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6. KNOWLEDGE MANAGEMENT AT INDUSTRIAL ENTERPRISES IN THE CONTEXT OF FORMING THEIR INNOVATIVE DEVELOPMENT STRATEGIES

6.1. Introduction

The completion of the 5th and the beginning of the 6th technological waves, as well as the beginning of the 4th industrial revolution lead to a radical transformation of existing industries and markets and the formation of new ones. All aspects of human society are being transformed. Under these circumstances, scientists actively seek survival strategies and ways to subsequent transition of national economies and separate enterprises to economic growth. During the change of technological waves the economic growth is possible only through innovative renovation of equipment, technologies, management methods, etc., which are based on actual relevant knowledge. Under these circumstances there arises the necessity of developing theoretical and methodological approaches to knowledge management at enterprises in order to determine strategic directions of their innovative development and to develop appropriate strategies that will allow them to form, strengthen and apply their competitive advantages, to take strong positions in certain target markets. This especially concerns enterprises as a certain industry determining the rate of innovative growth of other industries and the national economy as a whole.

It should be noted that the conceptual foundations of organizational knowledge management are covered in literary sources (Davenport, 1998; Sveiby, 2001; Dzhanetto & Uyler, 2005; Koulopoulos & Frappaolo, 2008; Mylner, 2003). The authors emphasize

the importance of the system of production and application of knowledge in ensuring the effectiveness of organizations.

The analysis of publications exploring current issues in knowledge management of organizations for providing conditions for their innovative development (Blanc & Bouillon, 2012; Borjigen, 2015; Jennex, 2014; Khedhaouria & Jamal, 2015; Landry & Amara, 2012; Matschke, Moskaliuk & Cress, 2012; Massingham, 2014) indicates the need to improve management tools and methods, their efficiency, and more.

Literary sources also investigate issues and prospects for improving the theoretical and methodological foundations of knowledge management of enterprises and institutions, as well as ensuring their innovative development (Cherkasova, 2010; Matviiv, 2007; Moiseienko, 2004; Polyakov & Polyakov, 2017; Rudenko & Kryvoruchko, 2016; Sytnik, 2017; Smolinskaya & Gribik, 2015; Tomakh, 2014; Vovk, 2013; Vostriakov & Hrebeshkova, 2009).

However, despite numerous researches, the issue of creating a comprehensive knowledge management system on the way of innovative development of the enterprise that forms and implements respective strategy needs further investigation. Thus, the purpose of the study is to develop the theoretical and methodological foundations of knowledge management at an industrial enterprise in the context of the formation of its innovative development strategies.

6.2. THE ROLE OF KNOWLEDGE IN THE SYSTEM OF MANAGEMENT OF THE SELECTION AND IMPLEMENTATION OF STRATEGIC DIRECTIONS OF INNOVATIVE DEVELOPMENT OF INDUSTRIAL ENTERPRISE

World experience proves that during the transformation of technological waves there is a "creative destruction" (Schumpeter, 1992; Glazyev, 1993) of existing industries and markets. It gives the innovative enterprises a chance to transform the achievements at science and technology into innovative products, technologies of their production, methods of management at all stages of production and sale of products, to form and apply competitive advantages, to start sustainable innovative development. A systematic analysis of researches (see section 1.1) and the experience of innovative growth leaders shows that market success is based on actual knowledge

concerning trends in external micro- and macro-environment conditions; problems caused by these changes for actual and potential consumers of products of the industry; trends at actual or potential product markets of the industry (related industries); trends in scientific and technological progress (STP) of the industry (related industries); potential of innovative development (PID) of the enterprise, etc.

PID is viewed as a set of innovative resources and opportunities to apply them, which determine the ability of an enterprise to develop innovatively (Shipulina, 2006). It comprises three components of the potential-subsystem:

- Market potential, characterizing sufficient consumer requests for innovative products of the enterprise, or the ability to form them (for radical innovations);

- Innovative potential, which characterizing the ability of the personnel of the enterprise to apply latest achievements of science and technology into products satisfying existing and prospective customer requests;

- Production and marketing potential, which characterizes the technical capacity and economic feasibility to produce and promote innovative products on the market.

In this article knowledge is viewed as the ability to apply a set of facts and rules to manage them in a specific subject area (Illyashenko & Shypulina, 2013).

Let's view stages of determining perspective (in terms of external and internal conditions) directions and strategies for innovative development of the enterprise (Table 1). Table. 1 presents types of knowledge as the basis for managerial decisions at certain stages, as well as their results, respectively: development directions (stage of development) of the industry of the enterprise; promising directions of innovative development under specific circumstances; strategies for innovative development of certain types acceptable under specific circumstances.

The methodological bases for decision making at stages E1, E2, E3 are outlined in the researches respectively: (Illiashenko, 2010); (Illiashenko & Shipulina, 2018), (Illiashenko, Shipulina, Illiashenko, 2018); (Illiashenko, 2015).

The characteristics of types of innovative development strategies (step E3) are presented below in Table. 2. The analysis of the essence of strategies in table 2 shows that strategies 5, 6, 7, 10 are protective; at the leader level - 2, 4, 8; leading - 1, 3, 9. The letters in the table 2 indicate: S - small enterprises, M - medium enterprises, L - large enterprises.

Table 6.1

Stages of determination of directions and strategies of innovative development of the enterprise

Stages	Knowledge types	Results
E1. Determination of development directions of the industry	31.1. Trends in the product markets of the enterprise industry 31.2. Trends in science and technology in the enterprise's industry	P1.1. Growth P1.2. Maturity P1.3. decline (radical transformation)
E2. Determination of perspective directions of innovative development of the enterprise	3.2.1. industry development direction n 3.2.2. Problems of the industry products consumers 3.2.3. Enterprise's PID level 3.2.4. Enterprises innovative culture level	P.2.1. catching up (defensive) P.2.2. Leader-leveled P.2.3. Advanced
E.3. Determination of innovative development strategy type	3.3.1. Promising directions of enterprise's innovative development 3.3.2. Business analysis results for innovative developments 3.3.3. Innovative business type	One of the strategies (table 2)

Source: developed by the author.

Thus, relevant knowledge is the basis for making effective management decisions on the choice and implementation of strategic directions of innovative development of industrial enterprise. Knowledge (as follows from table 2) is implemented in innovative developments that form the basis for industrial enterprise's innovative development strategies and are commercialized in the form of innovative products, technologies for their production or application (consumption), marketing activities allowing to explore new markets or their segments, increase product sales and profits, strengthen market positions, and more. They may also be directly commercialized in the form of patents for technical or technological solutions, manufacturing licenses, etc.

Consequently knowledge in innovation management play a dual role:

- on the one hand, it creates the basis for making effective decisions in the innovation management process;

- on the other hand, it is the result of an innovative activity (innovation process) and is implemented in innovative developments of different directions.

Table 6.2

Innovative development strategies

Strategy type	Innovative business type	Stages of innovative cycle				Stages of life cycle			
		Generation of idea and conception of the product	Business analysis	Product development	Market testing	Introduction to the market	Sales increase	Maturity	Decline
1.Licensing	Venture	s							
2. Imitative			s						
3. Licensing		s							
4. Imitative	Explorative					s			
5. Niche	Patient						s		
6. Traditional (Defensive)	Violent							m, l	
7. Niche	Commute								s
8. Imitative	Combined		m, l						
9. Offensive		m, l							
10. Defensive							m, l		

Source: (Illiashenko, 2010), modified.

It should be mentioned that documented and formalized knowledge is investigated in the research: scientific - hypotheses, theories, laws, concepts, etc. both theoretical and empirical; professional - skills, techniques, experience, know-how, etc.; technical and technological - physically embodied in inventions, drawings, technologies, know-how, procedures, algorithms etc. In practice, innovative decision-making also takes into account non-formalized, undocumented knowledge, in particular, life experience, intuition, etc.

The important role of knowledge as the basis of innovative activity and at the same time its result requires high efficiency of the management system of production

(acquisition) and application (commercialization) of knowledge. This allows to determine the priority directions of knowledge production, regarding the world (industry, market) tendencies and existing potential of the enterprise, to choose effective ways of their application. In fact, it influences managing the competitiveness of an innovative industrial enterprise, as knowledge becomes the main factor of competitiveness under conditions of economic transformations.

6.3. THEORETICAL AND METHODICAL FUNDAMENTALS OF KNOWLEDGE MANAGEMENT AT AN INDUSTRIAL ENTERPRISE

Knowledge management at the enterprise involves the production and analysis of knowledge concerning internal opportunities for innovative development (PID enterprises), as well as external, which are initiated by factors of external macro- and microenvironment. According to the results of the analysis, the degree of correspondence of internal development opportunities to external ones is determined, that is, the sufficiency level of potentials-subsystems of the PID enterprise (see p. 1.2) to provide innovative development in the existing conditions, regarding tendencies of their change. In case of non-correspondence the possibilities of its provision by creating and implementing innovative developments: product, technological or management, aimed at enhancing the PID (its components and their elements) are determined.

These management actions demand to identify sources of knowledge and methods of their production, as well as promising direction of application. Fig. 1 presents the author's systematization of the basic methods of obtaining (production) knowledge at an industrial enterprise.

Characteristics of the main areas of knowledge application and corresponding innovative development strategies are given in Table 3. As a criterion for choosing a specific type of innovative development strategy, normalized assessments of the adequacy of the potential of PID subsystems of the enterprise: ON_R - market; ON_I - innovative; ON_{PP} – productive are proposed to apply.

It is advisable to perform ON_R, ON_I, ON_{PP} estimations according to the developed methodology (Shipulina, 2006) and then normalize them according to the proposed

binary scale: $ON_i = 1$ if the level is sufficient; $ON_i = 0$ if the level is insufficient. In this case, the normalized integral estimation of the PID of the enterprise takes values from $ON_{PID} = (1, 1, 1)$ to $ON_{PID} = (0, 0, 0)$.

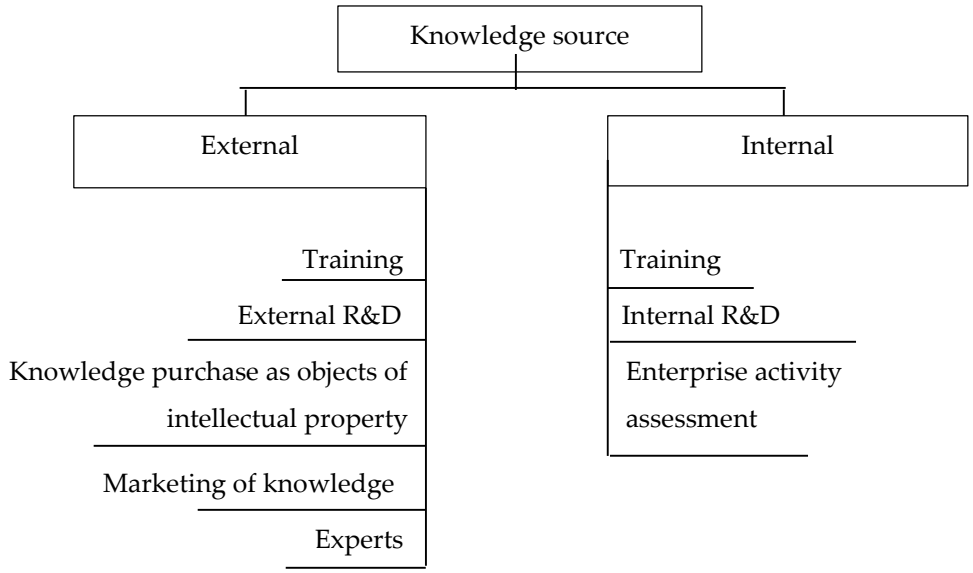

Fig. 6.1. Systematization of the main methods of obtaining knowledge at an enterprise

Source: developed by the author.

In cases when $ON_{PID} = (0, 0, 1)$ and $ON_{PID} = (0, 0, 0)$ it is recommended to consider the options for improving the knowledge management system (their production and application), as well as the management system of the innovative enterprise as a whole (including its PID).

When choosing strategies with alternatives, the type of innovative business and the size of the innovative enterprise should also be taken into account. (see tab. 2.)

A scheme for production management and application of knowledge at an enterprise is offer in Fig. 2. Arrows in the diagram indicate the flow of knowledge and actions to manage them.

The scheme outlines 2 sets of management actions (dashed lines) related respectively to the production and application of knowledge.

Block 1 of management activity is related to knowledge production, which is the basis for making decisions on the choice of perspective directions of innovative development of the enterprise (see stages E1 - E2 in Table 1).

Table 6.3

Strategic directions of knowledge application at industrial enterprises

The essence of the direction	Strategy selection criteria	Strategy number (table 2)
Advance development - the use of leading "breakthrough" innovations to take leading positions in the market	0, 1, 0; licensing; s	1
	1, 1, 0; licensing; s	3
	1, 1, 1; offensive; m, l	9
Leader-level development - constant imitation and competition with the leader	1, 1, 0; imitative; s	2
	1, 0, 0; imitative; s	4
	1, 0, 1; imitative; m,l	8
Protective - minor improvements of existing innovative developments to keep the market	1, 1, 1; niche; s	5
	1, 0, 1; protective; m,l	6
Advance development - the use of leading "breakthrough" innovations to take leading positions in the market	0, 1, 1; niche; s	7
	0, 1, 0; licensing; s	1

Source: developed by the author.

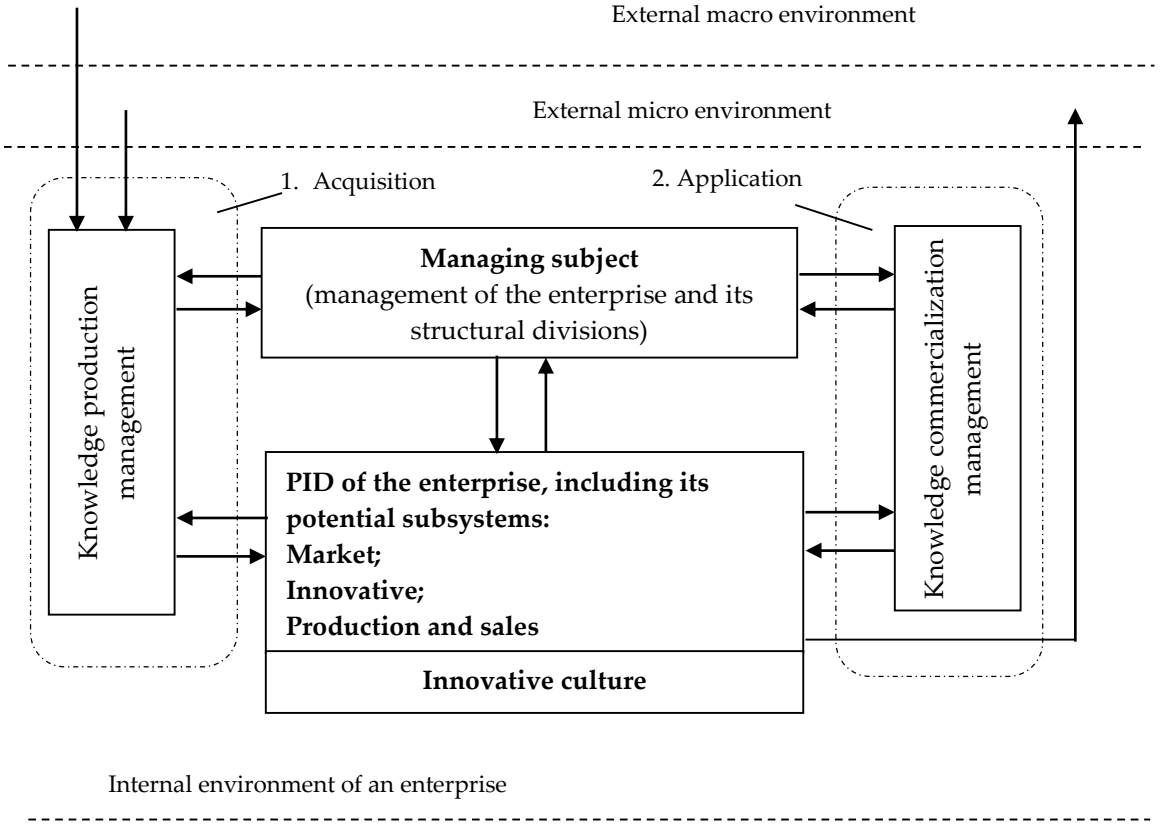

Fig. 6.2. An integrated scheme of knowledge management at industrial enterprises

Source: developed by the author.

The acquired knowledge contributes to the growth of the PID enterprise as a whole, as well as its individual potentials-subsystems. Together, they form and develop the knowledge base of the enterprise, which is distributed according to the nature and content of potentials-subsystems.

Some knowledge types relate to the corresponding constituent elements of the potential-subsystems:

- market potential – is knowledge of market development trends, consumer requests and problems, market positions of the company, etc.;

- innovative potential - knowledge concerning tendencies of science and technology development, intellectual and creative abilities of the personnel of the enterprise, its innovative culture, scientific and research potential, its intellectual property products, etc.;

- production and marketing potential - knowledge concerning financial, personnel, technical and technological, marketing, organizational and management resources and capabilities of an enterprise.

Appropriate methods of knowledge production (see Fig. 1) should be chosen in the result of analyzing their comparative effectiveness.

Block 2 of management activity is related to the determining rational strategies of knowledge application (see stage E3 in table 1, as well as table 2 and table 3). As follows from table 2 and table 3 main directions of knowledge application can be:

- Direct commercialization of knowledge embodied in intellectual property;

- Commercialization of innovative products or technologies that incorporate new knowledge;

- Improvement of knowledge management methods;

- Improvement of methods of enterprise management as a whole.

The latter two are related to increasing the PID level of enterprise.

Summarizing the point 1.3, we see that the presented research can form the basis of organizational and economic mechanism of knowledge management of an industrial enterprise in its innovative development.

6.4. KNOWLEDGE MANAGEMENT IN THE CONTEXT OF PROVIDING THE NECESSARY PID LEVEL OF INDUSTRIAL ENTERPRISE

As mentioned in Section 1.3, knowledge management in the context of the industrial enterprise's innovative development is focused on ensuring its PID level allowing effectively implement existing external opportunities for innovative growth and counteract the emerging threats. The enterprise PID estimation (ONPID) is a function of assessing the level of its potentials-subsystems, respectively: ONR - market; ONI - innovative; ONPP – productive and commercial. That is:

$$ON_{\text{ПІР}} = f(ON_R, ON_I, ON_{PP}). \qquad (6.1)$$

The value of the ON_{PID} assessment defined for a particular enterprise, is used to select strategies for its innovative development in the table. 3. These strategies are in line with the previously selected (see Table 1) directions of innovative development. However, in practical situations for some reasons (changes in environmental conditions, unexpected development of the market situation, management decisions, etc.) it is necessary to choose other strategies that require a higher level of PID (its components).

For example, for Ukrainian enterprises manufacturing machinery and equipment the catching up development in most cases is unpromising. Their foreign competitors have come a long way and have taken a strong position in the target markets. In this case, the only possible strategy is an innovative advancing, implemented on the principle of "advancing instead of catching up". In other words, it is better to choose your own way instead of repeating someone other's and move in the course of world development, seek and implement own potential advantages, use sufficient conditions in most appropriate fields. However, this may require increasing in the PID level of enterprises.

Consequently the approach to knowledge management of an enterprise is proposed in order to increase its PID level. Consider its main stages.

1. Diagnosis of enterprise's PID by potential subsystems and their constituent elements (Shipulina, 2006): market potential; innovative potential; production and marketing potential. Normalizing their ratings.

2. Determining the necessity of increasing the PID level of an enterprise. To do this, compare the calculated value of $ON_{ПІР.Р.}$ with the desired $ON_{ПІР.Р.}$:

$$ON_{\text{ПІР.р}} = ON_{\text{ПІР.б}} . \qquad (6.2)$$

If the result is unsatisfactory decisions are made to obtain and apply additional knowledge to provide the required level of ON_{PID} by individual components and their elements (Table 4).

Table 6.4

The knowledge as the basis for potentials-subsystems of the PID

PID Subsystems	Subsystems constituent elements	Content of knowledge
Market	Marketing, consumer, competitive	The current state and trends in consumer demand in actual or potential target markets. Existing and potential problems of consumers (market players in general). The main competitors, their comparative characteristics. Corporate structure of markets: economic counterparties, contact audiences, neutrals. Market infrastructure. Market positions of the enterprise, tendencies of their change. Enterprise marketing system, its potential
Innovative	Intellectual, informative, interface, research	Achievements and tendencies of development of science and technology of the enterprise's industry. Methods of generating and selecting innovative ideas, creating innovative products. Essence of interests of actual and potential economic counterparties and contact audiences, degree of mutual interaction. Access to knowledge bases and information bases. Methods of scientific and applied research in the enterprise industry. Possibilities of modern research and laboratory base of the enterprise's industry, as well as of the analyzed enterprise itself. Modern methods and forms of organization and management of innovative activity. Innovative culture of the enterprise (organizational, motivational, intellectual and creative components), methods of managing its formation and development
Production and sales	Financial, personnel, technological, marketing, organizational and management	Sources and conditions for financing innovative activities. Method of complex evaluation of innovation efficiency. Personnel potential, methods of selection, training, retraining of staff, the ability to perform work of a particular focus. Technical and technological capabilities of the enterprise (machine tools, equipment, technologies, etc.). Tools and methods of modern marketing, features of planning, conducting and evaluating the effectiveness of marketing innovation complex, knowledge marketing.

Source: developed by the author.

3. Acquisition (production) and application (commercialization) of knowledge in order to increase the level of PID of the enterprise (its potentials-subsystems). Characteristics of the corresponding tool and method support are given in Table 5. At this stage the technical ability and economic feasibility of managing knowledge production and application processes are analyzed.

Table 6.5

Methodological and organizational assurance of knowledge management for raising the enterprise's PID level

Characteristics	The constituent potentials of organization's PID		
	Market	Інноваційний	Market
Sources and tools for obtaining relevant knowledge	Strategic Marketing Analysis. Marketing research, knowledge marketing. Knowledge buying	Sources and tools for obtaining relevant knowledge	Strategic Marketing Analysis. Marketing research, knowledge marketing. Knowledge buying
Responsible for knowledge production	Marketing units	Responsible for knowledge production	Marketing units
Areas of knowledge application	Determining of promising development directions. Assessment of market prospects for innovative products. Developing a marketing program to promote a new product in the market	Areas of knowledge application	Determining of promising development directions. Assessment of market prospects for innovative products. Developing a marketing program to promote a new product in the market

Source: (Illiashenko S., Shipulina, Illiashenko N., Nagornyi, 2018) supplemented and adapted.

With this purpose the costs for achieving the correlation (2) and the expected results from the implementation of the innovative development strategy are compared and monitored. On this basis, further obtaining of additional knowledge and their application is discussed.

Paragraph 1 outlines the preconditions for knowledge management by formalized procedures at industrial enterprises in the context of ensuring the necessary and

sufficient level (to implement promising directions and strategies for innovative development) of its PID.

6.5. Summary

Summarizing the above, we can draw the following conclusions.

1. The role of knowledge in the system of managing the choice and implementation of strategic directions of innovative development at an industrial enterprise is clarified. It is shown that knowledge is the basis for effective management decisions to manage the innovation process. At the same time, they are the result of an innovative process that is embodied in product, technological, management and other innovative developments.

2. The theoretical and methodological principles of knowledge management at an industrial enterprise have been deepened, in particular: the systematization of the basic methods of knowledge obtaining and application has been specified; a methodological approach to managing the choice of strategic directions and strategies for knowledge-oriented innovative development; a comprehensive scheme for managing the knowledge production and application has been developed, including a scheme for the interaction of management decisions and knowledge flows; the basic ways of using knowledge are specified.

3. The approach to knowledge management from the point of view of increasing the level of innovative enterprise development potential has been improved, including: the sequence and content of the procedures for managing the potential and its potential-subsystems have been determined; the units responsible for managing the subsystems and their constituent elements are outlined; the essence and content of knowledge forming the basis of potentials subsystems are specified; the composition of facilities, methods and organizational support of knowledge management for raising the level of potentials-subsystems is specified.

4. The obtained results create the basis for development of a comprehensive knowledge management system of an industrial enterprise in the context of the formation of its innovative development strategies. Further research should focus on developing an organizational and economic mechanism for knowledge managing (by

formalized procedures) of an industrial enterprise in the context of shaping its innovative development strategies.

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