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ENTERPRISE DIGITALIZATION SECURITY LEVEL DIAGNOSTICS ACCORDING TO ITS LIFE CYCLE PHASE

Abstract. Taking into account the current conditions of companies' transition to remote mode of operation, it is of paramount importance to have a number of tools giving opportunity to assess the readiness of business entities to work with all the contractors remotely. Thus, it is necessary for enterprises and business entities to ensure the digitalization security. The article is devoted to the study of differences between the essence of the concepts «Information Security» and «Security of digitalization», as well as the analysis of enterprises digitalization security level. The authors proposed a method of assessing the enterprise digitalization security level from the standpoint of life cycle theory, which allows to identify signs of the «Information Recession» in its activities. The research methodology involves an integrated analysis of the main enterprise activity aspects at the different stages of its life cycle using an indicator that takes into account the depreciation of intangible assets, namely, computer security, the level of administrative costs and sales costs. Identification of the «Information Recession» conditions and determination of the digitalization security level was carried out by expert methods. Specialists on strategic development of enterprises acted as experts. Experts have eradicated such security levels of digitalization as «normal», «acceptable» and «critical». The method was tested on the materials of the Kryvyi Rih mining enterprises. The obtained results characterize the conditions for identifying the «Information Recession» in the activities of enterprises at such stages of their life cycles as «Formation», «Infancy», «Childhood», «Growth», «Stability» and «Recession». The proposed approach will allow to improve the processes of management automation and to increase the digitalization processes implementation efficiency for industrial enterprises.

***Keywords*:** digitalization security, life cycle theory, information recession, expert's assessments method, mining enterprises, business efficiency.

JEL Classification M15, M21, D21, L60, O13

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ДІАГНОСТИКА РІВНЯ БЕЗПЕКИ ДІДЖИТАЛІЗАЦІЇ ПІДПРИЄМСТВА З УРАХУВАННЯМ ФАЗИ ЙОГО ЖИТТЄВОГО ЦИКЛУ

Анотація. Зважаючи на сучасні умови переходу в дистанційний режим роботи, підприємствам важливо мати низку інструментів, які дозволять оцінити готовність об'єктів бізнесу до віддаленої роботи з усіма можливими контрагентами. Таким чином, перед підприємствами постає питання забезпечення безпеки діджиталізації. Присвячено дослідженню відмінностей між сутністю понять «інформаційна безпека» і «безпека діджиталізації», а також аналізу рівня безпеки діджиталізації підприємств. Запропоновано методику оцінювання рівня безпеки діджиталізації підприємства з позицій теорії життєвого циклу, що дозволяє виявити ознаки настання «інформаційного спаду» в його діяльності. Методологія дослідження передбачає проведення інтегрального аналізу основних аспектів функціонування підприємства на різних етапах його життєвого циклу за допомогою показника, що враховує ступінь спрацювання комп'ютерного забезпечення, рівень адміністративних витрат і витрат на збут. Виявлення умов настання «інформаційного спаду» і визначення рівня безпеки діджиталізації проводилось експертними методами. Експертами виступали спеціалісти з питань стратегічного розвитку підприємств. Зокрема, експерти виокремили такі рівні безпеки діджиталізації, як «нормальний», «допустимий» і «критичний». Методика була апробована на матеріалах провідних підприємств гірничорудної галузі Криворізького регіону України. Отримані результати характеризують умови виявлення характерних ознак «інформаційного спаду» в діяльності підприємств на таких етапах їхніх життєвих циклів, як «Становлення», «Малолітство», «Дитинство», «Ріст», «Стабільність» і «Спад». Запропонований підхід дозволить удосконалити процеси автоматизації управління та підвищити ефективність упровадження процесів діджиталізації в діяльність виробничих підприємств.

***Ключові слова*:** безпека діджиталізації, теорія життєвого циклу, інформаційний спад, метод експертних оцінок, гірничорудні підприємства, ефективність діяльності підприємства.

Формул: 1; рис.: 0; табл.: 3; бібл.: 28.

Introduction. The global economic situation in late 2019 and early 2020 has vividly shown that the key to business development in a pandemic is the maximum transition to remote work. It's not just about selling products over the Internet, the need to automate all business processes comes to the fore far and wide. From the economic point of view, the above mentioned must be determined by appropriate calculations and diagnostics of the possibility of remote work. The issue of automation was raised in ensuring information security a year ago. Nevertheless, in terms of COVID-19 it is far more rational to single out the concept of digitalization security as the next stage in the evolution of classical information security.

The problem of dynamic restructuring of the business environment encourages the assessment of digitalization safety. In its turn, ensuring of dynamic changes being taken into account is possible by considering the cyclical development of the enterprise. The latter should be based on the theory of life cycle which reveals the features of the enterprise development in terms of comprehensive digitalization. The urgency of problems a company is facing in the process of transition to continuous remote work option is an indisputable justification for the relevance of the study.

The aim of the study is to identify the differences between information security and security of digitalization, as well as to assess the level of security of digitization with regard to life cycle theory.

Literature review and the problem statement. Ukraine rapid integration into the information space accounts for the necessity to study modern research areas of digital security essence. When performing a literature review, it is of paramount importance to focus on the following areas: firstly, to characterize information security; secondly, to outline the security of digitalization in terms of its difference from information security; thirdly, to consider approaches of determining the level of digitalization security. Literature review was performed for the 2006—2020 period.

Apparently, information security is as a primary issue to start research with. In the past decade information security was viewed from the standpoint of technical support aimed at identifying potential threats [1]. In the works of Acquisti, A., Friedman, A. and Telang, R. [2] technical condition of the enterprise computer software, its serviceability and high-quality ability to differentiate hostile actions from the external and internal environment is considered as information security. Meanwhile, from economic point of view information security is defined as capital invested in computer software. The level of information security, in its turn, is determined by the following indicators of investment efficiency connected with computer software: ROI, NPV and IRR [3]. According to Dubnytskyi V., Naumenko N. and Tutayeva O. information security is maximum security of enterprise information protection from internal and external threats [4]. Moreover, the authors determine threats as all possible obstacles which users may face in the process of using information system. In terms of economic security, information economic security, in particular, is represented as a group of such expenses as control and information security system expenses; outside and intramural expenses to eliminate the consequences of violation of the privacy policy; technical system maintenance expenses [5]. The given approach is quite an effective one but it does not consider the index of enterprise development by introducing the protection level against information threats.

At the threshold of economic change information security is a prerequisite for the enterprise further development. Ponemon Institute study from 2012 determined that business leaders do not view information security as part of strategic development in most cases, (Ponemon Institute LLC, 2012). Further evolution of the information security understanding showed that the strategy of information security is a key to long-term development. In the work of Hohan A., Olaru M., & Pirnea I. [6] it was proved that the process of evaluating and ensuring information security requires constant improvement. It gives opportunity to counter threats more effectively, prevent their occurrence, increase the level of competitiveness [7] and provide the principles of human-centeredness [8]. The latter requires the use of an approach characterizing possible changes of the enterprise. At the same time, depending on the changes, it is appropriate to consider the features of security, taking into account the degree of development and awareness of information security [9].

Research results. Global changes in economic and information space encourage the transformation of well-known economic threats into a new form. The security of business processes comes to the fore in terms of their information support and development [11]. Therefore, the state of information development helps to distinguish between the concepts of information and digital security. Before identifying the main differences it is reasonable to explore the essence of digitalization security. In 2011 The Open Group announced information security management standards O-ISM3 targeted at the following: priority of information security goals (information privacy); ensuring the long-term and quality of information; control over information access and technical goals of information security [12]. Thus, information security can be defined as the complex system for ensuring the enterprise security from potential threats associated with digitalization, providing the resources of the enterprise are used efficiently. Researching the digitalization security, we define digitalization as a gradual introduction of innovative technologies

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at the enterprise aimed at automatization of all business processes. The major obtained result is increasing productivity and the rate of turnover due to the implementation of a person-centered approach to the economic relations of the enterprise with consumers. The key factor for attracting digitalization tools is the development of unique competitive advantages both for the specific type of product (service) and for the enterprise as well [14]. Examining the above issue in the sphere of legal regulation it is necessary to refer to the work of Kibenko O. [15] the judge of the Supreme Court Grand Chamber. The author maintains that nowadays the concept of digitalization is not used in Ukrainian legal science. Nevertheless, it is used more and more extensively in the European legal environment. In terms of European corporate law, digitalization is determined as a set of measures aimed at regulating corporate legislation involving the transition from paper information exchange to on-line procedures.

Thus, a transition from the face-to-face interaction of the enterprise with all counterparts to on-line interaction is an inevitable requirement, which a company should meet in order to save money, human resources and time [15]. In the process of ensuring a digitalization, the European law regulates three modes of communication such as on-line procedure involving communication through the website and available to the final consumer; direct on-line procedure which can be performed by the consumer independently without any middlemen; continuous on-line procedure characterized by the autonomy of all processes, that is, enterprise's counterpart is able to perform all the necessary on-line operations independently. The usefulness of European experience usage is beyond any doubt due to the total integration into the global economy. The essence of the consept of digitalization has different interpretations. For instance, Wikipedia interprets digitalization as a digital economy and defines the latter as an information technology-based business [16]. Scientists Kolomiyets H., Hlushach Yu. [17] offer to compare the concepts of digitalization and informatization and consider the latter to be a process of digitalization of all possible information in order to increase the efficiency of business entities' activities.

Hojeghan S.B., Esfangareh A.N. [18] defined digititalization as a key to business development based on the use of electronic platforms for the goods and services sales. Thus, nsuring the security of digitalization is impossible without the effective use of these tools. The strategy of digital security, in its turn, should take into account the comprehensive provision of information resources of all business processes [19]. Having reviewed subsequent and more recent literature, it was determined that today there is no complete and comprehensive understanding of the difference between information and digitalization security. The issue of the methodology assessing the level of digitalization security which takes into account the development criterion also remains unsolved. A study of various approaches defining the essence and differences between information and digital security was carried out. *Table 1* was formed using the empirical method, namely on the basis of generalization. It shows the main differences between information and digitalization security. Special attention was paid to define the concept, goals and economic components of assessment.

Table 1

The differences between information and digitalization security

Information security	Digitalization security
Definition:	
the complex system for ensuring the effective use of the resources to protect the enterprise from threats associated with digitalization.	the effective use of enterprise resources to automate all business processes and ensure comprehensive communication with consumers and counterparts.
Goals:	
privacy protection;	development of unique competitive advantages;
information quality ensuring;	application of a person-centered approach, development of positive image;
control over information access;	ensuring the communication effectiveness;
technical access to information.	administration and marketing cost reduction;
	labour productivity growth.
Economic components:	
the estimation of the financial costs from the threats.	the estimation of amortization of intangible assets in the context of business process automation and cost reduction.

Source: developed by the authors.

The authors determined the differences between information security and digitalization security, presented the aims of the above types of economic security and their economic components. The digitalization security level is based on such aims as development of unique competitive advantages; application of a person-centered approach, development of positive image; the communication effectiveness; administration, management and marketing costs reduction [8]. Thus, it is necessary to change the indices to ensure the achievement of the above goals according to the type of economic activity, consumers, market outlets, type of product. When determining the development process it is necessary to use the theory of the life cycle of the enterprise [20]. The theory provides grounds for identifying the criteria which enable more effective measures to ensure digitalization security. The life cycle theory of the enterprise is described in the study [22]. It includes eleven stages of life cycle. In our research, we consider it more effective to shorten the number of stages to the following stages «Formation», «Infancy», «Childhood», «Growth», «Stability», «Recession». One of the tasks of economic security at any stage of the life cycle is to eliminate the threat of getting into the «Economic recession» zone. This zone is inherent in each of above stages [23]. In order to provide digitalization security it is necessary to understand the «Economic recession» zone from the standpoint of the «Information recession».

In digitalization security terms «Information recession» is the relevant criteria that alert the enterprise about the loss of the previously established development pace. Based on the pace of scientific, technical and innovative progress in determining the conditions of «Information recession» it is necessary to use the following indicators:

- indicator of depreciation of enterprise computer software (*S*); the index of given indicator (I_s) is used when determining the development criterion;
- the level of administrative expenses (*AE*) and marketing cost (*MC*) when the volume of marketing of product does not change; the indices of given cost (I_{ae} and I_{mc} correspondingly) are used when determining the development criterion.

The development of a methodology for assessing the digitalization security is based on integrated analysis. Identification of the conditions of the «Information Recession» and the level of digitalization security at different stages of the life cycle was carried out by an expert method. The experts were specialists in strategic development. A survey of 15 experts on strategic development of domestic enterprises was conducted. The obtained results provide reliable evidence, asserting that the results of the digitalization security assessment should be divided into such levels as «normal», «acceptable» and «critical» ones with the value of the concordance coefficient of 0.81. The total indicator of «Information recession» is regulated by the following formula:

$$InR = I_s \times k_s + I_{ae} \times k_{ae} + I_{mc} \times k_{mc},$$

where *InR* is the integral index of the onset of information recession;

k_s, k_{ae}, k_{mc} — weight coefficients according to the index of computer software depreciation, administrative expenses, and marketing cost.

The less the obtained value of the integral index of the onset of information recession (*InR*), the higher the level of digitalization security. Weight coefficients of individual indices are determined by the expert method. The coefficient of expert opinions consistency is calculated depending on the type of economy, management and stage of the enterprise life cycle. More details can be found after considering the criteria of the «Information recession» in the context of the life cycle stages. The enterprise begins its life cycle with the «Formation» stage where the process of productive (trade) capacity development takes place, that is, we can determine it as the investment period [23]. It is easier to lay the basis for the security of digitalization at this stage. Therefore, the estimation and implementation of the investment project require the accounting of the cost for digitalization conditions fulfillment. So, the onset of the «Information recession» is impossible at this stage.

Table 2 dwells upon the conditions of the «Information recession» onset at the stage of «Infancy», «Childhood», «Growth». «Stability», «Recession» taking into account key features of the development. According to table 2 every stage of the enterprise life cycle has its own specific features of «Information recession» onset.

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Table 2

Typical conditions of the «Information recession» and corresponding level of digitalization security

Stages of the life cycle of the enterprise	Typical conditions of the «Information recession»	Presence of the «Information recession»	Level of digitalization
«Infancy» — the enterprise begins its activity and comes into the market.	$0,5 \leq InR < 1$	no	normal
	$InR_{(avg)} \geq 1$	«Information recession»	acceptable
«Childhood»	$InR \leq 0,4$	no	normal
$InR_{(avg)}$ — arithmetic average of *InR* over the two years	$0,4 < InR < 1$	«Information recession»	acceptable
	$InR_{(avg)} \geq 1$	«Information recession»	critical
«Growth»	$InR \leq 0,3$	no	normal
$InR_{(avg)}$ — arithmetic average of *InR* over the two years	$0,3 < InR < 1$	«Information recession»	acceptable
	$InR_{(avg)} \geq 1$	«Information recession»	critical
«Stability»	$InR \leq 0,5$	no	normal
$InR_{(avg)}$ — arithmetic average of InR over the three years	$0,5 < InR < 1$	«Information recession»	acceptable
	$InR_{(avg)} \geq 1$	«Information recession»	critical
«Recession»	$InR < 0,5$	«Information recession»	acceptable
	$0,5 \leq InR < 1$	«Information recession»	critical

Source: developed by the authors.

According to *Table 2*, the enterprise is in «Infancy» stage when making the first steps to gain the market niche. The increase in the volume of sales is a top necessity at this stage. Therefore, the implementation of modern means of communication is fundamental in ensuring company successful development. However, stating high level of computer software depreciation is not correct at this stage as the enterprise has just started to use it. Besides, a reduction of administrative expenses and marketing costs is out of the question due to the start of business. Therefore, the conditions of the «Information recession» emergence are regulated by the range of the integral index which is more than 1 and meets the «acceptable» level of digitalization security. As the enterprise begins its steps the «critical» kevel of digitalization is impossible. «Childhood» and «Growth» Stages are characterized by the rapid increase in the volume of marketing of products and profit. Therefore, at the «Childhood» stage it is necessary to reduce the integral index to 0.4 unit fractions and at the «Growth» stage to 0.3 unit fractions in order to reach the «normal» level. In other words, the enterprise takes constantly measures to decrease costs and reduce the coefficient of software depreciation. In turn, conditions for the onset of the «Information recession» are becoming stricter. The «acceptable» level of digitalization security will appear provided the value of the integral index at the «Childhood» stage is 0.4 unit fractions and at the «Growth» stage is 0.3 unit fractions. In case the integrated rate of information recession is more than 1 at least once over the last three years, the information recession is diagnosed using its arithmetical mean. The security level of digitalization is «critical» if the calculated value is equal to 1or higher. On the «Stability» stage there may be some growth but there is no increase in the volume of products marketing and profit. Therefore, when the value of the integral index is more than 0.5 unit fraction we can spot the «Information recession». Provided that the integrated indicator of the information recession coming is more than 1, the evaluation of the level of digitalization security is carried out similarly to the stages «Childhood» and «Growth». The «Recession» stage is characterized by the decrease in the volume of sales and profitability of the enterprise, hence, «Information recession» takes place regardless of the value of the integral index.

The next step is to apply the developed methodology on the example of mining enterprises of Ukraine, namely OJSC «Sukha Balka», OJSC «Kryvorizky Zalizorudnyy Kombinat», OJSC «Central GOK», OJSC «Inguletsky GOK» and OJSC «Northern GOK». It is proposed to evaluate

the digitalization security according to the following algorithm: first, it is necessary to determine at what stage of the life cycle the analyzed enterprises are; secondly, we calculate the integral indicator of the information recession conditions called «Information recession» with the help of formula (1); thirdly, we determine the presence of conditions for the onset of «Information recession» and the level of security of digitalization using *Table 2*. The analyzed enterprises are the leaders in iron ore extraction in Ukraine and they began their activities in the second half of the twentieth century. Taking into consideration the industry affiliation and the age of these companies, we believe that they have reached the «Stability» stage of development. The latter was proved in Astafieva's work [23]. Therefore, while determining the conditions of information recession and the level of digitalization security, we focus on the criteria proposed for the stage of «Stability» (see *Table 2*).

The next step is to calculate the indicator of «Information recession» existence. In this regard it is appropriate to use formula (1). When determining the weight coefficient of every component (based upon formula 1) the expert method was used for analyzed enterprises. A survey of 10 experts affirmed that the weight coefficient for computer software amortization is 0.4, while it is 0.2 for all the other facilities. In order to determine the level of the experts' opinions consistence, the concordance index was calculated which is 0.75. Thus, we can conclude that the survey results are fairly accurate. *Table 3* shows the results of the computation of integral index of information recession onset.

Table 3

Integral index computation of the information recession onset

Index	Years			
	2015	**2016**	**2017**	**2018**
OJSC «Sukha Balka»				
I_s	0.2976	2.4680	1.1793	0.8435
I_{ae}	1.0756	0.8090	0.8446	1.2131
I_{mc}	1.6687	0.6432	1.8683	0.8590
InR	0.6679	1.2777	1.0143	0.7518
$InR_{(avg)}$	-	1.0236		
OJSC «Kryvoriz′kyy Zalizorudnyy Kombinat»				
I_s	1,3981	1,0841	0,9334	0,8337
I_{ae}	1,1848	0,9992	1,1906	1,2071
I_{mc}	1,1247	1,3544	0,9488	1,1650
InR	1,0212	0,9044	0,8012	0,8079
OJSC «Central GOK»				
I_s	1,4497	1,1002	0,6718	1,1438
I_{ae}	1,2908	1,0904	1,2093	1,1784
I_{mc}	1,3040	1,0136	1,4622	1,0547
InR	1,0988	0,8609	0,8030	0,9041
OJSC «Inguletsky GOK»				
I_s	0,9780	0,9673	0,3288	1,0147
I_{ae}	1,3828	0,9735	1,3263	1,1018
I_{mc}	1,3784	1,1423	1,0695	2,1874
InR	0,9435	0,8101	0,6107	1,0637
$InR_{(avg)}$	-	0,8281		
OJSC «Northern GOK»				
I_s	0,9686	0,8000	0,1601	1,3278
I_{ae}	1,3035	1,0423	1,1613	1,2870
I_{mc}	1,8290	0,4187	2,1962	1,3629
InR	1,0140	0,6122	0,7356	1,0611
$InR_{(avg)}$	-	0,8029		

Source: calculated by the authors.

According to the calculations given in *Table 3*, the integral index of the onset of information recession for the last three years decreases from 1.2777 to 0.7518 at OJSC «Sukha Balka». Based on the criterion of information recession it is necessary to operate with *InR* (avg) in order to identify

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the level of digitalization security. The latter is equal to 1.0236, hence, it can be maintained that the level of digitalization security was «critical» at the end of 2018. Analyzing OJSC «Kryvorizkyy Zalizorudnyy Kombinat», we emphasize that the value of the integral index of the information recession onset for the last three years does not exceed 1. Thus, the level of digital security was «acceptable» at the end of 2018. A similar situation occurs at OJSC «Central GOK». OJSC «Inguletsky GOK» and OJSC «Northern GOK» operate in a like manner according to the results of calculations. The value of the integral index of the onset of information recession in 2018 is more than one, so its arithmetic mean value for the last three years is calculated. It was found out that the value of *InR* (avg) on OJSC «Inguletsky GOK» is 0.8281, and on OJSC «Northern GOK» is 0.8029 correspondingly. Thus, the level of digitalization security at both enterprises is «acceptable». Thus, it is determined that the conditions of the «Information Recession» are present at the analyzed industrial enterprises. While the level of digitalization security is «critical» at OJSC «Sukha Balka», we observe an «acceptable» level of digitalization security in other cases. Therefore, when developing a strategy to ensure the digitalization security, it is appropriate to apply measures to reduce the integrated indicator of the information recession conditions.

Conclusions. Today, when world business is in the grips of COVID-19, a large number of companies are forced to stop doing business completely or switch to remote operation. The traditional and clear process of enterprise operation at the micro and macro levels turned out to depend on digitalization degree of all the business processes. Overseas practice has significant experience in terms of information security. Hohan, Olaru, Pirnea, Acquisti, Friedman, Telang point out in their researches that information security must evolve constantly and change under the influence of external factors shaping the conditions of development. The above mentioned determines the feasibility of ensuring the safety of digitalization (Hojeghan, Esfangareh, Perederii) taking into account the criterion of its development. In their turn, the criteria for development should be determined using the theory of enterprise life cycles. Current research summarizes the approaches to information security assessment and proposes a method for assessing the digitalization security. The developed methodology provides opportunity to determine the level of digitalization security taking into account the theory of enterprises life cycles. Criteria for determining the level of digitalization security have been developed for each stage of the life cycle. Approbation of the methodology showed that the issue of developing measures for the transition from the «critical» level of digitalization security to an «acceptable» one and from «acceptable» to a «normal» one remains open. Both stage of enterprise development and its industry affiliation should be taken into account. In our opinion, the developed methodology for assessing the security of digitalization should be used to prevent excessive costs associated with the provision of business processes.

Література

1. McGraw G. Software Security: Building Security. Boston : Addison-Wesley Professional, 2006.
2. Acquisti A., Friedman A., Telang R. Is there a cost to privacy breaches? An event study. Workshop on the Economics of Information Security. Cambridge, 2006. October 12. URL : http://www.heinz.cmu.edu/~acquisti/papers/acquistifriedman-telang-privacy-breaches.pdf.
3. Bojanc R., Jerman-Blažič B. Quantitative Model for Economic Analyses of Information Security Investment in an Enterprise Information System. *Organizacija*. 2012. Vol. 45. P. 276—288. URL : https://doi.org/10.2478/v10051-012-0027-z.
4. Дубницький В. І., Науменко Н. Ю., Тутаєва О. В. Аспекти процесу оцінки ризиків інформаційної безпеки. *Економічна та інформаційна безпека: проблеми та перспективи* : матеріали Міжнар. наук.-практ. конф. (м. Дніпро, 27 квіт. 2018 р.). Дніпро : Дніпроп. держ. ун-т внутр. справ, 2018. С. 51—56. URL : http://er.dduvs.in.ua/handle/123456789/1177.
5. Шашина М. В., Володін В. В. Інформаційна складова економічної безпеки підприємства. *Ефективна економіка*. 2016. № 10. URL : http://www.economy.nayka.com.ua/?op=1&z=5176.
6. Hohan A., Olaru M., Pirnea I. Assessment and continuous improvement of information security based on TQM and business excellence principles. *Procedia Economics and Finance.* 2015. Vol. 32. P. 352—359.
7. Shariati M., Bahmani F., Shams F. Enterprise information security, a review of architectures and rameworks from interoperability perspective. *Procedia computer science*. 2011. Vol. 3. P. 537—543.
8. Toivonen M., Saari E. Human-Centered Digitalization and Services. Singapore : Springer. 2019.
9. Khan B., Alghathbar K. S., Nabi S. I., Khan M. K. Effectiveness of information security awareness methods based on psychological theories. *African Journal of Business Management*. 2011. Vol. 5 (26). P. 10862—10868.
10. Future state of IT security: A survey of IT security executives / Ponemon Institute LLC. San Francisco : s. n., RSA Conference. 2012.

11. Karpunina E. K., Konovalova M. E., Shurchkova J. V., Isaeva E. A., Abalakin A. A. Economic Security of Businesses as the Determinant of Digital Transformation Strategy. *Digital Economy: Complexity and Variety vs. Rationality*. 2020. Vol. 87. P. 251—260.
12. Open Group Standard: Open Information Security Management Maturity Model (O-ISM3), Version 2.0. Berkshire, United Kingdom : The Open Group, 2017. 130 p. URL : https://www.slideshare.net/vaceituno/open-information-security-management-maturity-model.
13. Konkolewsky H. Digital economy and the future of social security. *Administration*. 2017. Vol. 65 (4). P. 21—30.
14. Schwab K. The Fourth Industrial Revolution: what it means, how to respond. *Founder and Executive Chairman. World Economic Forum*. 2016. URL : https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond.
15. Кібенко О. Діджиталізація як нова ера розвитку корпоративного права. *Судебно-юридическая газета*. 2019. URL : https://sud.ua/ru/news/blog/145948-didzhitalizatsiya-yak-nova-era-rozvitku-korporativnogo-prava.
16. Digital Economy Act. *Wikipedia*. 2010. URL : https://en.wikipedia.org/wiki/Digital_Economy_Act_2010.
17. Коломієць Г. М., Глушач Ю. С. Цифрова економіка: контроверсійність змісту і впливу на господарський розвиток. *Бізнес-Інформ*. 2017. № 7. С. 137—143. URL : https:// www.business-inform.net/ annotated-catalogue/?year=2017 &astract=2017_07_0 &lang=ua &stqa=21.
18. Hojeghan S. B., Esfangareh A. N. Digital economy and tourism impacts, influences and challenges. *Procedia — Social and Behavioral Sciences*. 2011. Vol. 19. № 1. P. 308—16.
19. Perederii T. S. Strategy of digital security of enterprise as a driver digital transformation of economic Ukraine. *Вісник економічної науки України*. 2019. № 2 (37). С. 201—204.
20. Podgornaya A. I., Grudina S. I., Avdonina S. G. An Enterprise Flexible Development Model. *Procedia Economics and Finance*. 2015. Vol. 24. P. 519—522.
21. Ulesov D. V., Murtazina G., Safiullin L. N., Saipullaev U. A. Special Aspects of Development of Business in the Knowledge-Based Economy. *World Applied Sciences Journal*. 2013. Vol. 27 (13). P. 189—192.
22. Адизес И. Управление жизненным циклом корпорации / пер. с англ. В. Кузина. Москва : Манн, Иванов и Фербер, 2014. 512 с.
23. Астаф'єва К. О. Оцінка економічної безпеки підприємств із урахуванням етапів їх життєвих циклів : автореф. дис ... канд. екон. наук : 08.00.04. Кривий Ріг, 2013. 19 с.
24. Офіційний сайт ПАТ «Суха Балка». URL : http://sukhabalka.com.
25. Офіційний сайт ПАТ «Криворізький залізорудний комбінат». URL : https://www.krruda.dp.ua.
26. Офіційний сайт ПАТ «Центральний ГЗК». URL : https://cgok.metinvestholding.com/ua.
27. Офіційний сайт ПАТ «Інгулецький ГЗК». URL : https://ingok.metinvestholding.com/ua.
28. Офіційний сайт ПАТ «Північний ГЗК». URL : https://sevgok.metinvestholding.com/ua.

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References

1. McGraw, G. (2006). Software Security: Building Security. Boston: Addison-Wesley Professional.
2. Acquisti, A., Friedman, A., & Telang, R. (2006, October, 12). Is there a cost to privacy breaches? An event study. Workshop on the Economics of Information Security. Cambridge. Retrieved from http://www.heinz.cmu.edu/~acquisti/papers/acquistifriedman-telang-privacy-breaches.pdf.
3. Bojanc, R., & Jerman-Blažič, B. (2012). Quantitative Model for Economic Analyses of Information Security Investment in an Enterprise Information System. *Organizacija, 45*, 276—288. https://doi.org/10.2478/v10051-012-0027-z.
4. Dubnytskyi, V. I., Naumenko, N. Yu., & Tutaieva, O. V. (2018). Aspekty otsinky ryzykiv informatsiinoi bezpeky [Aspects of information security risk assessment]. *Ekonomichna ta informatsiina bezpeka: problemy ta perspektyvy — Economic and information security: problems and perspectives*, Dnipro, April 27, 51—55. Dnipro: Dniprop. derzh. un-t vnutr. sprav [in Ukrainian].
5. Shashyna, M. V., & Volodin, V. V. (2016). Informatsiina skladova ekonomichnoi bezpeky pidpryiemstva [Information component of economic security of the enterprise]. *Efektyvna ekonomika — Efficient Economy, 10*. Retrieved from http://www.economy.nayka.com.ua/?op=1&z=5176 [in Ukrainian].
6. Hohan, A., Olaru, M., & Pirnea, I. (2015). Assessment and continuous improvement of information security based on TQM and business excellence principles. *Procedia Economics and Finance, 32*, 352—359. https://doi.org/10.1016/S2212-5671(15)01404-5.
7. Shariati, M., Bahmani, F., & Shams, F. (2011). Enterprise information security, a review of architectures and frameworks from interoperability perspective. *Procedia computer science, 3*, 537—543. https://doi.org/10.1016/ j.procs.2010.12.089.
8. Toivonen, M., & Saari, E. (2019). Human-Centered Digitalization and Services. Singapore: Springer. https://doi.org/10.1007/978-981-13-7725-9.
9. Khan, B., Alghathbar, K. S., Nabi, S. I., & Khan, M. K. (2011). Effectiveness of information security awareness methods based on psychological theories. *African journal of business management, 5* (26), 10862—10868. https://doi.org/10.5897/AJBM11.067.
10. Ponemon Institute LLC. (2012). Future state of IT security. A survey of IT security executives. San Francisco: s.n., RSA Conference.
11. Karpunina, E. K., Konovalova, M. E., Shurchkova, J. V., Isaeva, E. A., & Abalakin, A. A. (2020). Economic Security of Businesses as the Determinant of Digital Transformation Strategy. *Digital Economy: Complexity and Variety vs. Rationality, 87*, 251—260. https://doi.org/10.1007/978-3-030-29586-8_30.
12. Open Group Standard: Open Information Security Management Maturity Model (O-ISM3). (2017). Version 2.0. Berkshire, United Kingdom: The Open Group, 130 p. Retrieved from https://www.slideshare.net/vaceituno/open-information-security-management-maturity-model.
13. Konkolewsky, H. (2017). Digital economy and the future of social security. *Administration, 65* (4), 21—30. https://doi.org/10.1515/admin-2017-0031.

ISSN 2306-4994 (print); ISSN 2310-8770 (online)

14. Schwab, K. (2016). The Fourth Industrial Revolution: what it means, how to respond. Founder and Executive Chairman. World Economic Forum. Retrieved from https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond.
15. Kibenko, O. (2019). Didzhytalizatsiia yak nova era rozvytku korporatyvnykh prav [Digitization as a new era of corporate rights development]. *Sudebno-yuridicheskaya gazeta — Forensic-legal newspaper*. Retrieved from https://sud.ua/ru/news/blog/145948-didzhitalizatsiya-yak-nova-era-rozvitku-korporativnogo-prava [in Ukrainian].
16. Digital Economy Act. (2010). *Wikipedia*. Retrieved from https://en.wikipedia.org/wiki/Digital_Economy_Act_2010.
17. Kolomiiets, H. M., & Hlushach, Yu. S. (2017). Tsyfrova ekonomika: kontroversiinist zmistu i vplyvu na hospodarskyi rozvytok [The Digital Economy: The Controversy of Content and Impact on Economic Development]. *Biznes Inform — Business Inform, 7*, 137—143. Retrieved from https://www.business-inform.net/annotated-catalogue/?year=2017&astract=2017_07_0&lang=ua&stqa=21.
18. Hojeghan, S. B., & Esfangareh, A. N. (2011). Digital economy and tourism impacts, influences and challenges. *Procedia — Social and Behavioral Sciences, Vol. 19*, 1, 308—16. https://doi.org/10.1016/j.sbspro.2011.05.136.
19. Perederii, T. S. (2019). Strategy of digital security of enterprise as a driver digital transformation of economic Ukraine. *Visnyk ekonomichnoi nauky Ukrainy — Herald of Economic Sciences of Ukraine, 2* (37), 201—204. https://doi.org/10.37405/1729-7206.2019.2(37).201-204.
20. Podgornaya, A. I., Grudina, S. I., & Avdonina, S. G. (2015). An Enterprise Flexible Development Model. *Procedia Economics and Finance, 24*, 519—522. https://doi.org/10.1016/s2212-5671(15)00621-8.
21. Ulesov, D. V., Murtazina, G., Safiullin, L. N., & Saipullaev, U. A. (2013). Special Aspects of Development of Business in the Knowledge-Based Economy. *World Applied Sciences Journal, 27* (13), 189—192. https://doi.org/10.5829/idosi.wasj.2013.27.emf.39.
22. Adyzes, I. K. (2014). *Upravlenie zhiznennym ciklom korporacii [Corporate lifecycle management]*. (V. Kuzin, Trans.). Moscow: Mann, Ivanov and Ferber [in Russian].
23. Astafieva, K. O. (2013). Otsinka ekonomichnoi bezpeky pidpryiemstv iz urakhuvanniam etapiv yikh zhyttievykh tsykliv [Assessment of economic security of enterprises, taking into account the stages of their life cycles]. *Extended abstract of candidate's thesis.* Kryvyi Rih [in Ukrainian].
24. PAT «Sukha Balka» (n. d.). *Ofitsiinyi sait [Official site]*. Retrieved from http://sukhabalka.com [in Ukrainian].
25. PAT «Kryvorizkyi zalizorudnyi kombinat» (n. d.). *Ofitsiinyi sait [Official site*]. Retrieved from https://www.krruda.dp.ua [in Ukrainian].
26. PAT «Tsentralnyi HZK» (n. d.). *Ofitsiinyi sait [Official site]*. Retrieved from https://cgok.metinvestholding.com/ua [in Ukrainian].
27. PAT «Inhuletskyi HZK» (n. d.). *Ofitsiinyi sait [Official site]*. Retrieved from https://ingok.metinvestholding.com/ua [in Ukrainian].
28. PAT «Pivnichnyi HZK» (n. d.). *Ofitsiinyi sait [Official site]*. Retrieved from https://sevgok.metinvestholding.com/ua [in Ukrainian].

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