

Elena Tkachenko<sup>1</sup>, Elena Rogova<sup>2</sup>, Sergey Bodrunov<sup>3</sup>,

<sup>1</sup>Saint Petersburg State University of Economics (St. Petersburg, Russia)

<sup>2</sup>National Research University Higher School of Economics (St. Petersburg, Russia)

<sup>3</sup>Institute for New Industrial Development (St. Petersburg, Russia)

[eletkachenko@ya.ru](mailto:eletkachenko@ya.ru)

[erogova@hse.ru](mailto:erogova@hse.ru)

[inir@inir.ru](mailto:inir@inir.ru)

## Development of Corporate Knowledge Management under Conditions of Cyclic Dynamics

### Abstract

The problem of effective knowledge management is one of the key objectives of improving the competitiveness of both individual companies and entire regions and states. The process of socio-economic systems developing is a nonlinear function that characterizes the dynamics of the efficiency of the system functioning, depending on the phase of the observed cycle. At the same time, microeconomic cycles are imposed on the waves of macroeconomic dynamics. Due to the relatively recent global formation and development of knowledge management systems, most researchers adhere to the concept of a rising wave in the context of the problems of knowledge management in macroeconomic terms. Our research covers the period of market transformation of the Russian economy, and the retrospective period of a planned economy in the USSR, starting from 1947. The results obtained show that knowledge management cycles have started long before the day when the term "knowledge management" appeared.

**Keywords:** knowledge management; cyclic dynamics; knowledge and technology transfer; Russian economy

### Introduction

Knowledge management is considered as a crucial approach to corporate strategic management in the modern world. It should be mentioned that the managers' attitude to knowledge management is changing alongside with the level of companies' development. In Russia, where rapid change of not only the stage of economic cycle but also the transformation of the whole economic system had occurred, the knowledge management system is affected by these transformations heavily. So it could be interesting for theory and practice of knowledge management to assess these changes in the relation with the concepts and routines that are used by companies. So the research is aimed at the study of practices of knowledge management in the conditions of social and economic dynamics. We also would assess the effectiveness of knowledge management implementation into the managerial practices of Russian companies.

One of the directions to improve the efficiency of knowledge management is the dissemination of innovative technologies via technology transfer and joint ventures foundation. We contribute to the research area through the elaboration of the algorithm for making, adopting, and implementing the decisions concerning the organization of knowledge management within a corporation on the base of a special unit. We also argue that this mechanism promotes the efficiency of knowledge management and an overall corporate performance.

The paper is organized as follows. The second section explains the research methodology that is used for our study. Then we examine the history of knowledge management development in Russia, starting from the Soviet period. We defined what best practices were kept and what have appeared recently. After that we examine methods of knowledge and technology transfer in Russian corporation and their changes under conditions of cyclic dynamics. On the base of these theoretical results we develop the model of knowledge management organization on the base of a special unit and assess the efficiency of this approach. To conclude, we discuss the results of the study and determine the directions for the further research.

### Research Methodology

The research is based on the theories and concepts justifying the cyclical nature of socio-economic systems development, particularly, Kondratiev long waves theory (1935), Schumpeter economic development theory (1934), and other theories of their followers. The analysis of macroeconomic cycles of knowledge management from the perspective of long and medium technological waves and cycles of production and employment must include an assessment of intra-corporate knowledge management cycles from the perspective of innovative technological and product cycles. The papers published by Woodward (1997), Clifton L. Smith, David J. Brooks (2013), Deve T. and Hapanyengwi G. (2014) develop the ideas of knowledge management from the perspective of a life-cycle concept.

Our research is based on the same approach. For the purposes of research, we applied the methods of historical and statistical analysis, observation, field research, and methods of big data analysis. Field studies were performed at 23 large and medium enterprises of Saint-Petersburg. Students of the university who had performed the survey were not allowed to use the special knowledge management terminology because of the top managers' negative attitude to this terminology.

Interviews with managers of large companies played a particular role in the research. All in all, over 200 companies of the Northwestern Federal District of the RF were interviewed. Interviews were conducted in June 2014 on the base of Saint Petersburg International Economic Forum. The interview consisted of two stages: the questionnaire and a personal talk. It should be mentioned that not all the participants agreed to fill the questionnaire. They argued their refuse with the negative attitude to knowledge management as a direction of business administration. Personal talk allowed to enlarge the circle of persons involved in the survey and to strengthen it. The sectoral structure of the participants of the survey is presented in Fig. 1.

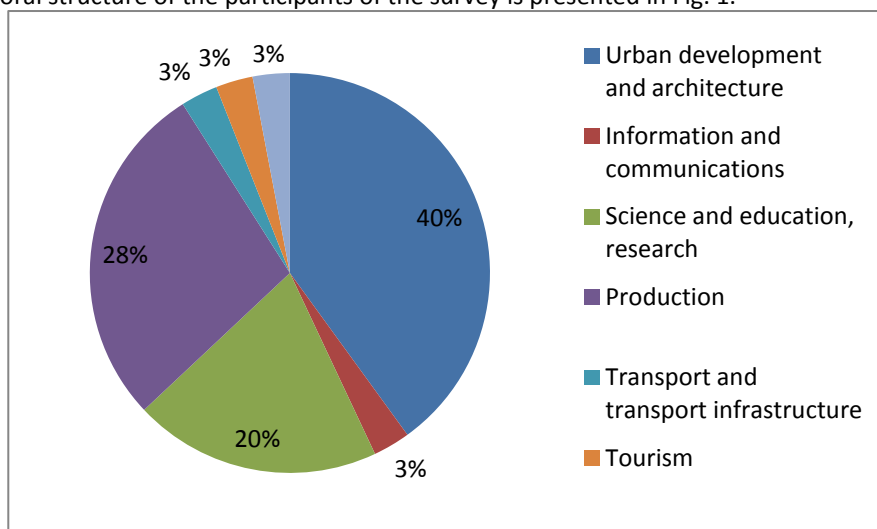


Fig. 1. The sectoral structure of the interview participants

The key questions during the interview and the answers distribution were as follows:

- 1) Do managers have any idea of what knowledge management is? (No - 85% Yes - 10%, No answer - 5%.)
- 2) Is there any need for the development of knowledge management system? (Yes - 7%, No - 93%.)
- 3) Does your company perform innovative activity? (Yes - 56%; No - 44%.)
- 4) Does your company have a system of corporate training? (Yes - 21%; No - 31%; Education and training are carried out on a regular basis with the assistance of specialized companies - 48%.)
- 5) Is there a division in your company engaged in research, development and design? (Yes 18%; No - 10%; The company is engaged in scientific and technical cooperation - 72%.)
- 6) Does your company have any department responsible for commercialization of technologies, technological transfer, and intellectual property protection? (Yes - 17%, No - 56%; The company employs specialized companies - 27%.)
- 7) What are the main problems of innovative activity? (You may select more than one answer.) (Lack of trained personnel - 73%; Intellectual property protection - 71%; Problems with commercialization of technology - 85%; Lack of funding - 35%.)

We applied big data analysis for the evaluation of the level of patent activity within the industries. The data processing is in progress, and we have an intention to use this data for assessment of the effectiveness of companies' intellectual assets protection.

Thus, the survey results allow us to come to a paradoxical conclusion – top management is not aware of knowledge management, and denies its importance for the improvement of a company's performance (it is especially clearly manifested in the interview with the representatives of the construction and processing industries), but, at the same time, companies implement an active policy of introducing the mechanisms of knowledge management - training, creation of new knowledge, and its commercial use. In this article, we have analyzed the historical reasons for such an attitude towards knowledge management, and suggest certain recommendations for the development of corporate knowledge management.

#### Historical aspect of knowledge management in the Russian economy under Conditions of Cyclic Dynamics

The Russian economy seems to be an ideal experimental field for the analysis of corporate knowledge management under the conditions of cyclical dynamics. During the period prior to market reforms, the Soviet Union developed its original knowledge management system, both at the level of society as a whole, and at the level of specific companies. On the 1st of May, 1947, "The Address to All Men of Science, Literature and Art, Scientific, Public and Other Organizations and Institutions of the Soviet Union" was published, signed by S. Vavilov, the President of the Academy of Sciences of the USSR, Presidents of National Academies of Sciences, and prominent scientists and public figures of the country. The authors of the message called the intellectuals of the USSR to create the All-Union Society for dissemination of political and scientific knowledge, "... there should be a mediator and a guide to pass on current advanced scientific knowledge from experts to people." This message resulted in the creation of a unique non-profit public organization - the "Znanie" (Knowledge) Society. In the USSR, very few people have heard of Toffler and Bell's works, only experts knew about Drucker's ideas, but Francis Bacon's thesis "Knowledge is power" became guidelines for action. The first branch of the "Znanie" Society was established on May 22, 1947, and it brought together leading scientists and university professors. The aim of the Society was to create a system of continuous education throughout a lifetime, continuous training and improvement in qualifications, promotion of advanced scientific ideas, and involvement of the masses in a self-education process. At the peak of its popularity, in 1970-1980, about 60 thousand researchers, scientists, and experts from all regions of the USSR became members of the "Znanie" Society. The Society had its own publishing house, which published scientific and popular scientific literature. Magazines, such as "Science and Life" and "Technology of Youth" contributed a lot to the dissemination of knowledge.

At the enterprise level, the development of knowledge management was taking various forms: promotion of professional growth; regular advanced training; development of cooperation/competition among both employees and teams as a whole (the so-called socialist competition); stimulation of inventive activity.

Scientific and Production Associations (SPAs), as a specific type of state-owned corporation, became the most developed form of integration of science and production. SPAs implemented the full innovation cycle, from development to after-sales. Research institutes, laboratories, design offices, and experimental productions constituted SPAs. The Scientific and Technical Committee had a great influence on management structure, and approved of the main directions of research and development, and assessed the effectiveness of the implementation of research and development projects.

SPAs had highly qualified personnel, reproduction of which was secured by the development of mentorship system, where experienced specialists shared their experience with young employees. In this case, such term as "knowledge management" was not used, but a knowledge management system was working quite efficiently. This system had, at fact, a number of strong drawbacks. It was overcentralized, and did not create any stimulus to innovate, both economic and moral. As a result, about 70% of all the industrial inventions were implemented only within their industries, very often the implementation was limited by only one enterprise, and the level of diffusion was extremely low (Radosevic, 1999). And this system was almost completely destroyed at the time of the USSR's collapse.

During the period of market reforms, starting from 1991, Russia survived four full economic cycles "crisis-recovery-stagnation-crisis". At that the same time, the terms of economy transformation were so harsh, that private corporations had no chance to survive without rapidly developing adaptive mechanisms. Corporate knowledge management systems in Russian companies were formed in response to the challenges of the economic environment: high uncertainty, unstable legislation, unstable currency, political risks, lack of experience in market management, and a catastrophic shortage of skilled managers. Vast state property privatization in 1992 and emergence of the foundations for corporate legislation rapidly formed a new market structure. The first stage of the formation of corporations coincided with the total degradation of the real economy.

On the one hand, corporations expressed high demand for management and production modernization. The level of technological lag was extremely high. Due to lack of competition on the domestic market, the Russian economy missed two waves of technological modernization, which resulted in the creation of significant technological gap. Corporate management was at zero level. There was no developed corporate legislation, and such concepts as corporate ethics, corporate social responsibility, and corporate culture were not known to the managerial community. Large companies had, at best, one or two managers with a modern education, graduates from foreign universities, or expatriate managers among employees.

Theoretical knowledge available only to a narrow circle of specialists had to be transformed into practical managerial competence. At this stage, no one spoke of knowledge management as a special form of management in Russia. At the same time, practical business needs required immediate actions in order to spread best practices. Very often, new managers of privatized corporations did not understand the value of knowledge accumulated in the company. They believed that after incorporation a company starts off with a clean slate.

We may cite the example of the loss of technical documentation in the Joint-Stock Company, Elektrosila, the largest power plant engineering enterprise, with a century-long history. Siemens was one of the founders of this company. In 1992, the new management closed the standardization department in the process of optimizing

the management team, and all data on technological standards and internal production standards was physically destroyed. Seven years later, in 1999, the company faced enormous challenges in the implementation of the budgeting and cost accounting system. It was impossible to apply standard costing due to the lack of internal costs standards. It took a long time and significant financial costs to train specialists in standards and to recover a standards database.

There were objective conditions for this, which were developed after the crisis of 1998, and a significant devaluation of the ruble. The company became competitive in global markets, and the problem of increasing the efficiency of the company led to conscious development of knowledge management models. Most Russian companies that survived the economic and political crisis of 1991-1992, and the financial crisis of 1998, underwent similar processes.

In the event of crisis, the need for systematization of knowledge and rapid dissemination of knowledge using the methods of crisis management led to the formation of systems of corporate training, the emergence of specialized departments performing regular assessments of the qualification levels of employees, and to the formation of an advanced training promotion system. On the other hand, management of technical and technological knowledge and competencies became a crucial issue.

During the period after the crisis of 1998, until the global financial crisis of 2008-2009, most Russian corporations undertook restructuring and optimization of business processes. The share of organizational innovations in the structure of innovation costs during this period was liberal.

On the contrary, product and technological innovations were almost disregarded. One of the reasons was the staffing gap. Russian companies started to feel the shortage of qualified engineers and workers. At the same time, the experience of qualified personnel training accumulated during the times of planned economy was lost. Actually, the system of passing on unique knowledge and know-how had to be formed from scratch, by trial and error.

The new stage of development in corporate knowledge management systems led to the emergence of corporate training systems for workers and engineers, establishment of corporate universities, development of cooperation between the corporate sector and state universities. This model enabled a number of problems to be solved at once, particularly:

- securing the transfer of knowledge between generations of workers,
- ensuring creation of new knowledge, first of all, due to promotion of research and innovation activities among young professionals,
- developing foresight in knowledge and technology, i.e. the development of long-term forecasts, allowing the research activity to be focused on the most promising fields.

The Okeanpribor Concern may serve as vivid example of the formation of such corporate knowledge management system, the result of which was the formation of a leading scientific school in underwater acoustics, and global technological leadership in this area.

The crisis of 2008 revealed the key problem of corporate knowledge management - the problem of effective technology transfer. According to our analysis, the development of these systems until 2008 was mainly focused on a knowledge carrier – a human being. Moreover, the problems of commercial and non-commercial transfer of formal knowledge in the form of intellectual property, as well as the problem of intellectual property protection, have come to the fore only after the global financial crisis of 2008.

### **Knowledge and technology transfer in Russian corporations**

The terminology describing the concepts of "technology", "technological innovation", "technological transfer", "technological exchange", has not yet been definitively established in academic literature. Detailed coverage of terminology is provided by Gumerova and Shaimiyeva (2008), where it is emphasized that, in almost all works of Russian scientists, the technology is understood as human impact on the objects of labour, the relationship between the main production factors determined by science and practice of economic and technical cooperation, and based on the interaction of mechanical, physical, and chemical properties of the means of production. In a number of papers, for example, (Rogova, 1995), technology is understood in a broader sense.

Basically, technological transfer<sup>1</sup> is understood as the transfer of technology (usually, in intangible form) from one organization to another. Technically, this concept does not apply to the transfer of technology or know-how and scientific data, but describes the transfer of the respective technologies, or optimization of specific technical processes, including that achieved through introduction of new technologies and materials, or by resolving the existing and identified technical problems that have been hidden at early stages. Technology transfer is the key element of any innovation system, as, due to this process, knowledge and technology are transformed into new specific products and services, and this contributes to economic growth and meeting social needs (Critical analysis..., 2006).

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<sup>1</sup>Hereinafter – TT.

Technology transfer is the transfer of scientific and technical knowledge and experience for the purposes of providing scientific and technical services, implementing processes, and production. The criterion for the event of transfer is active application of the transferred technology for industrial purposes. Very often, the concepts of "commercialization of technologies" and "technology transfer" are regarded as absolutely identical, which is not always true. Commercialization of technologies implies economically efficient implementation of technology on industrial scale (with a benefit for the developer and recipient). Successful commercialization requires simultaneous existence of a number of factors: technical feasibility on industrial scale; conscious demand of the recipient for innovation; the personnel able to embrace innovation; financial resources; and government support. Though, some authors, as De Falco (2012) underline, that despite the key factors of TT success are described in details, no optimizing or forecasting model exists, due to the extreme complexity of these processes.

Moreover, transfer of information in all accessible formats for the purposes of the performance of a certain task is the fundamental factor for TT. Thus, commercialization is the aim of the applied scientific research, and transfer is one of the ways to implement it.

From the perspective of corporate management, technological transfer should be considered in the context of knowledge management. Corporate knowledge management serves to ensure that organizational and technological levels of companies in the corporation correspond to the requirements of competitiveness and strategic stability of the corporation.

By its aims, objectives, and functions, technological management is close to knowledge management. As some researchers emphasize, in modern times knowledge becomes "polyvalent". It combines the results of fundamental and applied research, codified and implicit form, and may have different directions of practical use (Mowery, Rosenberg, 1998).

The main strategy of technological management is identification of new favourable opportunities and organization of processes for creating new knowledge, monitoring knowledge evolution, protecting the accumulated knowledge, and reducing the time for commercialization of new products.

The development of knowledge in the form of a technological forecast becomes practical issue in formulating the strategy.

Competition response time is getting shorter and shorter, which determines the crucial role of training in corporate structures.

Global technological vision will depend on knowledge, innovation, and general vision at corporate management level (Goldstein, 2002).

Thus, it is clear that knowledge management is one of the strategic links in the system of corporate management (Figure 2).

By the mechanism of knowledge management we mean a set of functional and supporting subsystems, as well as regulations of their interaction, enabling us to reach the goals and objectives of knowledge management in corporations

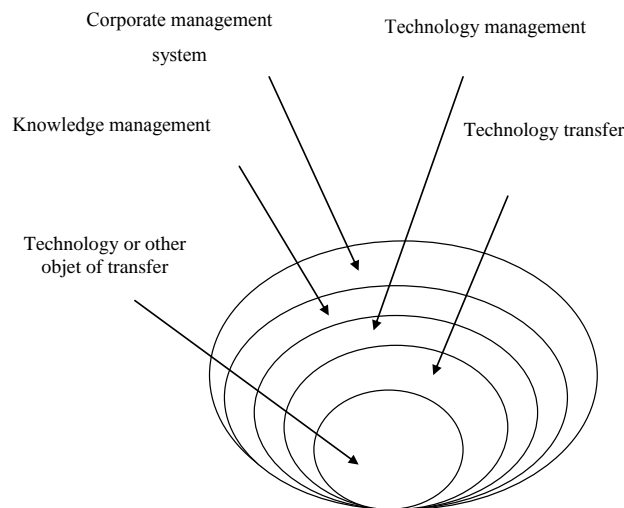


Figure 2. The place of knowledge management and technology transfer in corporate management

. The key functions of knowledge management are to ensure the creation and dissemination of new knowledge, to activate the innovation process, to reduce technological cycle time, to commercialize innovations, to develop creative potential in employees, and to increase the value of human capital, as well as forming an innovative corporate culture. The papers published by Abdullah, M. S., Benest, I., Evans, A. & Kimble, C. (2002), Supyuenyong, V., Islam,

N. (2006) Haslinda, A., Sarinah, A. (2009) develop the models of knowledge management system. Figure 3 presents the logical model of the knowledge management mechanism.

The knowledge management mechanism may be implemented in different organizational forms: on a purely contractual basis, or through the establishment of a collaborative innovation unit performing knowledge management functions in the interests of all companies in the corporation, etc.

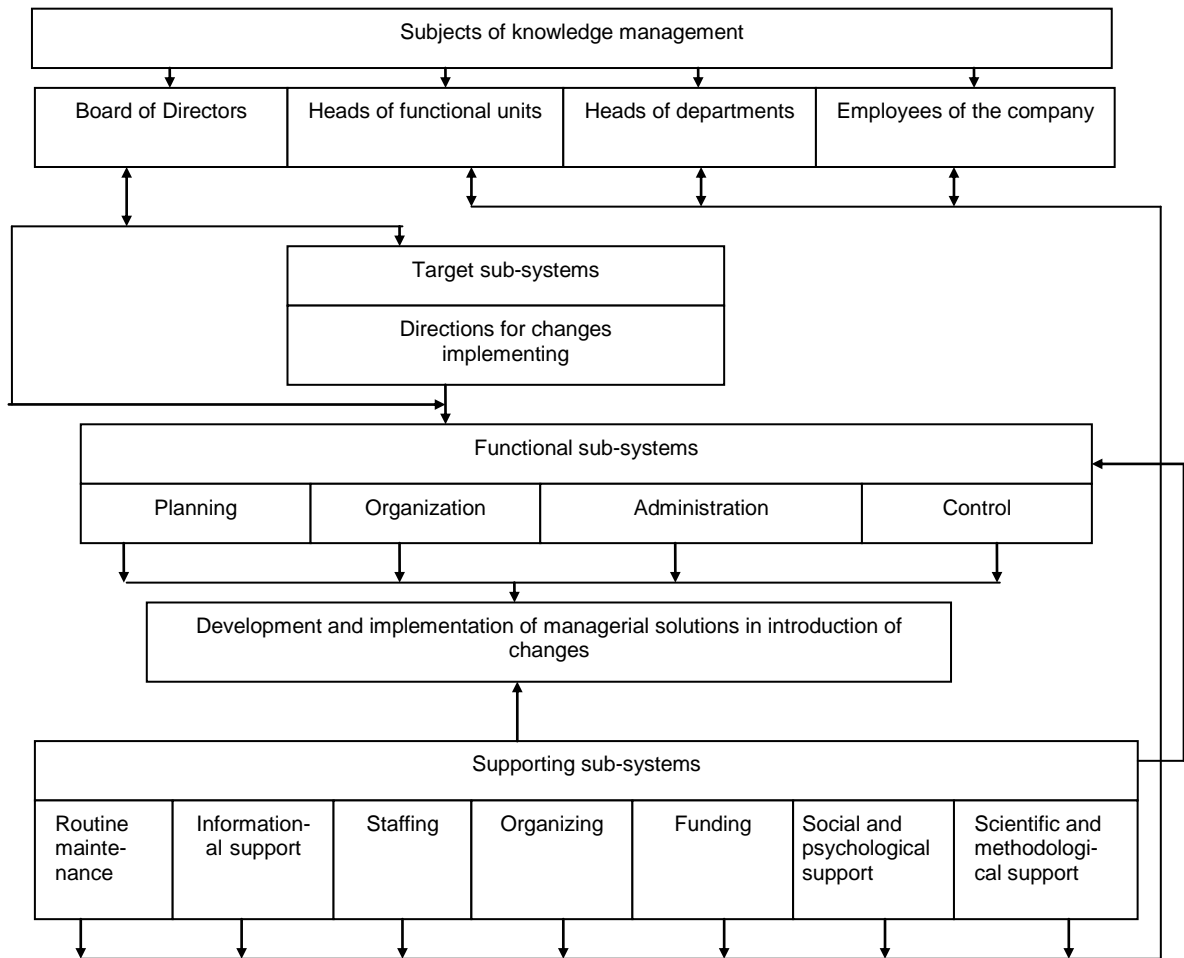


Figure 3. Logical model of knowledge management mechanism in corporations

### Model analysis of the effectiveness of the establishment of a special unit on knowledge management in the corporation

Let us review the procedure of the assessment of the efficiency of a special unit performing knowledge management functions for companies in a corporation. The organizational principle of such structure may be identified as a joint venture. Model analysis of the efficiency of establishing a joint venture was performed by Kolobov, Omelchenko, Orlov, 2008). However, the main disadvantage of this model, in our opinion, is the excessive focus on the cost effectiveness of marketing, and the target function not quite corresponding to the aims of inter-corporate management. Thus, the process of decision-making as to the establishment of the specialized unit of knowledge management may be represented as the following procedure (Fig. 4)

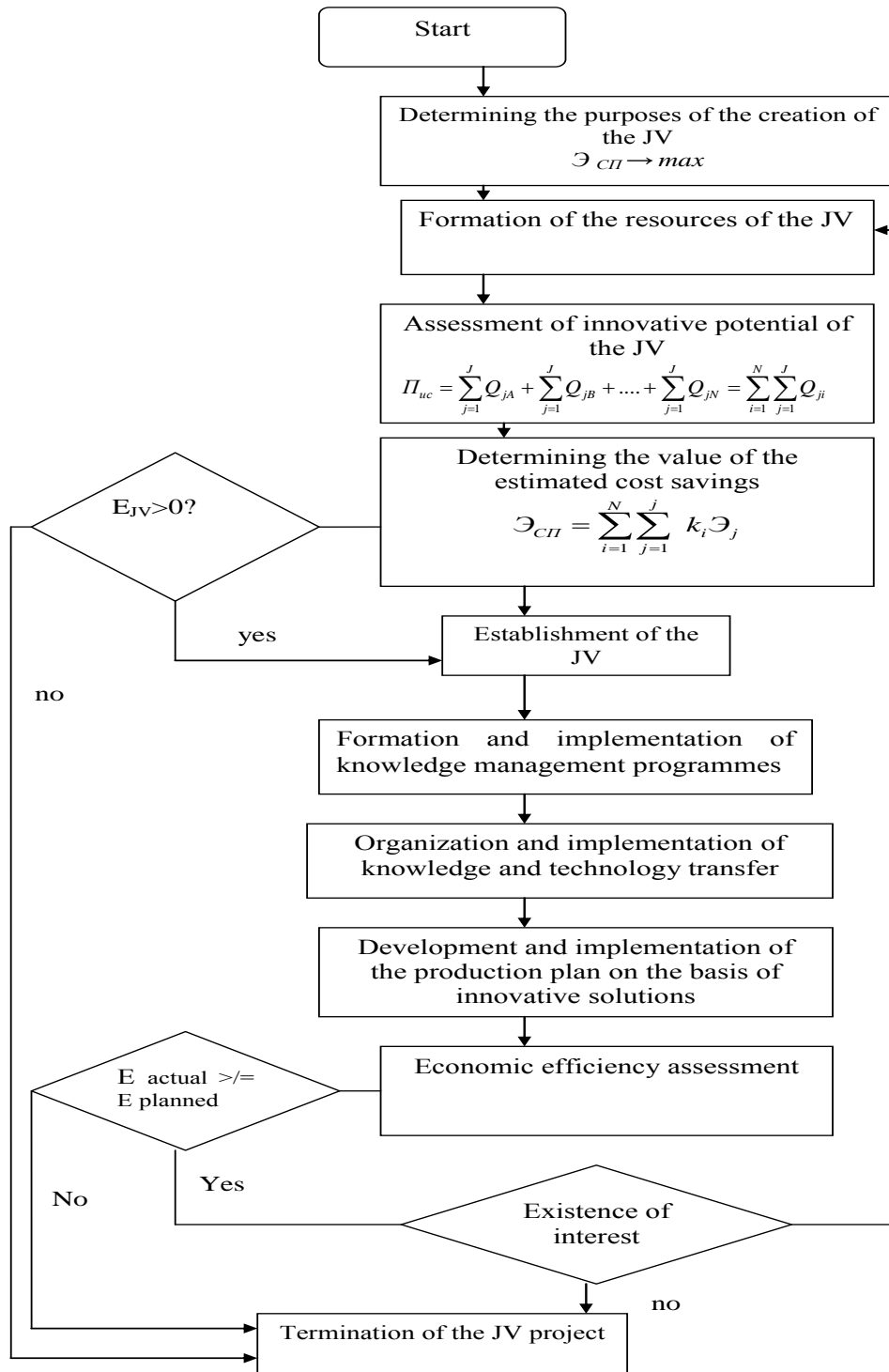


Fig. 4. Algorithm for making, adopting, and implementing the decisions as to the organization of an innovative joint venture within a corporation

Let's explain the point in details. The potential of the created structure in this developed model will be determined by the complex of intellectual resources invested by the participants of innovative process in the creation of an innovative company:

$$\Pi_{ic} = \Pi_{iA} + \Pi_{iB} + \dots + \Pi_{iN} = \sum_{j=1}^J Q_{jA} + \sum_{j=1}^J Q_{jB} + \dots + \sum_{j=1}^J Q_{jN} = \sum_{i=1}^N \sum_{j=1}^J Q_{ji}, \quad (1)$$

where  $\Pi_{ic}$  – is the innovative potential of the unit;

$\Pi_{iA} \dots \Pi_{iN}$  - contribution of each participant to the formation of its potential;

$Q_{ji}$  – quantity of j-resource, invested by the participant i of the joint venture.

The quantity of resources available that may be allocated without compromising the long-term sustainability of each business entity involved in the process of scientific and technical cooperation is the obvious limitation as to the contribution of each participant to the formation of the joint venture:

$$\Pi_{ii} \leq \Pi_i - \sum_{j=1}^J Q_j^p, \quad (2)$$

where  $\Pi_{ii}$  - contribution of each participant of the joint venture in terms of the formation of its potential;

$\Pi_i$  – economic potential of each participant of the joint venture;

$Q_j^p$  – internal need of the subject for the j-resource.

The existence of a specialized unit is expedient in case implementing knowledge management on the basis of pooling resources of the enterprises (participants of the corporations); it provides for the reduction of costs of all kinds of resources (scientific, technical, time, labour, industrial, financial, and inventory) allocated for innovative development, as compared to the existing models, for each participant of the corporation:

$$TC_{C\Pi} \leq \sum_{i=1}^N TC_i, \quad (3)$$

where  $TC_{C\Pi}$  denotes the total cost of the joint venture associated with centralized implementation of knowledge management.

$TC_i$  – expenses of each participant of the innovative process in case of refusal to centralize innovation activity..

The purpose of the joint venture is to achieve maximal cost savings associated with knowledge management:

$$\Theta_{C\Pi} = (\Theta_A + \Theta_B + \dots + \Theta_N) = \sum_{i=1}^N \sum_{j=1}^j k_i \Theta_j \rightarrow \max, \quad (4)$$

where  $\Theta_{C\Pi}$  - cumulative effect of the establishment of the joint venture;

$\Theta_j$  – savings of j-resource;

$k_i$  - share of the i-participant of the joint venture in the formation of j-resource.

If  $\Theta_{C\Pi} \leq 0$ , the joint venture is not expedient.

### Conclusion

Our research as to the development of corporate knowledge management systems under the conditions of cyclical dynamics has revealed certain patterns. Firstly, the intuitive understanding of the crucial importance of knowledge for the competitiveness of companies is enough for the purposes of implementing the basic principles of a knowledge management policy and applying knowledge management by managers of a company. Secondly, under the conditions of radical structural transformation of the economy, organizational and managerial knowledge, skills, and technology are eagerly sought at the initial stages. With the development of market relations, technical and technological leadership becomes the key factor, and the problems of creation and transfer of new knowledge and technologies come to the fore. Thirdly, under the conditions of a developing economy, the main objective is working out the mechanisms of intellectual property protection and the growth of the intellectual assets market. Fourthly, the economic efficiency of creating specialized units of knowledge management in corporations is determined by the possibility of reducing the innovative and technological cycle, as well as creating research and development cost savings for all participants of the corporation. In addition, an important result of our research was the revelation of the fact that managers are lacking information about knowledge management. Therefore, advanced training programs for top-managers provided, particularly, by leading Russian universities, should include elements related to knowledge management. We suppose to perform the second stage of field studies in October 2015 and to capture changes in the top managers attitude to knowledge management. Also we suppose to apply big data methods to the analysis of companies' patent activities.

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