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Valentyna Ivanova, Oleg Ivanov, Olena Ivanova

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## **Formation of human potential of industrial enterprises: model and information technology**

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**Valentyna Ivanova\***

Department of Economy, Entrepreneurship and Management,  
University of Educational Management,  
52 A Sichovykh Striltsiv Str., Kyiv, 04053, Ukraine  
Email: [ivanval2177@gmail.com](mailto:ivanval2177@gmail.com)  
\*Corresponding author

**Oleg Ivanov**

Department of Technology and Equipment for  
Processing and Food Industries,  
Poltava State Agrarian University,  
1/3 Skovorody Str., Poltava, 36003, Ukraine  
Email: [oleg.ivanov@pdaa.edu.ua](mailto:oleg.ivanov@pdaa.edu.ua)

**Olena Ivanova**

Department of Digital Economy and System Analysis,  
State University of Trade and Economics,  
19, Kyoto Str., Kyiv, 02156, Ukraine  
Email: [o.ivanova@knute.edu.ua](mailto:o.ivanova@knute.edu.ua)

**Abstract:** Every enterprise strives to create competitive advantages for ensuring stable positions in a competitive market or creating new market niches without competitors. For that to happen, enterprises need not only to generate innovations, but also to strengthen innovative activity. They must be constantly prepared for changes. This is possible due to the presence of a powerful human potential of the enterprise, which must be formed continuously. It was proven that knowledge is the basis of all components of an employee's human potential. This was taken into account in the offered model for the formation of the human potential of an enterprise. The human potential of an enterprise is formed through appropriate information flows and is supported with the necessary information. Therefore, the information technology is offered which will ensure the implementation of the model of the human potential formation and prevent the rupture of this process.

**Keywords:** human potential; human potential formation; industrial enterprises; enterprise human potential; human potential formation model; information technology of the human potential formation; model; information technology; innovation activity; knowledge.

**JEL codes:** D8, J24, O3.

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**Biographical notes:** Valentyna Ivanova is currently a Professor in the Department of Economy, Entrepreneurship and Management of the University of Educational Management, Kyiv. She completed her Doctorate in Economics with specialisation in Mathematical Methods, Models and Information Technologies in Economics. She is an active researcher with publications in Scopus and Web of Science indexed journals and the participant in international academic conferences. Her areas of scientific interests are information, digital information technology, strategic management, modelling, intelligent business, tourism business, innovation, and human potential.

Oleg Ivanov is a candidate of Technical Sciences, and an Associate Professor of the Department of Technology and Equipment for Processing and Food Industries at Poltava State Agrarian University. He has several publications in accredited and Scopus and Web of Science indexed journals according to his academic studies. His areas of scientific interests are processing and food processing technologies, intellectual property and personnel management.

Olena Ivanova is an Associate Professor of the Department of Digital Economy and System Analysis at State University of Trade and Economics. She has completed her PhD in Economic Sciences. Her studies are publicly presented in several articles in the accredited and Scopus and Web of Science indexed journals. Her areas of scientific interests are computer modelling of business processes, analysis of business processes, structural and functional modelling, and information technology in management.

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## 1 Introduction

### 1.1 Background

Business constantly operates in a competitive environment. From time to time, an enterprise creates a new market niche or a new market distancing from competitors, but this phenomenon is temporary. The vivid examples of development of the global automotive industry or IT business are widely known. Over time, an enterprise comes into the market, which replicates and improves a product or service, provided by a pioneer. And the competition begins again. Recently, we have observed very rapid changes in an economy and social sphere, especially driven by the influence of digital information technologies, which, at the same time, forces and stimulates enterprises to change in order to compete successfully. Hence, enterprises should constantly create competitive advantages for strengthening their competitiveness and developing business. The most obvious way to do this is to create an innovation of value, as well as an innovation chain to create that value, its promotion, and its delivery to a consumer. Enterprises should be ready to change, focusing on the generation and implementation of innovations, and strengthening an innovation activity.

People (personnel) generate and transfer innovations for practical use, particularly, due to personnel knowledge and ability to put it into practice. Most enterprise managers believe that they can always involve their employees to create innovations when necessary, using their knowledge. But the question arises, to what extent is this knowledge sufficient and relevant for generating something new? The uncertainty of the business environment is very high, which leads to unexpected and complex problems for the business (as it appeared during the pandemic). Then the knowledge of employees used by them to operate effectively in normal conditions and to fulfil the assigned tasks, may not be enough to generate innovations and create competitive advantages in new conditions. Knowledge updating as necessary, when a problem exists and needs to be quickly solved by developing an innovation, in our opinion, leads to time loss, reduces the ability to quickly respond to the competitors' threats, and can lead to a decrease in demand for products. In addition, it is important for enterprises not only to eliminate the competitors' threats, but also to stay ahead of their actions, quickly reacting to market changes and becoming a leader in the competitive race. To that to happen, they should constantly work on knowledge accumulation and renewal, i.e., to form the human potential of an enterprise.

Most of the theoretical and applied studies are devoted to the study of human capital. In fact, it is the human potential, which has already been realised and provided on an enterprise with the opportunity to obtain a commercial result.

Deep and strong potential capabilities of personnel, which have not yet been used by enterprises (human potential), can serve as a powerful basis for innovation and competitive advantages, and further their human capital. However, the problem of forming the human potential of enterprises, particularly, the industrial ones, as the basis of their innovative activity stays insufficiently studied.

## *1.2 Research aim and methods*

The aim of the study is to determine the approaches to formation of the human potential of an enterprise, concentrating on the development of a model and information technology and based on the essence of the components of the human potential of an individual employee, taking into account the specifics of the industrial enterprises to enhance their innovation activity and ensure competitiveness.

During the research, we used the collection of statistical data to show the importance of the enterprises' innovative activity for competitiveness and to identify negative trends that are characteristic of the innovative activity of industrial enterprises in Ukraine. It is important to realise that such activity plays a significant role in the transformation of industry in the modern conditions of the digital economy. The set-theoretic method is used in order to represent all the components of the human potential of an individual employee and the human potential of an enterprise as a whole. We used the set-theoretic method and modelling to develop and present a model for the formation of the human potential of an enterprise. Induction and deduction, methods of situational and comparative analysis, and the method of analysing the dynamics of economic processes were also used.

## 2 Theoretical framework

In next section, we show the importance of human potential for increasing the competitiveness of industrial enterprises through innovation activity and emphasising the role of knowledge in it.

### 2.1 Impact of innovation activity on business competitiveness

The world competitiveness of a country is the result of its strong domestic competition between economic entities. It forces them to constantly innovate to gain an advantage over competitors or to exit a competitive niche and create a new field of activity.

Hence, innovations and the conditions of their generation and implementation play the main role in ensuring competitiveness. In the global competitiveness index, these processes are characterised by a number of indicators, in particular, ‘growth of innovative companies’ (The Global Competitiveness Report, 2018, 2019). The countries leading in this rating in 2019, namely Singapore, the USA and Hong Kong, which occupy high positions among all other countries in the world rating, ranked 14th, 2nd and 16th places by this indicator respectively (The Global Competitiveness Report, 2018, 2019).

We examined the example of Ukraine to confirm the impact of innovation activity of enterprises on the competitiveness of the state economy (Ukraine attains the 85th position in the global rankings). The number of innovative enterprises in Ukraine grows very slowly. The indicator ‘Growth of innovative companies’ was ranked 109th place in 2019, which was only three positions higher compared to 2018 (The Global Competitiveness Report, 2018, 2019).

In particular, the state of innovation activity of Ukrainian industry over the past seven years is unsatisfactory. The share of the enterprises that have implemented innovations in the total number of industrial enterprises remains low, averaging 15% (State Statistics Service of Ukraine, 2020). It decreased to 13.8% in 2019 (State Statistics Service of Ukraine, 2020). Industrial enterprises developed and implemented innovations concerning new technological processes and product types Table 1. However, the share of the sold innovative products in the total volume of sold products is extremely low (State Statistics Service of Ukraine, 2020). It indicates a low level of innovation activity.

**Table 1** Introduction of innovations at industrial enterprises

<i>Indicators</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>2018</i>	<i>2019</i>
Number of new technological processes introduced into production, units	1,576	1,743	1,217	3,489	1,831	2,002	2,318
Number of types of innovative products introduced in the reporting year, units	3,138	3,661	3,136	4,139	2,387	3,843	2,148
The share of the volume of sold innovative products in the total volume of sold products, %	3.3	2.5	1.4	x	0.7	0.8	1.3

*Source:* Adapted from State Statistics Service of Ukraine (2020)

Undoubtedly, the innovation activity of industrial enterprises is especially important, because they are the basis of any economy, supplying people with necessary material

benefits. Such enterprises make it possible for other business entities to operate, providing them with the means of labour and making products for successful business. “The level of innovation activity is a crucial factor in the growth of competitiveness for both an individual industrial enterprise and the national economy as a whole” [Brauweiler et al., (2020), p.5]. The activity of industrial enterprises is the most complicated and labour-intensive regarding the organisation of production, business process management, personnel management and marketing of finished products. They require a significant amount of innovations in different directions, allowing to improve all components of the activity.

The results of innovation activities (innovations) that contribute to the efficient functioning of industrial enterprises and ensure their competitiveness refer to the following: the accounting and document management (ensuring the rational organisation of accounting and reporting); the information management (improvement of information system, introduction of new information technologies); the project management (development of new methodologies, improvement of quality of the project procedures performed); the logistics organisation (reduction of time waste on delivery, reduction of other losses for delivery); the organisation of personnel policy (new approaches to formation of the human potential and personnel selection); the marketing and sales of products (improvement of approaches to demand study, new methods and technologies of market analysis, new methods of product promotion, ensuring uninterrupted work with potential and existing customers); the design activity (introduction of new software for accuracy of performance); the planning of activity (improvement of cost planning, new approaches to a strategy choice); production (production of new products, high quality of production); the organisation of production (improvement of quality of production preparation, reduction or elimination of time breaks between production operations); and the support production (improvement of production technologies, stock optimisation, technical improvement).

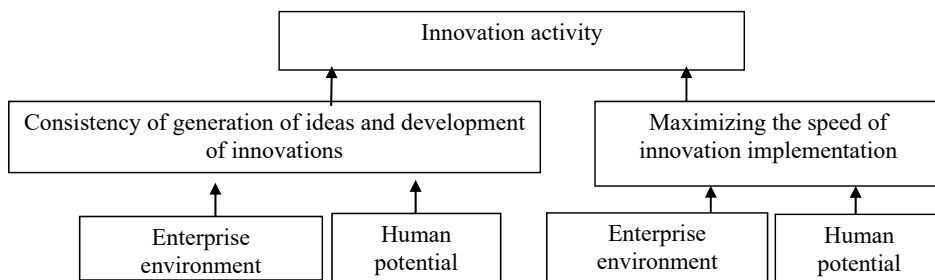
## *2.2 Innovation activity and human potential*

Certainly, the source of innovation is people (employees of enterprises). Using employees' knowledge, enterprises generate new ideas turning to the marketing, product, organisational, technical and technological innovations, in particular, to improve the company's operations through the new product output, the use of new methods of customer service, new methods of studying consumer expectations and demand, and new approaches to strategy development and business model updating.

The innovation activity of industrial enterprises is a consequence of active generation and use of knowledge, which are used by their employees to generate ideas. The most promising of them are further implemented as innovations. In turn, knowledge is the basis for formation of the human potential of an enterprise. Later in the article, we will consider the essence of this potential and the process of its formation in more detail.

Based on the abovementioned, we offer to consider innovation activity as a model consisting of the state of generation and implementation of innovations and availability of their supporting components (Figure 1). These components are human potential and the conditions created in an enterprise for the implementation of these processes. Its formation is of special importance for ensuring innovation activity, because it is the employees who generate ideas, develop and implement innovations, and create conditions for all these processes.

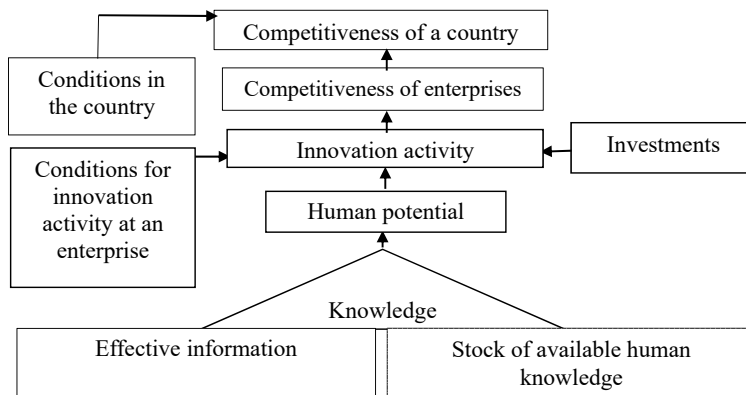
**Figure 1** Model of innovation activity of enterprise



This vision of innovation activity distinctly demonstrates that enterprises should form human potential, create conditions and support continuous generation of ideas for the development and rapid implementation of innovations to ensure innovation activity.

Industrial enterprises need to take into account that human potential is essential not only for ensuring innovation activity, but as a result, for the formation of their competitiveness, ensuring its high level for the country’s economy as a whole. Strong human potential allows companies to form a bank of ideas. If companies create the conditions for implementing and financing of ideas, then the level of innovation activity gets high enough to ensure competitiveness of such businesses. It strengthens domestic competition in a country and contributes to the growth of a national economy’s competitiveness Figure 2.

**Figure 2** The role of human potential in ensuring the competitiveness of enterprises



### 3 Literature review

Scientists study various problems regarding human potential and its impact on society and economy. The problem of capitalisation and the role of human potential in the innovative development of regions is considered (Derii, 2014). Its significance for territories (Tomchuk, 2019), knowledge economy (Tsymbal, 2016), society as a whole (Stefanyshyn, 2006; Sigayov and Shynkariuk, 2015; Guzenko, 2010; Hynda, 2014;

Nepriadkina, 2019) are studied. Approaches and methods of assessment of human potential (Kryvtsova, 2018; Ogienko, 2018b) are highlighted. Much less attention is paid to the study of the problem of its formation, and, in particular, at enterprises. Only the factors of its formation (Shevchenko and Nepokupna, 2019) and growth are considered, including health, education, creativity and innovation activity, demographic aspects, work experience, values, skills and qualifications, socio-communicative factors, the state and possibilities of migration, etc. (Simchenko et al., 2020). The factors affecting the formation of human potential include ‘family environment, education’ [Atanasova and Rinkova, (2018), p.40]. It is noted that the ‘formation of human potential depends largely on public relations, credit policy and its implementation’ [Bahrim, (2015), p.4].

A significant number of scientific developments concern the formation and development of the human potential of a state, a separate territory (region) or a person. Tomchuk (2019) studies the formation and directions of development of a territory’s human potential. According to the study, the issue of the potential formation and preservation is considered, in which medical support in the region was the main component (Ogienko and Gurina, 2018).

Nepriyadkina (2019) researches this problem at the state level, focusing on the development of education, healthcare, culture, labour market, and social institutions. It is argued that the ‘creation’ of human potential occurs ‘through education’, while it develops ‘through labour’ [Cvetkov, (2018), p.28]. Chernyshova (2015) considers education as a key factor in the formation and development of human potential. The formation of human potential is considered possible “only under the condition of targeted investments in its development by a state, a company and a person” [Hynda, (2015), p.146]. Shevchenko and Nepokupna (2019) consider the process of formation of human potential, focusing on the direct development of a person as a creative individual and personal growth. This process lasts from the birth of a person to the acquisition of a set of knowledge and physical potential [Bilska, 2016]. The formation of human potential is offered to consider ‘as an objective and least personal process’ [Argunova, (2017), p.97]. “The initial formation of human potential’ (social skills) occurs in society ‘mainly due to a state and a family” [Salakhova, (2020), p.160]. Human needs are considered as an element of the mechanism of human potential formation (Guzenko, 2010).

In the few studies of the formation of human capital at the enterprise level, the conditions and factors of this process are considered, rather than specific ways of its implementation. These studies offered not to “perceive an employee as the only subject at an enterprise who forms its human potential” (Sedanova, 2010). The need for stable operation of ‘a system of scientific institutions, formations, management structures equipped with modern information technologies’ is emphasised, although “organisations also independently search for the ways to obtain, master and apply internal (specific) knowledge” (Sedanova, 2010). An important role in the ‘formation of the human potential of a particular organisation’ is assigned to such measures as “the creation of safe working conditions, the stability of wages and the maintenance of its social significance; medical and social insurance of employees; providing opportunities for professional and personal development of personnel” [Rusheva, (2017), p.332].

Scientists have different approaches to the definition human potential. Stefanishin (2006, p.277) believes that “human potential is human abilities in general, independently of their use in tangible or intangible production”. Krivtsova (2018) considers it as a complex category that characterises the degree of satisfaction and improvement of the set of human needs. Sigayov and Shinkaryuk (2015) interpret the concept of ‘human



potential' as a set of health potential, fertile potential, as well as scientific, intellectual, vital, creative, labour, migration potentials. Derii (2014) considers it a set of creative abilities of people, their knowledge, skills and health. Guzenko (2010, p.30) defines this concept as human needs and interests, standard of living and health, "general and professional knowledge, qualifications, motivation, attitude to work, initiative and entrepreneurship, ways of behaviour". Bilska (2016, p.30) notes that human potential is identified as 'human opportunities available at a particular time or in the future that can be used in any field of socially useful activities to achieve this goal'. Gayduk (2016, p.116) interprets human potential as the maximum amount of "socially useful work that a person can perform, based on his/her level of health, education, material conditions for own state restoring, in a certain institutional (social) environment where an activity is carried out". Its components are called "abilities that ensure the human life and activities [Doctorovich, (2011), p.125], longevity, health, education, high professional qualification, and access to resources necessary to maintain a decent standard of living" [Davydova et al., (2019), p.205]. A person's potential is called 'a set of abilities and acquired knowledge, skills and abilities of a person that can be applied to achieve certain goals' (Chernyshova, 2015).

The human potential of an enterprise is presented as a 'set of social, psychometric and behavioural characteristics of employees' of a firm (Sedanova, 2010). At the firm level, human potential is "it is labour resources, total workforce, which is characterised by a certain level of education, professional experience, health status, culture, etc." [Goloviy, (2011), p.15]. But for an innovation firm, it is offered to recognise 'intellectual human potential' distinguishably as the set of intellectual, innovative, creative, social capabilities of employees "to act effectively in the production process, use the latest technologies, assimilate the gained knowledge, create new knowledge, output intellectual innovations, and produce innovative products and services" [Goloviy, (2011), p.16]. The maximum opportunity and propensity of a person to put their abilities into the professional practice and in everyday life is also called human potential (Davydova, 2018). Human potential "is defined as any latent qualities that can be realised or developed through experiences, leading to some objectively definable success and achievement" [David, (2020), p.20].

The essence of human potential is determined not only regarding an individual, but also to the characteristics of a region, a territory, or an economy. The human potential of a region is considered as a combination of "individual, labour, professional, social, cultural and creative abilities of people with the conditions for their implementation and development" [Ogienko, (2018a), p.73]. According to Soboleva (2007, p.12), "the human potential of an economy can be characterised as the physical and moral health reserve, general cultural and professional competence, creative, entrepreneurial and civic activity, accumulated by the population and realised in various fields of activity, as well as in the level and structure of needs". Kravchenko (2018) notes that human potential integrates various explicit and implicit abilities of the country's population. As a separate group of parameters characterises the human potential of 'innovators': 'professional competence'; 'intuition'; 'creative passion'; 'a tendency to act uncommonly'; 'objective self-assessment; talent; creativity' [Kravchenko, (2018) p.127].

Although some researchers offer an interpretation of intellectual potential of an employee, it is rather difficult to use it as a basis for the formation of intellectual potential of an enterprise.

## 4 Results

### 4.1 Human potential and its components

Although some researchers interpret the essence of the intellectual potential of an employee, these definitions can barely be used as a basis for the formation of the intellectual potential of an enterprise. Therefore, we offered our own definition of human potential of an individual employee and an enterprise as a whole, accompanying with the characteristics of human potential components. We demonstrate that knowledge is the basis of each component of an employee's human potential. Deep understanding of its essence helps solve the problem of forming the human potential of enterprises.

We define the human potential of an employee as a set of available results of mental activity, namely knowledge, skills, practical experience, available professional connections, personal connections (if they can be used for professional activity), personal developments and research (including personal patents), abilities for self-learning and self-motivation, and potential intellectual abilities.

According to the offered definition, the human potential of each employee is a set consisting of individual constituent elements:

$$pl = \{pl_{kw}, pl_{hb}, pl_{zd}, pl_{rs}, pl_{dj}, pl_{ag}, pl_{in}\},$$

where  $pl_{kw}$  – knowledge,  $pl_{hb}$  – skills,  $pl_{zd}$  – practical experience,  $pl_{rs}$  – professional and personal connections,  $pl_{dj}$  – personal developments and research,  $pl_{ag}$  – ability to self-motivation and self-learning,  $pl_{in}$  – potential intellectual abilities.

The basis of every component of human potential is human knowledge. The whole set of knowledge of an employee consists of his/her initial knowledge (knowledge at the beginning of a person's work at an enterprise) and new knowledge obtained by an employee as a result of the mental activity while working at an enterprise. These processes refer to the theoretical and practical information processing (information obtained as a result of practical application of knowledge).

Experience is the result of a person's mental activity when existing knowledge and additional information are used in practice. As a result, a person complements own existing knowledge with that knowledge resulted from the implementation of practical processes.

Skills are the result of a person's mental activity by the effective application of existing professional knowledge for the perfect practical performance.

Personal developments and research of employees result from the human mental activity on knowledge application for developments and research which did not produce practical outcomes (discoveries, inventions, offers on process rationalisation) and which are documented as patents (for inventions and developments) belonging personally to an employee.

Professional and personal connections of employees provide with certain information, which turns into knowledge resulting from mental activity. They are used in the professional activities of a person's (for example, knowledge of family dynasties).

Potential intellectual abilities of an employee are based on available knowledge. They provide a person's potential ability to intellectual activity and creative thinking.

Self-motivation abilities are based on the knowledge about the correct setting of goals, possible ways to achieve them and overcoming obstacles.

Self-learning abilities are formed due to a person's desire to increase the existing knowledge and availability of knowledge on how to organise this process independently.

The human potential of an enterprise is the set of human potentials of all its  $n$ -employees:

$$PL = \{pl_1, pl_2, pl_3, \dots, pl_n\},$$

where  $PL$  – human potential of an enterprise,  $pl$  – human potential of an individual employee.

#### *4.2 Model for human potential formation*

It was important to study deep understanding of industrial enterprises of the significance of innovative activity and human potential formation, the approaches to factual performance of this process in their activities and knowledge management.

For this, we interviewed the representatives of industrial enterprises, whose functions refer to personnel management: the heads of departments, employees of HR departments. Altogether, 78 representatives were interviewed from 25 enterprises that varied in size and industry (mechanical engineering, furniture manufacturing, rubber and plastic products, basic pharmaceutical products and drugs, food and beverage, clothing and leather goods). The distribution of their answers (as a percentage of the number of respondents) is presented in Table 2.

Based on the interview results, it is possible to state that industrial enterprises do not pay attention to the formation of human potential. More than 60% of respondents believe that this process is optional, although each of them noted the value of one or another component of human potential. Most of the respondents noted that updating the knowledge of employees is the task of the enterprise. Training was mentioned as the main method, which, unfortunately, is carried out in all enterprises as needed, not permanently. The majority of respondents believe that there are the employees who should be interested in increasing their knowledge, so no motivation for this is provided. Enterprises do not seek to find out the fullest amount of knowledge of employees, starting from their hiring, and create a knowledge base. The respondents note that they do not see threats related to the lack of knowledge of employees. Obviously, this is due to the underestimation of the opportunities provided by the employees' knowledge for the innovation activity of the enterprise (100% of the respondents answered 'no' to this question).

Although the majority of respondents recognise innovation activity as an important factor influencing competitiveness, innovations are implemented rarely. The lack of ideas and funding were mentioned as the main reason. However, the majority of respondents do not see the need to motivate employees to stimulate the acquisition of new knowledge that can be used to generate ideas. Only 20% of respondents believe that the knowledge of all employees can increase innovation activity, and only 5% of respondents consider employees as the main source of innovation. The results of the study show that industrial enterprises significantly underestimate the role of human potential (in particular, knowledge) in providing innovation activity, which would allow them to be more competitive. Accordingly, the process of its formation is not given due attention.

**Table 2** Results of interviews with representatives of industrial enterprises

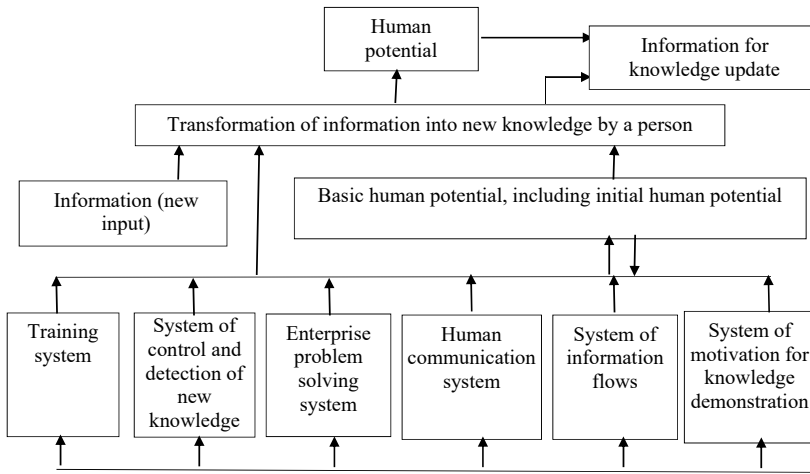
Questions	Distribution of responses, %		
	Yes	No	Undecided
<i>Formation of initial human potential</i>			
1. Does the company check the conformity of the level of knowledge of the applicant for the vacancy with the requirements of the vacant position?	100	0	0
2. Is a standard job interview used?	95	5	0
3. Is it necessary to find out what other meanings the applicant has (not related to the vacant position)?	0	98	2
4. Is the applicant's knowledge that does not relate to the vacant position is clarified?	0	100	0
5. Does the company use special methods or techniques to find out the maximum amount of knowledge of the applicant?	0	100	0
<i>Innovation activity</i>			
6. Do you think that the competitiveness of an enterprise depends on its innovation activity?	95	4	1
7. Does the company innovate frequently?	3	97	0
8. What is the main reason for the low innovation activity?			
a. lack of ideas	20	0	0
b. lack of funding	17	0	0
c. lack of ideas and funding	58	0	0
d. I don't think innovation activity is key in management	5	0	0
9. Do you think that the main source of innovation is external environment (experience of industry enterprises, university research results, etc.)?	95	5	0
10. Do you think that the main source of innovation is internal environment, i.e. your employees who use their existing knowledge and information from the external environment?	5	95	0
11. Do you think that the innovation activity of an enterprise depends only on managers?	51	38	11
12. Do you think that all knowledge of all employees can contribute to intensification of the innovation activity of the enterprise?	20	54	26
13. Is it necessary to motivate employees for activating the self-initiating increase in knowledge and their demonstration to generate new ideas?	17	64	19
14. Does the company estimate all the opportunities, provided by knowledge of all employees of the enterprise for innovation activity?	0	100	0
15. Does the company have a clear algorithm for using human potential for innovation activity?	0	100	0
<i>Knowledge management</i>			
16. Does the enterprise carry out knowledge diagnostics?	5	95	0
17. Can be a deficit of knowledge considered as a deficit of enterprise resources?	0	79	21
18. Does the enterprise identify new knowledge of employees within and outside of their performed functions?	7	93	0
19. Is the process of updating the knowledge of employees a task of the enterprise?	88	12	0
20. What contributes to an increase in the volume of knowledge (increase in human potential) at the enterprise?			
a. training employees in different ways	100	0	0
b. new information from outside	0	0	0
c. discussion and solution of enterprise problems	0	0	0

**Table 2** Results of interviews with representatives of industrial enterprises (continued)

Questions	Distribution of responses, %		
	Yes	No	Undecided
7 Does the company organise training for its employees?	99	1	0
8 Have you implemented an employee training system?	4	96	0
9 Is staff training provided as needed?	100	0	0
10 Is the process of updating knowledge continuous?	0	100	0
11 Is it necessary to create a database about the knowledge of employees?	2	56	42
12 Are the employees of the company motivated to increase their knowledge?	0	100	0
13 Are the employees of the company obliged to increase their knowledge?	100	0	0
14 Does the company assess the threats and risks that may arise due to the lack of knowledge (human potential)?	0	100	0
<i>Human potential and its formation</i>			
15 Which of the components of human potential do you value the most?			
a. knowledge	24	0	0
b. tips	0	0	0
c. practical advice	31	0	0
d. available professional connections	19	0	0
e. personal development and research	0	0	0
f. ability to self-study and self-motivation	26	0	0
16 Does the enterprise have a human potential formation system?	0	100	0
17 Is the algorithm for the formation of human potential determined?	0	100	0
18 Do you think that all knowledge, experience, skills of personnel should be (and are used) immediately as human capital, and the formation of human potential is optional?	62	0	38
19 Does renewal of knowledge for the formation of human potential appear as an on-going process at the enterprise?	0	92	18
20 Is there a relationship between human potential and enterprise problem solving?	2	98	0
21 Do you think that all the new information that appears as the result of the implementation of business processes can help increase human potential?	3	73	24
22 Is it important to ensure the continuity of the human potential formation process?	0	23	77
23 Has special information technology been developed and is being used for the formation of human potential?	0	100	0

We focus on addressing the problem of formation the human potential of enterprises and offer the model for its formation, which can be used by industrial enterprises. In our opinion, it clearly demonstrates the mechanism of this process and determines its necessary components. The use of the model improves not only the process of human potential formation, but, as a result, contributes to the improvement of the entire activity of enterprises. It is offered to form human potential of an industrial enterprise according to the structural model, which is presented in Figure 3.

**Figure 3** Model of human potential formation



The model of human potential formation is built on the fact that each enterprise should form a certain basic human potential. It is formed initially on the basis of the following components:

- the initial human potential, with which a person applies for a certain position in a company
- the initial human potential disregarding the vacant position; in this case, the base of people's data should be formed.

The people database is not analogous to the personal file of an employee. It should contain information about knowledge, skills, practical experience, available professional and personal connections, personal developments and research, potential intellectual abilities that do not relate to the performance of main working responsibilities. Such a base will maximally characterise the potential of both a person and an enterprise. It will allow assessing the possibility of opening new areas of activity as well as planning activities for the development of employees.

In future, basic human potential will be formed on the basis of initial human potential through the addition of new knowledge and other components of capacity that employees receive during work, and which become permanent (basic) after some time.

Transformation of information into new knowledge by a person and formation of the human potential takes place over a certain period of time on the basis of available basic

knowledge (basic human potential), information from the external environment and from a variety of systems created at the enterprise.

Thus, formation of the human potential of an enterprise requires the creation and operation of many systems, that is

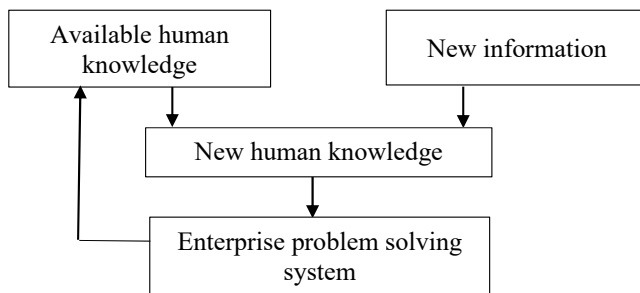
$$PS = \{ps_{kd}, ps_{zk}, ps_{vm}, ps_{ln}, ps_{ij}, ps_{kh}\}, \tag{1}$$

where  $ps_{kd}$  – training system, including advanced training;  $ps_{zk}$  – system of control and detection of new knowledge (obtaining explicit knowledge);  $ps_{vm}$  – problem solving system;  $ps_{ln}$  – human communication system;  $ps_{ij}$  – system of information flows;  $ps_{kh}$  – system of motivation for knowledge demonstration.

Systems provide the formation of basic human potential and appear as a source of information for its updating and obtaining the total human potential of an enterprise. They can be changed and improved under the influence of knowledge, which shapes human potential, and other knowledge, transmitted to all systems by information flows.

The problem-solving system is of particular importance for human potential formation in an enterprise. It allows revealing the implicit (hidden) knowledge of employees, which they use to solve the problem and present as their own new ideas and suggestions (new information). In fact, the problem-solving system helps generate new knowledge based on existing basic knowledge and attract new information. As a result, the company replenishes its human potential, realises it partly in human capital, and solves the existing problem Figure 4.

**Figure 4** The relationship of knowledge and problem solving of an enterprise



In general, we divide the sources of the formation of human potential of an enterprise as follows: the sources of passive formation (library of ideas, library of past problems and their solutions that make up corporate memory; initial human potential); the sources of active formation (training in educational institutions, system of advanced training, literature reading).

Focusing on the offered structural model of human potential formation in an enterprise Figure 3, we present it as the following theoretical-multiple model:

$$FPL = \langle PLb, IF, PH, PS, PO, TZ \rangle, \tag{2}$$

where  $PLb$  – the basic human potential of an enterprise, which is the set of basic human potential of all  $n$ -workers, i.e.,  $PLb = \{plb_1, plb_2, plb_3, \dots, plb_n\}$ ;  $IF$  – information,  $PH$  – processes of human mental activity,  $PS$  – a set of systems for human potential formation in an enterprise,  $PO$  – processes of organisation of creation and functioning of

the systems for human potential formation in an enterprise, TZ – time of transformation of information into knowledge.

Thus, the offered theoretical-multiple model of human potential formation in an enterprise, taking into account the above-mentioned set of systems (1) and the set of components of this process (2), will be as follows:

$$FPL = \langle PLb, IF, PH, pskd, ps_{zk}, ps_{vm}, ps_{ln}, ps_{ij}, ps_{kh}, PO, TZ \rangle. \quad (3)$$

### 4.3 Continuity of human potential formation

Human potential of an employee should be formed during all or most of the working time of each employee as a result of certain activities, actions, approaches, in particular through additional training, which accumulate knowledge and improve its quality.

All working time of the employee consists of effective working time concerning formation of human potential and losses of working time referring to formation of the human potential, as follows:

$$t_i = t_{li} + t_{vi},$$

where  $t_i$  – all working hours of the  $i$ -th employee for a period,  $t_{li}$  – effective working time of an employee in relation to the formation of the human potential,  $t_{vi}$  – loss of working time of an employee in relation to the human potential formation.

The general fund of working time at an enterprise can be represented then as the following:

$$T = \sum_{i=1}^I (t_{li} + t_{vi}).$$

The total efficient working time of an enterprise for the human potential formation is described by the following:

$$T_l = \sum_{i=1}^I t_{li}.$$

Accordingly, all working time waste for the human potential formation at an enterprise is denoted by the following formula:

$$T_v = \sum_{i=1}^I t_{vi}.$$

Effective working time for the human potential formation is the time that is used, in particular, to gain knowledge (experience) during training, problem solving, analysis of the taken actions, external and internal communications, and negotiations. Waste of working time regarding human potential formation is the time that does not allow replenishing and updating knowledge, in particular, time of movement and waiting, time of unproductive meetings, time of job adjustment, or time of routine operations.

Certainly, enterprises have the employees who constantly and carefully perform routine ‘mechanical’ operations; however, effective working hours should be available, because any field of work has an opportunity to improve processes. If employees do not



gain new knowledge, then  $T_1 = 0$ , that is, there is a gap in the knowledge acquisition, and, accordingly, during the human potential formation.

The human potential formation should be continuous, which is achieved by uninterrupted creation of new knowledge, the avoiding knowledge acquisition gap, and, accordingly, the rupture of human potential formation in an enterprise.

Thus, one of the main tasks of the human potential formation is to increase productive knowledge due to the increase of effective working time for human potential formation, i.e., there is always should be  $t_{hi} \geq t_{vi}$ .

The state of human potential in the enterprise ( $Z$ ) depends on the level of its formation ( $S_n$ ), which can be defined as  $S_1$  – high level,  $S_2$  – average,  $S_3$  – low level,  $S_4$  – formation gap (knowledge acquisition gap). It can be represented as

$$Z(S_n) = \begin{cases} S_1, & \text{if } \frac{T_1}{T_v} > 1, \\ S_2, & \text{if } \frac{T_1}{T_v} = 1, \\ S_3, & \text{if } \frac{T_1}{T_v} < 1, \\ S_4, & \text{if } \frac{T_1}{T_v} = 0, \end{cases}$$

To ensure high innovation activity, a medium or high level of human potential is needed. This is especially actual for industrial enterprises, where it is unsatisfactory.

#### 4.4 *Information technology to ensure human potential formation*

As is known, people form knowledge based on information, enabling performance of other processes in enterprises. Since we have determined that knowledge is the basis of human potential, the information flows should be streamlined in accordance with the main processes of information technology (receipt, storage, processing, transmission and use of information).

The human potential formation, as all management processes, should have the necessary information support and provide its performance with appropriate information flows (they ensure the receipt and transmission of information).

We present our approach to information technology for information support of organisation and implementation of the forming the human potential of an enterprise, which is based on all main components of information technology and involves the following technological processes:

- 1 Obtaining information from the following sources: basic human potential, collection of ideas of employees and formation of the corresponding library, problem solving system, system of internal and external training, system of control and identification of new knowledge.
- 2 Preservation of the information fund of available knowledge and information to replenish knowledge on the enterprise's server (partially in the cloud storage) with the provision of cybersecurity measures.

- 3 Information transfer through the automated system of communications and information flows.
- 4 Information processing by the system of measures for the transformation of implicit and informal knowledge into the explicit and formalised one.
- 5 Use of human potential due to free access of employees to the information fund.

Information technology for the human potential formation, in fact, provides this process with information, because knowledge of a person as well as experience and skills are formed through the transformation of information into knowledge. The implementation of the offered information technology should be carried out constantly.

Obviously, common state of human potential of an enterprise depends on its formation by each employee and the organisation of this process at an enterprise, involving the development and implementation of the system of appropriate activities.

## **5 Conclusions**

Industrial enterprises should pay more attention to innovation activity, the results of which usually contribute to their efficient operation and provide the formation of a number of competitive advantages. Lack of innovation activity negatively affects the competitiveness of enterprises and countries in general. The model of innovation activity shows that the human potential of an enterprise is one of its supporting components. This emphasises the importance and necessity of its formation to ensure innovation activity, because it is people who generate ideas, develop and implement innovations, create conditions for all these processes. The human potential of an enterprise is the multitude of human potential of all its employees. We offer to consider the human potential of an individual employee as a set of the results of mental activity (knowledge, skills, practical experience, existing professional and personal connections, personal developments and research, the ability for self-learning and self-motivation, potential intellectual abilities), the basis of which is knowledge.

It is advisable to form the human potential of an enterprise in accordance with the offered model, by which the supporting systems for organising this process at enterprises and maintaining its continuity are necessary. The model demonstrates the formation of basic and initial human potential. Its use will allow enterprises to form human potential as a powerful resource for their innovative activity. The complex of systems offered in the model will ensure the efficiency of this process. Businesses need to include a problem solving system as a powerful source of information to update most of the human potential.

Enterprises should ensure the continuity of the employee's human potential formation by avoiding the gap in the acquisition of knowledge, increasing the effective working time for its formation (during all or most of the employee's working time). The offered information technology for the human potential formation, proceeding from the essential role of information in this process, will ensure the implementation of the model of formation of the human potential of an enterprise and will help to avoid its rupture. Our research complements the literature on human capital and potential management. It will enable the formation of new research areas in theoretical terms to improve these processes. In future, we plan to substantiate in detail the methodology for building the

systems for the formation of the human potential of an enterprise and to develop practical tools for their creation.

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