

Quality Transformation of High Technology Industrial Enterprises Corporative Management in Terms of Transition to Digital Technology

Sergei Sergeevich GOLUBEV¹, Mikhail Yakovlevich VESELOVSKY^{2*},
Galina Ivanovna ANDRYUSCHENKO³, Igor Viktorovich BALYNIN⁴

¹Moscow Polytechnic University, Bolshaya Semenovskaya Street, 38, Moscow, 107023, Russia

²Technological University, Gagarin Street, 42, the city of Korolyov, Moscow region, 141070, Russia

³Russian Social University, Vilgelm Pick Street, 4, building 1, Moscow, Russia

⁴Financial University under the Government of the Russian Federation, Leningradsky prospect, 49, Moscow, 125993, Russia

*Corresponding author: Mikhail Yakovlevich Veselovsky; E-mail: consult46@bk.ru

Abstract

Industrial digital technology development has as a consequence transformation of high technology (high-tech) enterprises corporative management system. While using tools and methods of corporative management are changed considerably corporative management available methods become ineffective, they can't cover digital technology needs.

Changes of corporative management require to make decisions on staffing problems when adopting digital technologies. A board of directors plays an important role in the process of business digital transformation. They should understand what it is conducted for and how the company will provide its successful implementation. Competences in the sphere of digital technologies are of important key aspect not only within the whole enterprise but at the level of a board of directors as well.

Digital technologies influencing business-strategy enterprises, management organizing model, growth of value added as well as the cost of entry in a new business have been considered in the article.

Authors described organizational-economical mechanism of enterprises functioning when adopting digital technologies as well as experience of integrated informational area formation. It allows to increase effectiveness of corporative management with high-tech industrial enterprises.

Keywords: corporative management; digital technologies; a board of directors; staffing; high-tech industrial enterprises.

1. Introduction

Introducing digital technologies in work of industrial enterprises has led to the necessity of changes corporative management enterprises digital models, adoption of available organizational structures and company management systems on the basis of new digitization opportunities of enterprises economy and new approaches to run business. Digital technologies always closely interact with each other and provide technological changes of manufacturing process, increase labour productivity, assist to economic growth of enterprises as well as establish new high-performance work vacancies at high-tech industrial enterprises (Kergroach S, 2017).

Being influenced by digital technologies introducing in the corporative management processes existing process of organizing manufacturing is changed considerably, using tools and methods of corporative management are not effective, they can't cover digital technologies needs any more. While demand on new perspective competences is formed, new means of communications in business are appeared, new challenges for staffing policy are changed and business running models are arisen. It is therefore necessary for industrial enterprises to take into consideration changes of corporative management forms and methods in the digital era (Seidl da Fonseca R, 2017).

Old-fashioned approaches in corporative management don't work any more as information is of great importance in industrial

enterprises management today, digital management widens opportunities of an industrial enterprise, leads to the growth of share and service segments of the market, assists to new business models arising.

Artificial intelligence, new ways of information processing (text-mining, Big Data), new generation in business could widen considerably opportunities of industrial enterprises to adopt to the external world and changing working environment. When introducing digital technologies, the nature of relationship is changed essentially in the production system, involving tools of business, management of production, personnel and not only new corporative management perfection problems, but opportunities are also arisen (Arntz M., Gregory T., Zierahn U., 2016).

Introducing digital technologies in production is preferable first of all in scientific and high-tech branches of industry which are the most developed in technical and technological equipment of production, and have a highly qualified personnel. Poorly performing branches of industry which have no necessary skill in digitization can render a powerful destructive effect introducing digital technologies (Brynjolfsson E., McAfee A., 2011).

2. Methodology

To estimate influence of introducing digital technologies on the model of high-tech enterprises corporative management

questioning, poll, work group meetings on the problems of estimation influence of digital technologies on the system of corporate management and analysis of opinions were held. While corporate management is considered to be a set of measures directed to the owners protection and ultimately for increase value of a company and investment attraction.

Scientific proceedings of Russian and foreign scientists on the problems of digital technologies introducing at high-tech industrial enterprises, their influence organizational and financial activity of the corporations have been served as the methodological background. Within research work systematic approach, methods of financial-economical, logistic, comparative and factor analysis, method of Delfi and expert panel have been used.

Writing this article the authors used methods of strategic management of high-tech industrial enterprises where digital technologies were introduced which released scientific, high technological and innovative products.

3. Findings

3.1. Influence of digital technology introducing business-strategy enterprises

Digital technologies lead to change of business-strategy and industrial enterprises management model.

Business environment is becoming more flexible, it doesn't prevent internal and external innovations. Timely innovative technologies give new opportunities to form more effective business-models.

Earlier innovations were connected with high expenditures and risks. New patterns opportunities of tests were often difficult because of big costs and complications. Digital technologies allow to perform tests and experiments at such a level which seemed to be inaccessible before.

As a result digital technologies will assist to path from the idea to the introduction into the series quicker, will provide to elaborators opportunities to new item projects in the same informational environment, to evaluate item labour-intensiveness properly and regulate business-processes. It will assist to make defense enterprises activity more effective one.

But at the same time the majority of the private companies couldn't formulate integrated digital strategy and didn't start to forward movement to advanced innovative technologies (Shamsi A., 2017).

Thus, introducing digital technologies is accompanied by changes of defense-industrial sector enterprises management organizing model which contribute to more effective work of industrial enterprises.

3.2. Influence of digital technology introducing transformation of industrial enterprise management organizing model

Business model of enterprise should be considered as somewhat simplified idea of a business company as well as a mechanism of its functioning which offers methods of business administration. Conceptual business-model of an enterprise shows main elements of the value creation blocks, clients and financial model of business administration. Chain of the value creation should be considered as an organized and interconnected combination of processes which are necessary for creation and delivery of necessary and valuable products and services (Kravchenko A.C., 2019).

Digital technologies change management model of modern industrial enterprises. Digital technologies are transformed from business support funds to those of production effectiveness and industrial enterprises management increase. Big data and storage and calculation of cloud-computing technologies, internet of goods open new approaches to take decisions, development of new business-models of intellectual systems and allow to

automate fully technological processes (Bacon R., Kojima M., 2011; Nissen V., Lezina T., Saltan A., 2018).

Thus, internet of goods stimulates clever productions in energy. On the basis of internet of goods clever nets allow to produce monitoring of energy transfer and infrastructure state, to find out emergency, to eliminate interruption of power supply as well as stimulate using effective mechanisms of pricing in energy.

Such actively developing new industrial technologies as 3D-printing or additive technologies of layer-specific building of items and their joining digital technologies allows to change situation in the industry through integration of production design and delivery. At present 3D-printing is used for making set of spare parts models, but with broadening printing materials range, increase of surface processing accuracy and quality of ready commodities the role of such technologies will grow. Companies will sell non-physical objects but documentation for its elaboration (9).

Common model of digital transformation and adaptation to realities of digital economy of executive power federal bodies, state corporations, integrated structures and high-tech industrial enterprises can be represented as the most liable to digital transformation characteristics of internal and external environment (figure 1).

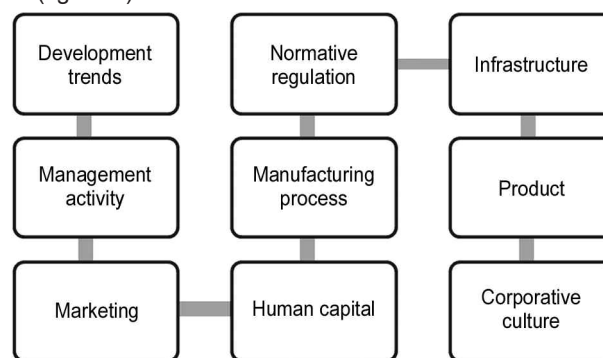


Figure 1. Common model of ideal digital transformation of high tech enterprise corporate management

Thus, it's necessary strategic interpretation of digital technologies development perspectives in their communication with business processes and business models for digital model development of corporation management.

3.3. Influence of digital technologies introducing on the growth of enterprise value added

Economical aspects of digital technologies introducing first of all are connected with considerable increase of value added product and lowering the barrier of entry in new spheres of business.

Economical theory considers value added and gross product as a source of economic growth and result of effective production increase. Due to up-to-date systems of labour payment workers are turned from participants of productive process into those of enterprise income formation (Tarabrin K.A., 2017) (figure 2).

Cardinal changes in the world concerned with the digital technology development and transition to the new technological structure open new opportunities for industrial enterprise development. The main strategy goal of industrial enterprises in terms of digital economy is diversification of economy and increase of high-tech product share including "clever" products.

Markets of "clever" products are developed more than twice quicker than those of traditional ones. In the "clever" market value added products more than a half is formed at the expense of intellectual investment in the technology. Markets of medical equipment, biotechnologies, energy- and resource-efficient equipment, telecommunication equipment, IT, electronics, new

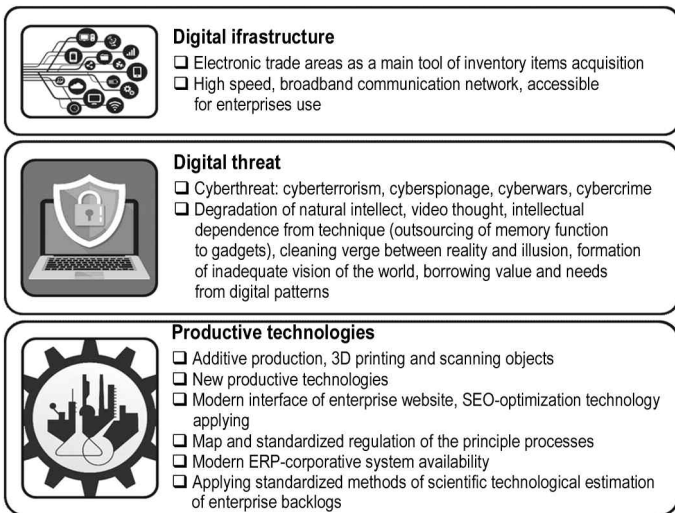


Figure 2. Priority elements of digital transformation which will be introduced at the high tech enterprises of defense-industrial sector

materials, robotics, a system of management. Automated management systems for enterprises, telecommunication networks of new generation, cybersecurity, etc. are considered to be of special perspective (Golubev S.S., Chebotaryov S.S., 2018).

Economical advantages for corporations and business based on digital economy are that they can economize at the expense of resources, operative cooperation with partners, immediate access to an ultimate customer, accelerate mastering a new product, decrease in value of a produced product and multiple time shortening of its output, opportunity of using new modern business models (Golubev S.S. et al., 2018).

When introducing digital technologies at industrial enterprises a lot of problem and risks are arisen too (information custody, data security), but their proper decision, economical analysis of taken decisions of process informatization will allow to raise management level and to achieve considerable economical and social success in the activity of the country industrial enterprises.

3.4. Influence of digital technology introducing on the entry cost in the business

Besides, in terms of digital economy the entry cost in the business is decreased up to 90% (figure 3).

Digital model of economy will allow to implement new kinds of business, a new model of investment attraction in the economy as well as more effective model of management (Worldwide research of Digital IQ, 2017).

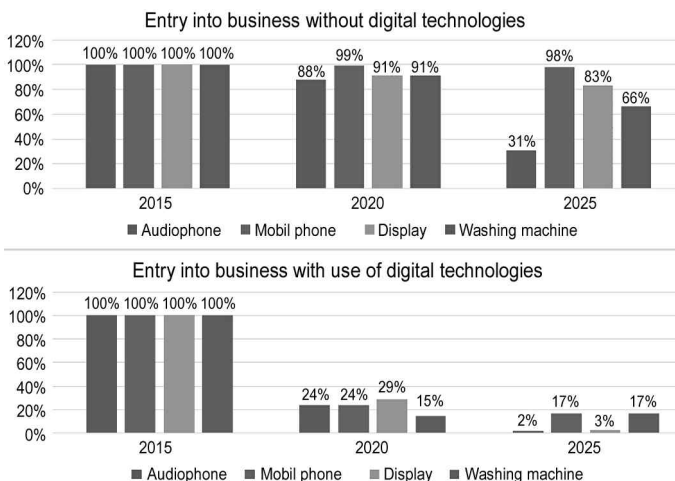


Figure 3. Entry into business without use of digital technologies and with use of digital technologies

3.5. Influence of digital technology introducing on the staffing policy

In according to influence of digital technology introducing on the management process and production new challenges are arisen for changing staffing policy and achieving sustainability, adaptation and effectiveness of labour market.

Employees of the future should have absolutely different competences than average person in business today. What kind of competences will be necessary for generation Z in the future? What will be important in 10-15 years for those who wants to be compativite and claimed in the labor market? All these problems are reflected in figure 3.2 (Golubev S.S. et al., 2019).

We need specialists of the time who are oriented in the digital environment, who understand how the newest technologies should be applied in their work and simply in their life.

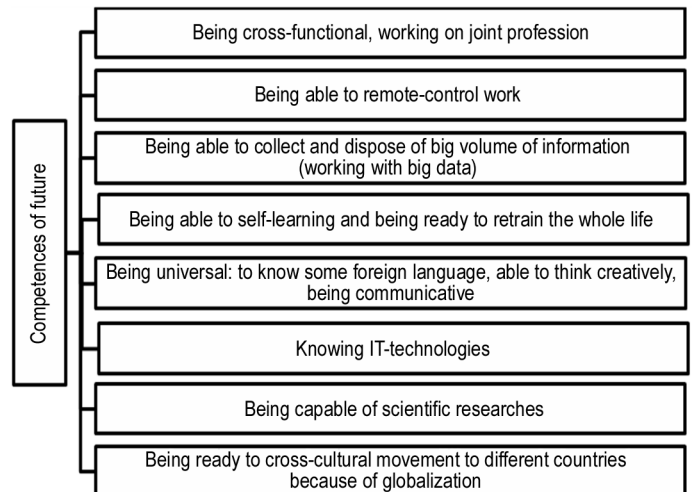


Figure 4. Competences of future

A board of directors plays an important role in the process of business digital transformation. As a rule, digitization of business is an integral component of the company strategy and top management is responsible for it. That's why discussing strategic tasks it's necessary to assign time to envisage consequences of digital technologies introducing (Goos M., Manning A., Salomons A., 2009).

Members of an enterprise board of directors as officials controlling implementation of the strategy play an important role in digital transformation of the company. They should understand what for it is conducted and how the company will provide its successful implementation. Competences in the sphere of digital technologies are considered to be a key aspect within the whole enterprise and at a board of directors level (Chulok A.V., 2017).

Board of directors members should understand what new technologies are the most relevant for the company, how to use them to get income. Besides, a board of directors should decide how the company will run innovative activity: to work within traditional centres of scientific research and development work and corporative incubators or it will be ready to open innovations and methods of design-thought.

Planning digital transformation in the company a board of directors should also estimate its readiness to the digital revolution. Technologies in which companies invest blur industry and contribute to the emergency of new business models and competitors. Current aspect of any branch can be changed essentially only in some years. Are there any specialists in a board of directors in your company with necessary knowledge and experience who can make the company prosperous in future? If there are not any professionals in the field of digital and new technologies, they must be included in a board of directors.

Need to have such specialists with knowledge and experience in the field of digital technologies has been realized

relatively recently. Only some years ago the idea to include an expert in technology in a board of directors didn't cause any enthusiasm of majority of directors. Today governing bodies are aware of such necessity, but only 23% of respondents participating in annual Russian poll, members of a board of directors 2017 held PwC noticed that tasks of technologies introducing are supervised at the board of directors level in their company (Havas A., Schartinger D., Weber M., 2010).

Only effective governing bodies can run digital transformation process successfully. Administration should be ready to innovative activity and cooperation, stimulate their introducing within the whole enterprise. Such process has already been implemented. More than 2/3 (68%) of leaders are responsible of digital technology advancement. Among 2500 largest companies of the world only 19% have a director on digital technologies or a specialist of the same position who is responsible of digital strategy of the company. Leaders of American and international companies are aimed first of all at strengthening innovative potential to get maximum profit from the new perspectives. Digital and technological opportunities as well as human capital were named as the following significant strategic priorities (Mahroum S., Dachs B., Weber M., 2007).

It's necessary to attract leaders to this work who will be responsible of different vectors of activity in the company including business-strategy, design, programming and human capital. Effort consolidation of professionals who are capable to look at the situation from different points of view at the very beginning stage of digital transformation will assist to widen digitization of business and achieve the assigned task. Together leaders responsible of different vectors of activity in the company can determine objectives concerned with priority trends of business digitization and join efforts to decide tasks on which digital transformation is depended.

Regardless of business digitization management structure in the company it's necessary to organize a regular awareness and

actual information about state of affairs. Leaders should discuss with the workers how digital technologies transform business. They should communicate with clients, partners and other interested persons constantly. They should decide how technologies can be used for such a continuous dialogue, in particular video, social network and mobile system (Roshchin S., Solntsev S., Vasilyev D., 2017).

With introducing new technologies which will help to implement corporative strategy companies should invest into training and qualification improvement of the personnel to eliminate deficit of highly qualified staff in the sphere of digital technologies. Directors may be interested in the fact how top-managers go with the times, how process of hiring and development of personnel can be changed. They should also understand how introducing new technologies will influence business processes in the company. A board of directors should participate in such investment. A board should know in details digital transformation of business and can work with new technologies to offer decisions, efficient for the company and implementation of its plans. The following variants of actions are shown which can be used by a member of a board of directors as a baseline.

4. Discussion

4.1. New organizational economic mechanism of industrial enterprise functioning when introducing digital technologies

New organizational economic mechanism of industrial enterprise is formed as a result of digital technologies introducing in the system of industrial enterprise corporative management. Newness of this mechanism consists of system and integrated approach to its formation (figure 5).

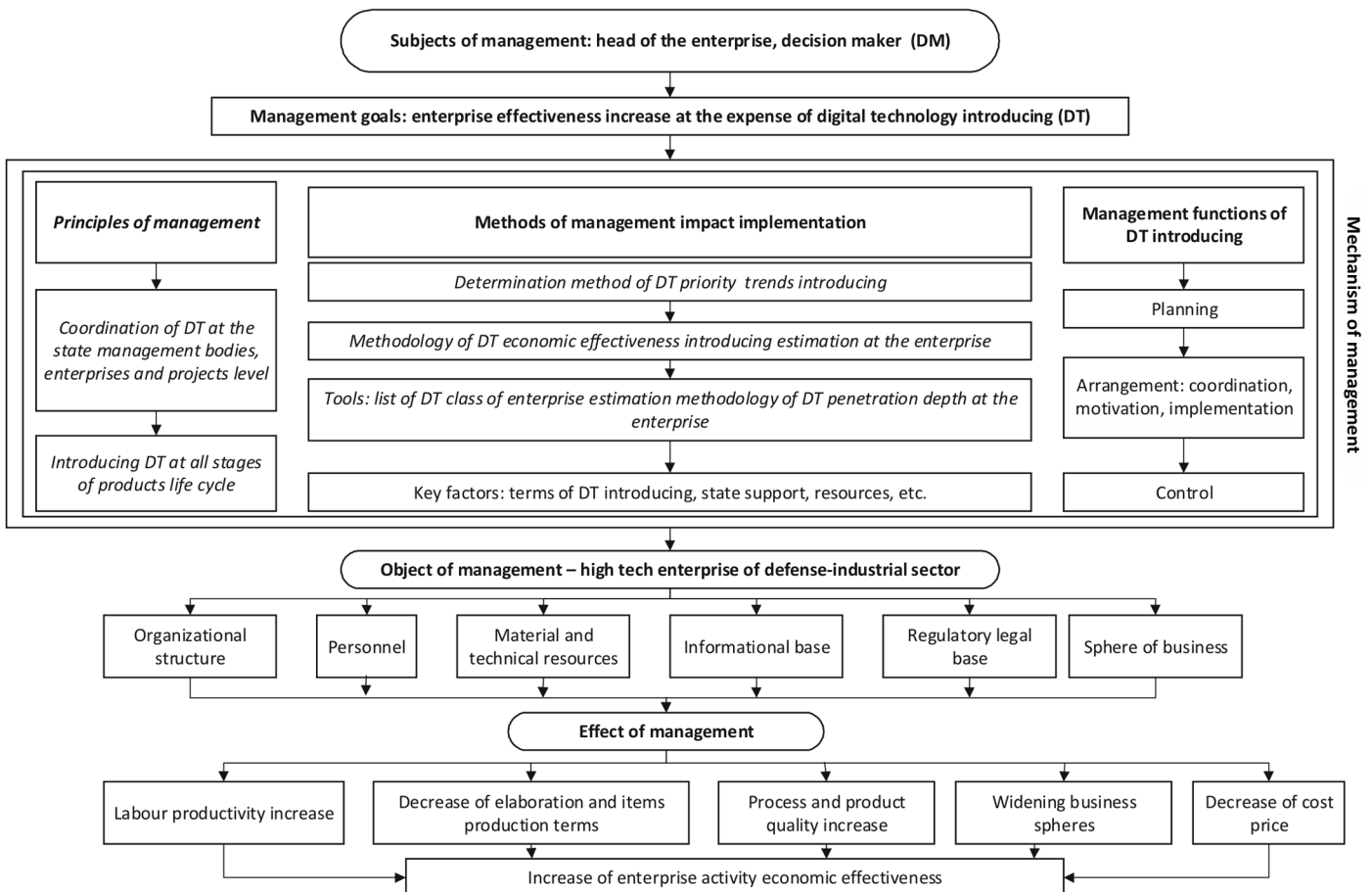


Figure 5. Organizational economic mechanism of corporate management when introducing digital technologies of industrial enterprise

Systemic approach is implemented when digital technologies are introduced into the processes of industrial enterprise management. It supposes coordination of digital technologies introducing into the process at the enterprise, its projects and state bodies management level.

It is determined by the fact that at present automated system of integrated informational area (IIA) of the defense-industrial sector, state informational system of industry (SISI), state automated estimation system of finance-technological risks, originating during state defense order carrying out are established. Digital technologies introducing at the enterprises will provide their communication with state system management.

Integrated informational area

Processes of digital technologies introducing change business-strategy work with data. Today it's necessary to solve a problem of proper management of the data. Earlier data generation was associated with costs. Only structured data could be used. Data of store houses were isolated and considered to be the tool of processes optimization. Ultimately data like any asset work in order to increase the performance of enterprise activity. A head of business working skillfully with the data can receive certain list of steps to achieve appropriate business objectives.

Digital technologies allow implementing continuous data generation. Their main task is to transform data into information. Opportunities of unstructured data interpretation are becoming accessible.

Connection between storages increases data value. The data are considered to be the key intangible asset necessary for cost added establishment.

If we speak about "digital transition" tendencies in the industry it should be implemented to integrate all IT-systems: sensors and tools, machine management, technological operations and enterprise management (operational management, business-planning, logistics). The further development of flexible productive systems is happened: modular assemblage, multiple robots, industrial internet and 3D-technologies. Analytical work is changed by transition from described analytics to expected, and then to directing one. The role of scientific technological development prognoses is increased, constant automated monitoring is implemented, results of which are taken into consideration when elaborating the state programs of development (Markovitch S., Willmott P., 2014).

Integrated model of digital management requires additional investment, but received advantages afford ground for in-

creasing effectiveness of corporative management as well as all business of the company.

It's necessary to notice that development of informational technologies being the main driver of industrial production effectiveness growth, perfection of the state and corporative management due to defense-industrial sector development at the same time causes new safety risk implementation of which in the defense sector can lead to the catastrophic consequences (Wolf W., 2019).

"Civil" informational and telecommunication technologies applying for enterprises of defense-industrial sector functioning support and establishment of armament model of the time, military and special technique (MST) is extremely vulnerable. Such degree of vulnerability is increasing steadily. In according to the Russian Federation Security Council only during 2016 there were more than 50 million cyberattacks to the informational resources of Russia. Comparing with 2015 their number was 3 times increased, 60% was implemented from the other countries (Elmaghraby A.S., Losavio M.M., 2014).

Carrying out research the authors found out that working at the projects there was delay at the industrial enterprises as co-executors didn't get information in time. Establishment of common informational area on certain projects will allow overcoming such a problem when introducing digital technologies.

5. Conclusion

Thus, in terms of introducing digital economy and digital technologies the system of interaction between managers of the enterprises and shareholders (owners) is changed essentially. Company activity effectiveness increase is the foundation on the basis of digital technologies introducing in the productive process and in the system of enterprise governing as well as increase of investment attraction and business value. It is achieved due to business model and enterprise governing change, lowering cost of entry in the new spheres of business in the digital era, the whole set of digital technologies advantages providing growth of enterprise value added.

In terms of introducing digital economy requirements to digital competence of corporative higher level members – a board of directors is very important, as it determines business development strategy and controls its effectiveness. Digital competence of a board of directors members will allow to increase digital technologies introducing effectiveness at the industrial enterprises.

References

- [1] Aghion P., Howitt P. (1994). Growth and Unemployment // *The Review of Economic Studies*. Vol. 61. No. 3. pp. 477-494.
- [2] Arntz M., Gregory T., Zierahn U. (2016). *The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis*. OECD Social, Employment and Migration Working Paper No. 189. Paris: OECD. Access: <http://dx.doi.org/10.1787/5jlz9h56dvq7-en>, date of addressing, 26.11.2017.
- [3] Bacon R., Kojima M. (2011). *Issues in estimating the employment generated by energy sector activities*. Washington, D.C.: The World Bank.
- BLS (2015). Employment Projections Program, Industry Employment and Output Projections to 2024. Monthly Labour Review, December 2015. Washington, D.C.: U.S. Bureau of Labour Statistics. Access mode: <https://www.bls.gov/opub/mlr/2015/article/industry-employmentand-output-projections-to-2024.htm>, date of addressing 24.11.2016.
- [4] Brynjolfsson E., McAfee A. (2011). *Race against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity and Irreversibly Transforming Employment and the Economy*. Lexington, MA: Digital Frontier Press.
- [5] Elmaghraby A.S., Losavio M.M. (2014). Cyber Security Challenges in Smart Cities: Safety, Security and Privacy // *Journal of Advanced Research*. Vol. 5. Iss. 4. pp. 491-497.
- [6] Goos M., Manning A., Salomons A. (2009). Job polarization in Europe // *American Economic Review: Papers & Proceedings*. Vol. 99. No. 2. pp. 58-63. Access: <http://dx.doi.org/10.1257/aer.99.2.58>, Date of addressing 26.11.2017.
- [7] Havas A., Scharfing D., Weber M. (2010). The impact of foresight on innovation policy-making: Recent experiences and future perspectives // *Research Evaluation*. Vol. 19. No. 2. pp. 91-104. DOI: 10.3152/095820210X510133.
- [8] Kergroach S. (2017). Industry 4.0: New Challenges and Opportunities for the Labour Market. *Foresight and STI Governance*, vol. 11, no 4, pp. 6-8. DOI: 10.17323/2500-2597. 2017.4.6.8
- [9] Mahroum S., Dachs B., Weber M. (2007). Trend spotting the future of information society technology human resources // *International Journal of Foresight and Innovation Policy*. Vol. 3. No. 2. pp. 169-186.
- [10] Markovitch S., Willmott P. (2014). *Accelerating the digitization of business processes* / McKinsey, 2014. URL: <http://www.mckinsey.com/>

- business-functions/digital-mckinsey/our-insights/accelerating-the-digitization-of-business-processes (date of addressing 19.09.2017).
- [11] Nissen V., Lezina T., Saltan A. (2018). The Role of IT-Management in the Digital Transformation of Russian Companies. *Foresight and STI Governance*, vol. 12, no. 3, pp. 53-61. DOI: 10.17323/2500-2597.2018.3.53.61
- [12] Roshchin S., Solntsev S., Vasilyev D. (2017). Recruiting and Job Search Technologies in the Age of Internet. *Foresight and STI Governance*, vol. 11, no. 4, pp. 33-43. DOI: 10.17323/2500-2597.2017.4.33.43
- [13] Seidl da Fonseca R. (2017). The Future of Employment: Evaluating the Impact of STI Foresight Exercises. *Foresight and STI Governance*, vol. 11, no. 4, pp. 9-22. DOI: 10.17323/1995-459X.2016.4.9.22
- [14] Golubev S.S., Volkov V.I., Shcherbakov A.G., Sekerin V.D., Gorokhova A.E. (2019). Manpower Support for Digital Technology Implementation Processes in Industrial Enterprises // *International Journal of Engineering and Advanced Technology (IJEAT)*, Vol. 8 Issue 3, February 2019, pp. 414-420. (<https://www.ijeat.org/wp-content/uploads/papers/v8i3/C5896028319.pdf>)
- [15] Frey C.B., Osborne M.A. (2013). *The future of employment: How susceptible are jobs to computerisation?* Oxford, UK: University of Oxford.
- [16] Shamsi A. (2017). The Relationship between Knowledge Management and Managerial Skills: The Role of Creative Thinking. *Foresight and STI Governance*, vol. 11, no. 4, pp. 44-51. DOI: 10.17323/2500-2597.2017.4.44.51
- [17] Wolf W. (2019). Cyber-physical systems // *Computer – 2009. – No. 3. – C. 88-89.*
- [18] Worldwide research of Digital IQ, 201 //PwC, February 2017 <https://www.pwc.com/gx/en/industries/industry-4.0.html> (Date of addressing 25.06.2018).
- [19] Golubev S.S., Chebotaryov S.S. (2018). Informational technologies as key mechanism of sustainable development of defense industrial enterprises under present-day conditions // *Economic strategies*. Vol. 20. No. 3 (153). pp. 68-81.
- [20] Golubev S.S., Chebotaryov S.S., Chibinev A., M., Yusupov R.M. (2018). Methodology of scientific technological forecasting of the Russian Federation under present-day conditions. *Creative economy*.
- [21] Kravchenko A.S. (2019). Model of company management arrangement. Essays of a specialist on management. URL: http://www.vodaspb.ru/arhive/dr_autor/model_org_upr_komp/model_org_upr_komp (date of addressing 02.01.2019).
- [22] Tarabrin K.A. (2017). From point of IT-decisions to breakthrough – creation of “clever factory” in defense industrial sector. *Connect*, No.4, pp. 3-15.
- [23] Chulok A.V. (2017). Stop worrying and begin studying. Mega-trends: look at dynamic portfolio the future competences // *BRICS Business Magazine*. No. 1(17). pp.58-61.

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.