mean revival of Soviet industry (although in a number of cases, these minimal steps are necessary), but qualitative renewal of the technological*** foundation of material production on the basis of the new understanding of the character of the world economy as suggested by INID. I refer here to the accelerating character of changes in the economic system, including the aforementioned components of the production process: its organisational foundation; technologies, materials, and

[1] See, for example: *Bodrunov S.D., Grinberg R.S. and Sorokin D.E. (2013). Reindustrializatsiia rossiiskoi ekonomiki: imperativy, potentsial, riski. Ekonomicheskoe vozrozhdenie Rossii, [Reindustrialization of the Russian economy: potential risk. Economic revival of Russia]* ***1 (35)****, pp. 19-49; Bodrunov S.D. (2012). K voprosu o reindustrializatsii rossiĭskoĭ ekonomiki v usloviiakh VTO. Ekonomicheskoe vozrozhdenie Rossii, [On the issue of reindustrialization of the Russian economy in the WTO. Economic revival of Russia,] No.* ***3 (33)****, pp. 47-52*; *Bodrunov S.D. (2014). Reindustrializatsiia. Kruglyi stol v Vol'nom ekonomicheskom obshchestve Rossii. Mir novoi ekonomiki, [Reindustrialization. Round table in The free economic society of Russia. World of new economy] 1, pp. 11-26; Tatarkin A.I. (2014).* Protrezvlenie posle rynochnoi eiforii zatianulos', no vse-taki proiskhodit. "*Gorod 812",* [Sobering up after the market euphoria has been delayed, but it is still happening. *"City 812"]*No. 32, pp. 21-23; Bodrunov S.D. and Grinberg R.S. (2013). Chto delat'? Imperativy, vozmozhnosti i problemy reindustrializatsii, *Sbornik materialov Nauchno-ekspertnogo Soveta pri Predsedatele Soveta Federatsii RF "Reindustrializatsiia: vozmozhnosti i ogranicheniia*". [What to do? Imperatives, opportunities, and challenges of reindustrialization. In: Collection of materials of the Scientific expert Council under the Chairman of the Federation Council of the Russian Federation "Reindustrialization: opportunities and limitations"] M.: Izdatel'stvo Soveta Federatsii RF; Bodrunov S.D. (2014). Reindustrializatsiia rossiĭskoi ekonomiki – vozmozhnosti i ogranichenia. *Nauchnye trudy Vol'nogo ekonomicheskogo obshchestva Rossii*, [Reindustrialization of the Russian economy: opportunities and limitations. *Scientific works of The free economic society of Russia*.] No. 1, pp. 15-46.

equipment; labour content in production; and finally, the result of the production process – the product.

Let me say here again that the task of creating a qualitatively new industrial base does not contradict the theses of famous scholars regarding the transfer to a new material production base, e.g. through broad-scale application of the fifth and sixth technological modes,[1] informatisation, miniaturisation, individualisation and a network-type arrangement of production,[2] broad use of the creative potential of employees,[3] etc. However, it is contrary to the ideas of those who adhere to the vulgar version of post-industrialism, promoting ***priority*** development of the non-production service centre, intermediary services and financial transactions. This misguided thinking is due to the experience of applying research methodologies that view the economic system as either a static photograph or a dynamic model, but almost always without taking into account the "dynamics of dynamics", acceleration, the second derivative that continuously, yet with variable acceleration rates, changes the essence of events, processes, system parts, the character of their interrelations, etc.

The main goal of re-industrialisation as an economic policy shall be the restoration of the role and place of industry as the base component in the country's economy during its structural realignment, and priority development of material production and the real sector of the economy on the basis of a new, cutting-edge technological paradigm within the framework of Russia's modernisation.

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[1] Glazev, S.Y. (2014). *O vneshnikh i vnutrennikh ugrozakh ekonomicheskoi bezopasnosti Rossii v usloviiakh amerikanskoi agressii*. M.

[2] Castells, M. (*1996). The Rise of the Network Society, The Information Age: Economy, Society and Culture Vol. I. Cambridge, Massachusetts; Oxford, UK: Blackwell.* ISBN 978-0-631-22140-1.

[3] Buzgalin, A.V. and A.I. Kolganov. (2014). Reindustrializatsiia kak nostalgiia? Polemicheskie zametki o tselevykh aktsentakh al'ternativnoi sotsial'no-ekonomicheskoĭ strategii. .[Reindustrialization as nostalgia? Polemical notes on the target accents of an alternative socio-economic strategy] *Sotsis*., 3; Krasilshchikov V.A. (1993). Modernizatsiia i Rossiia na poroge XXI veka. *Voprosy filosofii*, [Modernization and Russia on the threshold of the XXI century. *Issues on philosophy*] 7, 54-55; Sakaya T. (1991). The Knowledge-Value Revolution or a History of the Future. New York: Kodansha .

One of the ***consequences*** of deindustrialisation is lower effectiveness of Russia's involvement in the global division of labour. As a result, in most main sectors of the economy, our country's presence is visible only at the early stages of the value chain, which leads to ***technological dependence*** on developed countries. We "specialise" in extraction, production and delivery onto international markets of minimally processed products: natural gas, oil, ferrous and non-ferrous metals, potassium fertilisers, etc. Russia exports high-tech products mostly in the armaments and military equipment sector (with minor deliveries also in the nuclear industry, space technologies and titanium products).

So if we want to achieve sustainable development and retain our position as a global power, if we want to *guarantee our national security*, a difficult, uncompromising struggle lies ahead. In the world of the future, only those economies will be *competitive* that take up leading positions in developing and applying *high technologies* and provide good-quality *human capital, able to put these processes into practice.*

In 2012, President Putin in his pre-election articles set a task of achieving Russia's ***technological leadership*** as an important condition necessary for Russia to find a way out of the current situation. Speaking at the St. Petersburg International Economic Forum in 2014, President Putin said: Russia needs a real ***technological revolution***, considerable technological renewal, we need to carry out the largest technological re-equipment of our enterprises in the past fifty years.[1]

First and foremost, we need to solve the problem of deterioration of production capacities and fixed assets (Fig. 26). According to the data provided by the Russian Committee for Statistics, as of the end of 2013, the wear rate of the latter was between 40 and 60% in various industries, and the share of used up

[1] Website of the President of Russia. V.V. Putin's speech at the plenary session of the St. Petersburg International Economic Forum. Verbatim records of the plenary meeting of the 18th St. Petersburg International Economic Forum. URL: http://kremlin.ru/events/president/ news/21080

fixed assets (Fig. 27) in commercial organisations in Russia stood at 14.6% (13.3% in processing industries – this indicator has been stable since 2007).

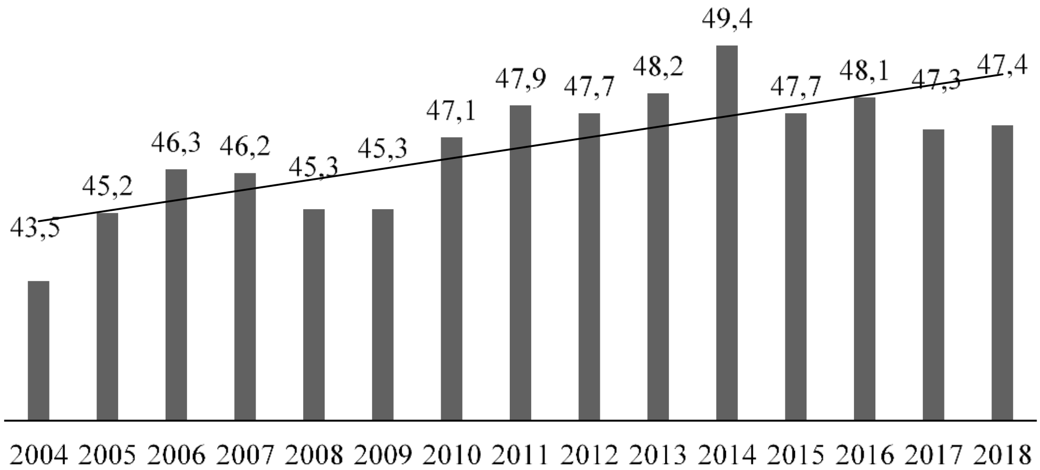


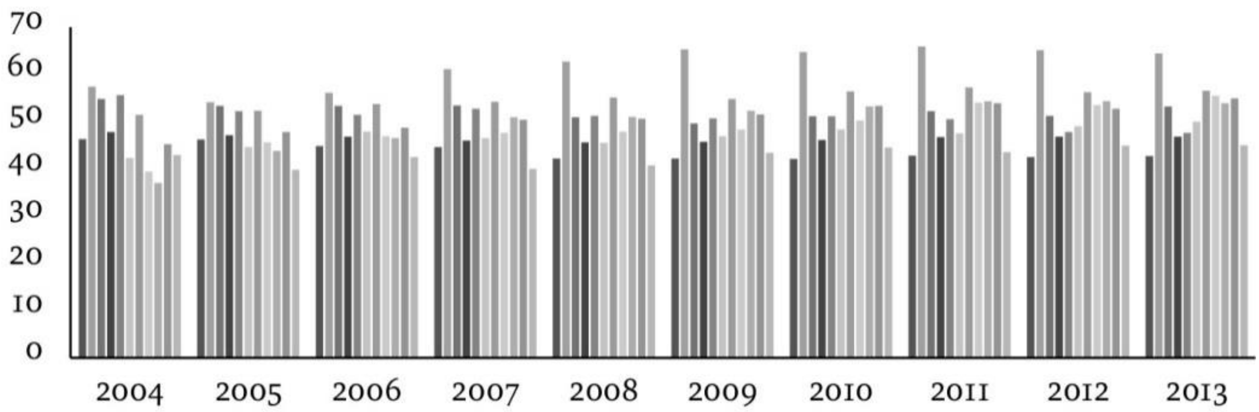
FIG. 26 Dynamics of fixed assets' deterioration, %

Sources: Website of Federal State Statistics Service. URL:
http://www.gks.ru/free_doc/new_site/business/osnfond/stizn_ved.xls
http://www.gks.ru/free_doc/new_site/business/osnfond/stizn_ved2.xlsx

Other sources provide more alarming data: the wear rate of fixed assets in the electrical energy and gas sectors is 60%, in oil processing - 80%, and in the coal industry – up to 90%.[1] In 2004, only 8.6% of manufacturing equipment in industry was less than five years old (for comparison, in 1988 this number stood at 33.7 %); 5.1% of equipment was between six and ten years old (29.1% in 1988); and 51.5% – more than 20 years old (12.4% in 1988). Therefore, over the "reform" years, the proportion of equipment over twenty years old grew sharply.[2] This means that no technological breakthroughs can be achieved at such enterprises; there is no equipment and no specialists to accomplish this task. The renewal coefficient of fixed assets in Russia in 2013 (small business excluded)

1 See: Russia's Energy Strategy to 2030.
2 Grazhdankin A. and S. Kara-Murza. (2013). *Belaia kniga Rossii. Stroitel'stvo, perestoĭka i reformy 1950-2012 gg.* [White Book of Russia. Construction, reconstruction and reforms] M.: Knizhny dom "Librokom".

amounted to just 11.4%



■ agriculture, hunting and forestry; ■ fishing and fish farming; ■ mining, ■ processing, ■ production and distribution of electricity, gas and water; ■ construction, ■ transportation and communications; ■ public administration and military security; ■ social security; ■ education; ■ health and social services; ■ other public, social and personal services

FIG. 27 Fixed assets deterioration by sector, %

Sources:
Russian Federal State Statistics Service. (2014). *Russia in Figures 2014*. URL: http://www.gks.ru/bgd/regl/b14_11/IssWWW.exe/Stg/d01/03-05.htm
Russian Federal State Statistics Service. (2009). Russian Statistical Yearbook-2009. URL: http://www.gks.ru/bgd/regl/b09_13/IssWWW.exe/Stg/html3/11-30.htm
Russian Federal State Statistics Service. (2009). Russian Statistical Yearbook-2009. URL: http://www.gks.ru/bgd/regl/b07_13/IssWWW.exe/Stg/d03/11-29.htm

How will Russia switch rapidly from a largely fourth to a sixth technological mode economy? O.S. Sukharev, Grand Doctor of Economics at the Institute of Economics of the RAS, believes that "any industrial programmes, any systemic changes – and technological logic proves it - must follow one another in order <...> you cannot leap across gaps to achieve breakthroughs <...> there can be missed generations of equipment in the process. Yes, you can partially close the gaps by importing technologies, but there can be no unfounded leaps of any sort, if we follow the technical logic."[1]

Other researchers beg to differ. For instance, S.Y. Glazev[2] believes that "for a successful technological leap, the countries that are lagging behind must carry out adequate assessment of new technological mode developments, and proactively introduce these innovations into production. Success is even more probable if the new technological mode is yet in its infancy. The change of dominating technological modes is characterised by the emergence of new "technological trajectories", emergence of new industry leaders, shorter periods of applying practical results of fundamental research into the real sector of the economy." According to Glazev, the current stage of economic development, characterised by a change of technological modes, presents an opportunity.

The Concept Programme of Long-Term Socio-Economic Development of Russia Through 2020 defines a strategic goal for the country to turn Russia into one of the global leaders of the world economy. The innovative model of economic growth presupposes the ability not only to produce new knowledge implemented in new technologies, but also to introduce the latter effectively into production, using corresponding types of new equipment. It is essential because only a full-cycle innovation - from conception to full involvement in economic activity, when the idea turns into a routine technology – can give an impetus to development.

To accomplish this, a developed industrial base is required. This is why countries with an innovative economy are mostly those with developed industrial potential, first and foremost, modern machine engineering and instrument engineering. These industries serve as nuclei for national innovative systems: on

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[1] *Rossiiskaia ekonomicheskaia sistema: budushchee vysokotekhnologicheskogo material'nogo proizvodstva: materialy zasedaniia Nauchnogo soveta Moskovskogo gosudarstvennogo universiteta im. M.V. Lomonosova po razrabotke sovremennoi ekonomicheskoi teorii i rossiiskoi modeli sotsial'no-ekonomicheskogo razvitiia (5 iiunia 2014 g.).* SPb: S.Y. Witte INID.

[2] Glazev S.Y. (2010). *Strategiia operezhaiushchego razvitiia Rossii v usloviiakh global'nogo krizisa*. [Strategy for Russia's outstripping development in the context of the global crisis] M.: Ekonomika

the one hand, they provide steady demand for technological innovations, and on the other - assist in their practical mastery in production processes.

While the manufacture of consumer or investment goods with use of new technologies and equipment can be outsourced beyond national territories (manufacturing outsourcing), owners of technological knowledge and integrators of new equipment production, and therefore receivers of the innovation revenue, however, are still companies, leaders in innovation. Without giving up on such opportunities, it should also be borne in mind that the large-scale transfer of the industrial sector outside the national economy not only undermines its stability, but also narrows the sources of innovative development. Thus, the national economy should retain its high-tech industrial core. Therefore, the economy of the future does not reject the industrial base; moreover, it offers new conditions for its development and for maintaining *competitiveness*. In these conditions, not just the *scale of the industrial potential*, but its *degree of innovation*, the ability for on-going technological renewal, start to play a primary role in supporting competitiveness and developing separate businesses and the national economy as a whole.

This local task in terms of its institutional essence, goals, and, to a large extent, *mechanisms* of implementing ***import substitution***, fits well with the broader task of *innovative* ***reindustrialisation*** of the Russian economy.[1] Should we achieve successful implementation of the *import substitution* policy, the strategy of *reindustrialisation* and *innovative modernisation* of our national economy, we will be able to achieve the goal of reaching the *new technological mode* currently being formed worldwide, gain technological leadership in priority directions of development, guarantee our *national security and introduce a new quality to the Russian economic system.*

1 Bodrunov S.D. (2015). *Teoriia i praktika importozameshcheniia: uroki i problemy*. [Theory and practice of import substitution: lessons and problems] SPb: S.Y. Witte INID.

Technological modernization of the Russian economy is impossible without ensuring a high level of innovation activity. However, Russia, which still has a fairly high scientific potential, cannot effectively ensure the transformation of this potential into new technologies. This situation depends both on the unfavorable macroeconomic conditions for innovation, and on the shortcomings of the national innovation system, which is not integral, and its individual components are poorly coordinated with each other. To take part in the struggle for technological leadership and enter the stage of a new second-generation industrial society (NIO.2), Russia needs deep changes in the institutional structure of the research and development sector, focusing on the constant updating of applied technologies and accelerated technology transfer.

We are regularly developing new technologies, but no significant progress can be seen in the main sectors. The number of new technologies used each year remains at approximately the same level (Fig. 28). The measurement of cutting-edge technologies by the Russian Federal Service of Statistics is providing on the basis of Frascati Manual – internationally recognised methodology for collecting and using R&D statistics of OECD[1], based on the work of Christopher Freeman.

[1] OECD (2015), *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris, https://doi.org/10.1787/9789264239012-en.

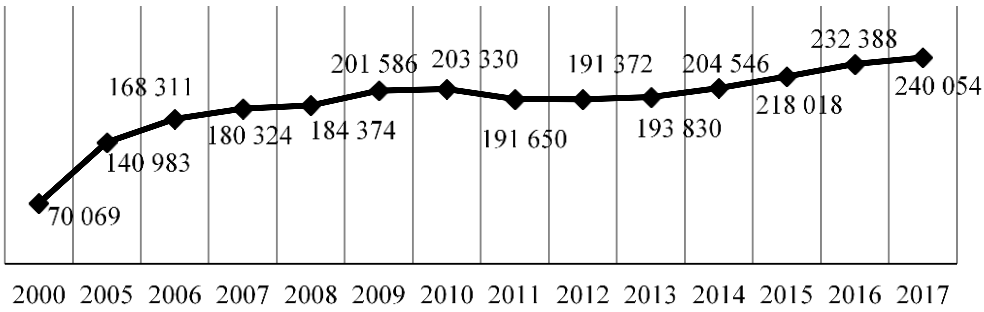

FIG. 28 Number of cutting-edge technologies used in Russian industry, units

Sources:

Russian Federal State Statistics Service. (2018). *Russia in Figures 2018*. URL: http://www.gks.ru/bgd/regl/b18_11/IssWWW.exe/Stg/d02/22-14.doc;

Russian Federal State Statistics Service. (2013). *Russia in Figures 2013*. URL: http://www.gks.ru/bgd/regl/b13_11/IssWWW.exe/Stg/d2/22-07.htm

Russian Federal State Statistics Service. (2007). *Russia in Figures 2007*. URL: http://www.gks.ru/bgd/regl/b07_11/IssWWW.exe/Stg/d020/21-07.htm

Overall, while ***the scientific and technical potential is high, innovative activity*** of Russian enterprises remains fairly ***low***, and has remained practically unchanged over the last few years. The share of organisations carrying out technological, organisational and marketing innovations in 2013 was less than 10%. This situation can be explained by lack of effective mechanisms for ***transforming*** the existing R&D potential into technologies required by the economy, and in particular by industry. To facilitate the generation, selection, development and implementation of new ideas into innovative technologies, a system of special institutions is required. In international parlance, these are known as ***national innovation systems (NIS).*** The concept was elaborated by Christopher Freeman and the term ***national system of innovation*** was first used in 1987 in his study of Japan's technological policy[1]. The works of his colleagues discussing

[1] Freeman, C. (1987). Technology Policy and Economic Performance: Lesson from Japan. London, New York: Frances Pinter Publishers; Freeman, C. (1988). Japan: A new national innovation system? In: G. Dosi, C. Freeman, R. R. Nelson, G. Silverberg and L. Soete (eds.) Technology and economy theory, London: Pinter; Freeman, C. (1995). 'The 'National System of Innovation' in historical perspective. *Cambridge Journal of Economics*: Volume 19, Issue 1, p. 5–24. doi:10.1093/oxfordjournals.cje.a035309

innovation systems are monographs entitled "National Innovation Systems" [1] and "Technology and Economic Theory".[2]***A national innovative system has not common*** definition. In OECD publication are offering five definitions by Christopher Freeman, Richard Nelson and others[3]. According to Christopher Freeman, "The network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies may be described as 'the national system of innovation'"[4].

So, the national innovation system defined as a ***set of separate institutions*** that jointly (and separately) contribute to the development and spreading of new technologies and form a structure within which the government shapes and applies a policy of influence on the innovation process (Fig. 29).

[1] National innovation systems. A comparative analysis (1993). Richard R. Nelson (Editor), New York–London: Oxford University Press, 1993.
[2] Lundvall, B.-Å. (1988) Innovation as an interactive process: From user-producer interaction to the National Innovation Systems. In: Dosi, G., Freeman, C., Nelson, R.R., Silverberg, G. and Soete, L.,(eds.), Technology and economic theory, London: Pinter Publishers..
[3] OECD (1997). National Innovation Systems. Paris: OECD Publications, p. 10.
[4] Freeman, C. (1987). Technology Policy and Economic Performance: Lesson from Japan. London, New York: Frances Pinter Publishers, p. 1.

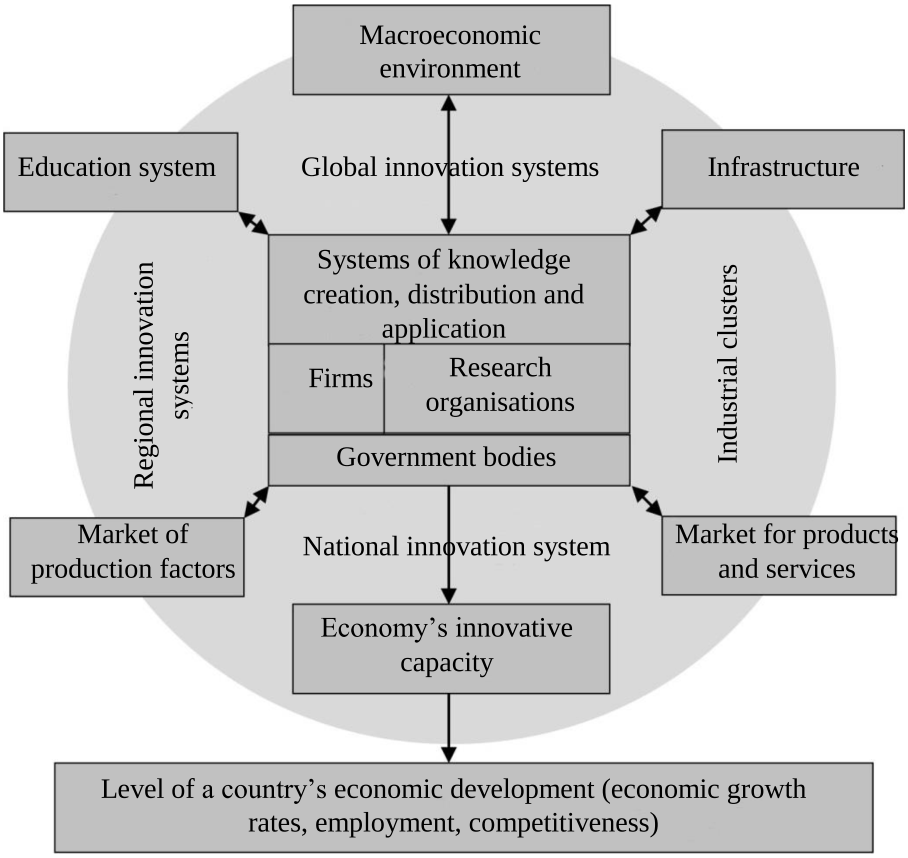

FIG. 29 National innovation system

Today, the notion of the ***national innovation system*** is being interpreted differently by various authors, although practically all definitions include common general elements. The main elements of the definition of NIS are:

- . Schumpeter's[1] ideas about competition on the basis of innovation and research and developmens in corporations as the critical economic dynamic;

-recognition of the special role of knowledge in economic development;

- consideration of the influence of the institutional context of innovative activities on its content and structure.

The NIS can also be viewed as a comprehensive system of institutions (legislative, structural, innovative) which shape a country's innovative environment. In other

[1] *Schumpeter, J.A.* (1983). *Teoriia ekonomicheskogo razvitiia.* M.

words, the NIS is the totality of interrelated organisations (structures) involved in, and supporting, the production and commercial and social application of scientific knowledge and technologies in a country. They have national roots, traditions, political and cultural peculiarities.

. Although Ch. Freemen stressed the significance of science and research system for innovations, he did not include the transfer of knowledge, used for the development of new technologies and products, into his definition of NIS. This step was made by Stan Metcalf[1]. The S.Yu. Witte Institute for New Industrial Development follows this ***approach*** to interpreting the term because the key component of each main element of modern material production is knowledge (see Ch. 1).

In essence, the NIS is a ***system of interrelated institutions for the creation, storage and transfer of knowledge and skills that determine new technologies.*** From this point of view, neither reindustrialisation in the aforementioned interpretation, nor further successful development of modern production (let alone the industry of the future) would be possible without ***deep integration*** of production with education and science, both as ideological imperative and the practice that follows. Given that, the ***integration of science, production and education*** serves ***as a necessary organisational condition and a prelude to implementing reindustrialisation in the Russian economy.***

Knowledge is considered as the main input hat the innovative system receives from the environment (it means – from scientifical, educational and informational systems of the society). This knowledge is ***transformed*** within the system into new and different kind of knowledge, by applying the input knowledge for the solution of the tasks of the technological development, which is, then, the system's output. The process of knowledge transformation, including its acquisition, production, distribution, arrangement and standardisation, as well as its application and

[1] Metcalfe S. (1995). The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspectives. In: Stoneman P. (ed.). Handbook of the economics of innovation and technological change. Oxford: Blackwell Publishers. Pp. 409–512.

management, is carried out by different organisations within the NIS. These include universities, research institutes, research and development and development departments of companies, technology transfer centres, standardisation institutes, patent agencies and government bodies involved in innovation policy.

In its main parameters, the ***Russian national innovation system*** is similar to analogous systems in developed countries, has passed through several stages in its emergence, and now functions on the basis of federal laws, state institutions, policies and programmes, such as it was in the Russian Strategy of Innovative Development to 2020[1] and the Strategy of scientific and technological development of the Russian Federation that is currently being developed

The main stages in the development of Russia's NIS are as follows:

- ***Preliminary stage:*** late December 1991 – Russian Foundation for Technological Development is created; April 1992 – Appearance of the Russian Foundation for Fundamental Research; February 2014 – Foundation for Assistance for the Development of Small Businesses in the Science and Technology Sector is created.
- ***First stage*** (2000–2005): selection and support for active teams and institutions; implementation of various projects; direct financing of important innovative projects of national significance; provision of grants to small high–tech enterprises; creation of the HR element of the innovation system; financing of pre–service and in–service training of staff;
- ***Second stage*** (2005–2010): development of the infrastructure of innovative activity and project instruments for resolving various problems, financed by the budget within the framework of federal target programmes. Formation of venture companies, special economic zones, technoparks, commercialisation centres: 2005 – creation of business incubators; end of 2005 – creation of six special economic zones; March 2006 – approval of a comprehensive programme entitled "Creation of High Technology Technoparks in the Russian Federation"; June 2006 – creation of the Russian Venture

[1] Innovative Development Strategy of the Russian Federation (approved by the Federal Government on 8 December 2011, No. 227-r). http://minsvyaz.ru/common/upLoad/2227-priL.pdf.

Company; 2007 – approval of the Nanoindustry Development Strategy; June 2007 – foundation of the State Establishment "Russian Corporation of Nanotechnologies".

- ***third stage*** (from 2010 to the present) – transfer of the main part of applied research from fundamental research institutions of the RAS and sectoral research institutions to universities. 2008–2010 – a number of universities were designated as national universities which received additional financing for development purposes; April 2010 – programme for state co–financing of high–tech production was founded; August 2010 – the list of companies with state participation, which are required to prepare innovative development programmes, approve them and report on their completion was defined; end of 2010 – launch of technological platforms; spring of 2012 – creation of innovative territorial clusters.

The main actors of the NIS are the state, the science and education innovation complex, the system of organisations for infrastructural servicing of investment reproduction, business structures, institutions of market infrastructure (Fig. 30).

The state as a key element of the national innovation system provides complex support for innovative processes in the economy, their strategic priorities and coordination. The main innovation institutions in Russia have been created, but ***the most important problem*** facing the Russian NIS is ***lack of demand for innovation.*** In the period from 2000 to 2010, the share of industrial companies carrying out technological innovations fell from 10.6 to 7.9%, and amounted to 8.9% in 2013. Meanwhile, the volume of innovative products, works and services increased (from 4.5% in 2009 to 9.2% in 2013); yet it is considerably lower than in most countries leading in the sphere of innovation.

The weakest aspect of the Russian innovative system is its ***low effectiveness*** due to the imprecisely defined interests of NIS participants, their contradictory character, lack of compatibility and necessary economic motivation, as well as a lack of harmonisation between indicators of innovative activity results for various subjects of the NIS.

RUSSIAN INNOVATION SYSTEM

1. *Institutions* for development and implementation of *state policy* in the sphere of innovative development of the economy (Ministry of Economic Development of the Russian Federation; Centre for Strategic Development; System of State Purchases; Ministry of Education and Science of the Russian Federation; Interdepartmental Commissions on Scientific and Technical Policy; Ministry of Finance of the Russian Federation, State Bank of the Russian Federation)

2. *Institutions* for production and distribution of knowledge (Russian Academy of Sciences, sectoral academies, national research universities, systems of educational institutions of secondary and higher professional education; institutions of post-graduate professional education, graduate schools, state innovation corporations (Rosnano, Skolkovo)

3. *Institutions for infrastructural servicing of the innovative process* (technoparks, technopolises, information technology centres, information and production complexes, science centres, business incubators, technology transfer centres)

4. *Market institutions for commercialisation of innovative products and services* (venture innovation foundation, regional venture foundations, venture companies, marketing companies, information centres, leasing companies, insurance companies, centres and agencies for protection of intellectual property rights)

5. *Legislation normative and legal base of innovative activities* (Federal Law on Science and State Science and Technical Policy; Civil Code of the Russian Federation, Part 4; Strategy for Innovative Development of the Russian Federation to 2020; Strategy for Socio-Economic Development of the Russian Regions, developed and approved in constituent regions of Russia, federal and sectoral normative acts, regulating innovative activities of enterprises and organisations)

6. *Organisation and production integrated business structures - subjects of the innovative process* (transnational companies, international strategic alliances, consortiums, trans-border clusters, financial and industrial groups, science and technology alliances, institutions of public-private partnerships, state corporations, industrial clusters, free economic zones (technological, industrial innovation zones, etc.), globally integrated companies, small and medium-sized businesses)

A new methodology for assessing the results and effectiveness of the NIS and its components is necessary. It must be based on a systemic approach oriented towards more intensive innovative renewal of Russian industry, creation of conditions for Russia to achieve ***technological leadership*** in the world in certain ***priority areas***, and formation of effective mechanisms for ***transformation of innovative potential*** into ***new technologies*** in demand on the market.

Yet another substantial reason for the lack of NIS results is the ***lack of a developed market for innovative products, services and technologies.*** Of considerable significance is the problem of insufficient development of the ***market for intellectual property.*** An analysis of the content of more than 150 federal, regional and departmental strategies and programmes of innovative development across industries, carried out by the INID in cooperation with the Russian Institute of Intellectual Property, has shown that the problems of developing the market for intellectual property, one of the drivers of innovative development, is not even considered in most of these documents.

We must recognise that, at this stage, technological modernisation of the Russian economy is impossible without a ***large-scale transfer*** of foreign technologies (annually, the country purchases $140–165 bn worth of them). However, due to financial and political limitations, Russia cannot receive the full range of those technologies. As a consequence, there appears a logical question on the ***goals*** of technological modernisation. On 13 January 2014, the Chairman of the Government of the Russian Federation approved the Forecast of Scientific and Technological Development of the Russian Federation (STD Forecast) to 2030.[1] Technological forecasting, according to the Government, will promote the search for new technological solutions, helping Russia achieve ***technological leadership*** and ***technological independence.*** The list of directions in which Russia is expected to achieve technological advantages, according to the STD forecast, will establish ***priorities*** for funding of new Russian research and expenses for purchasing technologies abroad. The following priority directions for scientific and technological development of the Russian Federation have been defined: information and communication technologies, biotechnologies, medicine and health, transport systems

1 Higher School of Economics. *Materials for the Long-Term Forecasting of Scientific and Technological Development of the Russian Federation to 2030*. http://prognoz2030.hse.ru/.

(including aircraft engineering and shipbuilding); space technologies and systems; materials (including nanotechnologies); technologies for the rational use of natural resources, energy efficiency.

Let me stress once again that the most significant difference between the current stage of industrial production and the stage when the set of measures for active industrial policy were used for the first time lies in its ***innovative character,*** which rests on the ***knowledge-based economy.*** So we are talking here not about simply defining a list of new technologies, but about turning the process of creating these technologies into a continuous process.

Obviously, the flow of new technologies had always existed in industrial production, regardless of the social order. However, since the end of the 20th century, the flow of innovations became constant, and ***on-going renewal*** of ***product lines*** and development of new ***technologies became an imperative for the effective functioning of production.*** Strategically developing production has become a process of on-going innovations; researching, finding, transferring and implementing new technologies has become an inalienable part of this production system, a part of the production process. Such an element of intersubjective relations between scientific and production structures in the process of industrial activities, such as ***technology transfer,*** is a necessary element of the production process. At the national level, guaranteeing this flow of innovation leads to R&D activities turning into a separate (potentially significant and expansive) sphere of the economy and to formation of ***national innovation systems*** serving all the stages of the ***innovation process*** within the national economy.

The state programme entitled "Development of Science and Technologies"[1] has been created to shape a competitive sector of research and development in the Russian Federation, able to provide for technological modernisation of the Russian economy. In 2013–2020, it is expected to finance this programme in the amount of RUR 1.187

[1] Ministry of Science and Education of the Russian Federation. http://минобрнауки.рф/%00%B4%00%BE%00%BA%01%83%00%BC% 00 %B5%D0%BD%D1%82%D1%8B/2966.

trillion. The main goal of the programme is to finance scientific and technical advances and use the results of these advances further in the programmes of various departments. The programme will also support interdisciplinary research which is tied to innovative achievements of the past several decades in the sphere of science and technology. Financing research aimed at achieving these goals has been growing steadily. The share of the federal budget financing science is gradually growing, as is its share in the GDP; yet this figure is still low at 0.5–0.6% (Fig. 31).

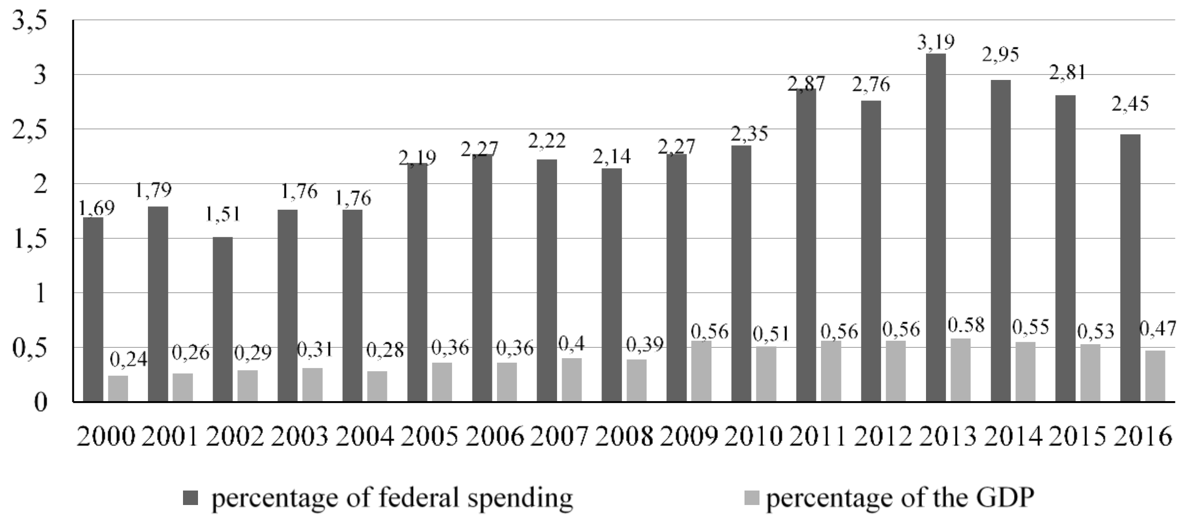

FIG. 31 Financing of science from the federal budget, share of GDP

Sources:

2004-2000: Russian Federal State Statistics Service. (2007). *Russia in Figures 2007*. URL: http://www.gks.ru/bgd/regl/b07_11/IssWWW.exe/Stg/d020/21-07.htm;

2005-2009: Russian Federal State Statistics Service. (2011). *Russia in Figures 2011*. URL: http://www.gks.ru/bgd/regl/b11_11/IssWWW.exe/Stg/d2/22-07.htm;

2009-2013: Russian Federal State Statistics Service. (2014). *Russia in Figures 2014*. URL: http://www.gks.ru/bgd/regl/b14_11/IssWWW.exe/Stg/d02/22-07.htm;

2014-2016: Russian Federal State Statistics Service. (2018). *Russia in Figures 2018*. URL: http://www.gks.ru/bgd/regl/b18_11/IssWWW.exe/Stg/d02/22-08.doc

However, this program was not completed. On March 29, 2019, the government of the Russian Federation approved the state program "Scientific and technological development of the Russian Federation". The state program will be implemented in

2019-2030, while the program "Development of science and technology" for 2013-2020 is prematurely terminated. Federal budget expenditures for the implementation of the state program will amount to 688.3 billion rubles in 2019, 740.7 billion rubles in 2020, and 795.9 billion rubles in 2021. By 2030, the amount of Federal budget allocations for the implementation of the state program is planned to increase to more than 1 trillion rubles a year.[1]

Till now, the measures adopted by the state to develop the innovation system and finance research are obviously insufficient. The number of organisations involved in research has decreased considerably (from 4099 in 2000 to 3605 in 2013), while the number of economic agents and the GDP grew. The attractiveness of research activities for companies and organisations has decreased (Fig. 32). According to data provided by the Russian Committee for Statistics, most research is done by specialised research and development organisations which are sometimes considerably removed from production processes. This testifies to the on-going disintegration of science and production, which reduces the rate at which innovations are implemented and new technologies introduced.

For our economy to take its deserved position in the global distribution of labour over the next several decades, a systemic integrative document must be designed, implemented and supported by legislation. This document, entitled "Conceptual Foundations of the National Technological Initiative (NTI),[2] is being developed by the Russian Academy of Sciences at the behest of the President of Russia pursuant to his State of the Federation Address on 4 December 2014. The Russian Venture Corporation (RVC) has started developing NTI roadmaps with the participation of some 750 experts.

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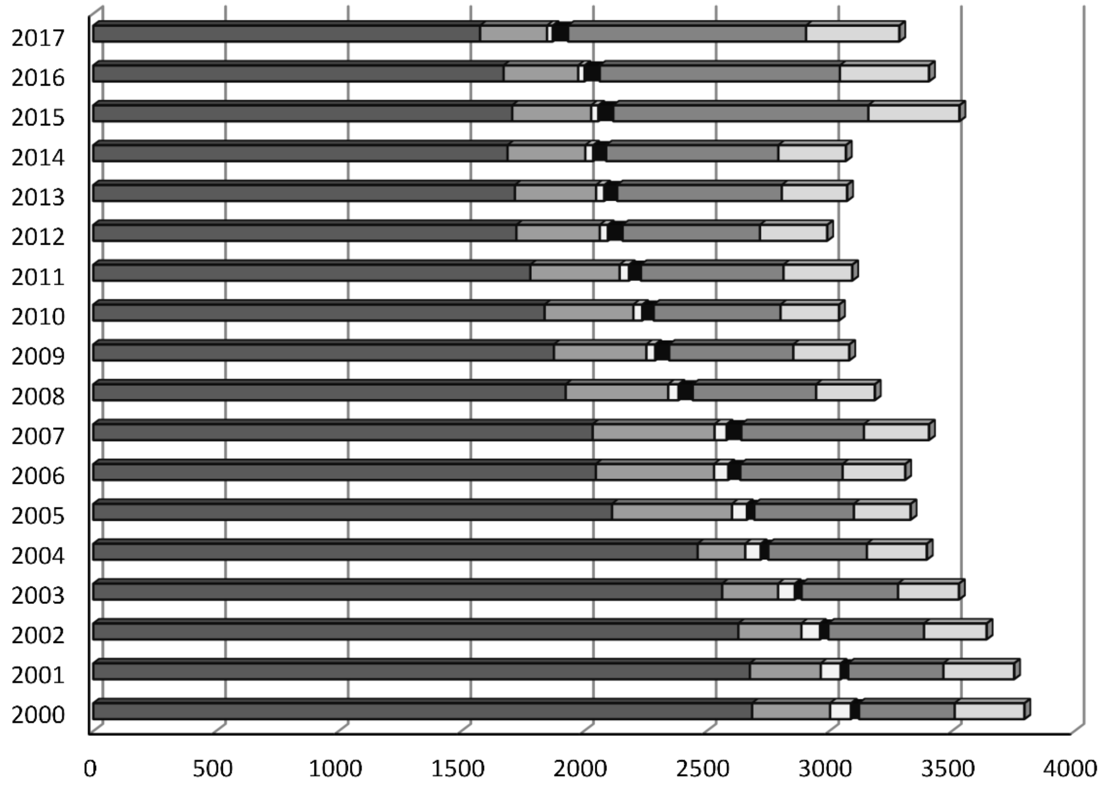
[1] Государственная программа «Научно-технологическое развитие Российской Федерации». [State program "Scientific and technological development of Russian Federation"] URL: http://government.ru/rugovclassifier/858/events/

2 Russian Academy of Sciences. http://ras.ru/viewnumbereddoc.aspx?id=69fa7c74-4033-4215-b908- 911a87acf803&_



science and research institutions; design bureaux; developers and planning and surveying agencies; pilot plants; institutions of higher education; industrial companies which had their own R&D and engineering divisions

FIG. 32 Structure of research participants

Source:

Russian Federal State Statistics Service. (2019). Chislo organizatsii, vypolniavshikh nauchnye issledovaniia i razrabotki, po tipam organizatsii po Rossiiskoi Federatsii [Number of organisations engaged in research and development in the Russian Federation by organization type]. Updated on 28.08.2018. URL: http://www.gks.ru/free_doc/new_site/business/nauka/t_1.xls

NTI was launched in 2016 as a large-scale program to accelerate the country's economic development by supporting high-tech startups and companies. In 2017, the government of the Russian Federation approved "road maps" for the development of technological renewal of a number of sectors of the economy.

In 2019, about 20% of projects that received NTI support have already started selling. By the end of 2019, 150 end-to-end technology projects had been launched: on artificial intelligence, virtual reality, quanta, sensors and robotics, and big data storage and analysis.

At the same time, proposals were being prepared for legislative initiatives that reduce barriers to the development of high-tech businesses. Of the 60 proposed draft laws and regulations, 40 have already been approved.[1]

The working group of the RAS (of which I am a member), headed by Deputy President of the RAS V. V. Ivanov, developed a draft document, in accordance with which countries that will be the technology leaders for the coming decades must meet a number of requirements. They must:

- have a well-defined and clear scientific, technical and ***innovation policy,*** focused on ***technological leadership*** and supported with the necessary ***resources,***
- ***offer a variety of research organising formats;***
- ***have science-intensive industry,*** based on their own technologies;
- ***offer education programmes*** geared toward developing creativity;
- ***have business as the main investor into*** research and development;
- have businesses working for ***societal development.***

To become a ***technological leader***, ***Russia*** must resolve a number of problems:

- Modernise its productive capacities;
- Support and stimulate innovative activity of enterprises;
- Finance research activities and develop new technologies;
- Prepare highly trained professionals at different levels - those of worker, researcher, instructor, manager;
- Actively develop the innovation infrastructure aimed at helping bridge science and business.

We will consider the goals of the project achieved when Russia has a competitive ***level of technology*** with the world’s leading technological countries.

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[1] НТИ: Статус реализации. Портал Национальной технологической инициативы. [NTI: The status of implementation. Portal of the National technological initiative]. URL: https://nti2035.ru/nti/realization

CHAPTER 15. Industrial Policy as an Instrument of Reindustrialisation and Import Substitution[1]

Economic sanctions against Russia have made it difficult for Russia to participate in the international technological division of labor. This has exacerbated the problem of import dependence and import substitution. Based on the analysis of the experience of import substitution policies implemented by various countries, the success of such policies is noted if it focuses on the development of effective exports of products from import-substituting production sectors. For this purpose, it is proposed to use the tools of active industrial policy and public-private partnership, to stimulate demand for high-tech products, and the long-term nature of the implemented programs. Possible risks of an active industrial policy and protectionist protection of modernized industries are also analyzed: reduced competition, increased burden on the budget, insufficient technological level of import-substituting industries.

15.1. Import Substitution and Export Restructuring: International Experience and Russian Issues

An important incentive to step up measures to reindustrialize the Russian economy is the need for import substitution due to Western sanctions (Table 7). Most enterprises in the sanctions list belong to the oil and gas sector and defence industry sector. It is obvious that the sanctions are aimed at making it difficult for Russia to realize its existing advantages in the fuel and energy resources sector, which is a major source of export revenue, and in the field of military production. Historically, the most high-skilled personnel, advanced technological developments and state-of-the-art machinery and equipment in Russia are concentrated in the defence industry. The

[1] The chapter is based on S.D. Bodrunov's paper delivered on 14.05.2015 at the panel discussion on Import Substitution and Other Reindustrialisation Strategies held as part of international research conference Assisting Industrial Development at a Time of Economic Crisis.

defence sector is a producer of not only military products, but also technically complex civilian goods (in 2020 – about 22% of the total production of the military-industrial sector). These products include telecommunications, embedded sensors, and medical and aerospace equipment. Defence industry not only manufacture military and civilian products, but also actively participate in the innovative and technological development of Russian industry. They also have close cooperation ties with civilian plants, research labs, design bureaux, etc.

TABLE 7 Russian Companies under Sanctions (the sample shows the typical representative of the main groups of sanctioned companies)

Company	Business Profile
Kalashnikov Concern	Manufactures weapons (combat automatic weapons and sniper, sports and hunting rifles), machinery and tools
Academician Shipunov Instrument Design Bureau	Develops anti-tank missile complexes, air defence systems, aircraft gun and grenade instrumentation
Military Industrial Corporation Science and Manufacturing Corporation of Mechanical Engineering	Develops missile equipment, including ballistic and cruise missiles, satellites and manned spaceships
Almaz Antey Air Defence Armaments Concern	Group of enterprises which develops and manufactures air and missile defence armaments
Radio Electronic Technologies Concern (RETC)	Management company which incorporates enterprises that develop and manufacture equipment for radio warfare and avionics
Rosneft	Extraction of oil (Russia's and world's top oil company by production volume) and natural gas (third largest in Russia)
Sozvezdie Concern	Develops and manufactures communications equipment
Uralvagonzavod Research and Production Enterprise Equipment	Corporation which manufactures railroad, construction and military technology, including T-90 tanks
United Shipbuilding Corporation	Russia's largest shipbuilding company comprising approximately 80% of all Russian shipbuilding enterprises
United Aircraft Engineering Corporation (UAEC)	Holding which comprises approximately 30 companies operating in Russia's aircraft engineering sector, including Sukhoi, Irkut, Tupolev, Yakovlev United Design Bureau, MiG, etc.
RT Stankoinstrument	Holding created for the integration of manufacturers with science and technology enterprises in the machine tool design products sector
RT-Khimkompozit	Holding which develops and manufactures polymer composite materials and products

Source: ITAR-TASS. tass.ru/.

As a result of the sanctions, the scheme for Russia's economic participation in the international division of labour, which had been formed throughout the years after the market reforms, collapsed. The fears experts had regarding risks to sustainable development without a developed domestic industry came true.[1] Without its own

[1] Mgoian, R.P. (2013). Finansovye instrumenty gosudarstvennoi podderzhki vysokotekhnologichnykh otraslei promyshlennosti. *Izvestiia Sankt-Peterburgskogo gosudarstvennogo ekonomicheskogo universiteta*, [Financial instruments of state support of high-tech sectors of industry]. 6 (84), 122-125; Plotnikov, V.A. (2012). Innovatsionnaia aktivnost' rossiiskikh promyshlennykh predpriiatii kak faktor ekonomicheskoi bezopasnosti. *Nauchnie vedomosti Belgorodskogo gosudarstvennogo universiteta. Seria: Istoria. Politologia. Ekonomika. Informatika*, [Innovative activity of Russian industrial enterprises as a factor of economic security] 13 (132), Vol. 23/1, 5-10; Gerasimov, I.V. (2014). Innovatsionnoe razvitie mashinostroitel'nogo diviziona GK

highly developed industrial and scientific-technological core of the economy, it is extremely difficult to compensate for the disruption of international technological exchange caused by external circumstances. It is possible to replace all previously imported types of technologies and modern machines and equipment only by having such a core.

In 2014, import substitution was officially identified as one of the key areas of Russia's economic development. President Putin, speaking at the St. Petersburg International Economic Forum in 2014, said: "I believe it necessary to analyse the possibilities for competitive import substitution in industry and agriculture in the very near future".[1] The president also said that the policy of import substitution must be carried out in accordance with WTO norms and the responsibilities Russia has to its partners in the Eurasian Economic Union. Internal sources of growth must serve as the foundation for import substitution programmes.

The main goals of import substitution are:

- To guarantee the national technological and economic security of Russia;
- To achieve technological independence in critically important areas of science and technology;
- To form a favourable trade balance;
- To incubate national leaders for conquering global markets.

Import substitution has many benefits: new jobs, low unemployment, rising quality of life goes up; accelerated scientific and technical progress; improved education; stronger economic and military security; higher demand for products made in the country and higher aggregate demand (as Keynes would have put it); and expanded production capacities (particularly in high-tech and innovative industrial enterprises).

"Rosatom" v usloviakh VTO (na primere kompanii ZAO "AEM-tekhnologii"). [Innovative development of the machine-building division of the state-owned company Rosatom in the WTO (on the example of AEM-technologies Ltd.] *Izvestiia Sankt-Peterburgskogo gosudarstvennogo ėkonomicheskogo universiteta*, 3, 80-82, etc.

[1] Website of the President of Russia. *V.V. Putin, speech at the plenary session of the St. Petersburg International Economic Forum. Verbatim records of the plenary meeting of the 18th St. Petersburg International Economic Forum*. URL: http://kremlin.ru/events/president/news/21080

Today, more and more economists (theoreticians and practitioners) agree that the strategy of priority development of modern high-tech material production integrated with R&D activities and education must become the foundation of import substitution and export restructuring. However, practical implementation lags far behind declarations. While Deputy Minister of Industry and Trade of the Russian Federation S. Tsyb observed that “import substitution is only possible ... if corresponding vacant production capacities are available”,[1] the Russian economic recession in the fourth quarter of 2014 found 30–40% unused production capacity and 15% industrial overemployment.[2] In many strategic sectors, the share of imported inputs exceeded 80%, which creates a potential threat to national security overall.[3]

Consistent implementation of the import substitution strategy will allow the negative effect of economic sanctions to be minimised. It will become the central element and direction of the entire state economic (and first and foremost industrial) policy of Russia.

It is no less important to develop new export directions – machines and equipment, technologies, know-how, educational services – and to develop and implement, in cooperation with foreign countries (including the countries of Asia and Latin America),long-term “incubation” programmes for integration of production, science and education, the so-called Production-Science-Education (PSE) clusters.

Import substitution has proved its usefulness in many countries:[4] for instance, Brazil, Argentina, Mexico, South Korea and Taiwan. The instruments used to stimulate import substitution growth were:

- protectionist measures, including lower prices for local products due to financial support from the state;

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1 Voronina, Y. (2014). Lekarstvo ot zavisimosti. *Rossiiskaia gazeta*. [A cure for dependence. *Russian newspaper*] 05.08.2014. http://www.rg.ru/2014/08/05/zameshenie.html.

2 Glazev, S.Y. (2014). *O vneshnikh i vnutrennikh ugrozakh ekonomicheskoi bezopasnosti Rossii v usloviakh amerikanskoi agressii*.[On external and internal threats to Russia's economic security in the context of American aggression] Research paper. M.: Russian Academy of Science

3*Voronina Y., Op. cit.*

4 E.g., see: Khoros, V.G. and D.B. Malysheva, eds. (2013). *Tretii mir: spustia polstoletiia*. [Third world: half a century later] M.: IMEMO RAN.

- limited import of industrial products;
- investment of the monies ***retained*** within the state after sales of import substitution products into modernisation of industrial enterprises.

In Brazil, the policy of import substitutionhas been developing for a long time and has passed several stages, starting from the turn of the 40s – 50s of the twentieth century. As part of this policy, protectionist protection of the domestic market was widely applied and serious import restrictions were imposed. For almost three decades (1950-1978), the output of the growing Brazilian industry increased by an average of 8.5% per year, which put Brazil among the world leaders in terms of industrial growth . Since the end of the twentieth century, Brazilian economic policy has not focused mainly on import substitution, but import substitution policy remains an important part of the plan for the development of Brazilian industry. Plan developed for 2011-2014, known as Plano Brasil Maior[1], was mostly geared, not toward limitation of imports, but stimulation of exports. The programme guaranteed Brazilian exporters a partial refund of taxes and offered them finance from the specially created state foundation for financing export operations. For the 2015-2017 period, the exports of goods increased by 13.9% and imports decreased by 12.1%.[2] Additionally, the country created globally competitive processing industry enterprises, first and foremost in aviation (Embraer is one of the leading world producers of aircrafts for local lines). Significantly, from 5.0% in 2015 to 6.8% in 2017, the share of high-tech products of the Brazilian export category "vehicles" has increased, which also includes the export of aircraft and spare parts for them.[3] Oil and metallurgical companies also increased their exports. This allowed Brazil to create an independent scientific and technological core of the economy, including, in addition to the above-mentioned industries, the nuclear industry, nuclear power plants and biofuel production.

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[2] Braziliia: na puti vykhoda iz sotcialno-ekonomicheskogo krizisa. Biulleten o tekushchikh tendentciiakh mirovoi ekonomiki №29. Fevral 2018. S. 9. [Brazil: on the way out of the socio-economic crisis. Bulletin on current trends in the world economy No. 29, February 2018, p.9.] URL: https://ac.gov.ru/archive/files/publication/a/16109.pdf.

[3] Braziliia: na puti vykhoda iz sotcialno-ekonomicheskogo krizisa. Biulleten o tekushchikh tendentciiakh mirovoi ekonomiki №29. Fevral 2018. S. 9. [Brazil: on the way out of the socio-economic crisis. Bulletin on current trends in the world economy No. 29, February 2018, p.9.] URL: https://ac.gov.ru/archive/files/publication/a/16109.pdf.

The experience of South Korea was also positive. The country used the import substitution programme not as an independent growth mechanism, but as a transitional policy for the period of improving the national economy and creating powerful export potential. This strategy became known as "export-oriented import substitution"[1].

In most countries, strategies of import substitution have led to increases in exports (Table 8) and the share of industry with high added value.

In Russia, ***import substitution is not a priority development sector of the government's economic policy.***[2] Although the volumes of exports and imports have been growing steadily since 1999, the export to import ratio decreased from 2.3 in 2000 to 1.57 in 2012. While the share of primary products in exports grew from 42.5% in 1995 to 72% in 2014, the share of higher technology manufactures - machinery, equipment and transport - decreased from 10.2% in 1995 to 4.5% in 2014. Imports were a mirror image with machinery, equipment and transport growing from 33.6% in 1995 to 48.3% in 2014, and food products decreasing by a factor of two, from 28% in 1995 to 14% in 2014.[3] These data testify to the low efficiency of import substitution programmes in recent decades. Until 2014, these programs were separate and disparate projects that were developed not at the Federal level, but at the departmental level.

After a number of economic sanctions were imposed on Russia since 2014, attention to the problem of import substitution has increased. In 2014-2015, import substitution programs become part of state programs for the development of industry and agriculture. In 2015, 19 industry-specific import substitution programs were also developed. Decisions were made restricting the import of a number of products,

[1] Litvinova A.V., Talalaeva N.S. (2020) Foresight Model of Export-Oriented Import Substitution in Russia. In: Inshakova A., Inshakova E. (eds) Competitive Russia: Foresight Model of Economic and Legal Development in the Digital Age. CRFMELD 2019. Lecture Notes in Networks and Systems, vol 110. Springer, Cham. https://doi.org/10.1007/978-3-030-45913-0_5; Abhyankar H.G., Dharmadhikari, Sonali. "Import Substitution" to "Export Promotion" —Chronicle Of The Neville Wadia Institute Of Management Studies And Research. April, 2011.

[2] Glaz'ev S.Y. (2014). *O vneshnikh i vnutrennikh ugrozakh ekonomicheskoi bezopasnosti Rossii v usloviiakh amerikanskoi agressii*. .[On external and internal threats to Russia's economic security in the context of American aggression] Research paper. M.: Russian Academy of Science.

3 Russian Federal State Statistics Service. http://www.gks.ru/bgd/regl/

including software. On August 4, 2015, the government of the Russian Federation decided to create a government Commission on import substitution.

And while modernisation and reindustrialisation of the economy have been on the agenda since 2000s, and many enterprises renewed their fixed assets, there has been little new investment and competitive industrial enterprises have not appeared in any number. Demand for Russian-made products is also insufficient to stimulate production.

TABLE 8 GDP Dynamics, GDP per capita, export and import (2010-2012)

Country	GDP growth, %			GDP per capita, $			Share in GDP, %					
							Export			Import		
	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
Argentina	9.1	8.5	0.9	11460.38	13693.7	14679.93	17.50	17.79	15.80	15.04	16.14	14.06
Brazil	7.5	2.7	1.0	10978.26	12576.20	11319.97	10.87	11.89	12.59	11.90	12.62	14.03
Belarus	7.7	5.5	1.7	5818.85	6305.77	6721.83	54.28	81.13	81.34	67.89	83.07	76.73
Kazakhstan	7.3	7.5	5	9070.65	11357.95	12120.31	43.96	49.47	47.60	29.21	27.75	30.33
Republic of Korea	6.5	3.7	2.3	22151.21	24155.83	24453.97	49.42	55.75	56.34	46.23	54.25	53.55
Mexico	5.1	4.0	4.0	8920.69	9802.89	9817.84	29.87	31.25	32.64	31.07	32.50	33.75
Russian Federation	4.5	4.3	3.4	10709.77	13324.29	14090.65	29.22	30.27	29.59	21.14	21.73	22.26
U.S.	2.5	1.8	2.8	48357.67	49854.52	51755.21	12.32	13.53	13.52	15.79	17.19	16.89
EU countries	2.0	1.6	-0.4	32381.81	34920.83	32917.26	40.19	42.90	43.18	39.32	41.90	41.41
Developing countries of Europe and Central Asia	5.9	6.2	1.8	6177.36	6852.42	6907.21	37.73	42.03	36.22	41.29	46.60	40.93
Developing countries of East Asia	9.7	8.3	7.4	3885.29	4699.64	5187.39	35.20	35.00	33.51	31.31	32.29	31.04
Developing countries of Latin America and the Caribbean	9.7	8.3	7.4	8611.928	9539.82	9404.30	22.16	23.47	23.73	22.75	24.12	25.09

Source: World Bank. www.worldbank.org/.

Moreover, internal technological exchange in Russia is slowing down. The number of cutting-edge production technologies in the processing industry is going down as well. The number of newly developed production technologies is growing, but in most cases, these technologies (which are new to Russia) do not allow it to compete on the international markets (Table 9).

TABLE 9 Creation and application of advanced production technologies in Russia's processing industry (2010-2018)

	Number of developed advanced production technologies	Number of developed production technologies that are new to Russia	Number of completely new advanced production technologies	Number of applied advanced production technologies
2010	231	215	16	135945
2011	338	320	18	118021
2012	336	320	16	119182
2013	398	374	24	121103
2014	414	382	32	127492
2015	442	416	26	146700
2016	523	491	32	152820
2017	442	409	33	157881
2018	502	468	34	164906

Sources:
2017-2018: Russian Federal State Statistics Service. Tekhnologicheskoe razvitie otraslei ekonomiki [Technological Development of Economic Segments]. URL: http://www.gks.ru/free_doc/new_site//technol/3-09.xls; http://www.gks.ru/free_doc/new_site//technol/3-10.xls; http://www.gks.ru/free_doc/new_site//technol/3-11.xls; http://www.gks.ru/free_doc/new_site//technol/3-12.xls; http://www.gks.ru/free_doc/new_site//technol/3-15.xlsx.
Miller, A.E. and T.I. Reutova. (2018). Otsenka sostoianiia i razvitiia proizvodstvennykh tekhnologii v obrabatyvaiushchei promyshlennosti [Assessment of the Current Situation and Development of Production Technologies in the Processing Industry]. Vetsnik Sibirskoi gosudarstvennoi avtomobil'no-dorozhnoi akademii. Vol. 15. 1 (59), 134-135.

At one of his presentations in the State Duma of the Federal Assembly of the Russian Federation, former Minister of Economic Development A.V. Ulyukaev said that development of the import substitution programme must proceed in three directions: diversification of imports and exports, and creation of new production capacities. I would add here modernisation of fixed assets that will allow diversification to be carried out, with a possible increase in the amount of exports of Russian products. I would say that the top priority would be to revive Russia's industry on a new technological basis: to carry out reindustrialisation of the Russian economy.

The government is focused on the local task of rapid substitution of import products in those areas that will in the near future become critically important for top priority sectors of the economy - consumer goods, health care, and provision of important social services. Further on the agenda are strategic initiatives in the sphere of provision of strategic resources and military defence systems. It is no less important to retain the unified communication space: telecommunications, communications, data transfer networks, including those in the financial sphere.

To carry out an effective import substitution policy, we need to restore the structure of Russian industry, and recreate the basic manufacturing niches that were filled by foreign manufacturers in the years of deindustrialisation and led to today's problems.

Let us take the foundation of technological independence: the machine-tool industry. Today, we manufacture 25 times fewer industrial machines than in 1991, while demand, despite the falling volume of industrial production, is still quite high, and most industrial machines are imported. Other baseline manufacturing strata are also important: microelectronics as the component base of modern industry, cutting-edge oil and gas equipment (for horizontal drilling, hydraulic fracturing, etc.). Money alone is not enough in this case. Powerful state support and concentrated effort by the state to determine top priorities and key projects are necessary. Organisational decisions being taken must be long-term, and the goals must focus on meeting these objectives. Private entrepreneurs must also be protected because modern industries are usually created by private business.

A protectionist policy must be put in place for Russian manufacturers (direct motivation for technological progress, stimulation of manufacturers' investments into modernisation of production capacities and new technologies, a reasonable and gradual decrease of imported industrial products). Changes are also necessary in the "financial space" in the life of industrial companies ("long" and "cheap" loans, changed mechanisms of providing state assistance, etc.). We must also insist on changing the administrative practice in relation to industry and entrepreneurship as a whole. We must change the legislation and law enforcement in the sphere of entrepreneurship activities, which make it possible now the voluntary decisions criminalizing common business practice; limit "grey" imports, and define legislatively the legal status of modern industrial structures (industrial parks, industrial clusters, etc.).

Previously, whenever a conversation regarding the need for reindustrialisation began, the most frequently asked question was - where to begin? Now, given the current circumstances, there is no such question. We can start on a full-scale reindustrialisation of the country with import substitution that will go in stages, in layers, from simple to complex. With this approach, we will clarify not only the global tasks and goals of reindustrialisation, but also, thanks to the current circumstances, its priorities and mechanisms for implementation.

The potential of the Russian economy is sufficient to formulate the principles of import substitution industrial policy. In the USSR (unlike the countries of Latin

America), we used to have developed industry, the role of which within the GDP has decreased recently. However, it still has a certain influence on the country's economy.

15.2. Means for Achieving Reindustrialisation and Import Substitution

The completed analysis and world practice show that successful ***reindustrialisation***, including export-oriented ***import substitution***, requires at least two priorities in national economic policy:

1 **- *a favourable economic environment* -** availability of resources, dismantling of administrative barriers and a reduction in red tape, tax holidays for industrial enterprises, long-term concessional lending, an increased level of investment and asset protection (rights and property of investors), etc.

2 ***- an active state industrial policy,*** which is focused on priority development of key spheres of material production (first and foremost, science-intensive high-tech production), as well as science and education.

Active industrial policy in the broadest sense presupposes:

- ***An adequate money and credit policy of the Central Bank and the budget and tax policy of the Ministry of Finance*** that provide the necessary financing for adequate development of industrial and agribusiness enterprises;
- ***Stimulation of internal demand*** for industrial enterprise products, including through supporting lower prices and the state order system;
- ***The long-term character of industrial programs and projects,*** allowing long-term investments to be attracted;
- ***Keeping the economy largely open*** (except the industries in the defence and

security sectors); development of cooperation with foreign partners – exchange of technologies, scientific cooperation, creation of cutting-edge production technologies;

- ***State support for export of*** competitive industrial products.

The following ***very important conclusion*** follows from the above: to achieve these goals, the state needs an active industrial policy, public-private partnerships (PPPs), selective protectionism and international cooperation in industry, science and education.

We should not forget about ***risk factors,*** of greatest importance among which are the following:

1) ***Lower competitiveness of Russian industrial products*** due to “sterile conditions” for development of Russian industrial enterprises (lack of state support and lack of competition with leading foreign manufacturers on the home market). As a result, the quality of management decreases, and all the conditions appear for lower quality and higher prices of products. This was the reason why it was decided to use not Russian-made but foreign parts in the ***Sukhoi Superjet 100***. Russian manufacturers could not provide parts at competitive prices and quality. As the pressure of sanctions grew and the exchange rate of the ruble to leading international reserve currencies fell, production of the Sukhoi Superjet 100 ran into problems. Obviously, the main way of solving this problem is to develop Russian innovative products,[282] implement applied research projects and introduce the results into industrial practice. This requires closer integration between science and industrial production.

282 Tsatsulin A.N. (2013). Podkhody k ekonomicheskomu analizu kompleksnoi innovatsionnoi aktivnosti. [Approaches to the economic analysis of complex innovation activity] *Izvestiia Sankt-Peterburgskogo gosudarstvennogo ekonomicheskogo universiteta*, 2 (80), 12-21.

2) ***Lower efficiency of the country's economy overall,*** if there is a transition from using imported products and technologies to the products and technologies of national manufacturers that are less competitive (in terms of price, quality and assortment) than foreign analogues. This situation can be observed in the oil and gas prospecting equipment sector for deposits in unconventional geological, natural and climatic conditions. Moreover, the lower quality of Russian medical equipment and medications can lead to a considerably worse quality of people's lives. Therefore, the import substitution policy in industry without a well-defined systemic approach for its implementation (including continuous monitoring of industrial development dynamics in various sectors for individual enterprises) can lead to lower competitiveness of the national economy as a whole. This is a systemic risk defined by inefficiency of the institutional environment.

3) ***Increased budget loads.*** Measures for implementing the import substitution policy within the strategy of reindustrialisation require considerable state investment. For instance, the defence industry development federal target programme for 2011-2020 will be financed to the tune of RUB 3 trillion. Should the economic situation in the country worsen (which is happening in Russia today), and should the government be unable to carry out planned budgetary programmes, the authorities will have two choices: either to cut expenses in the social sphere and in other spheres of the economy, or discontinue the financing of import substitution activities. This could result in ***increased corruption*** as representatives of state corporations and officials will get a chance (and will be tempted) to lobby the decisions regarding redistribution of limited budgetary monies.

4) ***Technology development gaps in Russian industry*** at the global level due to two circumstances. Firstly, in the case of a lengthy import substitution programme, there is a risk of partial substitution of imports from economically

developed countries with more affordable but low-tech imports from the countries of Asia, Latin America and EAEC partner countries. This will not only slow down the development of industry, but keep Russian industry lagging behind that of developed countries). The level of labour productivity in Russia is 35% of the level in the United States. This gap in productivity in non-resource sectors of Russian economy is two-thirds determined by lower technology levels and one-third by lower capital-labour ratio[283]. It will take 35 years to reach the current level of the United States, even at a productivity growth rate of 3% per year (which is higher than the current rate in Russia). But the US will also move ahead during this time, and it will take much longer to match them. Secondly, the import substitution strategy in the short term will help substitute foreign products with their Russian-made analogues. In essence, these products will be copies of foreign products and technologies currently on the market. This, too, will mean permanent technological lag . This risk can be overcome through proactive (in comparison with the production sector) development of Russia's research, design and technology base and education, which requires more active efforts in the area of science and education, and their integration with the production sector.[284]

Let me note here that political will alone, even with financial resources being available, will not suffice for implementing import substitution and reindustrialisation. To solve the complex and ambitious tasks of recreating high-tech

[283] Zaitcev A. (2016). Mezhstranovye razlichiia v proizvoditelnosti truda: rol kapitala, urovnia tekhnologii i prirodnoi renty. Voprosy Ekonomiki, №9, s. 67-93.[Zaitsev A. A. inter-Country differences in labor productivity: the role of capital, technology level and natural rent. Problems of economy, No. 9. P. 67-93].

[284] See: Krasilshchikov V.A. (1998). *Vdogonku za proshedshim vekom: Razvitie Rossii v XX veke s tochki zreniia mirovykh modernizatsii*. [In pursuit of the past century: Russia's development in the twentieth century from the point of view of world modernizations] M.: ROSSPEN.

material production, we will need world-class science and education, and culture that will make Russians proud and attract citizens from foreign countries.[285]

285 Bodrunov S.D. (2014). Integratsiia proizvodstva nauki i obrazovania i novaia industrializatsia Rossii. [Integration of production, science and education and new industrialization of Russia] 19.11.2014. *Vedomosti*, 215, 17.

CHAPTER 16. Reindustrialisation Imperatives, Opportunities and Issues[286]

A great deal has been written in recent years about how Russia needs a new model of economic growth[287] by writers who believe that a fundamental renewal of the present system of economic institutions is necessary, not merely "cosmetic" changes[288].

Reindustrialisation of a new, developing Russian economy should become its paradigm (see Chapter 7). The goals and tasks of reindustrialisation are defined in the Executive Order of the President of the Russian Federation,

[286] The chapter is based on the paper delivered at the meeting of the Scientific Advisory Board under the Chairman of the Federation Council of the Federal Assembly of the Russian Federation on 28.03.2013 and the paper presented at the plenary meeting of the Free Economic Society of Russia on 11.12.2013.

287 See: *Pshenichnikova S.N. (2013).* Investitsii v ekonomicheskii rost v evraziiskikh stranakh [Investment in economic growth in the Eurasian countries]. *Izvestiia Sankt-Peterburgskogo gosudarstvennogo ekonomicheskogo universiteta.* 5 (83), 14-26; *Bodrunov S.D., R.S. Grinberg R.S. and D.E. Sorokin. (2013).* Reindustrializatsiia rossiiskoi ekonomiki: imperativy, potentsial, riski. [Reindustrialization of the Russian economy: imperatives, potential, risks] *Ekonomicheskoe vozrozhdenie Rossii.* 1 (35), 19-49; *Popov A.I. and V.A. Plotnikov. (2012).* Vybor novoi modeli razvitiia i modernizatsiia: osnovy perekhoda k innovatsionnoi ekonomike. [Choice of a new development model and modernization; fundamentals of transition to an innovative economy] *Izvestiia Sankt-Peterburgskogo gosudarstvennogo ekonomicheskogo universiteta.* 2 (74), 197-209; *Karlik A.E. and M.A. Osipov. (2009).* Sostoianie i perspektivy makroekonomicheskogo razvitiia Rossii v kontekste teorii ekonomicheskogo rosta s uchetom krizisnykh iavleniy.[State and prospects of Russia's macroeconomic development in the context of the theory of economic growth taking into account the crisis phenomena] *Ekonomicheskie nauki.* 57, 12-18; *Popov A.I.* (2014). Neoindustrializatsiia rossiiskoi ekonomiki kak uslovie ustoichivogo razvitiia. [Neoindustrialization of the Russian economy as a condition for sustainable development] *Izvestiia Sankt-Peterburgskogo gosudarstvennogo ekonomicheskogo universiteta.* 3, 7-12; *Tatarkin A.I. (2014).* Protrezvlenie posle rynochnoi eiforii zatianulos', no vse-taki proiskhodit: interv'iu.[Sobering up after market euphoria dragged on but still happening] *Gorod 812.* 32, 21-23.

288 *Bodrunov S.D. and R.S. Grinberg.* (2013). Chto delat'? Imperativy, vozmozhnosti i problemy reindustrializatsii. *Reindustrializhastiia: vozmozhnosti i ogranicheniiat Sbornik materialov Nauchno-eksperimental'nogo soveta pri Predsedatele Soveta Federatsii RF.* [What to do? Imperatives, opportunities, and challenges of reindustrialization. In: Collection of materials of the Scientific expert Council under the Chairman of the Federation Council of the Russian Federation "Reindustrialization: opportunities and limitations"] M.: Izd. Soveta Federatsii RF; *Bodrunov S.D. (2014).* Reindustrializatsiia rossiiskoi ekonomiki - vozmozhnosti i ogranicheniia. *Nauchnye trudy Vol'nogo ekonomicheskogo obshchestva Rossii.* [Reindustrialization of the Russian economy: opportunities and limitations. *Scientific works of The free economic society of Russia.*] 1, 15-46.

dated 07 May 2012, No.596 “On the Long-Term State Economic Policy”. It is particularly important todetermine targeted indicators to check the solution of two interconnected major challenges: increase in investment in reindustrialisation (by not less than 25% of GDP by 2015, and up to 27% by 2018); the creation and development of 25,000,000 high-tech jobs by 2020.

16.1. Reindustrialisation of Russia: Prospects and Resources

Academician S.Y. Glazev indicates that the depression in economic sectors which have reached maturity provides additional opportunities to low-performing sectors. A crisis reduces the capitalisation of companies with advanced technologies and expands opportunities for buying controlling stakes in these companies or technologies. Moreover, as industry leading companies reduce their demand for high-technology equipment, it becomes more available for countries, dealing with challenges of catch-up development. For example, in the 1970s, South Korea was busy with the acquisition of equipment and technologies of Japanese shipbuilding, when tthe question of decrease of its excessive capacities came up. This dimension is the consistent part of the politics of industrial development known as ‘flying geese paradigm’, elaborated by Japanese economist Kaname Akamatsu[289].

To make a successful technological leap, policy-makers should properly estimate prospective growth areas and proactively implement new

[289] Akamatsu, Kaname (1962). A Historical pattern of Economic Growth in Developing Countries. Developing Economies No.1, p. 1-23.

technologies in sectors that are at the initial stage of development of a new technological mode. As mentioned above in Chapter 4, ***a characteristic of the current stage*** of economic development is that dominant technological modes are changing[290]***and*** new technological pathways are being opened.

Despite current challenges, Russia has the opportunity to join the leading group of global technological powers. We only need to properly assess our possibilities and consider limitations and risks. Our first question is: does Russia have enough ***financial resources*** for reindustrialisation? If the volume of investments in reindustrialisation it to be equal to 25% of GDP in 2015 (up to 27% of GDP in 2017), investment will have to amount to 20 trillion rubles per annum. The "Development of industry and increasing of its competitiveness" programme approved by the government at the end of December 2012 projected investment during the period until 2020 to be approximately 440 bn rubles per year. And this programme did not include all investment projectsnecessary for reindustrialization. Moreover, the Presidential Executive order included private as well as public investment only. Even so, thesefigures show that we need a dramatic increase in investment and that requires the repositioning of monetary and credit resources of both the state and corporations. However, the real level of investments to fixed assets was 20% of GDP in 2015 and 21,5% in 2017. [291]

[290] Strategiia ekonomicheskogo razvitiia Rossii. Po materialam obshcherossiiskoi diskussii, provedennoi Komitetom Gosudarstvennoi Dumy po ekonomicheskoi politike i predprinimatel'stvu, Otdeleniem ekonomiki RAN, Rossiiskim torgovo-finansovym soiuzom i Rossiiskim economicheskim zhurnalom. Reports presented at extended meetings of the State Duma Committee on Economic Policy and Entrepreneurship. (2000). [Strategy of economic development of Russia. According to the materials of the all-Russian discussion held by the State Duma Committee on economic policy and entrepreneurship, Department of Economics, the Russian trading-the financial Union and the Russian economic magazine. Reports presented at extended sessions of the State Duma Committee on economic policy and entrepreneurship]. *Rossiiskii ekonomicheskie zhurnal*. 7.

[291] (2019). Investitcii v Rossii. 2019: Statisticheskii sbornik. M.: Rosstat, s. 11 [Investment in Russia. 2019: Statistical collection, Moscow: Rosstat, p. 11].

Current levels of money supply of the Russian economy (under 50% of the GDP) and volume of credit (only 35% of the GDP) do not provide for positive economic growth. Financing industrial development is particularly difficult when interest rate exceed profit rates in key industries. Together with loosening of monetary, budgetary and fiscal policy, lowering of cost of credit for industry it is necessary to implement measures, which can reverse the trend of a large-scale outflow of capital from Russia, etc.

The expansion of credit issue for financing of structural investment modernisation programs and selected sectors of the national economy and industry can be a source of financing for large-scale modernisation of the national economy. Credit can be extended through real indexation of private deposits in Sberbank made before 1991. They are devaluated ten times by sudden hyperinflation during ‘shock therapy’ policy of 90s with insignificant deposit rate in compare to the rate of inflation. It is rational to limit the application of these indexed funds to three options (to be selected by citizens):

1) making a deposit to pension capital;

2) generating a mortgage fund for financing of social mortgage loans (for people in need of improved housing conditions);

3) acquiring shares of a special public investment fund for the modernisation of the national economy.

To ensure enough credit is available for financing of priority investment projects “financial freedom” will have to be limited and the risks of financial crises managed. This will require, first, a substantial improvement in credit policy and in the transparency of both general and foreign currency cash flow.

In particular, the struggle to bring the rate of inflation to 3-4%, allegedly to lower interest rates and thus investment in technologically advanced sectors, must be abandoned. Not only have they not worked, these policies have both domestic investment and markets and actually led to higher inflation.

Financial resources for reindustrialisation can also be provided by a policy of changing the balancebetween the export and import of capital.

The most controversial d and critical issue in providing the financial sources needed for reindustrialization is the application of financial reserves. We believe it is wrong to view only the National Wealth Fund (from 1st of January 2018, the former Reserve Fund was merged with it), as reserves against a possibility of a crisis. If we do that, the Reserve Fund which 01.09.2020 amounts to $ 177,61 bn or 11,7% of Russian GDP, will withdraw over 13 trillion rubles from the economy, monies which will not contribute to modernisation and innovation.In compare, this Fund was only 3, 75 trillion rubles or 3,6% of GDP in 1st of January 2018[292]. . But, at the same time, the country's gold and foreign currency reserves which in 25.09.2020 are equal to more than $580 bn (over 44 trillion rubles)[293] constitute an important financial reserve against crisis. Also, there are reserves of the Deposit Insurance Agency (3,5 trillion rubles)[294]. On the whole, the country's financial reserves in 2020 are equal to around 60 trillion rubles. According to available estimates, they are

[292] Ministry of Finance of the Russian Federation (2020). Volume of the National Welth Fund. Publish date: 11.09.2020 URL: https://minfin.gov.ru/en/key/nationalwealthfund/statistics/?id_65=104686-volume_of_the_national_wealth_fund

[293] Bank of Russia (2020). Databases. International Reserves of the Russian Federation (End of period) URL: https://www.cbr.ru/eng/hd_base/mrrf/mrrf_7d/

[294] Otchet o deiatelnosti gosudarstvennoi korporatcii «Agentstvo po strakhovaniiu vkladov» za pervoe polugodie 2020. [Report on the activities of the state Corporation "Deposit insurance Agency" for the first half of 2020] URL: https://www.asv.org.ru/agency/annual/2020/2020-II.pdf

tentimes as much as was spent by Russian government for the bailout of 2009 crisis (according to the estimation of deputy chairman of the Accounts Chamber of the Russian Federation it was 13,9% of GDP or about 5,4 trllion rubles)[295].

The further accumulation of such financial reserves makes no sense and could be even more dangerous for the economy than a shortage of these reserves. Accumulated financial reserves just moderate the consequences of crisis in the monetary and financial sectors, while it is the modernisation of economy that is a true and reliable protection from crisis.

We should think of financing reindustrialisation by transferring part of the state's gold and foreign currency reserves to the management of the Development Bank (now State Development Corporation 'VEB.RF'). This would increase the return on these funds: (in 2008, such funds obtained a maximum 4% return on dollar assets and 5.57% on euro assets.The minimum return, recorded in 2012t was a dismal 0.33% on dollar assets and 1.09% for euro assets.

To anticipate critics, let us note that the risks from any shortage of reserves that will result from their investment in reindustrialization are insignificant in comparison with risks arising from the preservation of primitive production patterns, time-worn infrastructure, technological inferiority, wide-scale poverty, shortage of housing and other problems, all of which need investment.

[295] Goregliad V.P. (2013). Mirovoi krizis i paradigmy gosudarstvennogo finansovogo regulirovaniia. M.: REU im. G.V. Plekhanova, , c. 206 [Goreglyad V. P. world crisis and paradigms of state financial regulation. Moscow: Plekhanov Russian University of Economics. P. 206].

Another way to increase investment in reindustrialization is by lowering taxation and changing its structure. According to the Ministry of Finance, tax concessions cost 1.8 trillion rubles per year (almost 3% of the GDP as of 2014 year-end). Most of these are on profit tax, VAT, MPT and corporate property tax. Industry gets no considerable tax relief. Instead, it is "fleeced" by every interfering bureaucrat in town. For example, the Legislative Assembly of Saint-Petersburg cancelled the industrial enterprises property tax relief that had been provided when new cadastral values of land exceeding market value were registered the base for this tax. Tax relief was instead provided to the most "financially struggling" (that really is not true…) sectors: trade, oil and gas producers, etc. In this case, the bureaucrats did not act in favor of the development or modernization of the industry, but in favor of the sectors that control the largest financial flows. Bringing discipline into the taxation system and reallocating relief strategically to the industrial sector can vastly improve investment for reindustrialisation.

While point to Russia's low ***nominal*** profit tax rate to Europe's much higher rate, 40-45%, in fact, Russia's ***effective*** rate of profit tax is comparable to Europe's at 20-22%. The difference between Europe and Russia is that in Europe profits reinvested or invested in innovations is exempt from tax in European countries. We need to restore such tax relief despite fears that it will only lead to corruption.

Russia should remain fully engaged with activities of international financial organisations without, however, entertaining any illusions of having a serious influence on their projects and decisions. It is obvious that they will express the interests of leading economic powers, who are unlikely to help turn Russia into an independent economic power.

Russia's government is able to borrow abroad on more acceptable terms, than private business from international financial institutions, national institutions of other states and international private financial companies. These funds can be channeled into special investment funds for financing development, innovation and re-industrialization. In Japan and in the Republic of Korea, governments co-financed much development and industry through public development banks.

Direct foreign investments (FDI), however, are not and cannot be the main source of large-scale modernisation of the Russian economy. In 2008 Russia received $27.03 bn of FDI, which was under 10% of the total Gross Fixed Capital Formation (GFCF) and of this only 4.5% went to the high-tech sector of the Russian industry, 12% – to extractive industries and 23% – to wholesale and retail.

It is difficult to imagine foreign investors committing to sectors which are avoided even by local business. Russia's attractiveness to foreign investors in the process industry sector, particularly in engineering, can be improved through lower internal prices for energy, metal, plastics, which account for up to 70% of expenses in automobile manufacturing, production of construction and agricultural machines. However, such options are precluded because all these products have been subject to 'free market' or 'global' pricing The state's investment efforts are critical to attracting foreign investment: indeed, it is unlikely that foreign investors will invest in the Russian economy when the state itself does not.

International financial institutions can be treated as platforms for specifying our vision of how the global financial system and terms of international trading of goods and services need to change though, while doing so, it is critical to obligations that hinder modernisation of the Russian economy.

The sort of international financial system we would like to see would feature the establishment of an international financial centre in Moscow but one which does not generate crises as the current world financial system does. This requires new rules for this centre, which would encourage the activity of real investors rather than speculators, and which would not conduct crises into Russia but provide a wall against financial contagion. Russia possesses the leverage to turn financial flows towards reindustrialisation and technological modernisation of the country, as V.V. Ivanter points out when he argues that the accumulated reserves of the state, energy generating and commodities-based industries, and the expansion of credit can be used as financial resources for investment and development.[296] He rightly believes that the very fact of applying these reserves will lead to the return of substantial funds to Russia, which will multiply the investment process.

16.2. Reindustrialisation: Overcoming Structural Imbalances

[296] Ivanter V.V. (2013). Novaia ekonomicheskaia politika. [New economic policy] *Ekonomicheskoe vozrozhdenie Rossii*. **2 (33)**, 7-12.

Russia's economy suffers from colossal structural disproportions. They distort financial flows and Russia's relations with the world economy, preserving its dependence on energy and primary commodities. The non-oil and gas budget deficit, which exceeded 10% of GDP in 2015, is an indicator of the budget's dependence on oil and gas revenues. As noted by the head of the Accounts Chamber of the Russian Federation Alexey Kudrin, from 2016 to 2019, the non-oil and gas budget deficit decreased from 9.1% of GDP to 6.1%. However, this was achieved due to the fact that the level of Federal spending decreased from 2016 to 2018 from 19.1% of GDP to 16.1% of GDP[297], and thus did not help in any way to finance economic development.

Though Russia is a leading energy producer, it is far from being a leader in the production of advanced technological equipment for exploration, extraction and refinement of oil and gas resources, and other commodities goods, due to the under-performance of its engineering industry.

Minerals amounted to 53.8% of Russian exports, machines, equipment and transport – 8.8% in 2000; in 2005 the figures were 64.8% and 5.6%, respectively; and in 2011 – 71.1% and 5%, respectively. This is why few expect Russia to escape its y a purely energy- and raw-exports role in the world economy. However, while this sector will remain an important part of Russia's economy we cannot allow it to become our trap,[298].

[297] Informatcionnoe agentstvo Finmarket (2019). Kudrin: tcelesoobrazno ne snizhat neneftegazovyi defitcit biudzheta menshe 6% VVP v blizhaishie 10 let. 16.09.2019 [Finmarket news Agency. Kudrin: it is advisable not to reduce the non-oil and gas budget deficit to less than 6% of GDP in the next 10 years. 16.09.2019] URL: http://www.finmarket.ru/news/5076822

298 "Should we pursue this scenario," said Vladimir Putin at his speech at the extended session of the National Council "On the Strategy of the Development of Russia till 2020" (08.02.2008), "We will be unable to ensure both the security of the country and its normal development. We will expose its existence to a threat; that is

We need a comprehensive industrial policy***or Russia's reindustrialisation through the planning and deployment of internal industrial and technological chains for production of both industrial inputs and consumer goods.***

Despite apparent losses in scientific and technical, academic and technological potential, Russia is capable overcoming its degradation and meeting the challenge of ***modernisation.*** Russia possesses 17 out of 50-55 macro-technologies composing the fifth technological mode (including nuclear, space, aviation technologies, separate segments of nano- and biotechnologies, as well as technologies in oil and gas production and processing, manufacturing of certain types of weapons, chemicals, power generation and transport machine building [299]). We should remember that technologies and machinery available on the market are always things of the past from the scientific and technological standpoint. So reliance on imports for creating out own technological base unavoidably ***strengthens*** technological inferiority and technological dependence.[300]

Estimating forthcoming difficulties, we shall recall our history of the twentieth century, which raises our possibility to implement megaprojects in

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what I put without any exaggeration". Site of the President of Russia. URL: kremlin.ru/events/ president/ transcripts/24825.

[299] See: Nauchnaia sessiia obshchego sobraniia RAN "Nauchno-tekhnologicheskii prognoz - vazhneishii element strategii razvitiia Rossii". (March 2009). *Vestnik RAN*. Tom. **79**, № 3.[Scientific session of the General meeting of the Russian Academy of Sciences "Scientific and technological forecast – the most important element of the Russian development strategy (March 2009). *Bulletin of the Russian Academy of Sciences*. Volume 79, No. 3].

[300] This does not mean a refusal from import. We should overcome the mentality of "hopeless obsolescence" and build a smart foreign economic policy that would take in account all aspects of this challenge.

the conditions of ruined engineering base, for example, after the Civil War or during the World War II[301].

The geopolitical situation for the country in some cases may predetermines the need for self-supportability for many sectors, even if it is more efficient from an economic point of view to use international division of labour. Reindustrialisation should focus on creatinga "self-development core" – a number firms manufacturing technologically advanced equipment for industrial sectors essential to our security. These firms should not rely on imports but have develop backward linkages domestically as the U.S., Japan and Germany have done and, in critical sectors, continue to do. This is the track followed by the countries which seek to become "the poles of dominance". The desirability of moving to a more egalitarian world that allows all countries to enjoy the benefits of international cooperation does not exclude the need to take into account the real circumstances that force them to fight for the necessary level of scientific and technological independence.

Thus, the state programme of industrial development in the machine-tool industry must aim at "import-substitution in machinery production with dual use technologies most demanded by military-industrial complexes. Such a complex is ***necessary*** for maintaining the armed services and equipping them with competitive weapon systems to ensure the protection of Russia's geopolitical and economic interests.[302].

301 This refers not to the reproduction of this experience under the current conditions, but to the possibility of solving this issue in principle.

302 This is evidenced by information in mass media on the rejection in import of NC systems for five-axis processing of details, the application of an obligatory condition to license export of double-purpose technologies in contracts for delivery into Russia by EU countries, the U.S. and Japan, which prohibits unauthorised use and

Such objectives for the machine tool industry necessarily implies public investment and production if the scale, quality and technological sophistication are to be high enough. .[303].

16.3. Urgency of an Innovation Breakthrough

Russia's strategy of innovative development until 2020 is aimed at the modernisation of the Russian economy's technological base. Its success can be measured by the share of enterprises in it that are actively innovating and by volume of its innovative products (Fig. 33).. The strategy specifies the scenario of catching-up development with elements of leadership in separate segments of the economy, in which we have already built, or can build, a competitive edge. According to targets specified in this document[304], the share of actively innovating industrial enterprises should increase by by a factor of 4-5 between 2010 and 2020, while the share of innovative products in the total volume of industrial products – should increase by a factor of 5-7. The share of Russian high technology goods in the total volume of exports was to grow by a factor of 8 over the same period. However, as data at Fig. 33 shows, there is no chance

transportation of high-technology mechanical processing equipment (for example, a requirement to equip machines with location monitoring GRS sensors or obligatory connection of equipment to the Internet).

303 According to published expert estimates, 70% of minor components used in the equipment manufactured by Russian machine tool building plants are imported.

304 Strategiia innovatcionnogo razvitiia Rossiiskoi Federatcii na period do 2020 goda. Utverzhdena rasporiazheniem Pravitelstva Rossiiskoi Federatcii ot 8 dekabria 2011 g. № 2227-r. [Strategy of innovative development of the Russian Federation for the period up to 2020. Approved by decree of the government of the Russian Federation No. 2227-R of December 8, 2011.]. URL: http://static.government.ru/media/files/4qRZEpm161xctpb156a3ibUMjILtn9oA.pdf

to fulfill these targets, because there are no positive shifts in the innovation activity.

In the 2014 was adopted the State program of Russian Federation "Economic development and innovation economy" with the aim to increase in 2024 the share of innovative active enterprises to 50%.[305] This target was confirmed in Presidential decree in 2018.[306]

The difficulties with the fulfillment of the targets of these programs induced the elaboration of a new one: "The strategy of scientific-technological development of Russian Federation". This strategy was adopted in 2016[307], in spite of the opinion of experts who believed that without analyzing the reasons for the failure of previous strategies, the new one will also not bring success[308]. The strategy is designed for two stages – 2017-2019 and 2020-2025, and it also mentions that it is valid until 2030-2035. However, this document does not put forward any specific goals that have quantitative characteristics, with the exception of two indicators of the cost of innovation activity.

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[305] Gosudarstvennaia programma Rossiiskoi Federatcii "Ekonomicheskoe razvitie i innovatcionnaia ekonomika". Utverzhdena postanovleniem Pravitelstva Rossiiskoi Federatcii ot 15 aprelia 2014 N 316 [State program of the Russian Federation "Economic development and innovative economy". Approved by the decree of the government of the Russian Federation of April 15, 2014 No. 316]. URL: https://www.economy.gov.ru/material/file/eaa304362f96677e423a4721a1f565aa/316_141019.pdf

[306] Ukaz prezidenta Rossiiskoi Federatcii «O natcionalnykh tceliakh i strategicheskikh zadachakh razvitiia Rossiiskoi Federatcii na period do 2024 goda» №204 ot 7 maia 2018 [Decree of the President of the Russian Federation "On national goals and strategic objectives of the development of the Russian Federation for the period up to 2024" No. 204 of may 7, 2018]. URL: http://static.kremlin.ru/media/acts/files/0001201805070038.pdf

[307] Strategiia nauchno-tekhnologicheskogo razvitiia Rossiiskoi Federatcii. Utverzhdena Ukazom prezidenta Rossiiskoi Federatcii ot 1 dekabria 2016 g. № 642 [Strategy of scientific and technological development of the Russian Federation. Approved by decree of the President of the Russian Federation No. 642 of December 1, 2016]. URL: http://static.kremlin.ru/media/events/files/ru/uZiATIOJiq5tZsJgqcZLY9YyL8PWTXQb.pdf

[308] Fonotov A. G. (2016). Strategiia-2035. Zhelaemoe. Vozmozhnoe. Dostizhimoe. *Innovatcii, № 6 (212*), s.24 [Fonotov A. G. (2016). Strategy-2035. Wishful. Possible. Achievable. *Innovations, No. 6 (212),* p. 24]a

The 2035 strategy was the latest in a long line of such plans: the 2020 Strategy, the 2024 State Program, theMinistry of Economic Development and Trade's 2000 plan for he principal directions for Russia's long-term social and economic development; the ; 2005 plan for Principal Directions of Policy for the Russian Federation in the Area of Innovation Systems Development until 2010; and the 2006 Strategy for the Development of Science and Innovations in the Russian Federation until 2015.

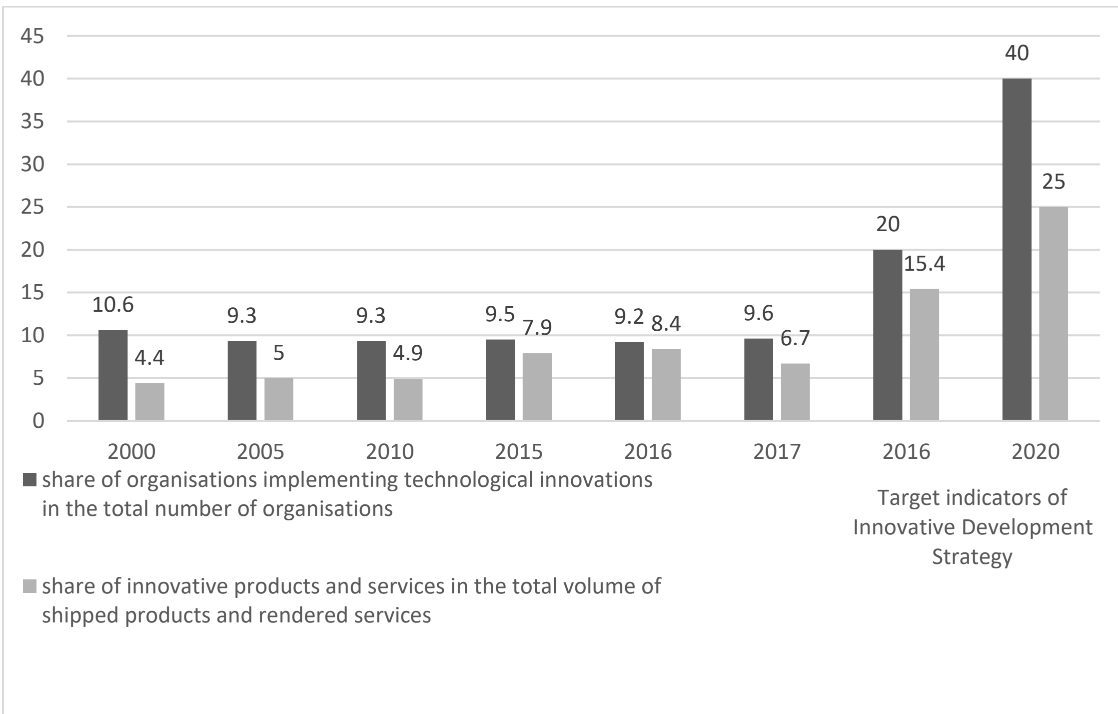

Fig. 33 Dynamics of industrial innovative activity

Sources:

Gokhberg, L.M., K.A. Ditkovsky, I.A. Kuznetsova et al. (2019). *Strategiia innovatsionnogo razvtiia Rossii na period do 2020 g.; Indikatory innovatsionnoi deiatel'nosti: 2019* [Russia's Innovative Development Strategy to 2020; Innovative Activity Indicators: 2019]. M.: NIU VShE.

So how realistic were their aims and why did they fail to meet their targets?

While an active innovation- and investment-friendly state stance is a necessary condition for industrial policy success, it is not a sufficient one. This stance must also be realistic, appreciating the limits of the possible, as both Russian and other national experiences how. WWhile control concentrated I a state permits it to accurately target its resources at certain innovation breakthroughs, say in space, nuclear, aviation, rocket production segments etc., success is also determined by economic performance on the whole. It too should involve large-scale application of technical, technological, organisational and administrative and other novelties, rely on advanced scientific knowledge in the related areas, while using results produced in sectors prioritized by innovation policy. The state itself is cannot entirely ensure this.

This means that successful industrial policy is also contingent on a critical number of entrepreneurs taking an interest in employing technological innovations in their own production. This element is sorely lacking in Russia, with neither the state, nor business generating demand for innovations. While Russian state expenditure on research and development (R&D) as a percentage of GDP, a fundamental element in fostering innovation is comparable with any leading country, expenditures of Russian entrepreneurs for these purposes are much smaller. So aggregate spending on R&D is much smaller and indicators reliant on it are negative (Table 10).

TABLE 10 Research intensity and scientific output of the national economies of several countries (2004)

Country	GDP per worker, thousands of USD	Share of R&D spending in GDP, %	Current competitiveness index	Share of hi-tech products in export, %	Share in global export of hi-tech equipment, %
U.S.	73.1	2.64	2*	28.2	16.3
China	7.2	1.0	46	16.7	4.6
Germany	56.0	2.50	13**	15.3	4.8
France	56.5	2.20	27	19.4	3.4
Russia	18.0	1.24	70	3.1	0.2

* In 2006 – 6th place

** In 2006 – 8th place

Sources:

Innovatsii v tsifrakh: 2004 [Innovations in Figures: 2004]. M.: TsISN.

World Economic Forum. *Global Competitiveness Report 2004-2005*.

There are two levels of problems limiting private sector innovation. First, these are macro-level problems: heavy "brain drain"; weak protection of intellectual property; high "anti-innovation" cost of credit; inadequate channels of distribution of public resources (corruption, bribes etc.); independence of public financing system and problems of private financing of projects and other. These problems are widely known.

Problems on the micro-level – the level of industrial enterprises – are analysed much more rarely. There is much to examine here since even the best macro-level environment cannot promote adequate innovation without effective change managers, and executive staff ready for the challenges of innovation; without enterprises' experience in the area, developed management systems, the corresponding infrastructure etc.

Of course, Russia also faces national-level problems: non-optimality and underdevelopment of infrastructure for innovation, transfer of technologies and intellectual property control. Comparing the situations in both Russia and China is particularly important in this regard (Table 11).

TABLE 11 Intellectual property (IP) management

China	Russia
Strategy "Towards innovative economy through intellectual property market" (adopted in mid-1990s)	Initiates the formation of IP management mechanisms (2010)
Public control system: unified – committees on intellectual property (vertical management– from Beijing to regional centres)	No unified public mechanism and no comprehensive policy: management on the federal level – over 20 ministries and departments; IP management in several regions supervised by "economic", "industrial" and/or "scientific" committees/departments
Number of IP objects: up to 30,000 patents per 1 municipality annually	Number of IP objects: 44,600 patents for the entire country in 2011

In 2011 totally were registered in China 526 412 patent applications, in Germany - 59 444, in Japan – 342 610, in USA – 503 582[309]. The ratio between patents in Russia and in other countries remains roughly the same now, if nor worse, with significant progress in China: in 2018 totally were registered in China 1,542,002 patent applications, in Germany - 67,898, in Japan – 313,567, in USA – 597,141, and in Russian Federation - 37,957[310].

China's success is in many ways due to its strategy, "An innovative economy through the market of intellectual property", implemented by the country, and due to the creation of a tough centralised system of public control over this process through committees on intellectual property (up to and including municipality), which help to lower administrative barriers in the process of shaping and development of the national intellectual property (IP) market. This experience was put to use in Kazakhstan, where all IP issues were passed to the Committee on intellectual property under the RK Justice Ministry, which has branches up to the municipal level (Table 12).

TABLE 12 State Intellectual Property Management in the CIS*

Country	Government entity
CIS	Interstate Council on Legal Protection and Defense of Intellectual Property (since 14.08.2011) - all intellectual property items (IPIs), Council on IP Matters under the Integration Committee of EurAsEC
Russian Federation	Federal Service for Intellectual Property (Rospatent) and 20 federal agencies (27.03.2013 - Ministry of Education and Science supported the project of creation of a single ministry of IP). Government Commission on Economic Development and Integration (sub-commission for IP)

309 World Intellectual Property Indicators 2012. WIPO Economics & Statistics Series. Geneve: WIPO, 2012, p. 172-175

310 WIPO (2019). World Intellectual Property Indicators 2019. Geneva: World Intellectual Property Organization, p. 32-33.

Republic of Kazakhstan	Committee of IP rights under the RK Ministry of Justice – all IPIs, structures up to the municipal level, Committee on Protection of IP Rights
Republic of Armenia	IP Agency (since 2002) – all IPIs, Inter-Institutional Commission to Oppose IP Violations (2009)
Republic of Azerbaijan	Agency on Copyright, State Committee on Standardisation, Metrology and Patents
Republic of Belarus	National Centre for IP under the State Committee for Science and Technology (since 2004) – all IPIs; Inter-Institutional Research and Methodology Council in the Area of IP (since 2005); Committee on Protection of Rights and Countering Violations in the Area of IP under the Council of Ministers of the RB
Kyrgyz Republic	Public service for IP and innovations under the Government of the KR – all IPIs, Inter-Institutional Committee on Countering IP Violations, State IP Fund
Republic of Moldova	Government-owned corporation "Public corporation for IP" under the Government of the RM – all IPIs
Republic of Tajikistan	National Centre for Patent and Information (NCPI) under the Ministry of Economic Development and Trade
Turkmenistan	Patent management under the Ministry of Economy and Development (1.03.2013 –Government resolution on the establishment of IP public service – all IPIs)
Republic of Uzbekistan	Agency for IP (since 2011) under the RU Cabinet of Ministers – all IPIs, Republican Committee on Countering Trading in Counterfeit Goods
Ukraine	IP public service under the Ministry of Education, Science, Youth and Sport – all IPIs, Coordination Council on Countering Violations in the Area of IP, Research and Development Establishment on IP of the National Academy of Sciences of Ukraine

*Sources: Republican Scientific Research Institute of Intellectual Property, Moscow.

The innovative activity of the business community depends not only on the availability and smoothness of the work of national innovation system institutions. What entices or forces entrepreneurs to modernise their business? The answer has long been known to the science of economics:

competition[311]. Innovation is one of the most important tools of competition, although it is an expensive one. Entrepreneurs will become seriously interested in new machines and technologies, if costs of their own application do not exceed labour costs. When labour is cheap, expenditures for technological renovation of existing production make no economic sense[312].

Speaking of the price of labour, we should not forget Russia's poverty indicators. Although, as Table 13 shows, the share of the population below the poverty line was 2.5 times lower in 2018 than in 1992, it is critical to note that whereas between 1992 and 2000, the poverty line stood at 50% of per capita income, now it is at 30% of per capita income. The share of people who receive less than 50% of per capita income has not changed since 2000, and is equal to almost 30% of the country's population; over 70% of the poor are economically active and t 10% are retirees. Moreover, as Table 14 shows, much of this cheap labour is employed in precisely those sectors that we wish to modernize. If this situation continues, it will be difficult to expect entrepreneurs' interest in innovations.

TABLE 13 Poverty indicators

311 "The law of the determination of value by labour time, a law which brings under its sway the individual capitalist who applies the new method of production, by compelling him to sell his goods under their social value, this same law, acting as a coercive law of competition, forces his competitors to adopt the new method". Marx was clearly referring to what was common knowledge. He quoted a publication of 1720: "…Every art, trade, or engine, doing work with labour of fewer hands, and consequently cheaper, begets in others a kind of necessity and emulation, either of using the same art, trade, or engine, or inventing something like it, that every man may be upon the square, that no man may be able to undersell his neighbour" ([H. Martyn] *The Advantages of East-India Trade to England*. London, 1720. P. 67) *(Marx K.* (1975). *Capital*. V. 1. In: Marx K. and F. Engels. F. Collected Works. Vol. 35. New York: International Publishers. P. 234).

312 This fact was observed by the first Russian political economist I.T. Pososhkov, who noted - in the manuscript prepared for Peter I (1724) - that "poor feeding hinders the interest of Russian people in best practices and prevents fair art multiplication" *(Pososhkov I.T. (2001). Kniga o skudosti i bogatstve*. [A book about scarcity and wealth] M.: "Economic Paper" Publishing, p. 248). Note, that "fair art" meant state of the art techniques in handicraft and industrial work in those days, i. e. to put it in modern language, low income does not promote modernisation.

Year	1992	1998	2000	2010	2018
Share of population with income below subsistence minimum, %	33.5	23.4	29.0	12.5	12.9
Subsistence minimum to per capita cash income, %	47.2	48.8	53.0	30.7	31.5
Share of population with income less than 50% of per capita cash income, %	26.5	~32	~29	~29	~29

Sources:
Russian Federal State Statistics Service. Raspredelenie naseleniia po velichine srednedushevykh denezhnykh dokhodov [Allocation of Population by Average Per Capita Cash Income]. Updated on 13.07.2019. URL: http://www.gks.ru/free_doc/new_site/population/bednost/tabl/1-2-1.doc;
Russian Federal State Statistics Service. Velichina prozhitochnogo minimuma (v srednem na dushu naseleniia; rublei v mesiats) [Subsistence Minimum (Average Per Capita; Rubles per Month)]. Updated on 08.07.2019. URL: http://www.gks.ru/free_doc/new_site/population/urov/urov_41kv.doc;
Russian Federal State Statistics Service. Chislennost' naseleniia s denezhnymi dokhodami nizhe velichiny prozhitochnogo minimuma i defitsit denezhnogo dokhoda [Number of People with Cash Income below Subsistence Minimum and Cash Income Deficit]. Updated on 02.08.2019. URL: http://www.gks.ru/free_doc/new_site/population/urov/urov_51g.doc.

At the same time, ***overcoming of cheapness of labour power is a compulsory, but not a sufficient condition for entrepreneurs' innovative efforts.*** The truth is that innovationis risky, as both economic science[313], and businessmen themselves[314] attest. It is no accident that the development of innovative entrepreneurship has required a wide spread of derivative financial instruments (derivatives) designed to insure investment risks. For example, innovative leasing is a risky operation due to the high uncertainty of the results

313 "The far greater cost of operating an *establishmen*t based on a new invention, as compared to later establishments arising out of their ruins, ex suis ossibus. This is so very true that trail-blazers generally go bankrupt..." *(Marx K. Capital*. V. 3, (1998). . in: Marx K. and Engels F. Collected Works. Vol. 37. New York: International Publishers. P. 106).

314 As Victoria Livshitz, founder of Grid Dinamics (Silicon Valley, U.S.), notes, "There is statistic in the U.S. that one out of ten enterprises becomes very successful. Two of them survive, and seven go bankrupt. But these ten projects are not taken from the street – they are the best of the best" (quoted from: *Bilevskaya E. (2010)*. Kreml' otsenit riski. [The Kremlin will assess the risks] *NG*. 11.08.10. P. 3).

of innovative entrepreneurship and the capital of such leasing projects needs to be hedged. Obviously, an investor is unlikely to invest their own funds in innovation without applying such protection measures, given the well-known statistics of risks in the implementation of innovative projects. Derivatives are the instruments of such hedging. Should a businessman have cheaper and more reliable competition tools at his/her disposal, he/she would rather choose them. However, derivatives, by protecting the basic assets from risks, increase the risk when these instruments themselves are traded. This fact played a significant role in the development of the financial crisis of 2008-2009.

TABLE 14. Average monthly nominal wage by sector, % to Russia's average

Year	1995	2000	2005	2011	2018
Average wage, rubles	472.4	2223.4	8554.9	23,369.2	43,445
By sector					
Fuel and energy resources	2.6-fold increase	3.1-fold increase	2.7-fold increase	220.8	293.7[1)]
Finance	1.5-fold increase	2.3-fold increase	2.6-fold increase	238.7	211,1
Production of machinery and equipment	80.3	88.8	97.9	97.5	91.3
Production of electrical, electronic and optical equipment	76.0	90.1	96.1	100.0	117[2)]

1) – oil and gas
2) – production of computers, electronic and optical goods
Sources:

Russian Federal State Statistics Service. (2019). *Russia in Figures 2019*. M.

Russian Federal State Statistics Service. (2003). *Russia in Figures 2003*. URL: http://www.gks.ru/bgd/regl/B03_11/IssWWW.exe/Stg/d010/i010680r.htm

16.4. Reindustrialisation Workforce

One imperative of reindustrialisation is the investment in human capital and an active ***personnel*** policy; it was planned to create an upgrade of 25 million high-tech working places by 2020[315]. Let us examine two important aspects of this problem:

- professional, social and demographic profile of personnel engaged in industry, possibility of their retraining and career development;
- problems and prospects of new personnel training for the industry.

The drain of specialists (especially those of active age) from industry still continues. The average number of employees in the economy of Russia was down from 1990 to 2010 by 7.7 million people (from 75.3 to 67,6) , and by 10.4 million people (from 21.0 to 10.6) – in industry[316]. The overall decline in employment was less than the decline in industrial employment, as there was an increase in the number of jobs in trade, finance, and other service industries, where some of those laid off from industrial enterprises moved. Mechanical engineering was compromised most of all, of7,7 million engaged in it in 1990, there were fewer than 3 million workers left. Not only did the number of industrial and manufacturing personnel decrease by 2.5 times, the situation reached disaster proportions in certain types of mechanical engineering. (Table 15).

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315 Ukaz Prezidenta Rossiiskoi Federatcii ot 07.05.2012 g. № 596 «O dolgosrochnoi gosudarstvennoi ekonomicheskoi politike» [Decree of the President of the Russian Federation No. 596 of 07.05.2012 "On long-term state economic policy"]. URL: http://kremlin.ru/acts/bank/35260

316 Tablitca 3.8. Srednegodovaia chislennost zaniatykh v ekonomike. Federalnaia sluzhba gosudarstvennoi statistiki. Trud i zaniatost v Rossii - 2011 [Table 3.8. Average annual number of people employed in the economy. Federal state statistics service. Labor and employment in Russia - 2011] URL: https://rosstat.gov.ru/bgd/regl/B11_36/IssWWW.exe/Stg/d1/03-08.htm;Obrabatyvaiushchaia promyshlennost v Rossii i v mire (sravnitelnyi analiz 13 stran). Avgust 2018 goda. Analiticheskii Otchet **J'son & Partners Consulting [Manufacturing industry in Russia and in the world (comparative analysis of 13 countries). August 2018. An analytical Report by J'son & Partners Consulting]**. **URL**: https://json.tv/ict_telecom_analytics_view/obrabatyvayuschaya-promyshlennost-v-rossii-i-v-mire-sravnitelnyy-analiz-13-stran-20180816061422

TABLE 15 Reduction in the number of industrial and manufacturing staff (IMS) in industrial production and mechanical engineering

Industrial segment	1990	1995	2004	Reduction in IMS (2004 against 1990), times
All industries, million people	21.0	16.0	11.9	1.8
Mechanical engineering, million people	8.0	4.9	3.2	2.5
including by sector, thousand people:				
diesel engines	68	40	21	3.2
mining and ore machinery and equipment	75	49	31	2.4
weight handling equipment	86	70	40	2.2
railroads	153	114	85	1.8
electrical engineering	545	345	252	2.2
chemical and petroleum engineering	280	191	241	1.2
machine-tool building and toolmaking	279	169	88	3.2
instrument engineering	748	388	170	4.4
automobile industry	814	706	566	1.4
bearing	113	75	47	2.4
tractors and agricultural machinery and equipment	512	280	86	6.0
road construction and utilities machinery and equipment	163	105	87	1.9
equipment and machinery for consumer, food industry and household appliances	198	139	73	2.7

Sources:

Russian Federal State Statistics Service. Srednegodovaia chislennost’ promyshlenno-proizvodstvenenogo personala v otrasliakh promyshlennosti po kategoriiam (tysiach chelovek) [Average Number of Industrial and Manufacturing Staff by Industrial Sector [thousand people)]. URL: http://www.gks.ru/bgd/regl/B05_48/IssWWW.exe/Stg/04-01.htm

This resulted in the ageing of industrial staff and unfilled vacancies. The number of employees grew in the post-Soviet period only in the mining industry, energy sector and iron-and-steel industry, while those employed in in mechanical engineering decreased dramatically (the quantity of people employed decreased over the period of reforms (1990-2018) by almost 80%). 1.702 million people continued to work at enterprises of this industry(production of machinery, equipment and vehicles)[317], there were 8 million people in 1990. But the problem of ageing of the staff is getting worse even in the relatively successful companies. Truly, the question here is about the lack of qualified and reliable core personnel of middle age. Enterprises that regained core personnel now have them training younger workers as possible. Less successful and competitive enterprises suffer from critical staff shortages.

The strategic deficit of human resources over the recent years has been exacerbated by the release of manpower due to the crisis reduction in demand for labour, restructuration of production and implementation of robotic technologies in modernised enterprises. In the context of a пeneral reduction in demand for labor and an uncompetitive level of wages in the machine tool industry, there is a loss of released qualified personnel for the industry. It is not without reason, that the Strategy of development of industry in the "Subprogram 7. Machine tool industry" specified "[318] risks related to a mismatch between qualification of personnel and requirements, needed for

[317] Calculated by the data in: Promyshlennoe proizvodstvo v Rossii. 2019: Statisticheskii sbornik/Rosstat. – M., 2019 [Industrial production in Russia. 2019. Statistical compendium. –

Moscow: Rosstat. 2019]. P. 39-40. URL: https://rosstat.gov.ru/storage/mediabank/Prom_proiz-vo2019.pdf
[318] Gosudarstvennaia programma Rossiiskoi Federatcii "Razvitie promyshlennosti i povyshenie ee konkurentosposobnosti na period do 2020 goda" (utverzhdena rasporiazheniem Pravitelstva RF ot 30 ianvaria 2013 g. № 91-r). Pasport Gosudarstvennoi programmy Rossiiskoi Federatcii "Razvitie promyshlennosti i povyshenie ee konkurentosposobnosti" na period do 2020 goda. Podprogramma 7. Stankoinstrumentalnaia promyshlennost.[State program of the Russian Federation "Development of industry and increase of its competitiveness for the period up to 2020" (approved by order of the Government of the Russian Federation No. 91-R of January 30, 2013). Passport of the State program of the Russian Federation "Development of industry and increase of its competitiveness" for the period up to 2020. Subprogram 7. Machine tool industry]. URL: http://base.garant.ru/70308410/

implementation of the sub-programme, as well as to physical absence of qualified workforce at the enterprises of industrial sector".

Meanwhile, the supply of qualified personnel for industry needs to be improved for reindustrialisation.

It is necessary to increase the number of people employed in microelectronics, modern mechanical engineering and in the all types of activities of the manufacturing of new types and models of technological equipment. It is necessary to create 6-7 million new high-tech jobsin mechanical engineering to ensure prevalence of high-tech types of activity. Besides, we should increase expenditures on R&D to 2.5-3% of the GDP; this will result in more than a million of working places in project, design and other similar organizations.

Thus, totally,it is necessary to create 7-8 million working places in the sectors of mechanical engineering and applied research and development, while the remaining 17-18 million workplaces will arise upon transition to new technologies in business activities, which consume products of mechanical engineering and information technologies. However, the staffing problem has been restraining technological modernisation so far.

There are several other staffing problems which also hamper the revival of Russia's mechanical engineering and metal-working on a new technological foundation:

- imbalance between interests of employers, employees and the state in modernisation;
- loss of staff of active working age, ***ageing*** of workforce and the difficulty

of re-educating older workers;

- lack of motivation of younger workers to be engaged in industrial production;
- low wages and salaries and and undervaluation of the complexity of production in transition to new technologies;
- insufficient compensation for new functions performed by workers and for special working conditions;
- lack of specialists educated for work on new equipment in industrial production;
- breakdown of training and re-training infrastructure at higher educational institutions;
- underestimation of the radical changes in production technologies achieved in developed countries in design of education programmes.

To supply trained specialists we need to restore the training system, including post-graduate training, focus it on applied technologies and create a system of additional training for lecturers at higher education institutions with the involvement of professionals from enterprises applying new technologies and software.

HR employees of industrial enterprises state that the existing formal education system does not train, or does not train enough technological specialists. If workers have no experience of work with certain new technologies, they will have to be additionally trained or retrained at the enterprises. It has, however, been acknowledged that spreading universal higher education which partly compensates for the failures of basic school education provides a reasonably good basis for further mastering of new professions.

Clearly, the success of any national reindustrialisation will be largely determined by the quality of staff policy of both the state and the corporations. Consequently, financial procedures of public regulation in the field of personnel training should combine with growth of the expenses of companies on preparation and re-training of specialists. However, employers, who are dissatisfied with public efforts in the area of staff training are unlikely to devote much to training employees either. According to the Russian Statistics Committee, training costs as a share of total labour costs from 2005 to 2013 remained at the disastrous 0.3%[319] . According to the results of Association fo Talent Development 2017 "State of the Industry" report and the ILO statistics the similar costs in the developed countries it is possible to estimate as 3,0-3,5% of total labor costs.[320].

Persistent imbalances between the professional education system and the needs of industrial enterprises has finally led the Russian Union of Industrialists and Entrepreneurs and "Business Russia" to step forward and offer to cooperate with public structures at all stages of the reform jf the system of professional learning: from the design of educational and professional standards to additional financing of universities, equipment of classes,

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[319] Rosstat (2014). Ctruktura zatrat organizatcii na rabochuiu silu po vidam ekonomicheskoi deiatelnosti (v protcentakh). [Rosstat (2014). Structure of organizations ' labor costs by type of economic activity (as a percentage)]. URL: https://rosstat.gov.ru/storage/mediabank/3-1-2.htm

[320] Maria Ho (2017). Learning Investment and Hours Are on the Rise. TD Magazine. December 2017 URL: https://www.td.org/magazines/td-magazine/learning-investment-and-hours-are-on-the-rise; Global Wage Report 2016/17: Wage inequality in the workplace. International Labour Office – Geneva: ILO, 2016. URL: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_537846.pdf

laboratories and workshops, corporate methods of module trainings, which are used nowadays to “finishing” graduates on their working places, and personal participation in the process of training. Public and private partnerships in the area of training staff who can reindustrialisethe Russian economy is urgent.

A modern technological base requires ***not just highly skilled, but a creative (constructive) employee who are likely to demand higher*** quality of life which can be satisfied by dynamic development of education, culture, healthcare and improvement of material conditions. Calls “to tighten the belts” for the good of future generations sound like anachronism in this context. People with “tighten belts” can *be* ***neither a source, nor a conductor of innovations*.**

Without the development of industries, ensuring the production and reproduction of national human ***potential adequate*** for tasks of new industrial development is not possible. It will inevitably lead to greater economicsocial and political imbalances and risk economic stagnation and social conflicts.

16.5. Commitment to Technological Priorities

Today, when the need for a large-scale economic modernisation is clearly recognised, the inability to really launch such process becomes more and more evident. The national economy has fallen into a structural and institutional “trap”: it could not properly respond to the development of internal demand by the increase of domestic production of competitive goods at the expense of increasing investment activity. There were at least three problems: inability to establish clear priorities; difficulty of obtaining a clear complete picture of the Russian economy's wishful structure; and, consequently, the difficulty of launching the projects that can drive the modernisation of its basic sectors.

The implications are clear: we must : 1) define priorities; 2) approve implementation mechanisms for the priorities; 3) focus resources in priority areas which ensure the fulfillment of stated objectives.

Establishing priorities will require collaborative work of expert specialists from different divisions of knowledge. These priorities have been changed several times in recent years (Table 16).

TABLE 16. Changes in priority directions in the development of science and technology

Priority directions	1996	2002	2006	2009	Directions of technological breakthrough
Fundamental research	+	–	–	–	–
Information and telecommunications technologies	+	+	+	+	+
Production technologies	+	+	–	–	–
New materials and chemical technologies	+	+	–	–	–
Living systems, medicine (life sciences)	+	+	+	+	+
Transport technologies	+	+	–	+	–
Power engineering and energy efficiency	+	+	+	+	+
Ecology and rational use of natural resources	+	+	+	+	–
Space technologies and systems	–	+	-	+	+
Nanosystems industry	–	–	+	+	+
Defence industry complex, nuclear technologies	–	+	+	+	+
Security and anti-terrorism	–	–	+	+	–

Sources: Ministry of Industry and Science of the Russian Federation. (2000). *Osnovnye napravleniia gosudarstvennoi nauchno-tekhnicheskoi politiki na srednesrochnyi i dolgosrochnyi period* [Medium- and Long-Term Main Directions of State Policy on Science and Technology]. (Produced under the instructions of the Government of the Russian Federation dated 27.10.2000 (IK-P 829 269); *Prioritetnye napravleniia razvitiia nauki, tekhnologii i tekhniki v Rossiisko Federatsii* (Pr - 843, dated 21.05.2006) [Priority Directions in the Development of Science, Technology and Machinery in the Russian Federation]; *Perechen' kriticheskikh tekhnologii Rossiiskoi Federatsii* (Pr - 844, dated 21.05.2006) [List of Critical Technologies of the Russian Federation]; *Prioritetnye napravleniia razvitiia nauki, tekhnologii i tekhniki v RF* (Decree of the President of Russia No. 899, dated 7.07 2011) [Priority Directions in the Development of Science, Technology and Machinery in the Russian Federation].

Given the fast pace of technological change some adjust of priorities is inevitable. However, such frequent changes clearly indicatea lack of direction in the development of the national economic policy. Priorities should be established not only on the macro-level, but also on the sectoral level and specified further through transformative projects whose implementation will have wide-spread technological and multiplicative multi-sectoral effects.

Practically, reindustrialisation policy in Russia today should be limited to public investment projects in expanding lines of industrial production which can be locomotives of sustainable growth, whereas the schemes of implementation of prepared investment projects imply the stipulation of "supporting points" (in terms of technological possibilities for realization) for these projects, the determination of which requires large-scale inventory auditing of technological potential. Only such inventory auditing, which can show us both the real picture of present technological possibilities and possibilities of technology development, will help estimate the opportunities for the implementation of targeted priorities, to define resources for consistent movement towards the set targets.

Our premise is the highly concentrated and centralized structure of Russian industry the fuel and energy industry (particularly in gas, energy and oil sectors), and by the excessive dispersion of capital in the manufacturing industry, primarily in machine engineering and instrument making industry, which leaves Russia without globally competitive machine-building corporations capable of competing with leading global corporations integrated into transnational financial and industrial groups.

As mentioned above, it was only in the second half of 2000s that the government began taking measures to aid concentration and restructuration in some sectors of mechanical engineering through public corporations and joint stock companies with a controlling stateinterest. Such initiatives in aircraft engineering, shipbuilding, sectors of defence industry complex, the Rostech Public Corporation aimed to adapt them to compete in the world market. The merger of dispersed state-controled machine-building assets under “Rosstankoprom” JSC was launched.

However, these mergers have had a a rather narrow focus related, for the most part, to the preservation of defense and related industrial potential of the country, which results in a rather weak systemic (general industrial) effect. Besides, just as in the Soviet times, the defence industry complex of Russia continues to be organisationally and economically separated from the civilian sector of technology- restricting the transfer of technologies. Unlike mineral mining corporations with a high share of export, national machine building complex (except for the separate defence industry sectors which are also successful exporters) has no opportunity to raise funds in external financial markets (long-term loans, IPOs), which leads to the persistence of low competitiveness. Remedying this will require serious attention to restorting applied science, design and engineering, which are in fact standing on the brink of extinction, by building a system of national research universities complementary to Russian Academy of Science centres.

What is typical, there is ***not a single mention of concrete priorities of industrial development*** in the section devoted to vision and tasks of national industrial development ***in the new edition of Strategy-2020***. It seems that the Russian government does not have a realistic picture of content of industrial policy. Economic ministries are likely to apply the old liberal approach where the state ***promotes active development of transport infrastructure only and public involvement in the implementation of projects on modernisation and diversification of industrial potential is minimised***. It is no coincidence that priorities in the Strategy-2020 only go as far as shaping a general institutional environment, but not to the content and methods of active industrial policy let alone a clear vision of its sectoral components and strategies.

Nor is a system of independent evaluation of progress in areas prioritized for diversification of industrial potential of the country or one for the selection of priority projects for public supportever been developed. There is still an ambiguous allocation of functions between the economic ministries. The Ministry of Industry and Trade is responsible for design of concepts and programmes for sectoral industrial development. The Ministry of Economic Development controls the investment component of the budget and selection of target development programmes, i.e. the creation of economic conditions for their implementation. The Ministry of Finance designs the general plan for the distribution of budget expenses.

Though Russia joined the WTO only after 18 years of negotiations, it still did so and non-competitive industry with disbalanced structure and this hardly simplified matters. The government was forced to hastily design special programmes to support different sectors of the national industry, and the effectiveness of these programmes is highly questionable. Accession to the WTO intensifies competitive challenges for national manufacturers, even as it curtails opportunities to improve their competitiveness. Membership in the WTO is the most beneficial for countries with highly competitive manufacturing industry, providing them with favourable export conditions. For other countries, it only makes it more difficult for them to become more competitive.

Russia's Foreign economic problems do not end here. International experience shows that a prerequisite for an industrial and technological leap is a rush of advanced technologies into the national economy through the purchase of foreign equipment, selective import of products and services containing information on technological novelties, imitation of foreign technologies and design according to purchased examples (reverse engineering) and purchase of non-material technologies (pre-production prototypes, patents, licenses, know-how). We can add the list the migration from other countries of ***complete or partial production of complex end and intermediate products, establishment of research and development and design facilities by transnational corporations in host countries)***, as well as ***the training of host country personnel employed at affiliates of transnational corporations.***

The Soviet experience is rather interesting in this context. In order to speed-up industrialisation, the share of machinery and equipment in its imports rose consistently in the 1920s and 1930s: it was, for instance, 46.8% in 1930. These imports made the Soviet Union one of the largest importers of engineering products of that period, accounting for 30% of the world total (excluding automobiles) in 1931 and for about 50% in 1932. In 1938, when the foundation of heavy industry had, for the most part, been laid, this share decreased but still remained at a rather high level – 34.5%.

Imported equipment was fundamental to the large-scale construction of new industrial enterprises in republics of the former USSR. In Russia, in particular, basis of machine-tool industry was established, including the first specialised enterprises of this industrial sector – "Frezer", "Kalibr", "Krasny Proletarii" and other. Large tractor building plants in Stalingrad and Chelyabinsk and the first automobile-making factories in Moscow and Gorkii were equipped with imported equipment. Import of electrical generators and steam-power plants covered almost 90% of the equipment needs of power projects. Iron and steel enterprises, including integrated plants in Magnitogorsk, Kuznetsk and Chelyabinsk, received the necessary equipment from abroad, mostly from USA and Germany.

Imports are bound to play and equally important role in the revival of Russian manufacturing industry today, as many types of machinery and equipment are either not produced in Russia at all or are, thanks to the degradation of the sector, of a quality too low even for Russian firms. According to calculations of the Institute for National Economic Forecasts under the RAS, only 44% of the fixed capital investment needs in the Russian economy can be covered by local production[321].

Moreover, Russia's imports are hardly being used for the reconstruction of the national economy. Imports remain focused mainly on the satisfaction of current consumer needs. For example, in 2011, according to the Federal Service

[321] Ivanter, V.V.. ed. (2006). *Innovatsionno-tekhnologicheskoe razvitie ekonomiki Rossii*. [Innovative and technological development of the Russian economy]. M.: Maks Press. P. 200.

of State Statistics, the share of consumer goods in the structure of imports was equal to 36.7*%*, and that of capital goods – only to 21.3%. By contrast, aAccording to the data of UN Comtrade (2007), consumer goods, including food and drinks, accounted for 5.6% of Chinese imports, 10.6% of Brazilian 5.2% of Indian and 11.3% of Mexican. The share of commercial equipment of the same countries imports was, by contrast, 43.8%; 26.6%; 19.1% and 31.8% respectively[322].

In a word, ***Russian imports are not yet*** an efficient tool for the acceleration of scientific and technological progress and the modernisation of production and technological potential of the country. To make them so, the import share of machinery and equipment for investment should be increased by 1.5-2 times.

Russia also imports a negligible amount of foreign soft technologies In 2011, the country spent around $1.9 bn for these purposes (0.5*%* of the total Russian import of products and services)[323]. In comparison, in the same year the U.S. – a leader of technological development – purchased $34.5 bn worth of foreign technologies, Japan – $19.2, Singapore – $19.4, Switzerland – $16 and China – $15 bn.

322 UN Comtrade has not published similar data since 2009. It is difficult to compare data of the Federal Service of State Statistics with international statistics, as grouping of goods in the local and global statistics differs. According to our estimates, based on data from UNCTAD, in 2011 the share of machinery and equipment (excluding automobiles) in import accounted for 27.1% in Russia, 31.4% – in China, 26.8% – in Brazil, 16% – in India and 36.9% – in Mexico. Should we exclude office and telecommunication equipment from the group of machinery and equipment, the shares in these countries will be the following: Russia – 20.8; China – 25.2; Brazil – 20; India – 11.9; Mexico – 24%. As for consumer goods, it is difficult to estimate their share on the basis of international statistics.

323 The WTO estimates our import of technologies differently ($6.1 bn in 2011), but does not provide a breakdown of its structure. See: WTO. *International Trade Statistics 2012*. www.wto.org.

There is another serious problem, the ***unfavourable*** structure of imported technologies. Engineering services (37%) and trademarks (22%), i.e. items that fall under the category of "mature" technologies with relatively low profitability, dominate. Share of patents, licenses and know-how related to the adoption of new processes and types of products amounts to only 9%.

When Russian entrepreneurs want to improve the technological level of their production, they prefer to purchase foreign technologies in the complete form – as machinery and equipment. This helps them to speed up and simplify the renovation of production while remaining with technologies that are still behind the curve. World experience shows, however, that the import of licenses and know-how is in many cases more profitable. License agreements, apart from saving money, provide an opportunity to get valuable know-how and assistance in the improvement of licensed products, and sometimes – in selling of these products on the foreign markets. Besides, such agreements can serve as the foundation for new national technological developments. According to experts, in the middle of the past decade more than half of all machinery products in the world were produced on the basis of license agreements[324]. Let us remember that it was through licenses and know-how that Japan, Singapore and other states closed the gap between them and the developed countries. Their experience underlines why the inflow of advanced technologies mainly in non-material form should become an important share of import in our country as well.

[324] *Problemy effektivnoi integratsii nauchno-tekhnologicheskogo potentsiala Rossii v mirovoe khoziaistvo*. [Problems of effective integration of Russia's scientific and technological potential into the world economy]. (2008). M.: LKI Publishing. P. 35.

Ultimately Russia does not import technology (as is and in the material form) because its enterprises, which are not forced into technological upgrading by competition, do not demand them. An insufficiently favourable investment climate and the lack of motivation for innovative development also play their role.

Another factor is lack of experience and structures which ensure the development of an idea defined in a license to an end product as a material, equipment or process. It is not enough to purchase a license that allows the use of the new technology. To be economically effective, it is necessary to provide several conditions to ensure that this technology was applied in the real production process: the complex of technological equipment with required parameters, engineers are able to organize the work and service of this complex, the production staff with the necessary training, supply adequate raw materials and components. Remedying this requires finishing and improving national innovation system particularly the revival of branch institutes, design engineering bureaus and pilot-producing plants. All these, which conducted not only academic pursuits and scientific research, but also the study of examples of foreign machinery which helped to have a finger on the pulse of global technological development, suffered in the period of ***systemic transformation***.

Such means of the import of technologies into Russia as direct purchase of investment equipment, licenses, know-how, as well as more complicated forms of engagement, including turn-key construction of plants, cooperation with foreign companies in the process of product manufacturing, joint research and development and the establishment of joint enterprises, should be supported by the state on a systematic basis.

In order to improve the investment climate, it is necessary to restore tax relief for investors and take measures to simplify the import of industrial machinery not produced domestically. Specifically, tariffs for import of such equipment can be brought to a zero for a period of 5-7 years, even when this is not provided for by the obligations towards the WTO. Such measure was in practice in the pre-crisis (before 2014-2015) period. However, Russia is not authorised to handle customs tariffs itself, as it is a member of the Customs Union: this is the prerogative of the Eurasian Economic Commission, and arranged by it decision.

It is also possible to acquire modern technologies through “industrial intelligence” by countries and corporations. Although never discussed officially, such acquisitions make it possible to eliminate technological inferiority in a given sector within a short time.

Boosting the import of investment equipment and technologies should be a core component of the general scientific and technical and industrial policy of the country. Bearing in mind domestic absorption capacities and and general prospects of technological advances in the world, priority technologies and types of equipment for local development as well as those to be imported should be identifiedin cooperation with direct users and designers of local machinery, so that it could be beneficial for all – national sector of research and development, local industry and technological security of the country on the whole.

16.6. New Model of Economic and Institutional Development

Economic reindustrialisation depends on the ability of the state to consolidate measures for the solution of all aforementioned problems under a systemic industrial policy. Its quality and efficiency will be determined by the quality of public institutions and procedures which create and impliement it by selecting priorities, carrying out investment projects, financing schemes and controlling the allocation of resources).

There is no effective system for working out the approach and defining the development prospects of the main sectors of the national economy and industry in Russia. “Concept – 2020” received no further specification in any documents on the development of separate sectors of the national economy and industry. Industry-specific concepts were developed with delay and only partially, except those for a small group of industries. They were not brought to the level of long-term programmes of modernisation and development of the most important industrial complexes and were weakly correlated with each other.

As a result, it is not clear, who will define the technological priorities of development (critical technologies) and how they will do so, what kind of expert reviews will be conducted and how they will be linked to prospects of development of the corresponding sectors of the national industry and economy. What appear to be isolated elements of industrial and technological policy are just a result of backstairs influence of interested economic entities and serve manly as a way to gain access to the Federal budget funds. The situation is further exacerbated by the non-transparency of Russian business in regard to real owners and generation of actual costs. This features of the Russian economy specially analyzed in the theory of 'insider control'.[325] also makes it difficult to build effective relations between the state and business necessary to finance priority development projects.

It is important not to confuse cause and effect when analysing the low quality of Russian institutions of public management. The fact is that the quality of these institutions' functioning is the result of their experience. Modern Russian institutions were formed during the dismantling of the Soviet planning system, "primitive accumulation" and dramatic reduction of public involvement in economy. These circumstances largely determine both the mentality and professional level of most state officials.

It is obvious that the activity level of the state cannot increase by itself or as a result of special campaigns for "clean-up and improvement". The quality of public institutions will really start to change when the nature of tasks to be solved changes upon the transition of functions from permissive and distributional to creative, which orienting state structures to creation the most favorable conditions for innovative activity, and direct support of such activity by all available ways.

Reindustrialisation, as we envisage it, is possible only in the ***modernised institutional environment.*** Most experts agree that poor institutional environment acts as the main obstacle for economic growth in Russia. The

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[325] Dzarasov R. Insider Rent Makes Russian Capitalism: A Rejoinder to Simon Pirani. Debatte: Journal of Contemporary Central and Eastern Europe Volume 19, 2011 - Issue 3. https://doi.org/10.1080/0965156X.2012.665281

effect of institutional changes is comparable to, and may be even higher than, fiscal and monetary policies.

Increasing investment to required levels is only half the battle. The motivation of entrepreneurs in relation to investment for reindustrialization must also be altered. As we know, uccessful entrepreneurship in Russia relies on close collaboration with public structures. However, this collaboration is not a matter of mere ‘partnership between the state and business’. Officials have the power to dictate to business. It does not matter whether they do sofor social benefit or profit. What matters is that certain institutions (as a rule, not official) make it possible. They constitute a specifically Russian form of government control over appropriation relations. Effective modernisation is impossible without coping with this persistent phenomenon. This is confirmed by both entrepreneurs[326] and economic authorities[327]. The same point was made by the President of the Russian Federation, “Costs for business can fluctuate – you can pay more or pay less depending on whether certain people who are affiliated with the government “favour” you. Rational behaviour of entrepreneurs in this case is not to observe the law, but to find protectors and negotiate a bargain. But such “negotiated” business will try, in turn, to stifle competition and clear

[326] See: Speech of A. Galushka, Vice-President of Business Russia, at the Business forum for real sector enterprises “Modernisation” on 14.09.2010. (See in: Kalmatckii M. Ne tot klimat [Not the climate]. *Novye izvestiia*. 15.09.2010. S. 3

327 See: Min points of Minister E. Nabiullina at the conference “Competition in Russia: ways to create favourable environment for business development” (Moscow, 26.11.2010) URL: http://old.economy.gov.ru/minec/press/news/doc20101126_06; Speech of Deputy Chairman of the Government of Russia and Minister of Finance A.L. Kudrin at the Eighth Krasnoyarsk Economic Forum, 18.02.2011. (see: https://www.gazeta.ru/financial/2011/02/18/3530254.shtml).

its own market niche using the powers of affiliated officials – instead of increasing economic efficiency of its own enterprises."[328]

Thus, the modernisation of the economy requires not only the development of competition in general, but the creation of conditions under which Russian entrepreneurs will be ***forced*** to use technological modernisation as the main instrument of competition. Elimination of monopolism both of big corporations, especially state-controlled, and of not so much big business, used the support of local authorities, is also ***necessary, but not sufficient*** for the development of competition. It is important to ensure the change in the mechanism for the appropriation of the result of economic activity. The main trouble today is illegal takeover which may involve skimming entrepreneurs of produced goods or unfair appropriation of the business itself and, ultimately, the destruction of someone's life's work.

The fight against illegal takeover and calls for innovative behaviour will be unsuccessful so long as the appropriation of property remains more attractive than the development of said property. Countermeasures (financing, investment and tax concessions or mechanisms of public and private co-financing) are not significant enough in order to allow for the lowering of innovative activity risks. Institutions that render other (non-innovative) instruments of competition considerably more risky are much more effective.

The current governmentalisation of the Russian economy is defined by low legitimacy of ownership rights for capital goods and production output which was predetermined by the mechanisms for privatisation of state property

328 *Putin*, V.V. (2012). Nam nuzhna novaia ekonomika. [We need new economy]. *Vedomosti*. 30.01.12.

employed in the 1990s. Highly primitive “renewal” of the concept of ownership was conducted then under the slogan of denationalisation and was unsupported by any research or global experience. This process resulted in the emergence of “ineffective” (from the economic perspective) owners[329]. In practice, Russia reverted to its historical legacy described by V.V. Rozanov in the beginning of the twentieth century, “All ownership in Russia emerged from “begging” from, “presenting” to or “robbing” somebody. There is very little ***work*** for property. This is why it is neither strong nor respected”[330].

As a result, all actions of the state (or its representatives) aimed at the limitation of “business freedom” – even if they are illegal – are supported by the population, especially when they are conducted under the slogan of protecting the rights of “common people”. This situation creates the gap the Russian economy.

Privatisation in itself is not the same as denationalisation. The only reliable mechanism for the real denationalisation of economy, as experience shows, is continuous active work of civil institutions. They can curb selfish interests of entrepreneurs and the state’s constant urge to get excessively involved in the economy. These institutes shape the most important part of regulation in the socially-oriented economy. Therefore, it comes as no surprise that countries which are dealing with the consequences of the “socialist”

[329] The situation in the major part of the former Soviet Union is quite similar. See: *Kindzerskii Yu.* (2010). Deformatsiia instituta sobstvennosti v Ukraine i problemy formirovaniia effektivnogo sobstvennika v neeffektivnom gosudarstve.[Deformation of the property institution in Ukraine and the problem of forming an effective owner in an inefficient state] *Voprosy ekonomiki*. 7.
330 Rozanov V.V. (1990). *Uedinennoe*. [Secluded]. M., P. 37.

organization of public production are focusing on the development of such institutions.

Civil institutions emerge as a result of changes in mentality and behaviour. This is why we should not equate the policy for building a civil institutional system with a system of government measures aimed at the establishment of different non-governmental (social) structures. Such “policy” may lead to the emergence of quasi-civil relations. The task of the state is to create the social and economic political environment that would remove the barriers (administrative, economic, social etc.) that hamper the social activity of civilians or efforts on creating the material (economic) base for this activity.

If we manage to solve this institutional problem in the process of social modernisation and if entrepreneurs feel confident about their future, they will start to develop their business and leave its output to their descendants and the society – here, on their home turf, as opposed to transferring products and profits overseas. Then we will see both investments and innovations.

Chapter 16. Reindustrialisation Imperatives, Opportunities and Issues[331]

A great deal has been written in recent years about how Russia needs a new model of economic growth[332] by writers who believe that a fundamental renewal of the present system of economic institutions is necessary, not merely "cosmetic" changes[333].

Reindustrialisation of a new, developing Russian economy should become its paradigm (see Chapter 7). The goals and tasks of reindustrialisation are defined in the Executive Order of the President of the Russian Federation,

[331] The chapter is based on the paper delivered at the meeting of the Scientific Advisory Board under the Chairman of the Federation Council of the Federal Assembly of the Russian Federation on 28.03.2013 and the paper presented at the plenary meeting of the Free Economic Society of Russia on 11.12.2013.

332 See: *Pshenichnikova S.N. (2013)*. Investitsii v ekonomicheskii rost v evraziiskikh stranakh [Investment in economic growth in the Eurasian countries]. *Izvestiia Sankt-Peterburgskogo gosudarstvennogo ekonomicheskogo universiteta*. 5 (83), 14-26; *Bodrunov S.D., R.S. Grinberg R.S. and D.E. Sorokin. (2013)*. Reindustrializatsiia rossiiskoi ekonomiki: imperativy, potentsial, riski. [Reindustrialization of the Russian economy: imperatives, potential, risks] *Ekonomicheskoe vozrozhdenie Rossii*. 1 (35), 19-49; *Popov A.I. and V.A. Plotnikov. (2012)*. Vybor novoi modeli razvitiia i modernizatsiia: osnovy perekhoda k innovatsionnoi ekonomike. [Choice of a new development model and modernization; fundamentals of transition to an innovative economy] *Izvestiia Sankt-Peterburgskogo gosudarstvennogo ekonomicheskogo universiteta*. 2 (74), 197-209; *Karlik A.E. and M.A. Osipov. (2009)*. Sostoianie i perspektivy makroekonomicheskogo razvitiia Rossii v kontekste teorii ekonomicheskogo rosta s uchetom krizisnykh iavleniy.[State and prospects of Russia's macroeconomic development in the context of the theory of economic growth taking into account the crisis phenomena] *Ekonomicheskie nauki*. 57, 12-18; *Popov A.I.* (2014). Neoindustrializatsiia rossiiskoi ekonomiki kak uslovie ustoichivogo razvitiia. [Neoindustrialization of the Russian economy as a condition for sustainable development] *Izvestiia Sankt-Peterburgskogo gosudarstvennogo ekonomicheskogo universiteta*. 3, 7-12; *Tatarkin A.I. (2014)*. Protrezvlenie posle rynochnoi eiforii zatianulos', no vse-taki proiskhodit: interv'iu.[Sobering up after market euphoria dragged on but still happening] *Gorod 812*. 32, 21-23.

333 *Bodrunov S.D. and R.S. Grinberg*. (2013). Chto delat'? Imperativy, vozmozhnosti i problemy reindustrializatsii. *Reindustrializhastiia: vozmozhnosti i ogranicheniiat Sbornik materialov Nauchno-eksperimental'nogo soveta pri Predsedatele Soveta Federatsii RF*. [What to do? Imperatives, opportunities, and challenges of reindustrialization. In: Collection of materials of the Scientific expert Council under the Chairman of the Federation Council of the Russian Federation "Reindustrialization: opportunities and limitations"] M.: Izd. Soveta Federatsii RF; *Bodrunov S.D. (2014)*. Reindustrializatsiia rossiiskoi ekonomiki - vozmozhnosti i ogranicheniia. *Nauchnye trudy Vol'nogo ekonomicheskogo obshchestva Rossii*. [Reindustrialization of the Russian economy: opportunities and limitations. *Scientific works of The free economic society of Russia*.] 1, 15-46.

dated 07 May 2012, No.596 “On the Long-Term State Economic Policy”. It is particularly important todetermine targeted indicators to check the solution of two interconnected major challenges: increase in investment in reindustrialisation (by not less than 25% of GDP by 2015, and up to 27% by 2018); the creation and development of 25,000,000 high-tech jobs by 2020.

16.1. Reindustrialisation of Russia: Prospects and Resources

Academician S.Y. Glazev indicates that the depression in economic sectors which have reached maturity provides additional opportunities to low-performing sectors. A crisis reduces the capitalisation of companies with advanced technologies and expands opportunities for buying controlling stakes in these companies or technologies. Moreover, as industry leading companies reduce their demand for high-technology equipment, it becomes more available for countries, dealing with challenges of catch-up development. For example, in the 1970s, South Korea was busy with the acquisition of equipment and technologies of Japanese shipbuilding, when tthe question of decrease of its excessive capacities came up. This dimension is the consistent part of the politics of industrial development known as ‘flying geese paradigm’, elaborated by Japanese economist Kaname Akamatsu[334].

To make a successful technological leap, policy-makers should properly estimate prospective growth areas and proactively implement new

[334] Akamatsu, Kaname (1962). A Historical pattern of Economic Growth in Developing Countries. Developing Economies No.1, p. 1-23.

technologies in sectors that are at the initial stage of development of a new technological mode. As mentioned above in Chapter 4, ***a characteristic of the current stage*** of economic development is that dominant technological modes are changing[335]***and*** new technological pathways are being opened.

Despite current challenges, Russia has the opportunity to join the leading group of global technological powers. We only need to properly assess our possibilities and consider limitations and risks. Our first question is: does Russia have enough ***financial resources*** for reindustrialisation? If the volume of investments in reindustrialisation it to be equal to 25% of GDP in 2015 (up to 27% of GDP in 2017), investment will have to amount to 20 trillion rubles per annum. The "Development of industry and increasing of its competitiveness" programme approved by the government at the end of December 2012 projected investment during the period until 2020 to be approximately 440 bn rubles per year. And this programme did not include all investment projectsnecessary for reindustrialization. Moreover, the Presidential Executive order included private as well as public investment only. Even so, thesefigures show that we need a dramatic increase in investment and that requires the repositioning of monetary and credit resources of both the state and corporations. However, the real level of investments to fixed assets was 20% of GDP in 2015 and 21,5% in 2017. [336]

[335] Strategiia ekonomicheskogo razvitiia Rossii. Po materialam obshcherossiiskoi diskussii, provedennoi Komitetom Gosudarstvennoi Dumy po ekonomicheskoi politike i predprinimatel'stvu, Otdeleniem ekonomiki RAN, Rossiiskim torgovo-finansovym soiuzom i Rossiiskim economicheskim zhurnalom. Reports presented at extended meetings of the State Duma Committee on Economic Policy and Entrepreneurship. (2000). [Strategy of economic development of Russia. According to the materials of the all-Russian discussion held by the State Duma Committee on economic policy and entrepreneurship, Department of Economics, the Russian trading-the financial Union and the Russian economic magazine. Reports presented at extended sessions of the State Duma Committee on economic policy and entrepreneurship]. *Rossiiskii ekonomicheskie zhurnal*. 7.

[336] (2019). Investitcii v Rossii. 2019: Statisticheskii sbornik. M.: Rosstat, s. 11 [Investment in Russia. 2019: Statistical collection, Moscow: Rosstat, p. 11].

Current levels of money supply of the Russian economy (under 50% of the GDP) and volume of credit (only 35% of the GDP) do not provide for positive economic growth. Financing industrial development is particularly difficult when interest rate exceed profit rates in key industries. Together with loosening of monetary, budgetary and fiscal policy, lowering of cost of credit for industry it is necessary to implement measures, which can reverse the trend of a large-scale outflow of capital from Russia, etc.

The expansion of credit issue for financing of structural investment modernisation programs and selected sectors of the national economy and industry can be a source of financing for large-scale modernisation of the national economy. Credit can be extended through real indexation of private deposits in Sberbank made before 1991. They are devaluated ten times by sudden hyperinflation during 'shock therapy' policy of 90s with insignificant deposit rate in compare to the rate of inflation. It is rational to limit the application of these indexed funds to three options (to be selected by citizens):

4) making a deposit to pension capital;

5) generating a mortgage fund for financing of social mortgage loans (for people in need of improved housing conditions);

6) acquiring shares of a special public investment fund for the modernisation of the national economy.

To ensure enough credit is available for financing of priority investment projects "financial freedom" will have to be limited and the risks of financial crises managed. This will require, first, a substantial improvement in credit policy and in the transparency of both general and foreign currency cash flow.

In particular, the struggle to bring the rate of inflation to 3-4%, allegedly to lower interest rates and thus investment in technologically advanced sectors, must be abandoned. Not only have they not worked, these policies have both domestic investment and markets and actually led to higher inflation.

Financial resources for reindustrialisation can also be provided by a policy of changing the balancebetween the export and import of capital.

The most controversial d and critical issue in providing the financial sources needed for reindustrialization is the application of financial reserves. We believe it is wrong to view only the National Wealth Fund (from 1st of January 2018, the former Reserve Fund was merged with it), as reserves against a possibility of a crisis. If we do that, the Reserve Fund which 01.09.2020 amounts to $ 177,61 bn or 11,7% of Russian GDP, will withdraw over 13 trillion rubles from the economy, monies which will not contribute to modernisation and innovation.In compare, this Fund was only 3, 75 trillion rubles or 3,6% of GDP in 1st of January 2018[337]. . But, at the same time, the country's gold and foreign currency reserves which in 25.09.2020 are equal to more than $580 bn (over 44 trillion rubles)[338] constitute an important financial reserve against crisis. Also, there are reserves of the Deposit Insurance Agency (3,5 trillion rubles)[339]. On the whole, the country's financial reserves in 2020 are equal to around 60 trillion rubles. According to available estimates, they are

337 Ministry of Finance of the Russian Federation (2020). Volume of the National Welth Fund. Publish date: 11.09.2020 URL: https://minfin.gov.ru/en/key/nationalwealthfund/statistics/?id_65=104686-volume_of_the_national_wealth_fund

338 Bank of Russia (2020). Databases. International Reserves of the Russian Federation (End of period) URL: https://www.cbr.ru/eng/hd_base/mrrf/mrrf_7d/

339 Otchet o deiatelnosti gosudarstvennoi korporatcii «Agentstvo po strakhovaniiu vkladov» za pervoe polugodie 2020. [Report on the activities of the state Corporation "Deposit insurance Agency" for the first half of 2020] URL: https://www.asv.org.ru/agency/annual/2020/2020-II.pdf

tentimes as much as was spent by Russian government for the bailout of 2009 crisis (according to the estimation of deputy chairman of the Accounts Chamber of the Russian Federation it was 13,9% of GDP or about 5,4 trllion rubles)[340].

The further accumulation of such financial reserves makes no sense and could be even more dangerous for the economy than a shortage of these reserves. Accumulated financial reserves just moderate the consequences of crisis in the monetary and financial sectors, while it is the modernisation of economy that is a true and reliable protection from crisis.

We should think of financing reindustrialisation by transferring part of the state's gold and foreign currency reserves to the management of the Development Bank (now State Development Corporation 'VEB.RF'). This would increase the return on these funds: (in 2008, such funds obtained a maximum 4% return on dollar assets and 5.57% on euro assets.The minimum return, recorded in 2012t was a dismal 0.33% on dollar assets and 1.09% for euro assets.

To anticipate critics, let us note that the risks from any shortage of reserves that will result from their investment in reindustrialization are insignificant in comparison with risks arising from the preservation of primitive production patterns, time-worn infrastructure, technological inferiority, wide-scale poverty, shortage of housing and other problems, all of which need investment.

[340] Goregliad V.P. (2013). Mirovoi krizis i paradigmy gosudarstvennogo finansovogo regulirovaniia. M.: REU im. G.V. Plekhanova, , c. 206 [Goreglyad V. P. world crisis and paradigms of state financial regulation. Moscow: Plekhanov Russian University of Economics. P. 206].

Another way to increase investment in reindustrialization is by lowering taxation and changing its structure. According to the Ministry of Finance, tax concessions cost 1.8 trillion rubles per year (almost 3% of the GDP as of 2014 year-end). Most of these are on profit tax, VAT, MPT and corporate property tax. Industry gets no considerable tax relief. Instead, it is "fleeced" by every interfering bureaucrat in town. For example, the Legislative Assembly of Saint-Petersburg cancelled the industrial enterprises property tax relief that had been provided when new cadastral values of land exceeding market value were registered the base for this tax. Tax relief was instead provided to the most "financially struggling" (that really is not true…) sectors: trade, oil and gas producers, etc. In this case, the bureaucrats did not act in favor of the development or modernization of the industry, but in favor of the sectors that control the largest financial flows. Bringing discipline into the taxation system and reallocating relief strategically to the industrial sector can vastly improve investment for reindustrialisation.

While point to Russia's low ***nominal*** profit tax rate to Europe's much higher rate, 40-45%, in fact, Russia's ***effective*** rate of profit tax is comparable to Europe's at 20-22%. The difference between Europe and Russia is that in Europe profits reinvested or invested in innovations is exempt from tax in European countries. We need to restore such tax relief despite fears that it will only lead to corruption.

Russia should remain fully engaged with activities of international financial organisations without, however, entertaining any illusions of having a serious influence on their projects and decisions. It is obvious that they will express the interests of leading economic powers, who are unlikely to help turn Russia into an independent economic power.

Russia's government is able to borrow abroad on more acceptable terms, than private business from international financial institutions, national institutions of other states and international private financial companies. These funds can be channeled into special investment funds for financing development, innovation and re-industrialization. In Japan and in the Republic of Korea, governments co-financed much development and industry through public development banks.

Direct foreign investments (FDI), however, are not and cannot be the main source of large-scale modernisation of the Russian economy. In 2008 Russia received $27.03 bn of FDI, which was under 10% of the total Gross Fixed Capital Formation (GFCF) and of this only 4.5% went to the high-tech sector of the Russian industry, 12% – to extractive industries and 23% – to wholesale and retail.

It is difficult to imagine foreign investors committing to sectors which are avoided even by local business. Russia's attractiveness to foreign investors in the process industry sector, particularly in engineering, can be improved through lower internal prices for energy, metal, plastics, which account for up to 70% of expenses in automobile manufacturing, production of construction and agricultural machines. However, such options are precluded because all these products have been subject to 'free market' or 'global' pricing The state's investment efforts are critical to attracting foreign investment: indeed, it is unlikely that foreign investors will invest in the Russian economy when the state itself does not.

International financial institutions can be treated as platforms for specifying our vision of how the global financial system and terms of international trading of goods and services need to change though, while doing so, it is critical to obligations that hinder modernisation of the Russian economy.

The sort of international financial system we would like to see would feature the establishment of an international financial centre in Moscow but one which does not generate crises as the current world financial system does. This requires new rules for this centre, which would encourage the activity of real investors rather than speculators, and which would not conduct crises into Russia but provide a wall against financial contagion. Russia possesses the leverage to turn financial flows towards reindustrialisation and technological modernisation of the country, as V.V. Ivanter points out when he argues that the accumulated reserves of the state, energy generating and commodities-based industries, and the expansion of credit can be used as financial resources for investment and development.[341] He rightly believes that the very fact of applying these reserves will lead to the return of substantial funds to Russia, which will multiply the investment process.

16.2. Reindustrialisation: Overcoming Structural Imbalances

[341] Ivanter V.V. (2013). Novaia ekonomicheskaia politika. [New economic policy] *Ekonomicheskoe vozrozhdenie Rossii*. **2 (33)**, 7-12.

Russia's economy suffers from colossal structural disproportions. They distort financial flows and Russia's relations with the world economy, preserving its dependence on energy and primary commodities. The non-oil and gas budget deficit, which exceeded 10% of GDP in 2015, is an indicator of the budget's dependence on oil and gas revenues. As noted by the head of the Accounts Chamber of the Russian Federation Alexey Kudrin, from 2016 to 2019, the non-oil and gas budget deficit decreased from 9.1% of GDP to 6.1%. However, this was achieved due to the fact that the level of Federal spending decreased from 2016 to 2018 from 19.1% of GDP to 16.1% of GDP[342], and thus did not help in any way to finance economic development.

Though Russia is a leading energy producer, it is far from being a leader in the production of advanced technological equipment for exploration, extraction and refinement of oil and gas resources, and other commodities goods, due to the under-performance of its engineering industry.

Minerals amounted to 53.8% of Russian exports, machines, equipment and transport – 8.8% in 2000; in 2005 the figures were 64.8% and 5.6%, respectively; and in 2011 – 71.1% and 5%, respectively. This is why few expect Russia to escape its y a purely energy- and raw-exports role in the world economy. However, while this sector will remain an important part of Russia's economy we cannot allow it to become our trap,[343].

[342] Informatcionnoe agentstvo Finmarket (2019). Kudrin: tcelesoobrazno ne snizhat neneftegazovyi defitcit biudzheta menshe 6% VVP v blizhaishie 10 let. 16.09.2019 [Finmarket news Agency. Kudrin: it is advisable not to reduce the non-oil and gas budget deficit to less than 6% of GDP in the next 10 years. 16.09.2019] URL: http://www.finmarket.ru/news/5076822

343 "Should we pursue this scenario," said Vladimir Putin at his speech at the extended session of the National Council "On the Strategy of the Development of Russia till 2020" (08.02.2008), "We will be unable to ensure both the security of the country and its normal development. We will expose its existence to a threat; that is

We need a comprehensive industrial policy***or Russia's reindustrialisation through the planning and deployment of internal industrial and technological chains for production of both industrial inputs and consumer goods.***

Despite apparent losses in scientific and technical, academic and technological potential, Russia is capable overcoming its degradation and meeting the challenge of ***modernisation.*** Russia possesses 17 out of 50-55 macro-technologies composing the fifth technological mode (including nuclear, space, aviation technologies, separate segments of nano- and biotechnologies, as well as technologies in oil and gas production and processing, manufacturing of certain types of weapons, chemicals, power generation and transport machine building [344]). We should remember that technologies and machinery available on the market are always things of the past from the scientific and technological standpoint. So reliance on imports for creating out own technological base unavoidably ***strengthens*** technological inferiority and technological dependence.[345]

Estimating forthcoming difficulties, we shall recall our history of the twentieth century, which raises our possibility to implement megaprojects in

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what I put without any exaggeration". Site of the President of Russia. URL: kremlin.ru/events/ president/ transcripts/24825.

[344] See: Nauchnaia sessiia obshchego sobraniia RAN "Nauchno-tekhnologicheskii prognoz - vazhneishii element strategii razvitiia Rossii". (March 2009). *Vestnik RAN*. Tom. **79**, № 3.[Scientific session of the General meeting of the Russian Academy of Sciences "Scientific and technological forecast – the most important element of the Russian development strategy (March 2009). *Bulletin of the Russian Academy of Sciences*. Volume 79, No. 3].

[345] This does not mean a refusal from import. We should overcome the mentality of "hopeless obsolescence" and build a smart foreign economic policy that would take in account all aspects of this challenge.

the conditions of ruined engineering base, for example, after the Civil War or during the World War II[346].

The geopolitical situation for the country in some cases may predetermines the need for self-supportability for many sectors, even if it is more efficient from an economic point of view to use international division of labour. Reindustrialisation should focus on creatinga “self-development core” – a number firms manufacturing technologically advanced equipment for industrial sectors essential to our security. These firms should not rely on imports but have develop backward linkages domestically as the U.S., Japan and Germany have done and, in critical sectors, continue to do. This is the track followed by the countries which seek to become “the poles of dominance”. The desirability of moving to a more egalitarian world that allows all countries to enjoy the benefits of international cooperation does not exclude the need to take into account the real circumstances that force them to fight for the necessary level of scientific and technological independence.

Thus, the state programme of industrial development in the machine-tool industry must aim at “import-substitution in machinery production with dual use technologies most demanded by military-industrial complexes. Such a complex is ***necessary*** for maintaining the armed services and equipping them with competitive weapon systems to ensure the protection of Russia’s geopolitical and economic interests.[347].

346 This refers not to the reproduction of this experience under the current conditions, but to the possibility of solving this issue in principle.

347 This is evidenced by information in mass media on the rejection in import of NC systems for five-axis processing of details, the application of an obligatory condition to license export of double-purpose technologies in contracts for delivery into Russia by EU countries, the U.S. and Japan, which prohibits unauthorised use and

Such objectives for the machine tool industry necessarily implies public investment and production if the scale, quality and technological sophistication are to be high enough. .[348].

16.3. Urgency of an Innovation Breakthrough

Russia's strategy of innovative development until 2020 is aimed at the modernisation of the Russian economy's technological base. Its success can be measured by the share of enterprises in it that are actively innovating and by volume of its innovative products (Fig. 33).. The strategy specifies the scenario of catching-up development with elements of leadership in separate segments of the economy, in which we have already built, or can build, a competitive edge. According to targets specified in this document[349], the share of actively innovating industrial enterprises should increase by by a factor of 4-5 between 2010 and 2020, while the share of innovative products in the total volume of industrial products – should increase by a factor of 5-7. The share of Russian high technology goods in the total volume of exports was to grow by a factor of 8 over the same period. However, as data at Fig. 33 shows, there is no chance

transportation of high-technology mechanical processing equipment (for example, a requirement to equip machines with location monitoring GRS sensors or obligatory connection of equipment to the Internet).

[348] According to published expert estimates, 70% of minor components used in the equipment manufactured by Russian machine tool building plants are imported.

[349] Strategiia innovatcionnogo razvitiia Rossiiskoi Federatcii na period do 2020 goda. Utverzhdena rasporiazheniem Pravitelstva Rossiiskoi Federatcii ot 8 dekabria 2011 g. № 2227-r. [Strategy of innovative development of the Russian Federation for the period up to 2020. Approved by decree of the government of the Russian Federation No. 2227-R of December 8, 2011.]. URL: http://static.government.ru/media/files/4qRZEpm161xctpb156a3ibUMjILtn9oA.pdf

to fulfill these targets, because there are no positive shifts in the innovation activity.

In the 2014 was adopted the State program of Russian Federation “Economic development and innovation economy” with the aim to increase in 2024 the share of innovative active enterprises to 50%.[350] This target was confirmed in Presidential decree in 2018.[351]

The difficulties with the fulfillment of the targets of these programs induced the elaboration of a new one: “The strategy of scientific-technological development of Russian Federation”. This strategy was adopted in 2016[352], in spite of the opinion of experts who believed that without analyzing the reasons for the failure of previous strategies, the new one will also not bring success[353]. The strategy is designed for two stages – 2017-2019 and 2020-2025, and it also mentions that it is valid until 2030-2035. However, this document does not put forward any specific goals that have quantitative characteristics, with the exception of two indicators of the cost of innovation activity.

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[350] Gosudarstvennaia programma Rossiiskoi Federatcii "Ekonomicheskoe razvitie i innovatcionnaia ekonomika". Utverzhdena postanovleniem Pravitelstva Rossiiskoi Federatcii ot 15 aprelia 2014 N 316 [State program of the Russian Federation "Economic development and innovative economy". Approved by the decree of the government of the Russian Federation of April 15, 2014 No. 316]. URL: https://www.economy.gov.ru/material/file/eaa304362f96677e423a4721a1f565aa/316_141019.pdf

[351] Ukaz prezidenta Rossiiskoi Federatcii «O natcionalnykh tceliakh i strategicheskikh zadachakh razvitiia Rossiiskoi Federatcii na period do 2024 goda» №204 ot 7 maia 2018 [Decree of the President of the Russian Federation "On national goals and strategic objectives of the development of the Russian Federation for the period up to 2024" No. 204 of may 7, 2018]. URL: http://static.kremlin.ru/media/acts/files/0001201805070038.pdf

[352] Strategiia nauchno-tekhnologicheskogo razvitiia Rossiiskoi Federatcii. Utverzhdena Ukazom prezidenta Rossiiskoi Federatcii ot 1 dekabria 2016 g. № 642 [Strategy of scientific and technological development of the Russian Federation. Approved by decree of the President of the Russian Federation No. 642 of December 1, 2016]. URL: http://static.kremlin.ru/media/events/files/ru/uZiATIOJiq5tZsJgqcZLY9YyL8PWTXQb.pdf

[353] Fonotov A. G. (2016). Strategiia-2035. Zhelaemoe. Vozmozhnoe. Dostizhimoe. *Innovatcii, № 6 (212*), s.24 [Fonotov A. G. (2016). Strategy-2035. Wishful. Possible. Achievable. *Innovations, No. 6 (212),* p. 24]a

The 2035 strategy was the latest in a long line of such plans: the 2020 Strategy, the 2024 State Program, theMinistry of Economic Development and Trade's 2000 plan for he principal directions for Russia's long-term social and economic development; the ; 2005 plan for Principal Directions of Policy for the Russian Federation in the Area of Innovation Systems Development until 2010; and the 2006 Strategy for the Development of Science and Innovations in the Russian Federation until 2015.

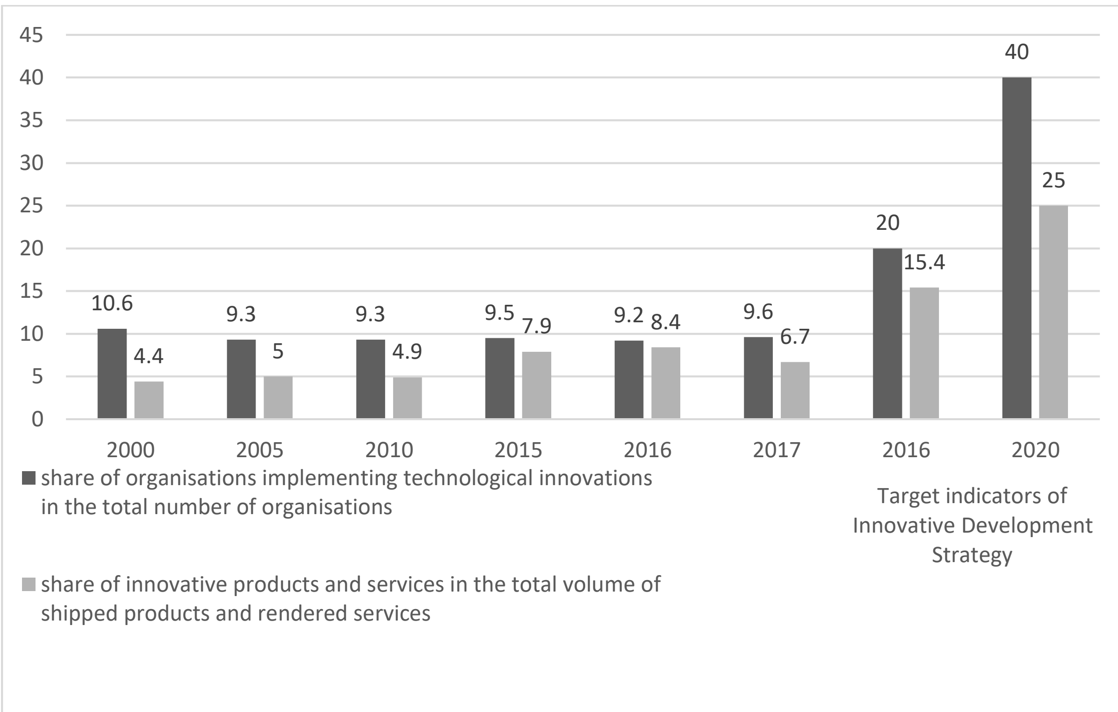

Fig. 33 Dynamics of industrial innovative activity

Sources:

Gokhberg, L.M., K.A. Ditkovsky, I.A. Kuznetsova et al. (2019). *Strategiia innovatsionnogo razvtiia Rossii na period do 2020 g.; Indikatory innovatsionnoi deiatel'nosti: 2019* [Russia's Innovative Development Strategy to 2020; Innovative Activity Indicators: 2019]. M.: NIU VShE.

So how realistic were their aims and why did they fail to meet their targets?

While an active innovation- and investment-friendly state stance is a necessary condition for industrial policy success, it is not a sufficient one. This stance must also be realistic, appreciating the limits of the possible, as both Russian and other national experiences how. WWhile control concentrated I a state permits it to accurately target its resources at certain innovation breakthroughs, say in space, nuclear, aviation, rocket production segments etc., success is also determined by economic performance on the whole. It too should involve large-scale application of technical, technological, organisational and administrative and other novelties, rely on advanced scientific knowledge in the related areas, while using results produced in sectors prioritized by innovation policy. The state itself is cannot entirely ensure this.

This means that successful industrial policy is also contingent on a critical number of entrepreneurs taking an interest in employing technological innovations in their own production. This element is sorely lacking in Russia, with neither the state, nor business generating demand for innovations. While Russian state expenditure on research and development (R&D) as a percentage of GDP, a fundamental element in fostering innovation is comparable with any leading country, expenditures of Russian entrepreneurs for these purposes are much smaller. So aggregate spending on R&D is much smaller and indicators reliant on it are negative (Table 10).

TABLE 10 Research intensity and scientific output of the national economies of several countries (2004)

Country	GDP per worker, thousands of USD	Share of R&D spending in GDP, %	Current competitiveness index	Share of hi-tech products in export, %	Share in global export of hi-tech equipment, %
U.S.	73.1	2.64	2*	28.2	16.3
China	7.2	1.0	46	16.7	4.6
Germany	56.0	2.50	13**	15.3	4.8
France	56.5	2.20	27	19.4	3.4
Russia	18.0	1.24	70	3.1	0.2

* In 2006 – 6th place

** In 2006 – 8th place

Sources:

Innovatsii v tsifrakh: 2004 [Innovations in Figures: 2004]. M.: TsISN.

World Economic Forum. *Global Competitiveness Report 2004-2005*.

There are two levels of problems limiting private sector innovation. First, these are macro-level problems: heavy "brain drain"; weak protection of intellectual property; high "anti-innovation" cost of credit; inadequate channels of distribution of public resources (corruption, bribes etc.); independence of public financing system and problems of private financing of projects and other. These problems are widely known.

Problems on the micro-level – the level of industrial enterprises – are analysed much more rarely. There is much to examine here since even the best macro-level environment cannot promote adequate innovation without effective change managers, and executive staff ready for the challenges of innovation; without enterprises' experience in the area, developed management systems, the corresponding infrastructure etc.

Of course, Russia also faces national-level problems: non-optimality and underdevelopment of infrastructure for innovation, transfer of technologies and intellectual property control. Comparing the situations in both Russia and China is particularly important in this regard (Table 11).

TABLE 11 Intellectual property (IP) management

China	Russia
Strategy "Towards innovative economy through intellectual property market" (adopted in mid-1990s)	Initiates the formation of IP management mechanisms (2010)
Public control system: unified - committees on intellectual property (vertical management- from Beijing to regional centres)	No unified public mechanism and no comprehensive policy: management on the federal level - over 20 ministries and departments; IP management in several regions supervised by "economic", "industrial" and/or "scientific" committees/departments
Number of IP objects: up to 30,000 patents per 1 municipality annually	Number of IP objects: 44,600 patents for the entire country in 2011

In 2011 totally were registered in China 526 412 patent applications, in Germany - 59 444, in Japan – 342 610, in USA – 503 582[354]. The ratio between patents in Russia and in other countries remains roughly the same now, if nor worse, with significant progress in China: in 2018 totally were registered in China 1,542,002 patent applications, in Germany - 67,898, in Japan – 313,567, in USA – 597,141, and in Russian Federation - 37,957[355].

China's success is in many ways due to its strategy, "An innovative economy through the market of intellectual property", implemented by the country, and due to the creation of a tough centralised system of public control over this process through committees on intellectual property (up to and including municipality), which help to lower administrative barriers in the process of shaping and development of the national intellectual property (IP) market. This experience was put to use in Kazakhstan, where all IP issues were passed to the Committee on intellectual property under the RK Justice Ministry, which has branches up to the municipal level (Table 12).

TABLE 12 State Intellectual Property Management in the CIS*

Country	Government entity
CIS	Interstate Council on Legal Protection and Defense of Intellectual Property (since 14.08.2011) - all intellectual property items (IPIs), Council on IP Matters under the Integration Committee of EurAsEC
Russian Federation	Federal Service for Intellectual Property (Rospatent) and 20 federal agencies (27.03.2013 - Ministry of Education and Science supported the project of creation of a single ministry of IP). Government Commission on Economic Development and Integration (sub-commission for IP)

[354] World Intellectual Property Indicators 2012. WIPO Economics & Statistics Series. Geneve: WIPO, 2012, p. 172-175

[355] WIPO (2019). World Intellectual Property Indicators 2019. Geneva: World Intellectual Property Organization, p. 32-33.

Republic of Kazakhstan	Committee of IP rights under the RK Ministry of Justice – all IPIs, structures up to the municipal level, Committee on Protection of IP Rights
Republic of Armenia	IP Agency (since 2002) – all IPIs, Inter-Institutional Commission to Oppose IP Violations (2009)
Republic of Azerbaijan	Agency on Copyright, State Committee on Standardisation, Metrology and Patents
Republic of Belarus	National Centre for IP under the State Committee for Science and Technology (since 2004) – all IPIs; Inter-Institutional Research and Methodology Council in the Area of IP (since 2005); Committee on Protection of Rights and Countering Violations in the Area of IP under the Council of Ministers of the RB
Kyrgyz Republic	Public service for IP and innovations under the Government of the KR – all IPIs, Inter-Institutional Committee on Countering IP Violations, State IP Fund
Republic of Moldova	Government-owned corporation “Public corporation for IP” under the Government of the RM – all IPIs
Republic of Tajikistan	National Centre for Patent and Information (NCPI) under the Ministry of Economic Development and Trade
Turkmenistan	Patent management under the Ministry of Economy and Development (1.03.2013 –Government resolution on the establishment of IP public service – all IPIs)
Republic of Uzbekistan	Agency for IP (since 2011) under the RU Cabinet of Ministers – all IPIs, Republican Committee on Countering Trading in Counterfeit Goods
Ukraine	IP public service under the Ministry of Education, Science, Youth and Sport – all IPIs, Coordination Council on Countering Violations in the Area of IP, Research and Development Establishment on IP of the National Academy of Sciences of Ukraine

*Sources: Republican Scientific Research Institute of Intellectual Property, Moscow.

The innovative activity of the business community depends not only on the availability and smoothness of the work of national innovation system institutions. What entices or forces entrepreneurs to modernise their business? The answer has long been known to the science of economics:

competition[356]. Innovation is one of the most important tools of competition, although it is an expensive one. Entrepreneurs will become seriously interested in new machines and technologies, if costs of their own application do not exceed labour costs. When labour is cheap, expenditures for technological renovation of existing production make no economic sense[357].

Speaking of the price of labour, we should not forget Russia's poverty indicators. Although, as Table 13 shows, the share of the population below the poverty line was 2.5 times lower in 2018 than in 1992, it is critical to note that whereas between 1992 and 2000, the poverty line stood at 50% of per capita income, now it is at 30% of per capita income. The share of people who receive less than 50% of per capita income has not changed since 2000, and is equal to almost 30% of the country's population; over 70% of the poor are economically active and t 10% are retirees. Moreover, as Table 14 shows, much of this cheap labour is employed in precisely those sectors that we wish to modernize. If this situation continues, it will be difficult to expect entrepreneurs' interest in innovations.

TABLE 13 Poverty indicators

356 "The law of the determination of value by labour time, a law which brings under its sway the individual capitalist who applies the new method of production, by compelling him to sell his goods under their social value, this same law, acting as a coercive law of competition, forces his competitors to adopt the new method". Marx was clearly referring to what was common knowledge. He quoted a publication of 1720: "…Every art, trade, or engine, doing work with labour of fewer hands, and consequently cheaper, begets in others a kind of necessity and emulation, either of using the same art, trade, or engine, or inventing something like it, that every man may be upon the square, that no man may be able to undersell his neighbour" ([H. Martyn] *The Advantages of East-India Trade to England*. London, 1720. P. 67) *(Marx K.* (1975). *Capital*. V. 1. In: Marx K. and F. Engels. F. Collected Works. Vol. 35. New York: International Publishers. P. 234).

357 This fact was observed by the first Russian political economist I.T. Pososhkov, who noted - in the manuscript prepared for Peter I (1724) - that "poor feeding hinders the interest of Russian people in best practices and prevents fair art multiplication" *(Pososhkov I.T. (2001). Kniga o skudosti i bogatstve*. [A book about scarcity and wealth] M.: "Economic Paper" Publishing, p. 248). Note, that "fair art" meant state of the art techniques in handicraft and industrial work in those days, i. e. to put it in modern language, low income does not promote modernisation.

Year	1992	1998	2000	2010	2018
Share of population with income below subsistence minimum, %	33.5	23.4	29.0	12.5	12.9
Subsistence minimum to per capita cash income, %	47.2	48.8	53.0	30.7	31.5
Share of population with income less than 50% of per capita cash income, %	26.5	~32	~29	~29	~29

Sources:

Russian Federal State Statistics Service. Raspredelenie naseleniia po velichine srednedushevykh denezhnykh dokhodov [Allocation of Population by Average Per Capita Cash Income]. Updated on 13.07.2019. URL: http://www.gks.ru/free_doc/new_site/population/bednost/tabl/1-2-1.doc;

Russian Federal State Statistics Service. Velichina prozhitochnogo minimuma (v srednem na dushu naseleniia; rublei v mesiats) [Subsistence Minimum (Average Per Capita; Rubles per Month)]. Updated on 08.07.2019. URL: http://www.gks.ru/free_doc/new_site/population/urov/urov_41kv.doc;

Russian Federal State Statistics Service. Chislennost' naseleniia s denezhnymi dokhodami nizhe velichiny prozhitochnogo minimuma i defitsit denezhnogo dokhoda [Number of People with Cash Income below Subsistence Minimum and Cash Income Deficit]. Updated on 02.08.2019. URL: http://www.gks.ru/free_doc/new_site/population/urov/urov_51g.doc.

At the same time, ***overcoming of cheapness of labour power is a compulsory, but not a sufficient condition for entrepreneurs' innovative efforts.*** The truth is that innovationis risky, as both economic science[358], and businessmen themselves[359] attest. It is no accident that the development of innovative entrepreneurship has required a wide spread of derivative financial instruments (derivatives) designed to insure investment risks. For example, innovative leasing is a risky operation due to the high uncertainty of the results

358 "The far greater cost of operating an *establishmen*t based on a new invention, as compared to later establishments arising out of their ruins, ex suis ossibus. This is so very true that trail-blazers generally go bankrupt..." *(Marx K. Capital*. V. 3, (1998). . in: Marx K. and Engels F. Collected Works. Vol. 37. New York: International Publishers. P. 106).

359 As Victoria Livshitz, founder of Grid Dinamics (Silicon Valley, U.S.), notes, "There is statistic in the U.S. that one out of ten enterprises becomes very successful. Two of them survive, and seven go bankrupt. But these ten projects are not taken from the street – they are the best of the best" (quoted from: *Bilevskaya E. (2010)*. Kreml' otsenit riski. [The Kremlin will assess the risks] *NG*. 11.08.10. P. 3).

of innovative entrepreneurship and the capital of such leasing projects needs to be hedged. Obviously, an investor is unlikely to invest their own funds in innovation without applying such protection measures, given the well-known statistics of risks in the implementation of innovative projects. Derivatives are the instruments of such hedging. Should a businessman have cheaper and more reliable competition tools at his/her disposal, he/she would rather choose them. However, derivatives, by protecting the basic assets from risks, increase the risk when these instruments themselves are traded. This fact played a significant role in the development of the financial crisis of 2008-2009.

TABLE 14. Average monthly nominal wage by sector, % to Russia's average

Year	1995	2000	2005	2011	2018
Average wage, rubles	472.4	2223.4	8554.9	23,369.2	43,445
By sector					
Fuel and energy resources	2.6-fold increase	3.1-fold increase	2.7-fold increase	220.8	293.7[1)]
Finance	1.5-fold increase	2.3-fold increase	2.6-fold increase	238.7	211,1
Production of machinery and equipment	80.3	88.8	97.9	97.5	91.3
Production of electrical, electronic and optical equipment	76.0	90.1	96.1	100.0	117[2)]

[1)] – oil and gas
[2)] – production of computers, electronic and optical goods
Sources:

Russian Federal State Statistics Service. (2019). *Russia in Figures 2019*. M.

Russian Federal State Statistics Service. (2003). *Russia in Figures 2003*. URL: http://www.gks.ru/bgd/regl/B03_11/IssWWW.exe/Stg/d010/i010680r.htm

16.4. Reindustrialisation Workforce

One imperative of reindustrialisation is the investment in human capital and an active ***personnel*** policy; it was planned to create an upgrade of 25 million high-tech working places by 2020[360]. Let us examine two important aspects of this problem:

- professional, social and demographic profile of personnel engaged in industry, possibility of their retraining and career development;
- problems and prospects of new personnel training for the industry.

The drain of specialists (especially those of active age) from industry still continues. The average number of employees in the economy of Russia was down from 1990 to 2010 by 7.7 million people (from 75.3 to 67,6) , and by 10.4 million people (from 21.0 to 10.6) – in industry[361]. The overall decline in employment was less than the decline in industrial employment, as there was an increase in the number of jobs in trade, finance, and other service industries, where some of those laid off from industrial enterprises moved. Mechanical engineering was compromised most of all, of7,7 million engaged in it in 1990, there were fewer than 3 million workers left. Not only did the number of industrial and manufacturing personnel decrease by 2.5 times, the situation reached disaster proportions in certain types of mechanical engineering. (Table 15).

[360] Ukaz Prezidenta Rossiiskoi Federatcii ot 07.05.2012 g. № 596 «O dolgosrochnoi gosudarstvennoi ekonomicheskoi politike» [Decree of the President of the Russian Federation No. 596 of 07.05.2012 "On long-term state economic policy"]. URL: http://kremlin.ru/acts/bank/35260

[361] Tablitca 3.8. Srednegodovaia chislennost zaniatykh v ekonomike. Federalnaia sluzhba gosudarstvennoi statistiki. Trud i zaniatost v Rossii - 2011 [Table 3.8. Average annual number of people employed in the economy. Federal state statistics service. Labor and employment in Russia - 2011] URL: https://rosstat.gov.ru/bgd/regl/B11_36/IssWWW.exe/Stg/d1/03-08.htm;Obrabatyvaiushchaia promyshlennost v Rossii i v mire (sravnitelnyi analiz 13 stran). Avgust 2018 goda. Analiticheskii Otchet **J'son & Partners Consulting [Manufacturing industry in Russia and in the world (comparative analysis of 13 countries). August 2018. An analytical Report by J'son & Partners Consulting]**. **URL**: https://json.tv/ict_telecom_analytics_view/obrabatyvayuschaya-promyshlennost-v-rossii-i-v-mire-sravnitelnyy-analiz-13-stran-20180816061422

TABLE 15 Reduction in the number of industrial and manufacturing staff (IMS) in industrial production and mechanical engineering

Industrial segment	1990	1995	2004	Reduction in IMS (2004 against 1990), times
All industries, million people	21.0	16.0	11.9	1.8
Mechanical engineering, million people	8.0	4.9	3.2	2.5
including by sector, thousand people:				
diesel engines	68	40	21	3.2
mining and ore machinery and equipment	75	49	31	2.4
weight handling equipment	86	70	40	2.2
railroads	153	114	85	1.8
electrical engineering	545	345	252	2.2
chemical and petroleum engineering	280	191	241	1.2
machine-tool building and toolmaking	279	169	88	3.2
instrument engineering	748	388	170	4.4
automobile industry	814	706	566	1.4
bearing	113	75	47	2.4
tractors and agricultural machinery and equipment	512	280	86	6.0
road construction and utilities machinery and equipment	163	105	87	1.9
equipment and machinery for consumer, food industry and household appliances	198	139	73	2.7

Sources:

Russian Federal State Statistics Service. Srednegodovaia chislennost' promyshlenno-proizvodstvenenogo personala v otrasliakh promyshlennosti po kategoriiam (tysiach chelovek) [Average Number of Industrial and Manufacturing Staff by Industrial Sector [thousand people)]. URL: http://www.gks.ru/bgd/regl/B05_48/IssWWW.exe/Stg/04-01.htm

This resulted in the ageing of industrial staff and unfilled vacancies. The number of employees grew in the post-Soviet period only in the mining industry, energy sector and iron-and-steel industry, while those employed in in mechanical engineering decreased dramatically (the quantity of people employed decreased over the period of reforms (1990-2018) by almost 80%).

1.702 million people continued to work at enterprises of this industry(production of machinery, equipment and vehicles)[362], there were 8 million people in 1990. But the problem of ageing of the staff is getting worse even in the relatively successful companies. Truly, the question here is about the lack of qualified and reliable core personnel of middle age. Enterprises that regained core personnel now have them training younger workers as possible. Less successful and competitive enterprises suffer from critical staff shortages.

The strategic deficit of human resources over the recent years has been exacerbated by the release of manpower due to the crisis reduction in demand for labour, restructuration of production and implementation of robotic technologies in modernised enterprises. In the context of a пeneral reduction in demand for labor and an uncompetitive level of wages in the machine tool industry, there is a loss of released qualified personnel for the industry. It is not without reason, that the Strategy of development of industry in the "Subprogram 7. Machine tool industry" specified "[363] risks related to a mismatch between qualification of personnel and requirements, needed for implementation of the sub-programme, as well as to physical absence of qualified workforce at the enterprises of industrial sector".

[362] Calculated by the data in: Promyshlennoe proizvodstvo v Rossii. 2019: Statisticheskii sbornik/Rosstat. – M., 2019 [Industrial production in Russia. 2019. Statistical compendium. –

Moscow: Rosstat. 2019]. P. 39-40. URL: https://rosstat.gov.ru/storage/mediabank/Prom_proiz-vo2019.pdf

[363] Gosudarstvennaia programma Rossiiskoi Federatcii "Razvitie promyshlennosti i povyshenie ee konkurentosposobnosti na period do 2020 goda" (utverzhdena rasporiazheniem Pravitelstva RF ot 30 ianvaria 2013 g. № 91-r). Pasport Gosudarstvennoi programmy Rossiiskoi Federatcii "Razvitie promyshlennosti i povyshenie ee konkurentosposobnosti" na period do 2020 goda. Podprogramma 7. Stankoinstrumentalnaia promyshlennost.[State program of the Russian Federation "Development of industry and increase of its competitiveness for the period up to 2020" (approved by order of the Government of the Russian Federation No. 91-R of January 30, 2013). Passport of the State program of the Russian Federation "Development of industry and increase of its competitiveness" for the period up to 2020. Subprogram 7. Machine tool industry]. URL: http://base.garant.ru/70308410/

Meanwhile, the supply of qualified personnel for industry needs to be improved for reindustrialisation.

It is necessary to increase the number of people employed in microelectronics, modern mechanical engineering and in the all types of activities of the manufacturing of new types and models of technological equipment. It is necessary to create 6-7 million new high-tech jobsin mechanical engineering to ensure prevalence of high-tech types of activity. Besides, we should increase expenditures on R&D to 2.5-3% of the GDP; this will result in more than a million of working places in project, design and other similar organizations.

Thus, totally,it is necessary to create 7-8 million working places in the sectors of mechanical engineering and applied research and development, while the remaining 17-18 million workplaces will arise upon transition to new technologies in business activities, which consume products of mechanical engineering and information technologies. However, the staffing problem has been restraining technological modernisation so far.

There are several other staffing problems which also hamper the revival of Russia's mechanical engineering and metal-working on a new technological foundation:

- imbalance between interests of employers, employees and the state in modernisation;
- loss of staff of active working age, ***ageing*** of workforce and the difficulty of re-educating older workers;
- lack of motivation of younger workers to be engaged in industrial

production;

- low wages and salaries and and undervaluation of the complexity of production in transition to new technologies;
- insufficient compensation for new functions performed by workers and for special working conditions;
- lack of specialists educated for work on new equipment in industrial production;
- breakdown of training and re-training infrastructure at higher educational institutions;
- underestimation of the radical changes in production technologies achieved in developed countries in design of education programmes.

To supply trained specialists we need to restore the training system, including post-graduate training, focus it on applied technologies and create a system of additional training for lecturers at higher education institutions with the involvement of professionals from enterprises applying new technologies and software.

HR employees of industrial enterprises state that the existing formal education system does not train, or does not train enough technological specialists. If workers have no experience of work with certain new technologies, they will have to be additionally trained or retrained at the enterprises. It has, however, been acknowledged that spreading universal higher education which partly compensates for the failures of basic school education provides a reasonably good basis for further mastering of new professions.

Clearly, the success of any national reindustrialisation will be largely determined by the quality of staff policy of both the state and the corporations. Consequently, financial procedures of public regulation in the field of personnel training should combine with growth of the expenses of companies on preparation and re-training of specialists. However, employers, who are dissatisfied with public efforts in the area of staff training are unlikely to devote much to training employees either. According to the Russian Statistics Committee, training costs as a share of total labour costs from 2005 to 2013 remained at the disastrous 0.3%[364] . According to the results of Association fo Talent Development 2017 "State of the Industry" report and the ILO statistics the similar costs in the developed countries it is possible to estimate as 3,0-3,5% of total labor costs.[365].

Persistent imbalances between the professional education system and the needs of industrial enterprises has finally led the Russian Union of Industrialists and Entrepreneurs and "Business Russia" to step forward and offer to cooperate with public structures at all stages of the reform jf the system of professional learning: from the design of educational and professional standards to additional financing of universities, equipment of classes, laboratories and workshops, corporate methods of module trainings, which are used nowadays to "finishing" graduates on their working places, and personal

[364] Rosstat (2014). Ctruktura zatrat organizatcii na rabochuiu silu po vidam ekonomicheskoi deiatelnosti (v protcentakh). [Rosstat (2014). Structure of organizations ' labor costs by type of economic activity (as a percentage)]. URL: https://rosstat.gov.ru/storage/mediabank/3-1-2.htm

[365] Maria Ho (2017). Learning Investment and Hours Are on the Rise. TD Magazine. December 2017 URL: https://www.td.org/magazines/td-magazine/learning-investment-and-hours-are-on-the-rise; Global Wage Report 2016/17: Wage inequality in the workplace. International Labour Office – Geneva: ILO, 2016. URL: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_537846.pdf

participation in the process of training. Public and private partnerships in the area of training staff who can reindustrialisethe Russian economy is urgent.

A modern technological base requires ***not just highly skilled, but a creative (constructive) employee who are likely to demand higher*** quality of life which can be satisfied by dynamic development of education, culture, healthcare and improvement of material conditions. Calls "to tighten the belts" for the good of future generations sound like anachronism in this context. People with "tighten belts" can *be* ***neither a source, nor a conductor of innovations*.**

Without the development of industries, ensuring the production and reproduction of national human ***potential adequate*** for tasks of new industrial development is not possible. It will inevitably lead to greater economicsocial and political imbalances and risk economic stagnation and social conflicts.

16.5. Commitment to Technological Priorities

Today, when the need for a large-scale economic modernisation is clearly recognised, the inability to really launch such process becomes more and more evident. The national economy has fallen into a structural and institutional "trap": it could not properly respond to the development of internal demand by the increase of domestic production of competitive goods at the expense of increasing investment activity. There were at least three problems: inability to establish clear priorities; difficulty of obtaining a clear complete picture of the

Russian economy's wishful structure; and, consequently, the difficulty of launching the projects that can drive the modernisation of its basic sectors.

The implications are clear: we must : 1) define priorities; 2) approve implementation mechanisms for the priorities; 3) focus resources in priority areas which ensure the fulfillment of stated objectives.

Establishing priorities will require collaborative work of expert specialists from different divisions of knowledge. These priorities have been changed several times in recent years (Table 16).

TABLE 16. Changes in priority directions in the development of science and technology

Priority directions	1996	2002	2006	2009	Directions of technological breakthrough
Fundamental research	+	–	–	–	–
Information and telecommunications technologies	+	+	+	+	+
Production technologies	+	+	–	–	–
New materials and chemical technologies	+	+	–	–	–
Living systems, medicine (life sciences)	+	+	+	+	+
Transport technologies	+	+	–	+	–
Power engineering and energy efficiency	+	+	+	+	+
Ecology and rational use of natural resources	+	+	+	+	–
Space technologies and systems	–	+	-	+	+
Nanosystems industry	–	–	+	+	+
Defence industry complex, nuclear technologies	–	+	+	+	+
Security and anti-terrorism	–	–	+	+	–

Sources: Ministry of Industry and Science of the Russian Federation. (2000). *Osnovnye napravleniia gosudarstvennoi nauchno-tekhnicheskoi politiki na srednesrochnyi i dolgosrochnyi period* [Medium- and Long-Term Main Directions of State Policy on Science and Technology]. (Produced under the instructions of the Government of the Russian Federation dated 27.10.2000 (IK-P 829 269); *Prioritetnye napravleniia razvitiia nauki, tekhnologii i tekhniki v Rossiisko Federatsii* (Pr - 843, dated 21.05.2006) [Priority Directions in the Development of Science, Technology and Machinery in the Russian Federation]; *Perechen' kriticheskikh tekhnologii Rossiiskoi Federatsii* (Pr - 844, dated 21.05.2006) [List of Critical Technologies of the Russian Federation]; *Prioritetnye napravleniia razvitiia nauki, tekhnologii i tekhniki v RF* (Decree of the President of Russia No. 899, dated 7.07 2011) [Priority Directions in the Development of Science, Technology and Machinery in the Russian Federation].

Given the fast pace of technological change some adjust of priorities is inevitable. However, such frequent changes clearly indicatea lack of direction in the development of the national economic policy. Priorities should be established not only on the macro-level, but also on the sectoral level and specified further through transformative projects whose implementation will have wide-spread technological and multiplicative multi-sectoral effects.

Practically, reindustrialisation policy in Russia today should be limited to public investment projects in expanding lines of industrial production which can be locomotives of sustainable growth, whereas the schemes of implementation of prepared investment projects imply the stipulation of "supporting points" (in terms of technological possibilities for realization) for these projects, the determination of which requires large-scale inventory auditing of technological potential. Only such inventory auditing, which can show us both the real picture of present technological possibilities and possibilities of technology development, will help estimate the opportunities for the implementation of targeted priorities, to define resources for consistent movement towards the set targets.

Our premise is the highly concentrated and centralized structure of Russian industry the fuel and energy industry (particularly in gas, energy and oil sectors), and by the excessive dispersion of capital in the manufacturing industry, primarily in machine engineering and instrument making industry, which leaves Russia without globally competitive machine-building corporations capable of competing with leading global corporations integrated into transnational financial and industrial groups.

As mentioned above, it was only in the second half of 2000s that the government began taking measures to aid concentration and restructuration in some sectors of mechanical engineering through public corporations and joint stock companies with a controlling stateinterest. Such initiatives in aircraft engineering, shipbuilding, sectors of defence industry complex, the Rostech Public Corporation aimed to adapt them to compete in the world market. The merger of dispersed state-controled machine-building assets under “Rosstankoprom” JSC was launched.

However, these mergers have had a a rather narrow focus related, for the most part, to the preservation of defense and related industrial potential of the country, which results in a rather weak systemic (general industrial) effect. Besides, just as in the Soviet times, the defence industry complex of Russia continues to be organisationally and economically separated from the civilian sector of technology- restricting the transfer of technologies. Unlike mineral mining corporations with a high share of export, national machine building complex (except for the separate defence industry sectors which are also successful exporters) has no opportunity to raise funds in external financial markets (long-term loans, IPOs), which leads to the persistence of low competitiveness. Remedying this will require serious attention to restorting applied science, design and engineering, which are in fact standing on the brink of extinction, by building a system of national research universities complementary to Russian Academy of Science centres.

What is typical, there is ***not a single mention of concrete priorities of industrial development*** in the section devoted to vision and tasks of national industrial development ***in the new edition of Strategy-2020***. It seems that the Russian government does not have a realistic picture of content of industrial policy. Economic ministries are likely to apply the old liberal approach where the state ***promotes active development of transport infrastructure only and public involvement in the implementation of projects on modernisation and diversification of industrial potential is minimised***. It is no coincidence that priorities in the Strategy-2020 only go as far as shaping a general institutional environment, but not to the content and methods of active industrial policy let alone a clear vision of its sectoral components and strategies.

Nor is a system of independent evaluation of progress in areas prioritized for diversification of industrial potential of the country or one for the selection of priority projects for public supportever been developed. There is still an ambiguous allocation of functions between the economic ministries. The Ministry of Industry and Trade is responsible for design of concepts and programmes for sectoral industrial development. The Ministry of Economic Development controls the investment component of the budget and selection of target development programmes, i.e. the creation of economic conditions for their implementation. The Ministry of Finance designs the general plan for the distribution of budget expenses.

Though Russia joined the WTO only after 18 years of negotiations, it still did so and non-competitive industry with disbalanced structure and this hardly simplified matters. The government was forced to hastily design special programmes to support different sectors of the national industry, and the effectiveness of these programmes is highly questionable. Accession to the WTO intensifies competitive challenges for national manufacturers, even as it curtails opportunities to improve their competitiveness. Membership in the WTO is the most beneficial for countries with highly competitive manufacturing industry, providing them with favourable export conditions. For other countries, it only makes it more difficult for them to become more competitive.

Russia's Foreign economic problems do not end here. International experience shows that a prerequisite for an industrial and technological leap is a rush of advanced technologies into the national economy through the purchase of foreign equipment, selective import of products and services containing information on technological novelties, imitation of foreign technologies and design according to purchased examples (reverse engineering) and purchase of non-material technologies (pre-production prototypes, patents, licenses, know-how). We can add the list the migration from other countries of ***complete or partial production of complex end and intermediate products, establishment of research and development and design facilities by transnational corporations in host countries)***, as well as ***the training of host country personnel employed at affiliates of transnational corporations.***

The Soviet experience is rather interesting in this context. In order to speed-up industrialisation, the share of machinery and equipment in its imports rose consistently in the 1920s and 1930s: it was, for instance, 46.8% in 1930. These imports made the Soviet Union one of the largest importers of engineering products of that period, accounting for 30% of the world total (excluding automobiles) in 1931 and for about 50% in 1932. In 1938, when the foundation of heavy industry had, for the most part, been laid, this share decreased but still remained at a rather high level – 34.5%.

Imported equipment was fundamental to the large-scale construction of new industrial enterprises in republics of the former USSR. In Russia, in particular, basis of machine-tool industry was established, including the first specialised enterprises of this industrial sector – “Frezer”, “Kalibr”, “Krasny Proletarii” and other. Large tractor building plants in Stalingrad and Chelyabinsk and the first automobile-making factories in Moscow and Gorkii were equipped with imported equipment. Import of electrical generators and steam-power plants covered almost 90% of the equipment needs of power projects. Iron and steel enterprises, including integrated plants in Magnitogorsk, Kuznetsk and Chelyabinsk, received the necessary equipment from abroad, mostly from USA and Germany.

Imports are bound to play and equally important role in the revival of Russian manufacturing industry today, as many types of machinery and equipment are either not produced in Russia at all or are, thanks to the degradation of the sector, of a quality too low even for Russian firms. According to calculations of the Institute for National Economic Forecasts under the RAS, only 44% of the fixed capital investment needs in the Russian economy can be covered by local production[366].

Moreover, Russia’s imports are hardly being used for the reconstruction of the national economy. Imports remain focused mainly on the satisfaction of current consumer needs. For example, in 2011, according to the Federal Service

[366] Ivanter, V.V.. ed. (2006). *Innovatsionno-tekhnologicheskoe razvitie ekonomiki Rossii*. [Innovative and technological development of the Russian economy]. M.: Maks Press. P. 200.

of State Statistics, the share of consumer goods in the structure of imports was equal to 36.7*%*, and that of capital goods – only to 21.3%. By contrast, aAccording to the data of UN Comtrade (2007), consumer goods, including food and drinks, accounted for 5.6% of Chinese imports, 10.6% of Brazilian 5.2% of Indian and 11.3% of Mexican. The share of commercial equipment of the same countries imports was, by contrast, 43.8%; 26.6%; 19.1% and 31.8% respectively[367].

In a word, ***Russian imports are not yet*** an efficient tool for the acceleration of scientific and technological progress and the modernisation of production and technological potential of the country. To make them so, the import share of machinery and equipment for investment should be increased by 1.5-2 times.

Russia also imports a negligible amount of foreign soft technologies In 2011, the country spent around $1.9 bn for these purposes (0.5*%* of the total Russian import of products and services)[368]. In comparison, in the same year the U.S. – a leader of technological development – purchased $34.5 bn worth of foreign technologies, Japan – $19.2, Singapore – $19.4, Switzerland – $16 and China – $15 bn.

367 UN Comtrade has not published similar data since 2009. It is difficult to compare data of the Federal Service of State Statistics with international statistics, as grouping of goods in the local and global statistics differs. According to our estimates, based on data from UNCTAD, in 2011 the share of machinery and equipment (excluding automobiles) in import accounted for 27.1% in Russia, 31.4% – in China, 26.8% – in Brazil, 16% – in India and 36.9% – in Mexico. Should we exclude office and telecommunication equipment from the group of machinery and equipment, the shares in these countries will be the following: Russia – 20.8; China – 25.2; Brazil – 20; India – 11.9; Mexico – 24%. As for consumer goods, it is difficult to estimate their share on the basis of international statistics.

368 The WTO estimates our import of technologies differently ($6.1 bn in 2011), but does not provide a breakdown of its structure. See: WTO. *International Trade Statistics 2012*. www.wto.org.

There is another serious problem, the ***unfavourable*** structure of imported technologies. Engineering services (37%) and trademarks (22%), i.e. items that fall under the category of "mature" technologies with relatively low profitability, dominate. Share of patents, licenses and know-how related to the adoption of new processes and types of products amounts to only 9%.

When Russian entrepreneurs want to improve the technological level of their production, they prefer to purchase foreign technologies in the complete form – as machinery and equipment. This helps them to speed up and simplify the renovation of production while remaining with technologies that are still behind the curve. World experience shows, however, that the import of licenses and know-how is in many cases more profitable. License agreements, apart from saving money, provide an opportunity to get valuable know-how and assistance in the improvement of licensed products, and sometimes – in selling of these products on the foreign markets. Besides, such agreements can serve as the foundation for new national technological developments. According to experts, in the middle of the past decade more than half of all machinery products in the world were produced on the basis of license agreements[369]. Let us remember that it was through licenses and know-how that Japan, Singapore and other states closed the gap between them and the developed countries. Their experience underlines why the inflow of advanced technologies mainly in non-material form should become an important share of import in our country as well.

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[369] *Problemy effektivnoi integratsii nauchno-tekhnologicheskogo potentsiala Rossii v mirovoe khoziaistvo*. [Problems of effective integration of Russia's scientific and technological potential into the world economy]. (2008). M.: LKI Publishing. P. 35.

Ultimately Russia does not import technology (as is and in the material form) because its enterprises, which are not forced into technological upgrading by competition, do not demand them. An insufficiently favourable investment climate and the lack of motivation for innovative development also play their role.

Another factor is lack of experience and structures which ensure the development of an idea defined in a license to an end product as a material, equipment or process. It is not enough to purchase a license that allows the use of the new technology. To be economically effective, it is necessary to provide several conditions to ensure that this technology was applied in the real production process: the complex of technological equipment with required parameters, engineers are able to organize the work and service of this complex, the production staff with the necessary training, supply adequate raw materials and components. Remedying this requires finishing and improving national innovation system particularly the revival of branch institutes, design engineering bureaus and pilot-producing plants. All these, which conducted not only academic pursuits and scientific research, but also the study of examples of foreign machinery which helped to have a finger on the pulse of global technological development, suffered in the period of ***systemic transformation***.

Such means of the import of technologies into Russia as direct purchase of investment equipment, licenses, know-how, as well as more complicated forms of engagement, including turn-key construction of plants, cooperation with foreign companies in the process of product manufacturing, joint research and development and the establishment of joint enterprises, should be supported by the state on a systematic basis.

In order to improve the investment climate, it is necessary to restore tax relief for investors and take measures to simplify the import of industrial machinery not produced domestically. Specifically, tariffs for import of such equipment can be brought to a zero for a period of 5-7 years, even when this is not provided for by the obligations towards the WTO. Such measure was in practice in the pre-crisis (before 2014-2015) period. However, Russia is not authorised to handle customs tariffs itself, as it is a member of the Customs Union: this is the prerogative of the Eurasian Economic Commission, and arranged by it decision.

It is also possible to acquire modern technologies through "industrial intelligence" by countries and corporations. Although never discussed officially, such acquisitions make it possible to eliminate technological inferiority in a given sector within a short time.

Boosting the import of investment equipment and technologies should be a core component of the general scientific and technical and industrial policy of the country. Bearing in mind domestic absorption capacities and and general prospects of technological advances in the world, priority technologies and types of equipment for local development as well as those to be imported should be identifiedin cooperation with direct users and designers of local machinery, so that it could be beneficial for all – national sector of research and development, local industry and technological security of the country on the whole.

16.6. New Model of Economic and Institutional Development

Economic reindustrialisation depends on the ability of the state to consolidate measures for the solution of all aforementioned problems under a systemic industrial policy. Its quality and efficiency will be determined by the quality of public institutions and procedures which create and impliement it by selecting priorities, carrying out investment projects, financing schemes and controlling the allocation of resources).

There is no effective system for working out the approach and defining the development prospects of the main sectors of the national economy and industry in Russia. “Concept – 2020” received no further specification in any documents on the development of separate sectors of the national economy and industry. Industry-specific concepts were developed with delay and only partially, except those for a small group of industries. They were not brought to the level of long-term programmes of modernisation and development of the most important industrial complexes and were weakly correlated with each other.

As a result, it is not clear, who will define the technological priorities of development (critical technologies) and how they will do so, what kind of expert reviews will be conducted and how they will be linked to prospects of development of the corresponding sectors of the national industry and economy. What appear to be isolated elements of industrial and technological policy are just a result of backstairs influence of interested economic entities and serve manly as a way to gain access to the Federal budget funds. The situation is further exacerbated by the non-transparency of Russian business in regard to real owners and generation of actual costs. This features of the Russian economy specially analyzed in the theory of 'insider control'.[370] also makes it difficult to build effective relations between the state and business necessary to finance priority development projects.

It is important not to confuse cause and effect when analysing the low quality of Russian institutions of public management. The fact is that the quality of these institutions' functioning is the result of their experience. Modern Russian institutions were formed during the dismantling of the Soviet planning system, "primitive accumulation" and dramatic reduction of public involvement in economy. These circumstances largely determine both the mentality and professional level of most state officials.

It is obvious that the activity level of the state cannot increase by itself or as a result of special campaigns for "clean-up and improvement". The quality of public institutions will really start to change when the nature of tasks to be solved changes upon the transition of functions from permissive and distributional to creative, which orienting state structures to creation the most favorable conditions for innovative activity, and direct support of such activity by all available ways.

Reindustrialisation, as we envisage it, is possible only in the ***modernised institutional environment.*** Most experts agree that poor institutional environment acts as the main obstacle for economic growth in Russia. The

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[370] Dzarasov R. Insider Rent Makes Russian Capitalism: A Rejoinder to Simon Pirani. Debatte: Journal of Contemporary Central and Eastern Europe Volume 19, 2011 - Issue 3. https://doi.org/10.1080/0965156X.2012.665281

effect of institutional changes is comparable to, and may be even higher than, fiscal and monetary policies.

Increasing investment to required levels is only half the battle. The motivation of entrepreneurs in relation to investment for reindustrialization must also be altered. As we know, uccessful entrepreneurship in Russia relies on close collaboration with public structures. However, this collaboration is not a matter of mere ‘partnership between the state and business’. Officials have the power to dictate to business. It does not matter whether they do sofor social benefit or profit. What matters is that certain institutions (as a rule, not official) make it possible. They constitute a specifically Russian form of government control over appropriation relations. Effective modernisation is impossible without coping with this persistent phenomenon. This is confirmed by both entrepreneurs[371] and economic authorities[372]. The same point was made by the President of the Russian Federation, “Costs for business can fluctuate – you can pay more or pay less depending on whether certain people who are affiliated with the government “favour” you. Rational behaviour of entrepreneurs in this case is not to observe the law, but to find protectors and negotiate a bargain. But such “negotiated” business will try, in turn, to stifle competition and clear

[371] See: Speech of A. Galushka, Vice-President of Business Russia, at the Business forum for real sector enterprises “Modernisation” on 14.09.2010. (See in: Kalmatckii M. Ne tot klimat [Not the climate]. *Novye izvestiia*. 15.09.2010. S. 3

372 See: Min points of Minister E. Nabiullina at the conference “Competition in Russia: ways to create favourable environment for business development” (Moscow, 26.11.2010) URL: http://old.economy.gov.ru/minec/press/news/doc20101126_06; Speech of Deputy Chairman of the Government of Russia and Minister of Finance A.L. Kudrin at the Eighth Krasnoyarsk Economic Forum, 18.02.2011. (see: https://www.gazeta.ru/financial/2011/02/18/3530254.shtml).

its own market niche using the powers of affiliated officials – instead of increasing economic efficiency of its own enterprises."[373]

Thus, the modernisation of the economy requires not only the development of competition in general, but the creation of conditions under which Russian entrepreneurs will be ***forced*** to use technological modernisation as the main instrument of competition. Elimination of monopolism both of big corporations, especially state-controlled, and of not so much big business, used the support of local authorities, is also ***necessary, but not sufficient*** for the development of competition. It is important to ensure the change in the mechanism for the appropriation of the result of economic activity. The main trouble today is illegal takeover which may involve skimming entrepreneurs of produced goods or unfair appropriation of the business itself and, ultimately, the destruction of someone's life's work.

The fight against illegal takeover and calls for innovative behaviour will be unsuccessful so long as the appropriation of property remains more attractive than the development of said property. Countermeasures (financing, investment and tax concessions or mechanisms of public and private co-financing) are not significant enough in order to allow for the lowering of innovative activity risks. Institutions that render other (non-innovative) instruments of competition considerably more risky are much more effective.

The current governmentalisation of the Russian economy is defined by low legitimacy of ownership rights for capital goods and production output which was predetermined by the mechanisms for privatisation of state property

373 *Putin*, V.V. (2012). Nam nuzhna novaia ekonomika. [We need new economy]. *Vedomosti*. 30.01.12.

employed in the 1990s. Highly primitive "renewal" of the concept of ownership was conducted then under the slogan of denationalisation and was unsupported by any research or global experience. This process resulted in the emergence of "ineffective" (from the economic perspective) owners[374]. In practice, Russia reverted to its historical legacy described by V.V. Rozanov in the beginning of the twentieth century, "All ownership in Russia emerged from "begging" from, "presenting" to or "robbing" somebody. There is very little ***work*** for property. This is why it is neither strong nor respected"[375].

As a result, all actions of the state (or its representatives) aimed at the limitation of "business freedom" – even if they are illegal – are supported by the population, especially when they are conducted under the slogan of protecting the rights of "common people". This situation creates the gap the Russian economy.

Privatisation in itself is not the same as denationalisation. The only reliable mechanism for the real denationalisation of economy, as experience shows, is continuous active work of civil institutions. They can curb selfish interests of entrepreneurs and the state's constant urge to get excessively involved in the economy. These institutes shape the most important part of regulation in the socially-oriented economy. Therefore, it comes as no surprise that countries which are dealing with the consequences of the "socialist"

[374] The situation in the major part of the former Soviet Union is quite similar. See: *Kindzerskii Yu*. (2010). Deformatsiia instituta sobstvennosti v Ukraine i problemy formirovaniia effektivnogo sobstvennika v neeffektivnom gosudarstve.[Deformation of the property institution in Ukraine and the problem of forming an effective owner in an inefficient state] *Voprosy ekonomiki*. 7.
375 Rozanov V.V. (1990). *Uedinennoe*. [Secluded]. M., P. 37.

organization of public production are focusing on the development of such institutions.

Civil institutions emerge as a result of changes in mentality and behaviour. This is why we should not equate the policy for building a civil institutional system with a system of government measures aimed at the establishment of different non-governmental (social) structures. Such “policy” may lead to the emergence of quasi-civil relations. The task of the state is to create the social and economic political environment that would remove the barriers (administrative, economic, social etc.) that hamper the social activity of civilians or efforts on creating the material (economic) base for this activity.

If we manage to solve this institutional problem in the process of social modernisation and if entrepreneurs feel confident about their future, they will start to develop their business and leave its output to their descendants and the society – here, on their home turf, as opposed to transferring products and profits overseas. Then we will see both investments and innovations.

CHAPTER 17. Revival of Production, Science and Education: Fundamental Priority of Modern Industrial Policy

Successful reindustrialisation is impossible without the ***integration of production with education and science.*** To consider the ties between production, education and science, we need a systemic method that recognises complex correlations between the elements of the system and its interaction with external factors..[376]

Let us start by considering the historic experience: the period between the 1950s and early 1970s.

17.1. Learning from Russia's Past: Issues Related to the Critical Application of Soviet Experience

The Soviet Union had extensive experience in solving problems of integrative development of high-tech production, science and education. Numerous large-scale high-tech projects were completed in the USSR and they led to the formation of clusters around new industrial production projects (auxiliary production facilities, R&D institutions and other structures), which helped develop general and technical culture, promoted the development of the country's economy, etc.

376 See, for example: *Kornai I.A. (2002).* Sistemnaia Paradigma. [Systemic paradigm] *Voprosy ekonomiki*. **4**, 10-12; *Kleiner G.B. (2013). Sistemnaia ekonomika kak platforma razvitiia sovremennoi ekonomicheskoi teorii.[System economy as a platform for the development of modern economic theory] Voprosy ekonomiki*, ***6***; *Kleiner G.B. (2013).* Kakaya ekonomika nuzhna Rossii i dlia chego? [What kind of economy does Russia need and for what?] *Voprosy ekonomiki*. **10**, 21.

As a result, these large science and technical projects in the nuclear industry, space and computer technology and many other sectors led to social and economic progress, allowed the USSR to lead the rest of the world in a number of areas, made the entire socio-economic system more reliable and decreased its developmental risks. All successful projects – (Russia is still using resources and technologies created in the Soviet era) – were implemented in close contact between fundamental and applied science, education and material production.

The lack of qualified personnel for faster industrial development (in the process of developing new production facilities in the USSR) was dealt with by establishing micro-level ties between educational institutions and production facilities. In the 1920s, factory schools were first founded. Later these institutions developed into professional and technical schools and colleges. These educational institutions catered to the needs of specific industrial enterprises and provided on-site training for students, thus integrating the process of professional education and industrial production.

The next logical step was to include higher education in this chain. Starting in 1959, the largest and most advanced industrial firms founded specialised institutions of higher learning to prepare qualified personnel for their needs. Students came from the facility itself and from similar companies across the country. This helped integrate higher professional education with production and technology processes. During their studies, students usually acquired 3 to 4 distinct qualifications: as forepersons, technicians and then in their senior year - as engineers, designers, lab researchers. Throughout their studies, students at these universities remained employees of the enterprise. They absorbed the corporate culture of the industrial enterprise from the moment of their admission to the university.

The history of the Soviet atomic project is a great example of this approach. Specialised universities and new R&D institutes were created within the framework of this project, with the participation of leading theoretical physicists of the time - P. Kapitsa, L. Landau, P. Skobeltsin, I. Tamm, and many others. The late 1940s saw the creation of the Moscow Institute of Physical Engineering and the Department of Technical Physics (now the Moscow Institute of Technical Physics)at the Moscow State University. The R&D Institute of Nuclear Physics (originally known as R&D Institute of Physics No.2) was founded at the Department of Physics of the MSU. In 1949, the Department of Substance Structure founded the Section of Substance Structure (later known as the Nuclear Physics Section), which consisted of five departments.[377] Similar measures were adopted for the implementation of the rocket and space programme, creation and manufacturing of computing technology, etc.

This integration was provided within the framework of large science and technology projects of nationwide significance. As an example, we can consider the conversion of railroad transportation to diesel locomotives and electric engines, large-scale panel housing construction, transfer of radio-electronic industry to semi-conductor components, etc. Their implementation was made easier by the centralisation of resources and public property management practices.

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377 *Panasiuk M.I., E.A. Romanovskii, A.V. Kessenikh. (2002). Nachalnyi etap podgotovki fizikov-iadershchikov v Moskovskom gosudarstvennom universitete v tridtsatye-piatidesiatye gody. Istoriia atomnogo proekta.* ***2****. Moscow: Russian Christian Institute for the Humanities, p. 491. [The initial stage of training nuclear physicists at Moscow state University in the thirties. History of the nuclear project]*

However, the experience of integration also revealed the ***negative sides of this experience. In*** many cases, material resources were not used efficiently; employees were overworked; it was difficult to overcome administrative barriers and conflicts of interests among the participants; decision-making was excessively centralisedand excessively secretive impairing the spread of present-day science and technology solutions beyond the defence sector.

As the number of bureaucrats in the Soviet economy grew, these shortcomings became all too obvious. They stood in the way of effective cooperation between production, education, and science. Moreover, this integration was not based on sufficient economic motivation of the participants.

The latter shortcoming, which was of special importance in the process of applying R&D results into production, was dealt with in the USSR by arranging micro-level integration of science and production. The setup of science and production corporations (SPCs) bore its fruit. The first SPC in the USSR was Pozitron. Founded in 1969 in Leningrad, it produced electronic components and special-purpose equipment for the Ministry of Defence. The plant was also the first in Russia to produce small colour TVs and VDRs on a large-scale.

Too much time was spent on the coordination of scientific and technical issues when moving from experimental or small-scale production at an R&D Institute to large-scale production in manufacturing enterprises. To resolve these issues, interested parties often turned to intermediaries in their specialised state ministries. As Pozitron R&D Corporation was set up, its principal elements included an R&D Institute with an experimental plant. The corporation also included the Central Bureau for Technology and Equipment

Design (CBTED) with an experimental plant, and large-scale product-making enterprises with branches outside Leningrad. The General Director of the Corporation headed the Institute and its experimental plant, as well. First Deputy General Director also served as the advisor to the Corporation Board and Chief Engineer of the R&D Institute. Deputy General Director for Production also doubled as Chief Engineer of the experimental plant; the Deputy General Director for Mechanisation headed the CBTED and its experimental plant.

During the Kosygin reforms, the R&DC used the principle of internal self-support with partial use of goods/money relationship. The reform reduced the share of products that were planned to be released centrally, and allowed enterprises and associations to decide on their own production issues that were not included in the plans. The prices of these products were determined by the enterprises themselves, and they independently concluded contracts for their sale to customers. In addition, part of the profit remaining at the disposal of the enterprise increased, and it could be used for material incentives for employees. The unique feature of the internal self-support system used at Pozitron was the exclusion of mutual supplies from the turnover, which led to lower reported production volumes but focused the workers on increasing the output of end products. This is why the corporation's output grew considerably. Over the first half-year of operation, the volume of output of certain products quadrupled[378].

378 "Pozitron": soiuz nauki i proizvodstva. ["Positron": Union of science and production]. Sotsialisticheskaia industriia. (1970). **109** (234), May 12, 1970. URL: statehistoryru/2681/Pervoe-v-SSSR-nauchno-proizvodstvennoe-obedinenie-Pozitron/

Despite the obvious successes, the corporation failed to overcome institutional and economic obstacles of the planned Soviet economy model. High speed of scientific and technical progress also could not be guaranteed. The problems of the planned economy system in the USSR got worse in the 1970s-1980s and showed the necessity for qualitative changes in the economic system overall.

We are talking about the need for qualitative changes, since the main advantages of the Soviet economic system were also the reasons for its shortcomings. The advantages were the ability to ensure deep structural changes in the economy in a short time due to the mechanism of centralized resource management, which made it possible to ensure their redistribution, as well as the ability to coordinate economic decisions throughout the state. However, the disadvantages of this system were also rooted here: the high degree of centralization of decision-making largely limited the initiative of performers and did not take into account their economic interests.

It was possible to develop such methods of centralized coordination of economic activities that would not exclude the initiative from below and would not ignore the economic interests of performers, but on the contrary – would rely on this initiative and include economic interests in the Arsenal of methods for improving production efficiency. However, in the USSR, the inert Soviet and party bureaucracy was unable to use the possibility and to solve this problem, and history eventually left no chance for an evolutionary improvement of the system. Despite this, the combination of advantages of centralized coordination of economic activities when implementing long-term development programmes with a greater autonomy and economic interest of all involved in their design and implementation, not only remains open, but requires very close attention. The practical experience of the USSR in this sense should be taken into account both from its positive and negative sides.

Summarising the Soviet experience, let me mention the following points that emerge from it and can be applied to reindustrialisation:

- The development of ***large integrated structures*** that join together science, education and high-tech production into networks is critical.[379] These structures must be more flexible and less hierarchical and bureaucratised than in the USSR. No less important is the task of considering market criteria, stimuli and motives (cutting costs, monetary stimulation, etc.) in their creation and functioning;
- The development of ***large-scale long-term state programmes,*** which, unlike the Soviet directive plans, must be based on indicators, flexible indirect checks, balances (taxes, credits, etc.) and feedback loops and bring together private and public resources[380];
- ***Ideological*** and ***political support for programmes,*** which creates additional motivation for their implementation by means of encouraging and promoting the reindustrialisation mind-set among the members of the professional community and the general public.

The Soviet institutional environment was characterised by a high degree of resource centralisation and precise administrative mechanisms for these resources as state property. Today these important parameters are no longer

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379 *Vatutina O.O., Y.V. Vertakova. (2010). Sozdanie otraslevoi integrirovannoi struktury dlia povysheniia investitsionnoi privlekatelnosti otrasli.[Creating an integrated industry structure to increase the investment attractiveness of the industry] Mikroekonomika.* ***1****, 174-180.*
380 *Gruchy A.G.* (1984). Uncertainty, indicative planning and industrial policy. *Journal of Economic Issues*. Vol. 18. **1**, 159-180.

in place, and the mechanisms of economic policy must be different, with consideration of today's institutional environment in Russia.

The negative aspects of the Soviet experience include solving problems through direct administrative pressure (unfortunately, this is what present-day officials also do, by getting engaged in "manualmode" of administration[381]. This approach is unproductive, as the economic effectiveness of adopted decisions is often doubtful. Additionally, we can hardly recognise as effective an approach to integration between production, science and education that lacks stable institutions providing for horizontal ties, communicates all solutions upward and bypasses direct participants who receive instructions from hierarchical structures.

However, in 1991, these lessons (both positive and negative) were not taken into consideration.

17.2. Post-Soviet Russia: Positive and Negative Experiences

Let us now examine the sectors that collapsed during the period of fascination with market fundamentalist ideology in the 1990s. This period clearly showed that market self-regulation does not work without material, institutional and macroeconomic prerequisites. Giving up on active state

[381] This means making decisions not within the framework of standard management procedures, but rather intervening in economic processes in individual cases when such intervention is considered necessary by the highest administrative bodies.

regulation and programming in the economy led to considerable downturn in the development of Russian science, education, and production.

During the first stage of economic reforms, the attitude to science, especially fundamental research science, changed dramatically: it was now considered a un-productive expense. The financing of science was reduced, the salary of research staff fell in absolute and relative terms (in comparison with other sectors of economy). Many qualified R&D workers left the sector, and some of them moved abroad. In the early 2000s, the number of Doctors of Science from Russia working in the U.S. was comparable to the number of scholars who remained in the country.[382]

Not only did fundamental science suffer, the number of local R&D departments within companies also decreased dramatically. Fundamental and applied sciences were separated, and the production sector was devoid of the support of applied science.[383]

Education became disconnected from the production sector. The application of strictly commercial criteria to higher education in conditions of reduced financing led to an opportunistic reaction. Universities sharply increased the number of surrogate programmes in law, economics and management, often not having the duly qualified faculty to teach these subjects. Technical majors became unpopular with all attendant negative consequences. A considerable number of students enrolled in university programmes just to

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[382] There is no perfect statistical data in this case. The review of available statistical resources and expert estimations of 'brain drain' from Russia see in: Riazantcev S.V., Pismennaia E.E. (2013). Emigratciia uchenykh iz Rossii: "tcirkuliatciia" ili "utechka" umov. Sotciologicheskie issledovaniia, № 4(348), s. 24-35 [Emigration of scientists from Russia: "circulation "or " leakage" intelligences'. Sociological research, No. 4(348), pp. 24-35].

383 Discussed by, for example, the Director of the Institute of the U.S. and Canada. See: *Rogov S. (2010). Nevostrebovannost' nauki - ugroza bezopasnosti strany. [Unclaimed science is a threat to the country's security]. Nezavisimaia Gazeta. 08.02.2010. URL:* http://www.ng.ru/ideas/2010-02-08/9_science.html

receive a diploma, which gave them access to better sections of the labour market.[384] At the same time, there was a dramatic decrease in the number of highly qualified workers; private businesses chose not to invest in secondary professional schools (now known as technical colleges), and the salaries in this sector began dropping considerably. Today, when the business community complains that there are not enough qualified workers, they are dealing with the reverse side of their own strategy.

However, the main problem was the overall degradation of production. Widespread layoffs in the real sector of the economy and the decline in the technological level of production determined the lack of interest in R&D activities and in training of qualified personnel. This type of production did not generate any interest in innovations or highly qualified workforce.

The disintegration of production, education and science, as well as the fundamentalism of market reforms in accordance with unbridled market-regulation of the economy had a negative impact on Russian industry. Industrial stagnation is obvious in machine-tooling, civil aircraft engineering, instrument engineering, high-tech rolled products making, making of other steel products for construction purposes, etc. (Table 17).

As a result, the real sector of Russian economy adapted by means of cutting down production volumes and technological primitivisation. For 1992-2011 years of manufacturing of machine tools with numerical control in Russia fell by 25 times. The age of equipment in the machine tool industry reached an

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[384] See: Kolganov A.I. (2011). Institutsionalnye i organizatsionnye problemy uchastiia rossiyskikh universitetov v innovatsionnom protsesse. *Universitet kak zveno natsionalnoi innovatsionnoi sistemy*. [Institutional and organizational problems of participation of Russian universities in the innovation process. *In: University as a link in the national innovation system*] Moscow: MAX-Press.

average of 17.7 years in 2010, and the share of completely worn-out equipment was 22.1%.[385] By 1988 the Soviet industry produced over 63 models of robots and manipulators[386]. By the early 1990s, about 100,000 robots were produced in the USSR. The country used about 40% of all robots in the world. After 1992, the production and procurement of robots decreased tenfold, and many installed robots were dismantled or destroyed. In 2014, the last mass production of industrial robots in Russia was eliminated.[387]

The production of machine-tools in Russia fell from almost 70,000 a year in 1991 to slightly over 3,500 in 2012 (by more than 20 times). Compare this with the machine-tooling sector of the USSR which had corresponded to international standards: in 1984-1990 the USSR exported more than 45,000 pieces of machine-tools and press-forging equipment to West Germany alone[388].

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[385] Gribkov A.A., Zakharchenko D.V., Kornienko A.A. (2013). Konkurentosposobnost stankostroeniia Rossii. Voprosy ekonomiki. № 2013, s. 126-137 [Gribkov A., Zakharchenko D., Kornienko A. Competitiveness of Russia's Machine-tool Industry. Problems of Economy. No. 3, p. 126-137]. https://doi.org/10.32609/0042-8736-2013-3-126-137

[386] Lizan I. Dogoniaiushchaia robotizatciia. 02 Maia 2019 [Lizan I. Catching up with robotics. 02 May 2019]. URL: https://www.sonar2050.org/publications/promyshlennaya-revolyuciya/

[387] Ermolov I.L. (2019). O roli promyshlennoi robototekhniki v razvitii promyshlennosti Rossii. Innovatcii № 10 (252), s. 127-128 [Ermolov I. L. On the role of industrial robotics in the development of Russian industry Innovations No. 10 (252), 2019, pp. 127-128]. doi 10.26310/2071-3010.2019.252.10.015

[388] *Mekhanik A. (2013). Stanok dlya novogo uklada. [Machine tool for new mode] Ekspert. **7 (839).*** URL: http://expert.ru/expert/2013/07/stanok-dlya-novogo-uklada/

TABLE 17. Production of certain types of machinery and equipment in Russia, pcs

Machinery/equipment type	1990	1995	2000	2005	2010	2015	2016
Electric traveling cranes (including special cranes)	2943	370	638	729	2568	1787	1722
Metalcutting equipment	74171	18033	8885	4867	2832	3367	4166
CNC lathes	16700	280	176	279	129	204	357
Woodworking equipment	25439	11192	10232	4489	3909	4753	5084
Metalforming and forging equipment	27302	2184	1246	1533	2218	3200	2810
Spinning equipment	1509	133	8	16	33	8	84
Weaving equipment	18341	1890	95	95	5	42	7

Sources:
Russian Federal State Statistics Service. (2010-2016). Proizvodstvo mashin i oborudovaniia v Rossiiskoi Federatsii [Production of Machines and Equipment in the Russian Federation]. URL: http://www.gks.ru/free_doc/new_site/business/prom/natura/15g.xls
Russian Federal State Statistics Service. (1990-2009). Proizvodstvo mashin i oborudovaniia [Production of Machines and Equipment]. URL: http://www.gks.ru/free_doc/new_site/business/prom/natura/natura38g.htm
Russian Federal State Statistics Service. (1995-2009). Proizvodstvo mashin i oborudovaniia [Production of Machines and Equipment]. URL: http://www.gks.ru/bgd/regl/B10_48/IssWWW.exe/Stg/d01/06-137.htm

A considerable downturn was noted in such a high-tech sector as civil aircraft engineering (Table 18).

TABLE 18 Production of civil aircraft in Russia (1991-2013)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Russia	66	83	72	25	19	11	12	9	10	10	7	7	10	11
Other CIS countries	114	124	45	32	19	12	21	4	3	1	3	3	6	9

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Russia	10	14	12	17	12	13	19	22	32	37	17	22	41

Other CIS countries	10	3	3	5	3	7	8	8	4	…	…	…	…

Sources: Sukhoi Superjet 100 website. http://superjet100.info/wiki:prod-by-type.

Butov A.M. (2018). *Rynok produktsii grazhdanskogo aviastroeniia*. [Civil aviation production market] National Research University Higher School of Economics. URL: https://dcenter.hse.ru/data/2018/11/19/1141804200/%D0%A0%D1%8B%D0%BD%D0%BE%D0%BA%20%D0%BF%D1%80%D0%BE%D0%B4%D1%83%D0%BA%D1%86%D0%B8%D0%B8%20%D0%B3%D1%80%D0%B0%D0%B6%D0%B4%D0%B0%D0%BD%D1%81%D0%BA%D0%BE%D0%B3%D0%BE%20%D0%B0%D0%B2%D0%B8%D0%B0%D1%81%D1%82%D1%80%D0%BE%D0%B5%D0%BD%D0%B8%D1%8F%202018.pdf

In 2012, in Russia sold 307 industrial robots (while in Germany sold 14,500). The number of robots per 10,000 employees in South Korea - 396, in Japan - 332, in Germany - 273, in Russia - only 2[389].

The primitivisation of the economy has affected even such a conservative sector as agriculture. Large agricultural corporations were destroyed and most of the production was transferred to individual farms. In 1990-1999, the area of individual farms grew from 3.25 to 6.14 mln hectares, and the average individual land plot area - from 200 to 400 ares. Individual producers started producing significantly more than larger enterprises. In 1990, these enterprises produced some 73.7% of agricultural products (sold at state-regulated prices), while individuals produced 26.3%; in 1998, the figures were 38.7% and 59.2% respectively, and in 1999 - 40.3% and 57.2%. In 1999, private farms produced 92% of all potatoes, and in 2000 - 92.4%. The increasing role of individual gardens with little fixed capital equipment is a sign of sharp economic downturn, according to *Belaia kniga* (White Book)[390], which contains facts about the economic development of

[389] http://www.robotforum.ru/novosti-texnogologij/svezhaya-statistika-mirovyie-prodazhi-robotov.html

[390] *Glaz'ev S.Y. and S.A. Batchikov. (2003). Belaia kniga. Ekonomicheskie reformy v Rossii 1991-2001. M.: Algoritm, Eksmo [Glaz'ev S.Y. and S.A. Batchikov. White Book. Economic reforms in Russia 1991-2001. Moscow: Algoritm, Eksmo] (Tables 19-24 cite figures from this source).*

Russia during the first decade of radical market reforms.. These processes took place against the background of general deterioration of agriculture, with fewer farming lands, fewer heads of large cattle, decreased production of grain, potatoes, meat, milk, etc. (Table 19).

TABLE 19 Development indicators of Russian agricultural production, 1990-2000 against 2017

Indicator	1990	1999	2000	2017
Number of enterprises (as at January 1), thousands	25.8	332	334	344[2)]
Number of employees in agricultural production, mln	9.7	8.5	8.4	5.1
Farmland, mln of hectares	213.8	197.6	197.0	222.0[)]
Total crop area, mln hectares	117.7	88.3	85.4	80.0
Livestock population (as at year end), mln heads				
large cattle	57.0	28.0	27.3	18.3
pigs	38.3	18.3	15.7	23.1
Production, mln tons:				
grain (weight after refinement)	116.7	54.7	65.5	135.5
potatoes	35.9[1)]	28.0	29.5	21.7
meat and poultry (dead weight)	10.1	4.3	4.4	10.3
milk	55.7	32.3	32.3	30.2
eggs, bn pcs	47.9[1)]	33.1	34.1	44.8
wool, thousand tons	225	40	40	57
Average number per enterprise:				
employees	322	188	170	…
crop area for all crops, thousand hectares	4.3	2.7	2.5	…
large cattle, heads	1756	615	574	…
pigs, heads	1050	325	273	…

[1)] - 1986-1990 (annual average)

[2)] – as at July 1, 2016

Sources:
1986-2000: Russian Federal State Statistics Service. (2003). *Russian Statistical Yearbook-2003*. URL: http://www.gks.ru/bgd/regl/b03_13/Main.htm;
2017: Russian Federal State Statistics Service. (2018). *Russian Statistical Yearbook-2018*. M.

Despite considerable growth in food import, decline in agriculture led to a decrease in the consumption of food per capita. While food production increased in the twenty first century, it has not rebounded to pre-reform production volumes and structure of food consumption (Table 20).

TABLE 20. Average consumption of major food categories per capita in the U.S. and Russia (kg)

Food categories	U.S.	RSFSR	U.S.	Russia	U.S.	Russia
	1989		1997		2014	2015
Meat and meat products	113	69	114	46	118	73
Milk and dairy products (in milk equivalent)	263	396	305	229	276	239
Eggs, pcs	229	309	239	210	263	269
Fish and fish products	12,2	21,3	10	9,3	…	…
Sugar	28	45,2	30	33	59	39
Bread products	100	115	112	118	…	118
Potatoes	57	106	57	130	56	112

Source:
2014-2015: Russian Federal State Statistics Service. (2016). Russian Statistical Yearbook-2016. URL: http://www.gks.ru/bgd/regl/b16_13/IssWWW.exe/Stg/d04/27-16.doc

The situation in the service sector in the 1990s was also contradictory. While the demand for high-tech ICT services grew (partially due to growing demand from trade and financial markets), the demand for air transportation, to the contrary, decreased significantly. The degradation of civil aircraft engineering in Russia is related, to a large extent, to this fact. The report on the Condition of Competition on the Air Transportation Market of the CIS presented by the Interstate Council for Anti-Monopoly Policy of the CIS Executive Committee states,

> Before the 1990s, the aviation transport sector in the USSR grew very fast, and in 1989, the indicators of air travel in the USSR were equal to those of developed countries. The economic and political crisis of the 1990s led to a sharp decline in air transportation. The volume of transportation, as well

as the number of passengers, decreased about 4-fold. The most rapid decline occurred in the early 1990s. Since the late 1990s, we have observed a stable increase in the air transportation sector. However, the difference is still great: in 2005 there were about 1.5 fewer air passengers than in 2005.[391]

The considerable collapse of the most technologically advanced industries in the 1990s is especially evident when compared with a better situation in the raw materials and low degree of processing sector (Table 21). While the overall production of steel decreased only very slightly, the output of high-tech rolled steel products and other steel construction materials decreased by many times.

TABLE 21 Utilization of industrial enterprises' production facilities (%)

Product	1980	1990	1993	1997	2000	2010	2017
Steel	95	94	69	68	77	79	…
Plain steel							85
Alloy steel							44
Stainless steel							22
Metal-cutting machinery	87	81	54	16	17	7.7	20
Metalforming and forging machinery	…	83	…	…	13	38	14
Bearings	…	89	…	…	55	29	27
Tractors	98	81	42	8	19	25	16
Concrete	91	93	62	36	44	65	52
Footwear	89	87	48	17	29	69	57
Washing machines	88	87	51	12	-	…	…
Refrigerators and freezers	…	98.4	…	…	39	68	47

Sources:

Russian Federal State Statistics Service. Uroven' ispol'zovaniia srednegodovoi proizvodstvennoi moshchnosti organizatsii po vypusku otdel'nykh vidov produktsii (s 1990 po 2009 gg.) [Utilization of Enterprises' Average Annual Production Capacity for the Production of Certain Types of Products (from 1990 until 2009)]. URL: http://www.gks.ru/free_doc/new_site/business/prom/moch.htm

Russian Federal State Statistics Service. Uroven' ispol'zovaniia srednegodovoi proizvodstvennoi moshchnosti organizatsii po vypusku otdel'nykh vidov produktsii (s 2010 po 2016 gg.) [Utilization of Enterprises' Average Annual Production Capacity for the Production of Certain Types of Products (from 2010 until 2016)]. URL: http://www.gks.ru/free_doc/new_site/business/prom/mosh10.doc

391 Federal Anti-Monopoly Service. www.fas.gov.ru/analytical-materials/analytical-materials_21436.html.

Russian Federal State Statistics Service. Uroven' ispol'zovaniia srednegodovoi proizvodstvennoi moshchnosti organizatsii po vypusku otdel'nykh vidov produktsii (godovye dannye s 2017 g.) v sootvetstvii s OKPD2 [Utilization of Enterprises' Average Annual Production Capacity for the Production of Certain Types of Products (annual data since 2017) in accordance with Russian Classification of Products by Economic Activities]. URL: http://www.gks.ru/free_doc/new_site/business/prom/natura/urov-motsh.doc

In addition to declining material production, considerable losses were seen in the transport and utilities infrastructure (see Tables 22, 23).

Therefore, we may conclude that the economy reacted to the reforms of the 1990s by reducing production volumes and by ***technologically primitivising production.*** Businesses had no intentions of increasing R&D spending or to finance education programmes for highly qualified professionals (Table 24). For a long time, no efforts were made to replace the destroyed forms of integration between science, production and education in the planned system of economy, with new institutions that corresponded to the conditions of the market economy.

TABLE 22 Construction of solid-surface roads in various regions of the Russian Federation, km

Region	1990	1994	1995	1996	1997
Moscow Region	641.1	207.9	226.6	64.5	5.4
Central Black Earth Region	2419.4	581.8	532.9	379.4	167.8
Orel Region	539.9	80.7	55.9	1.3	3.0
North-West	2200.1	150.5	109.0	40.7	57.9
Kaliningrad Region	140.5	14.0	15.6	6.9	-
Republic of Buryatia	279.9	17.9	27.6	8.9	3.9
Primorsky Territory	230.7	51.7	70.8	18.2	10.9

TABLE 23 Commissioning of water pipelines in the Russian Federation, km

Region	1990	1995	1996	1997	2001
Russian Federation (total)	7524.3	2647.3	1330.1	1513.6	1076.9
Central Region	883.2	143.3	95.0	81.4	
Central Black Earth Region	1229.2	223.3	136.8	97.9	

Voronezh Region	227.5	32.4	38.1	3.7	
Tambov Region	151.4	45.7	24.2	2.4	

TABLE 24 Graduation dynamics of graduation for qualified workers and service sector employees, thousands

Year	2005	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total number of graduates	702.5	537.6	580.5	516.7	483.5	436.0	451.0	445.0	…	…
Including industrial professions	214.0	168.1	174.8	160.0	152.6	138.3	146.5	127.7	134.7	131.2

Sources:
2014-2015: Russian Federal State Statistics Service. (2016). Russian Statistical Yearbook-2016. URL: http://www.gks.ru/bgd/regl/b16_13/Main.htm
2016-2017: Russian Federal State Statistics Service. (2018). Russian Statistical Yearbook-2018. M.

To sum this up, let us say that the ideology of market fundamentalism prevents the resolution of important issues of import substitution, reindustrialisation and modernisation. We agree with the conclusion of the Director of the RAS Institute of Economics R. S. Grinberg, who wrote,

> The negative results (i.e. failures) of market reforms are clearly visible and badly felt. They override the successes by far. And the problem lies not only in the fact that over the years of reforms the country lost half of its potential. What is even worse is that the processes of primitivisation of production, de-intellectualisation of labour and degradation of the social sphere, were so far not discontinued. To this we should also add the appearance of large numbers of poor people. Over the years of radical reforms their number grew drastically[392].

This conclusion, however, was not fully taken into account in subsequent years.

[392] Grinberg R.S. (2005). Rossiia: Ekonomicheskii uspekh bez razvitiia i demokratii? [Russia: Economic successes without development and democracy?] *Ekonomicheskoe vozrozhdenie Rossii*. **2**, 11.

The recovery growth of the 2000s unfortunately changed very little in this regard. The increase in production in a number of sectors (including several high-tech sectors) did not compensate for the collapse of the 1990s; the situation in machine and equipment manufacturing remained as bad as it had been, if not worse. Most importantly, the distortions in Russia's economic structure that the reform period introduced were not addressed.

The recognition that the Russian economy has no reliable sources of economic growth other than innovation was slowed down by the inertia of economic institutions of the 1990s, traditions of macroeconomic policy and the related tradition of balancing economic interests.

In the 2000s, an attempt was undertaken to resolve this problem by means of ambitious bureaucratic projects implemented in specially-created state corporations (Skolkovo, Rusnano, Rostec, etc.) which was criticised for good reasons, including the inefficient spending of budgetary monies and related abuse of power.[393]

Paradoxically, the international experience of successful functioning of various forms of interaction between production, science and education (e.g. in the U.S. defence sector, transnational corporations in science-intensive production, programmes incorporating fundamental research and applied research in the Scandinavian countries) is much closer to the experience of the Soviet planned economy than to the mechanisms used over the past 20 years in

[393] A special study on this topic: *Sokolov A.A. (2013). Vliianie rentoorientirovannogo povedeniia na investitsii rossiiskikh gosudarstvennykh korporatsii. [Impact of rent-seeking behavior on investments of Russian state corporations]. M.* URL: http://www.cemi.rssi.ru/news/cemi/sokolov.pdf

the “market” economy of post-Soviet Russia. Not only Soviet, but foreign experience in this area was mostly ignored in Russia.

The integration of production, science and education is one of the most important directions in the state regulation of the economy in a number of leading industrially developed countries. For instance, in Japan scientific and technical cooperation between industry, science and education over many years has been a strategic development focus of the state innovative policy. Since the mid-1990s, Japan has adopted a number of legislative acts that establish and reinforce ties between the private sector, science and the state. The law on Science and Technologies enacted in 1995 provided state support for university research projects; in 1998, the law on the Development of Technology Licensing Organisations (TLOs) allowed companies to use the results of university research activities with the assistance of intermediary programmes between universities and industrial enterprises. The law on Support for Industrial Technology Development Programmes adopted in 2000 allowed the faculty of state universities to create private companies to assure practical use of research results in industrial production. Moreover, universities started focusing on supporting the development of production technologies. Finally, to stimulate development of the country’s economy by using the results of R&D activities, the framework law on Intellectual Property was adopted in 2002. The new law defined the mechanism for the interaction between industry, science and education.

Moreover, in accordance with the current legislation in Japan, programmes for developing scientific and technical cooperation between the industry, science and the state are also being actively developed.[394] Japan borrowed this approach from the U.S., where these programmes were very effective in increasing competitiveness in the country in biotechnologies and ICT (information and communication technologies).

Another characteristic example is Germany. Top priority initiatives and projects of the German government include:

a) integration of science, education and industry:

- state support for innovative clusters with participation of small and mid-sized enterprises and science organisations (Industrial Union Organisation named after Otto von Guericke);
- implementation of target innovative projects in new federal lands;
- development of new instruments for financing of perspective innovative clusters;
- holding the federal competition "Germany's Best Innovation Cluster" with the participation of colleges and universities;
- improvement of models of public-private partnerships in the sphere of developing innovations;

b) fine-tuning the system of education for researchers, involvement of research students into research and development activities.

The integration of production, science and education is a powerful element also of programmes aimed at creating and reinforcing the system of technological cooperation between business and science in the U.S. and industrially-developed countries of Europe startingin the late 1980s - early

394 *Gruchy A.G.* (1984). Uncertainty, indicative planning and industrial policy. *Journal of Economic Issues*. Vol. 18. **1**, 159-180.

1990s. An important role in that development was played by the famous Bayh-Dole Act and other legislative acts.

The Bayh-Dole Act (December 1980) created a uniform patent policy among the many federal agencies that fund research, enabling small businesses and non-profit organizations, including universities, to retain title to inventions made under federally-funded research programs. Due to possibilities, granted by this act, 154 FDA-approved drugs that were discovered in 1980–2010 in whole or in part at U.S. public sector research institutions have been brought to market. In 1980–2008 6652 startup companies were formed, and 3381 of these companies were still operating at the end of 2008.[395]

Annual growth of the number of patents issued to US universities in 1963-1984 were 18,5 per year average, and in 1985-1997 increased dramatically to 159,7 per year. If before 1980 number of patents issued annually to US universities in most par of the years were less than 200, in 1998 it was more than 3000. Universities increased their share of total number of US patents from about 0.2 % in 1963 to nearly 4 % by 1999.[396]

The Soviet and Russian experience described above must be critically assessed and implemented within the import substitution policy and the strategy of reindustrialisation.

As of late, some ***positive trends*** were found in Russia in the sphere of integrating production, science and education. Examples include the work of the Khrunichev State Space R&D Centre, Aerospace Equipment Group and

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[395] Loise V., Stevens A.J. The Bayh-Dole Act Turns 30. *Science Translational Medicine.* 06 Oct 2010: Vol. 2, Issue 52, pp. 52cm27 DOI: 10.1126/scitranslmed.3001481 URL: https://stm.sciencemag.org/content/scitransmed/2/52/52cm27.full.pdf

[396] Tseng A., Raudensky M., Assessments of technology transfer activities of US universities and associated impact of Bayh–Dole Act. Scientometrics 101(3):1851-1869. December 2014. DOI: 10.1007/s11192-014-1404-6

others, where successful projects were implemented. In accordance with the strategy for the development of the rocket-and-space industry, as well as according to the Federal Target Programme on Reforming and Developing the Defence Industry Sector in 2002-2006 approved by the Government of the Russian Federation on October 11, 2001 under No. 713, the Khrunichev Centre became home to a large integrated structure for the development and creation of heavy class booster vehicles. One of its most important integration goals is to retain the production, science and technology potential of the enterprise, allowing the carrying out of state orders. On February 3, 2007, President Putin signed a decree on Federal State Unitary Establishment Khrunichev State Space Research and Development Centre. Today the Khrunichev Centre cooperates with a number of leading technical universities of Russia, enrolling target groups students who work in the Centre and its design bureaus upon graduation.

At present, the system of continuous targeted training of specialists for Khrunichev Centre in organizations of higher and secondary professional education is effectively functioning, providing an influx of qualified personnel. It includes special classes in schools in which teaching is conducted with the assistance of technical universities, group colleges, universities, and special places in postgraduate schools of universities, in addition to training its own postgraduate school of Khrunichev Centre. The network of such targeted training covers the leading universities in Moscow and the best provincial technical universities. On this basis, more than 600 people are already being trained, and about 100 people who have completed training have already been employed by the Khrunichev Centre enterprises. In addition, various forms of continuing education are provided for already working specialists.[397]

Analogous micro-level projects are carried out in innovative clusters, technology transfer networks[398], technological hubs, etc. However, there are many more negative examples in this sphere. The country has no systemic long-term strategy for the integration of production, science and education at a higher level. Problems are mostly being resolved "manually," corruption is widespread, etc.

17.3. Reintegration of Science, Education and Production: Looking for Solutions

To develop new high-tech material production, new theoretical ideas must be implemented as concrete mass production technologies. The following components are necessary to that end: 1) ***fundamental and applied science***;

[397] Zelentcov V.V., Petrikevich B.B., Karachenkov A.E. Tekhnologicheskie osnovy nepreryvnoi integrirovannoi tcelevoi podgotovki spetcialistov dlia raketno-kosmicheskogo kompleksa. Integratciia obrazovaniia, nauki i proizvodstva v interesakh vysokotekhnologicheskogo kompleksa. Materialy Mezhdunarodnogo foruma «Tekhnologii v mashinostroenii - 2010». Moskva: Assotciatciia tekhnicheskikh universitetov. 2010. S. 100-108 [Zelentsov V. V., Petrikevich B. B., Karachenkov A. E. Technological bases of continuous integrated target training of specialists for the rocket and space complex. Integration of education, science and production in the interests of the high-tech complex. Papers of the international forum "Technologies in mechanical engineering - 2010". Moscow: Association of technical universities. 2010. P. 100-108]; Tcelevoe obuchenie. Gosudarstvennyi kosmicheskii nauchno-proizvodstvennyi tcentr imeni M.V.Khrunicheva. [Targeted training. State space research and production center named after M. V. Khrunichev]. URL: http://www.khrunichev.ru/main.php?id=248

398 *Osipenko A.S. (2014)*. Tekhnologicheskii transfer v sisteme obespecheniia innovatsionnogo razvitiia promyshlennosti. [Technological transfer in the system of ensuring innovative development of industry] *Ekonomicheskoe vozrozhdenie Rossii*. **1 (39),** 83-88.

2) ***people who are capable of carrying out design operations and implement them in production*** in conditions of new technologies, which is impossible without 3) ***high-quality life-long education accessible to everyone.*** These aspects of the problem are well-known. In particular, they have been mentioned time and over again by the RAS Member B.S. Kashin and the RAS Corresponding Member O. N. Smolin[399], but the economic community exhibits divergent views on the matter.

However, imperatives alone are not enough. To solve the problem of reintegration of production, science and education, the new role of these sectors in modern conditions must be considered, including the following key aspects:

1. ***The area that provides key production resources*** allows for the formation and development of human creative potential in the twenty first century economy. Economists have always known that the workforce is a major factor in production, or, as Marxists would put it, the main productive force. The peculiarity of the modern economy, however, is that human beings serve not only as the workforce with certain qualifications performing certain standard assignments on a machine or at the conveyor belt; modern workers have a new

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399 "First, we must create the goal-setting road map for Russian science to give it practical and measurable tasks to achieve. On the other hand, we must raise the status of the Russian scholar. In this, we must get rid of fictitious indicators of quality of his or her research, developed by some obscure Western experts," B. S. Kashin says, "I am of the impression that Russian authorities do not wish to hear the opinion of professional economists. Perhaps they only want the specific cohort of the "expert community" to stamp their approval on the solution that had been already adopted. In this scenario, science and managerial decision-making are viewed separately. Moreover, they often find themselves at odds with each other. I would call this an anti-scientific approach to decision-making in socio-political and economic spheres." *(Kashin B.S. (2011).* Filosofiia innovatsionnogo parazitizma. [The philosophy of innovative parasitism] *Svobodnaia Pressa*. 13.12.2011. URL: http://commpart.livejournal.com/15221.html). O. N. Smolin emphatically says, "Until we restore the system of education, Russia will remain a third-world country. We must either change our economic course of action, or national security of our country, its wholeness and our future will be threatened. *(Smolin O.N. (2014). Vystuplenie na Moskovskom ekonomicheskom forume.[Speech at the Moscow economic forum]* URL: http://me-forum.ru/media/events/plenary_discuss_I/).

quality. In the economy of the twenty first century, human creative potential plays the most important role. The development of creative potential necessitates the development of education, which must be available to everyone and continuous throughout one's life. O. N. Smolin, among others, sees the development of education as a necessary component of the economic revival, and I tend to agree with him on that.[400]

2. ***Without the development of fundamental research, the creation of new technologies and the promotion of innovations,***which constitute the most expensive and competitive commodity of the world economy would be impossible. It is the creation and promotion of innovations that determines the competitiveness of national economy and national security.

3. ***Production*** today is not only the foundation of the economy that dictates the objectives of science and education**,** *but also its development depends to a decisive extent on* ***the application of potential accumulated in education and science.*** The unity and contradictory nature pertaining to priorities in science, education, and culture, on the one hand, and material production, on the other hand, have been critically important in the twenty first century. Under inefficient economic policy, this contradiction may become more pronounced, and any investments into production in this case will lead to the reduction in spending on science and education. However, this contradiction can be resolved if education, science and culture work together towards the progress in material production, which can be achieved not by diverting funds from social programmes, but by attracting more qualified workers and using new technologies.

[400] *Smolin O.N. (2006). Obrazovanie dlia vsekh*. [Education for everybody] Moscow: Prospect.

These are the fundamental reasons behind the integration of the aforementioned spheres in the process of holistic, programmable, long-term development. What steps can we take to promote this goal?

First, we must achieve certain well-known objectives:

- train creative staff, specialists and professionals within the education system;
- develop research and design projects based on fundamental scientific achievements;
- create pre-production prototypes based on new technologies;
- establish large-scale manufacturing of these products at Russian enterprises.

However, under current conditions, these objectives can be achieved only to a certain extent.

Therefore, ***second,*** in today's Russia we must also focus on ***the remaining elements of high-tech economic modes*** (mostly in the defence sector), and design and implement programmes to create new technologies and cutting-edge products in areas where they would have the most effect on the economy.

Third, these initiatives may employ market stimuli (financing via government contracts, long-term credits, guarantees), public-private partnerships, long-term state programmes and an active industrial policy in a well-balanced blend .

Fourth, organisationally and legally, achieving these goals may require creating special institutions to support long-term development programmes (working on design and implementation of strategic programmes, active industrial and structural policy, etc.) and reduce red-tape in financial, credit, tax and customs systems and expand state support in the sphere of patenting and certification of technological processes, products, etc.

An important role in this area can be assigned to ***integrated Production-Science-Education clusters*** of various organisational and legal formats, from open networks to complexes with unified development programmes working towards a common long-term result under common financial authority and coordinated management. The choice of a particular format depends on the characteristics of problems at hand and existing prerequisites.

Conclusion. Crystal Clear Marx

As it happened, the first edition of this book was published shortly before the 200th anniversary of Karl Marx's birth. Inevitably, the bi-centenary prompted us to revisit his ideas. It is becoming increasingly obvious that Karl Marx was largely right in his predictions. He was the first to predict the role that science and knowledge would play in modern production. Back in the mid-19th century, he perceived "“...the transformation of the production process from the simple labour process into a scientific process, one forcing the powers of Nature into its service and thus setting them to work in the service of human needs...”C”[401] Moreover, Marx placed special emphasis on the role of human knowledge in the transformation of the social relations of production. He regarded the development of knowledge embodied in technological processes to be an indicator of the degree to which “...the conditions of the social life process itself have been brought under the control of the *general intellect* and remoulded according to it”.[402] But it's not just about direct production technologies – ultimately, it's about the "universal intelligence" of humanity subordinating all the life processes of society and transforming them in the most reasonable and humane way.

Based on scientific comprehension of nature, natural processes would be transformed into technological processes to reach the point where “Labour no longer appears so much as included in the production process, but rather man relates himself to that process as its overseer and regulator .”[403] I would like to emphasise that it is the technological application of science that will ensure the removal of people from

[401] Marx K. (1987). Economic Works 1857-1861. Economic Manuscripts of 1857-58. In: Marx K., Engels F. Collected Works. Vol. 29. New York: International Publishers. P. 86.
[402] Ibid, p. 92.
[403] Ibid, p. 91.

immediate production process when, as Marx put it, worker " stands beside the production process, rather than being its main agent "[404]

According to Marx, the liberation of the human being, the proverbial "ascent from the realm of necessity into the realm of freedom" starts at the point where the growing power of human knowledge enables humans to comprehensively satisfy human wants on the one hand, and accomplish it without the direct involvement of people in the production process, on the other hand: "[T]he realm of freedom actually begins only where labour which is determined by necessity and mundane considerations ceases; thus in the very nature of things it lies beyond the sphere of actual material production."[405]

Will the transition to a society that is fully based on such principles be smooth and conflict-free? Will we move from "zoo" to "noo" in an effortless and imperceptible way? Hardly. We will surely face some resistance and experience various pitfalls along this path. The "zoo," meaning the bestial part of human nature, will resist and try to hamper progress and turn development back towards destruction.

So, how can we counter this trend? What shape should this really revolutionary transition from "zoo" to "noo" take? We can argue for certain that this transition will not take place if we stick to the old beastlike methods because they cannot be used to create a new society that is devoid of bestial features – a society in which the individual, according to Friedrich Engels, "

finally marked off from the rest of the animal kingdom, and emerges from mere

animal conditions of existence into really human ones."[406] The transition to *noo* will be based on a natural, *knowledge-driven* and technological revolution. It

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[404] Ibid, p. 91.

[405] Marx, K. (1998). Capital. Vol. 3. In: Marx, K. and Engels F. Collected Works. Vol. 37. New York: International Publishers. , p. 807.

[406] Engels, F. (1961). Socialism: Utopian and Scientific. In: Marx, K. and Engels F. Collected Works. Vol. 24. New York: International Publishers, p. 323.

will mark the beginning of an accelerated transition to the next, more knowledge-intensive stage of the noo-version of human civilisation and its social order. This transition will be driven by the progress of knowledge, intellect and the human mind towards increasingly comprehensive satisfaction of growing human wants.

It is precisely the possibility for increasingly comprehensive satisfaction of human wants that will serve as a critical prerequisite for diffusing the tensions which accompany the transition. At the same time, genuine human wants – education, exploration, spiritual development and culture – will move to the forefront in the structure of human demands. All aspects of the human lifestyle – wellness, social relations, consumption, etc. – will be transformed based on cultural values.

Accelerated development of human knowledge will push the society to align the pace of its spiritual and social development with technological development. Otherwise, the society will perish: given the imbalance between growing technological potential and opportunities for rational regulation of social development, the technosphere may expand uncontrollably and lead to an increase in resource consumption. An equally spontaneous technological intervention into the very human nature could also take place. Therefore, we should first align material and spiritual wants, and only the latter will gradually get to the point where they prevail over former. The rise of *noo*civilisation is possible only under these circumstances. Then *noo*nomy, not economy, will become the knowledge-intensive and smart means for the satisfaction of wants for both individuals and the *noo*society as a whole.