DEVISING A COMPREHENSIVE METHOD TO MANAGE DIGITAL COMPETENCIES

Researching the changes that are taking place in the era of digitalization makes it possible to track the digital footprint of consumers and form new trends and models in business management. The object of this study is the digital literacy of citizens. The vast majority of society cannot imagine their life without online activity, viewing web pages, sites, and social networks. That is why there is an increasing need to expand knowledge of digital literacy. The purpose of this research is the formation of the "BEST" matrix, which makes it possible to determine the level of knowledge and possession of digital competencies of the staff. For diagnosis, 10 criteria were selected, and the specific weight of each of them was calculated, which was summarized in the survey form. Determination of the importance of each factor is carried out by the method of expert assessment, taking into account that the overall coefficient of importance=1 for each group of factors. Achieving maximum efficiency (5–10 points) will ensure a stay in the "S" segment of the matrix, which indicates a high level of business process management, knowledge and compliance with the descriptors of digital competencies by the staff. This contributes to the solution of the problem of knowledge of the descriptors of digital literacy and makes it possible to improve the efficiency of the enterprise, as well as to repulse cyber attacks in a timely manner. The application of defined digital competencies will allow making optimal decisions in the process of applying digital skills, while ensuring the uniqueness of digital literacy in business management. The results can be used by enterprise managers to analyze and build countermeasures against data leaks or cyber attacks. This will contribute to the establishment of cooperation between enterprises and stakeholders and the formation of consumer trust

Keywords: cyber business management, personal data, digital literacy, integrated method, efficiency, competence

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1. Introduction

Digital literacy contributes to the acceleration of economic growth and attracting investments, the development of digitalization in industry and entrepreneurship, increasing competitiveness, modernization, as well as the creation of high-tech industries, access to the opportunities of the digital world. That is why changes in modern society are caused by the intensive spread of informatization and technologization processes, which, in turn, form the appropriate level of culture and determine the relevance of digital competence research.

In the era of digitalization development, a key role is played by digital skills and digital literacy, which are characterized by the ability to apply modern software products, communication tools, and information technologies in practice. Cases of data leakage, which have become more frequent, and the scale of this phenomenon is growing, are causing increasing concern among consumers. Businesses need to understand such concerns and take appropriate

measures, or they risk losing the ability to manage their business. That is why, in order to thrive in the new economy based on information, it is advisable for enterprises to develop knowledge of the descriptors of digital competence of the staff. An important role is played by a set of properties and characteristics that will make it possible to describe the content modules of the competencies that are possible when performing such activities. These include ensuring cyber security and protection of personal data, building trust in data management, strict compliance with legislation and transparency in work, understanding consumers, since the work of enterprises is focused on them.

Thus, it can be concluded that rapid globalization processes and digital changes lead to the need to improve and form new models for determining digital competencies. Taking into account changes in organizational processes, consumer needs, technologies, professional knowledge and skills, the need for digital competences is gaining relevance at all levels of the enterprise's organizational structure.

2. Literature review and problem statement

Research on a specific topic is often conducted by representatives of various scientific schools, scientists, and practitioners. Thus, in work [1], digital transformation is substantiated as a change in the form of enterprise activity, reorganization of the organizational structure, application of new business models, new sources and forms of income, attraction of a wider range of consumers, bringing their service to a new level. The disadvantage is that the results of the study are generalized in accordance with the international experience of assessing cyber security for positioning countries according to their level of development in the global space.

Paper [2] describes the operation in new formats of business structures, including in the form of digital platforms, as well as the transition from optimization to the digital economy. However, the disadvantage is that the described Index of Digital Transformation of Industry is intended for evaluation in the utility sector only, as a composite indicator. This narrows the opportunities to evaluate the enterprise of any direction in the industry. Study [3] describes the relevance of the work of an industrial enterprise and suggests how it is possible to analyze the activity and evaluate enterprises of various industries and types of activity. The shortcoming of this work is that the description is tied to a narrow field of activity, namely category management.

Work [4] revealed the issue of digital technologies as a concept that determines the development of socio-economic systems under the conditions of the dominant influence of information and technology and is based on behavioral determinants – behavioral, cultural, and social components. Also, organizational or social changes based on the introduction of digital technologies are presented in [5], but the authors of work [6] are convinced that digital transformation is a change in human nature, thinking, life, and management caused by the use of digital technologies.

Work [7] describes the features of the global economy, which is undergoing deep transformation during the fourth industrial revolution. This affects changes in the traditional technological and social characteristics of the enterprise, including new elements of the knowledge economy, digitization, the distributed/virtual workplace and the networked organization. This study summarizes the key characteristics and success factors of the hybrid enterprise form. However, the authors did not take into account the lack of digital competencies and skills of the staff, which directly affect the development of the enterprise and its life cycle. Paper [8] provides an assessment of how the widespread adoption of new digital technologies (i.e., the Internet of Things, big data and analytics, robotic systems, and additive manufacturing) may affect the location and organization of activities in global value chains. The work describes the advantages of the fourth industrial revolution but there are no prognostic views regarding the formation of a new stage, such as digital ecosystems.

Work [9] describes past events in the world economy and international business research, as well as contemporary realities and views on organizational processes in the future. This makes it possible to conclude that the study of digital competences is incomplete if changes in business processes are not taken into account. This article describes four realities of international business: the rise of populism and economic nationalism, sustainable development and climate change, new digital technologies, and changing power relations. However, in the direction of digital technologies, there is no mention of digital descriptors, as well as the need to develop citizens' digital literacy.

Work [10] presents a review and assessment of programs that assess the level of awareness of cyber threats. The authors adapted four indicators of the European Literacy Policy Network (impact, sustainability, accessibility, and monitoring) to assess awareness to make them suitable for evaluating the CSA program. Measuring all four indicators has been proven to help ensure that the evaluation process is systematic, complete, and repeatable. The disadvantage is that it does not take into account the elements of digital literacy that allow compliance with the rules of cyber security.

Article [11] defines the mechanism and persons involved in the process of corporate governance, emphasizes the peculiarities of corporate governance under the conditions of digital transformation of business, outlines the advantages and disadvantages of digitalization of corporate governance. The authors singled out the stages of introducing digital technologies into the corporate management system. However, the presented stages are too generalized and aimed specifically at the peculiarities of corporate management. It is also not taken into account that the digital transformation of business is interconnected with cyber threats and cyber hygiene.

An effective mechanism of legal regulation of combating cyberthreats is presented in work [12]. The purpose of this study is to analyze the influence of the maturity level of e-government on the job satisfaction of civil servants. The disadvantage of the work is that a separate segment of the population is defined, namely civil servants. Legal regulation of combating cyber threats is relevant for citizens of any sphere of activity. Work [13] identified critical elements affecting public perception and willingness to support e-government services in Vietnam. The obtained data indicate that the implementation of e-government services was influenced by three important factors: the perceived value of the services, the expansion of electronic capabilities of citizens, and the fear of Covid-19. However, the authors neglected the issue of rapid changes in globalization processes and the occurrence of force majeure circumstances, such as war conditions. These are the conditions that require special cyber security skills.

The study of the development of cyber culture in work [14] shows that a new model of social development is being formed due to the balancing of the subject between two realities – social and virtual, but there are no mentions of the impact of innovations in the information space. Instead, work [15] focuses on the formation of the information culture of the individual, which is a necessary condition for the successful adaptation of a person in the information society. The study analyzed different approaches to understanding information culture as a component of modern educational activity. Taking into account these approaches, the authors claim that the information culture, to which the observance of digital literacy belongs, is a holistic social phenomenon, which is an essential factor in the development of the general culture of humankind.

In work [16], the authors describe the Digital Competence Framework for Citizens (DigComp), which is the norm of the European Union. The publication explores two areas of digital literacy:

1) the integrated DigComp 2.2 framework, which provides more than 250 new examples of digital competencies;

2) a case study for a new artificial intelligence (AI) driven system. This shows that for more than ten years the Digital Competence Framework for Citizens (DigComp) has provided a common understanding across the EU and beyond what digital competence is. Thus, it served as a basis for policy formation in the field of digital skills. DigComp is already widely recognized as a pan-European Framework for the development and measurement of digital competence. In the future, DigComp can also play a central role in the achievement of the EU's ambitious goals to improve the digital skills of the whole population and the development of the European Digital Skills Certificate. In the Digital Compass for Europe's Digital Decade document, the EU set ambitious policy goals: to reach at least 80 % of the population with basic digital skills and to have 20 million IT professionals by 2030. The first of these goals is also taken up by the European Action Plan in the field of social rights [16].

An interesting view is in [17], which characterizes various models of digital literacy that allow educators to develop and assess the level of digital skills. So, for example, the SAMR matrix (substitution, addition, modification, rethinking) is practically a descriptive structure that hierarchically displays different types of technology use in education according to levels or stages. Such stages involve extremes – from substitution ("to do in digital format" what was traditionally done using conventional resources) to rethinking (curriculum, pedagogy, rethought with the help of digital technologies) [17].

In [18], the authors formed the TPACK model, which combines elements into a central core that combines conceptual knowledge with the aim of applying technology to improve learning with the help of supportive pedagogy with respect to digital skills. Analyzing the SAMR and TPACK models, it is possible to conclude that they are focused mainly on representatives of education and cannot be adapted to business.

A somewhat different model is reported in [19], which presents the results of a Delphi study on what a more holistic structure of digital competence might look like. A survey of 95 experts, including representatives from academia, education and training, government and policy, as well as IT business, identified twelve elements considered important for broad digital competence. When discussing this model, experts point to the limitations of its direct application in specific contexts.

Study [20] provides an overview of key findings from a mixed-methods study examining changes in digital skills requirements in Australia. The context is that the success of digital transformation in Australia is largely dependent on the development of appropriate digital skills and strategies to meet the challenges of digital transformation.

Summarizing the review of literary sources, it is worth noting that the views of scientists who are convinced that digital technologies play a key role under the conditions of digital reality are relevant. However, there are no qualitative methods for assessing digital competences in business management, which would allow assessing the level of digital literacy skills of staff and citizens and ensure compliance with protection against cyber threats. An urgent scientific task is the development of a comprehensive method of forming the "BEST" matrix, which will allow assessing the efficiency of business processes and the existing state of digital competencies.

3. The aim and objectives of the study

The purpose of this study is to devise a comprehensive method of digital competence management for analyzing changes in the digital technology market in the context of digital literacy. This will improve the requirements for the levels of mastery of professional digital skills (descriptors) of the staff.

To achieve the goal, the following tasks were defined:

– to identify the threats that arise in case of lack of knowledge of digital competences by the personnel of the enterprise based on the results of the survey;

– to generalize the cascade of descriptors of the Framework in terms of compliance with digital literacy;

– to construct the "BEST" matrix for determining the level of knowledge and possession of digital competences.

4. The study materials and methods

Conceptual foundations and methodological approaches to digital literacy management became the theoretical and methodological basis for writing this article. Fig. 1 shows the algorithm of the methodical approach to the study of digital competences, as an imperative of digital literacy. The sequence of the complex of actions will make it possible to achieve the fulfillment of the defined tasks. In case of non-compliance, it is envisaged to make corrections in the stages preceding the achievement of the goal. If you break the order of the steps or lose one of them, the algorithm may not be executed to the end or lead to an incorrect result.

In order to identify cyber threats, a survey was conducted in February–March 2023 of 108 respondents aged 18+, of different social status, professional skills and positions from 64 enterprises of Ukraine established at the state level of forms of ownership and activity. For the offline survey, adult respondents who voluntarily answered the questions of the questionnaire «Trust in digital literacy» were selected. The key questions of the questionnaire were as follows:

– what are the main reasons for the lack of desire to cooperate with the enterprise;

– what are the obstacles preventing your enterprise from achieving success in the field of cyber security;

– in which industry did you experience a data leak or cyber attack;

– choose the criterion that is the most important for saving personal data of consumers;

– what should be the role of the IT director at the enterprise;

– what skills should a cyber security specialist possess;

– are you familiar with the concept of "digital competence"?

In each questionnaire, the respondent indicated consent to the processing of personal data and provided answers.

Also, expert evaluations provide an opportunity to form the level of knowledge and possession of digital competences. Subjective probability makes it possible to establish deficiencies in the knowledge of digital descriptors. This is relevant when it comes to non-compliance with the rules of digital literacy and leakage of data about the company's employees and customers. In this regard, there is a need for the complex application of situational management methods, intellectual and expert methods, which will contribute to the development of measures aimed at improving digital literacy at the enterprise, as well as the introduction of digital skills.

The use of Big Data technologies for the implementation of an appropriate digital competence assessment system will ensure the expansion of the functionality of processing unstructured data of various types and nature.

| Stage 1 | Complex of general scientific and special methods: analytical, historical and logical generalizations – to systematize evolutionary changes in digital competence models |

| Stage 2 | Methods of comparative analysis and synthesis – to clarify the constituent elements (descriptors) that allow you to identify and analyze the digital competencies of staff |

| Stage 3 | Marketing and sociological research methods (surveys) and generalization methods - to conduct a survey and identify global macrotrends in the transformation of digital competencies |

| Stage 4 | Economic and statistical methods (knockout research, semi-scientific and technical-economic analysis, research and continuous excavations of MS Excel products) for the purpose of visual research results |

Yes — Descriptor generalization digital competencies — No — Corrective actions

| Stage 5 | Synthesis of results for monitoring the assessment of the organizational effect of managing business processes of an enterprise and the level of knowledge and possession of digital competencies | Corrective actions

Formation of the matrix «BEST» for the purpose of determination of the level of knowledge and possession digital competencies — No

Fig. 1. Algorithm of a methodical approach to researching the conceptual foundations of digital competence management

5. Results of investigating the integrated method of digital competence management

5. 1. Identification of threats in the case of lack of knowledge of digital competences by the personnel of the enterprise

Digital development, the Covid-19 pandemic, and martial law in Ukraine have turned relationships mostly into image-to-image communication through social media in the Internet space.

That is why the components of information digital competence involve the observance of such skills as cognition, activity, and adherence to values. Cognitivity implies the ability to effectively work with information in all forms of its representation. The activity is characterized by the ability and skills to work with modern IT tools and software. In the formation of digital competences, the observance of value guidelines in the possession of skills for working with information, modern digital technology, and compliance with the norms of academic integrity are integral.

The Digital Trust survey shows that the vast majority of consumers will not do business with a business again if they learn that their sensitive personal data has been used or stolen. As a result of the survey, the reasons for which consumers are not ready to continue cooperation with the company were determined (Fig. 2). According to the results of the survey, it was established that the protection and preservation of personal data of the user is one of the key tasks for the enterprise.

The vast majority of respondents agree with the statement that risks related to cyber security and personal data protection are among the most serious threats facing society. Taking this into account, business representatives are obliged to demonstrate the reliability of the information security system to existing and potential customers. The rapidly changing technological environment gives cause for concern. 8 % of respondents see a threat to their data in the fact that the company does not use modern technologies to protect the consumer's personal data. Instead, 17 % are ready to name the transfer of general information about personal data as the main problem. Another 24 % identify the human factor as the main threat to user data. However, the answer about transferring personal data to a third party without the consumer's personal consent leads by a large margin (32 %). The number of cyberattacks had increased significantly over the past year, respondents are confident: 33 % believe that the increase was significant, 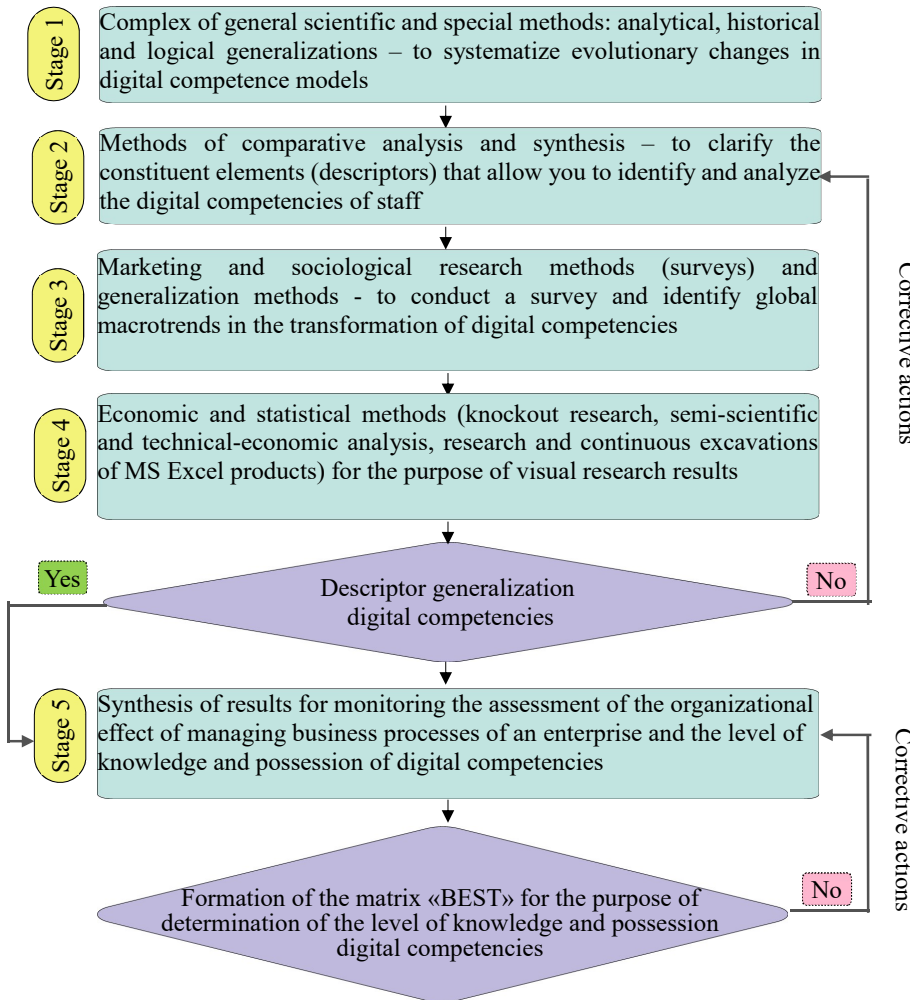31 % noted a small increase, and only 3 % of respondents mentioned a reduction in attacks. Therefore, simply investing in cybersecurity infrastructure and implementing appropriate controls is not enough to gain consumer trust. Enterprises need to demonstrate to their consumers and business partners that the measures they have taken in the field of information security are effective; and this is impossible without compliance with digital competencies. Cyberattacks need to be prevented but if an incident does occur, the ability to recover lost data efficiently and transparently will help restore consumer confidence. Based on the results of the survey, industries were identified that do not inspire confidence in terms of countering data leaks or cyber attacks (Fig. 3).

Thus, the highest degree of mistrust in terms of the threat of leakage of personal data of consumers is caused by the banking and insurance spheres. That is why, in the fight for users, companies need to adhere to digital competencies by focusing their efforts on three main principles – limitation of use and disclosure, protection, and respect. Thus, enterprises will be able to build a policy of working with personal data and control systems that contribute to the formation of consumer trust.

The surveyed respondents believe that the business processes that take place at the enterprise affect the responsibility for preserving personal data much more than the state, however, the state has more effective resource capabilities to ensure information protection (Fig. 4).

The pandemic and aggression from the Russian Federation contributed to an acceleration in solving problems related to personnel changes, as well as in designing scenarios for behavior in unforeseen events. Thus, every third specialist seeks to expand the knowledge of IT security and receive round-the-clock IT support in professional activities. Almost 15 % of IT specialists plan to implement electronic document management and tokens (secure key carriers), which will enable high-quality and safe work with information.

Thus, the vast majority of respondents believe that it is more important for enterprises to ensure the confidentiality of customer data than to meet regulatory requirements. The conducted survey shows that the majority of respondents are pragmatic about their personal data because companies collect more information than the consumer would like to provide them. The number of hacker attacks is constantly increasing, and the company's information security is not sufficiently protected against these threats. However, society's life is unreal without the use of the Internet. There is a tendency that the consumer does not pay for certain services that he receives through the use of the Internet: for searching for information, for e-mail, for storing data in the cloud, for communication in social networks. However, it should not be forgotten that these services are only conditionally free, because payment for them is made with personal data of consumers. It is likely that consumers agree that the regulation of personal data protection in Ukraine needs to be improved. One of these directions is the formation and observance of digital literacy, and mastering of digital competences.
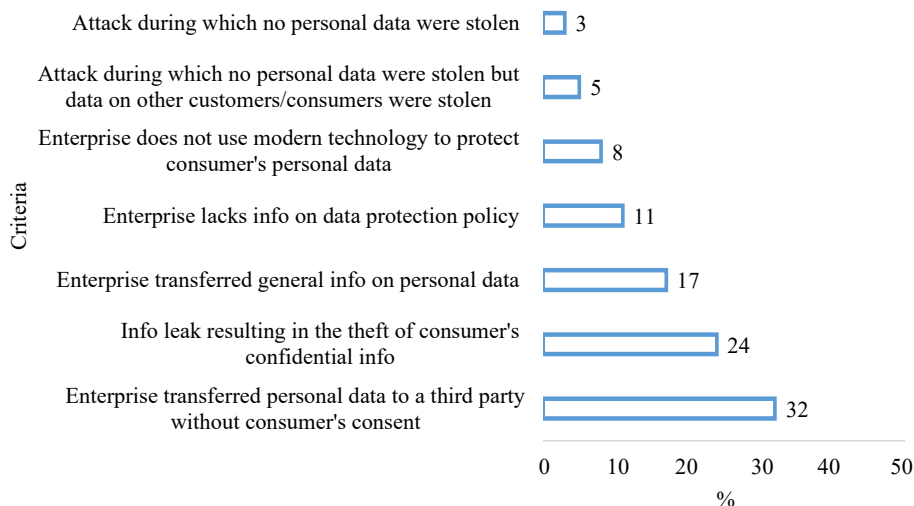

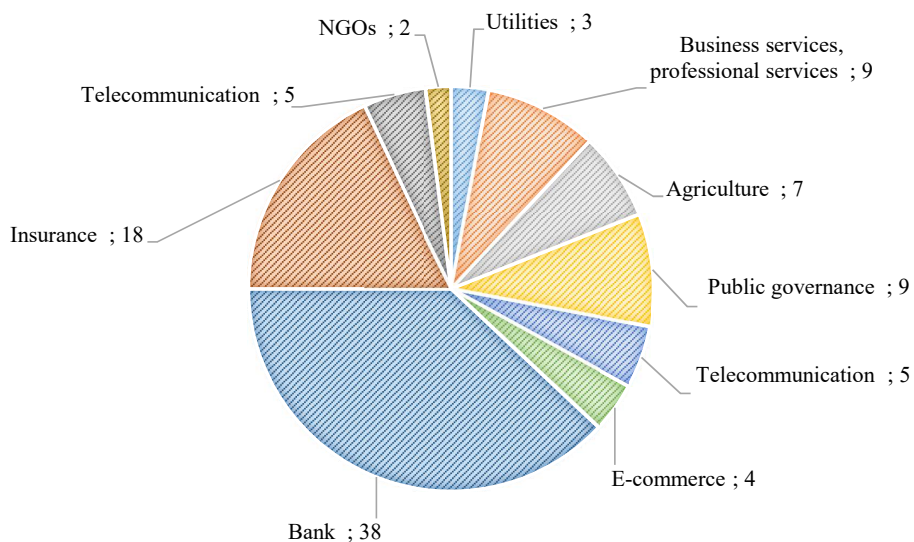Fig. 2. Reasons for not wanting to cooperate with the company, %

Fig. 3. Industries that do not inspire confidence in terms of countering data leaks or cyber attacks, %
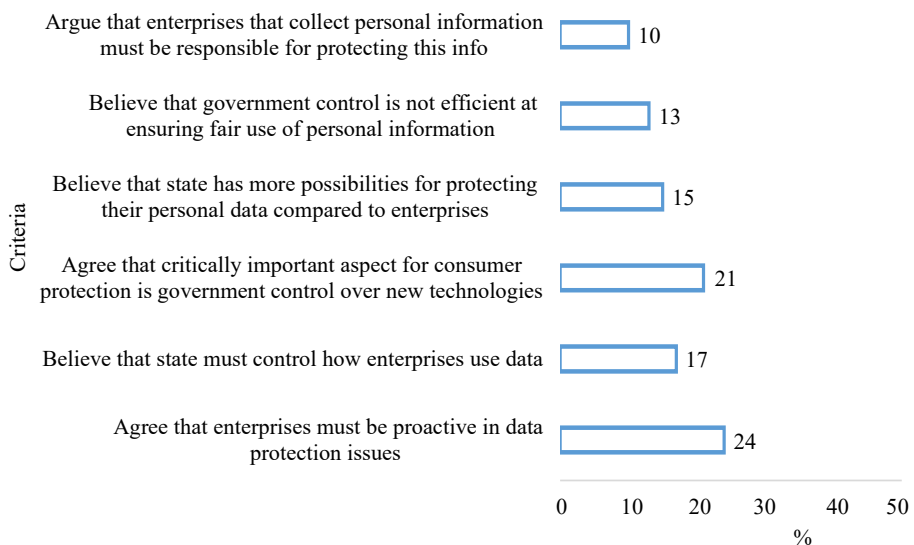

Fig. 4. Ranking of activities from the point of view of their responsibility for the preservation of personal data of consumers, %

5. 2. Construction of a cascade of Framework descriptors under the conditions of compliance with digital literacy

The levels of possession of digital competences indicate a certain minimally necessary set of knowledge, abilities, and skills of citizens, which they should possess. Such skills are necessary to perform a given set of functions depending on the position held or the task set before them. The real level of mastery of certain competencies is determined by testing citizens according to the relevant meaningful educational modules. It was for this purpose that in 2019, the Ministry of Digital Transformation of Ukraine presented "The State and I" (a mobile application, web portal, and brand of the digital state) [21]. Among the many possibilities, the "DIYA" portal contains a section "Digital education" where the framework of digital competence is presented in detail. Such a tool was created in order to improve the level of digital competences of Ukrainians, to help in the creation of state policy and the planning of educational initiatives. Such measures are aimed at increasing the level of digital literacy and the practical use of IT technology tools and services by specific target groups of the population. The framework covers 5 areas of digital competences, which contain 20 competences and 6 levels of proficiency [22]. Thus, it is a tool for the formation of effective digital competences, the implementation of which will ensure the development of digital literacy and the avoidance of IT obstacles. Summarizing [22], we shall form a cascade of descriptors of the Digital Competence Framework under the conditions of compliance with the digital literacy of the staff (Fig. 5).

In the development of the Ukrainian framework of digital competences for citizens, an approach was used, which involves the adaptation of the best European frameworks of digital competences, as well as the corresponding normative and scientific-methodical principles developed in Ukraine.

The presented cascade of descriptors of the Digital Competence Framework covers the implementation of some provisions that are relevant in the conduct of activities of various industries:

– transition to Industry 4.0. and Societies 5.0.

requires the acquisition not only of a certain set but of a whole set of key competencies of a citizen or specialist;

– various factors of the internal and external environment as a result of their interaction affect the formation of digital competences and descriptors;

– the formation of the list of necessary competencies takes into account the mentality, worldview, values, economic and technological capabilities of the country, industry and enterprise;

– the generalized choice of digital competences is influenced by factors related to the individual, namely age, gender, marital status, social status, education, skills and knowledge;

– the selection, definition, and implementation of digital competencies requires additional discussion, application of the Delphi method and Agile technologies by specialists of various structural units.
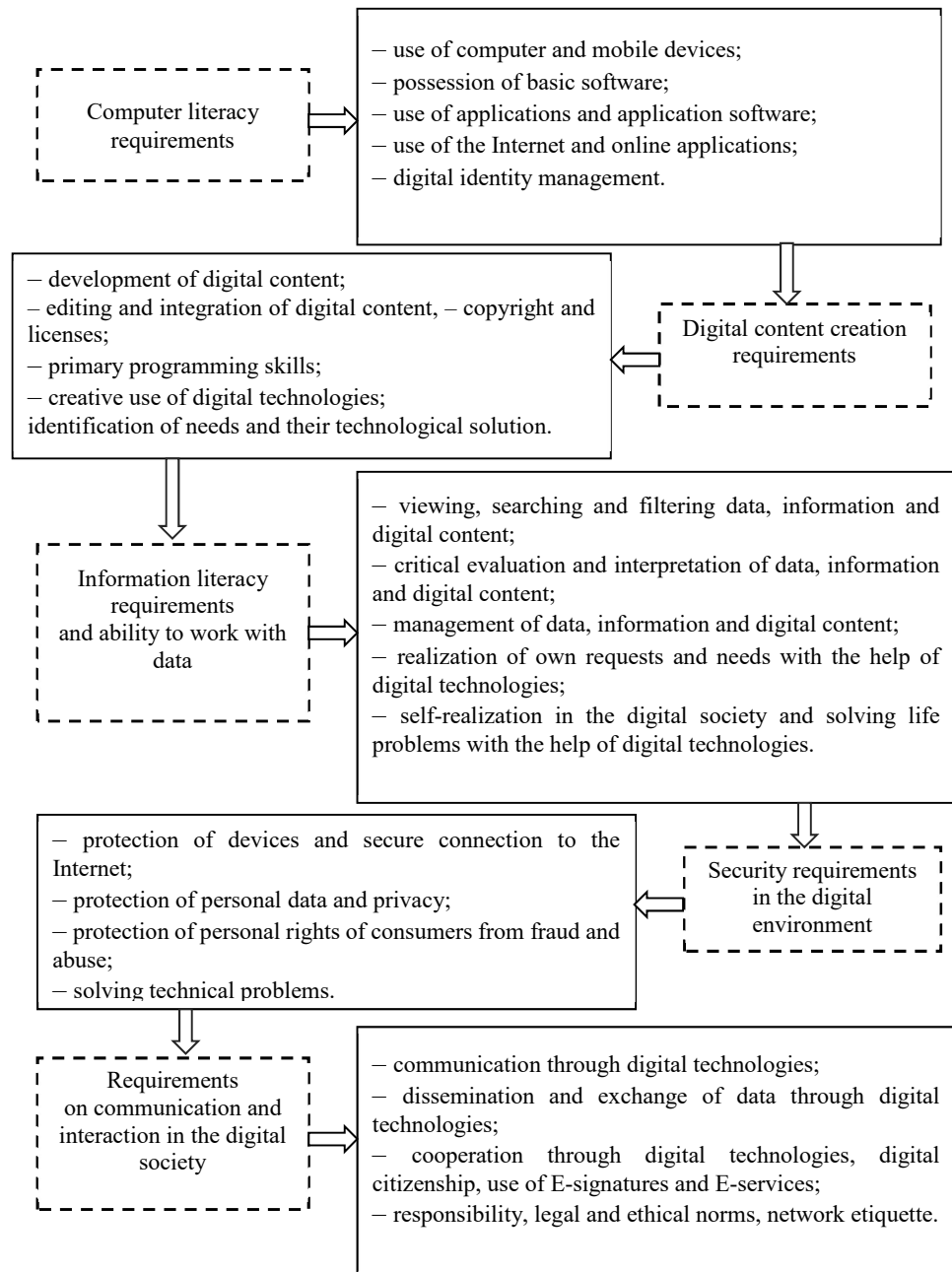

Fig. 5. The cascade of descriptors of the Digital Competence Framework
Source: summarized based on [22]

Thus, the identified directions in the cascade of digital competences reflect detailed information and filling with the necessary descriptors. Adherence to the digital competencies defined in society or at the enterprise will provide citizens and employees with the opportunity to avoid digital literacy mistakes. An important condition is that with the help of certain resources it is possible to take a test and buy a certificate on the level of knowledge of digital competences.

5. 3. Formation of the "BEST" matrix for determining the level of knowledge and possession of digital competencies

The defined descriptors describe the basic content of the corresponding structural unit. The use of descriptors simplifies the formation of requirements for the competences of citizens depending on the positions offered to them or the functions performed. Formation of information needs, acquisition, analysis, evaluation, generation, storage, presentation of information is important as part of digital competence. When creating digital content, the possibility of its editing, creative use, registration of copyright and licenses is relevant. And finally, as part of digital competence, security guarantees in the digital environment are relevant.

The increase in the number of users of software with involvement in digital learning is gaining popularity in the development of digitalization of a country, city, or business. There is also a trend towards the development of online education, which in turn acts as the main supplier of specialists in the field of management.

Diagnosis of the situation regarding the formation of digital competences at the enterprise can be carried out using a matrix of positions depending on the level of knowledge of digital competences and business process management, in particular, in the field of managing personal data of consumers. Depending on the ratio of these factors, it is possible to form four positions of the enterprise, which are given in the matrix for determining the level of knowledge and possession of digital competences «BEST» (Fig. 6). The level of knowledge and possession of digital competences is marked on the horizontal axis of the matrix, and the level of management of business processes of the enterprise is indicated on the vertical axis. The measurement of these indicators is usually carried out by the method of expert evaluation based on the data obtained in the process of researching the degree of mastery of descriptors of digital competences.

It is possible to evaluate and find the place of the enterprise in the matrix with the help of the survey balance (Table 1).

It is proposed to evaluate the specified criteria by calculating S_{mbp} (1) and S_{dc} (2):

$$S_{mbp} = 0.08 * S_{fa} + 0.10 * S_{sm} + 0.11 * S_{hr} +$$
$$+ 0.07 * S_{ma} + 0.07 * S_{cm} + 0.12 * S_{ps} + 0.07 * S_{sqm} +$$
$$+ 0.11 * S_{aes} + 0.14 * S_{it} + 0.13 * S_{od}, \quad (1)$$

where S_{mbp} is the organizational effect of managing business processes of the enterprise;

S_{fa} – financial activity management level;
S_{sm} – level of strategic management;
S_{hr} – personnel management level;
S_{ma} – level of marketing and advertising management;
S_{cm} – the level of management of purchases, logistics, category management;
S_{ps} – level of management of production and sales processes;

S_{sqm} – level of service management and quality management;

S_{aes} – level of management of administrative and economic support;

S_{it} – IT sector management level;

S_{od} – level of management of organizational development and design.

0.08; 0.10; 0.11; 0.07; 0.07; 0.12; 0.07; 0.11; 0.14; 0.13 – corresponding weighting factors of indicators.

$$S_{dc} = 0.11 * S_{cl} + 0.10 * S_{odc} + 0.08 * S_{il} +$$
$$+ 0.09 * S_{sde} + 0.11 * S_{cdc} + 0.07 * S_{dt} +$$
$$+ 0.12 * S_{cds} + 0.12 * S_{ne} + 0.15 * S_{sde} + 0.05 * S_{psd}, \quad (2)$$

where S_{dc} is the organizational effect of knowledge and possession of digital competences;

S_{cl} – the level of knowledge and mastery of the basics of computer literacy;

S_{odc} – self-assessment of one's own digital competence;

S_{il} – the level of knowledge and mastery of information literacy and the ability to work with data;

S_{sde} – the level of solving problems in the digital environment;

S_{cdc} – level of knowledge and mastery of creating digital content;

S_{dt} – level of creative use of digital technologies;

S_{cds} – the level of communications and interaction in the digital society;

S_{ne} – the level of compliance with network etiquette;

S_{sde} – level of security in the digital environment;

S_{psd} – the level of development of professional skills in the digital environment.

0.11; 0.10; 0.08; 0.09; 0.11; 0.07; 0.12; 0.12; 0.15; 0.05 – corresponding weighting factors of indicators.

The proposed comprehensive method will make it possible to assess the digital competences of each employee and identify "bottlenecks" in the management of business processes of the enterprise. Achieving maximum efficiency will ensure the specialist's stay in the "S" segment, which indicates a high level of business process management, knowledge and adherence to digital competence descriptors. This will avoid obstacles such as attacks during which personal data is stolen, non-compliance with modern cyber hygiene rules, lack of a data protection policy, information leakage or transfer of data to a third party.

The digital competence management method is a mixed approach consisting of expert interviews, questionnaires, and comparisons. Representatives of the top management of 23 enterprises that participated in the offline survey of the questionnaire "Trust in digital literacy" expressed a desire to participate in the approbation of the method of assessing digital competences. During March 2023, expert respondents (practitioners of enterprises in various fields of activity, who have at least 5 years of work experience and a higher education in management or IT) were involved in the project of approbation of the digital competence management method. Expert interviews were conducted in order to determine the company's place on the "BEST" matrix. Based on the results of MS Excel processing of the completed survey forms, the organizational effect of the enterprise's business process management and the level of knowledge and possession of digital competencies was calculated. This made it possible to summarize the results in the form of a map of the positioning of enterprises according to the "BEST" matrix (Fig. 7).

Table 1

Generalized monitoring results of the evaluation of the organizational effect of managing the enterprise's business processes and the level of knowledge and possession of digital competencies

No.	Factor	Signif-icance factor, P_j	Score, point, T_j,	Significance of the factor, λ_j
	The level of management of business processes of the enterprise			
1	Financial activities (S_{fa})	0.08	For each of the proposed indicators, an assessment is carried out on a scale in points, where: 10–8 points – the work is carried out in full and meets the requirements of the documentation; 7–4 points – the work is not carried out in full, there are comments (they are entered in the checklist); 3–1 points – work is carried out in a minimum amount; "0" – no work is being done at all	For each of the proposed indicators, the significance of the factor is determined by multiplying the significance coefficient by the factor assessment
2	Strategic management (S_{sm})	0.10		
3	HR management (S_{hr})	0.11		
4	Marketing and advertising (S_{ma})	0.07		
5	Procurement, logistics, category management (S_{cm})	0.07		
6	Production and sales process (S_{ps})	0.12		
7	Service and quality management (S_{sqm})	0.07		
8	Administrative and economic support (S_{aes})	0.11		
9	IT sector (S_{it})	0.14		
10	Organizational development and design (S_{od})	0.13		
	Organizational effect	1	–	The total result of the significance of factors to assess the level of management of business processes in the enterprise
	Level of knowledge and knowledge of digital competencies			
1	Basics of computer literacy (S_{cl})	0.11	For each of the proposed indicators, an assessment is carried out on a scale in points, where: 10–8 points – the work is carried out in full and meets the requirements of the documentation; 7–4 points – the work is not carried out in full, there are comments (they are entered in the checklist); 3–1 points – work is carried out in a minimum amount; "0" – no work is being done at all	For each of the proposed indicators, the significance of the factor is determined by multiplying the significance coefficient by the factor assessment
2	Self-assessment of one's own digital competence (S_{odc})	0.10		
3	Information literacy and ability to work with data (S_{il})	0.08		
4	Troubleshooting in the digital environment (S_{sde})	0.09		
5	Digital content creation (S_{cdc})	0.11		
6	Creative use of digital technology (S_{dt})	0.07		
7	Communication and interaction in the digital society (S_{cds})	0.12		
8	Compliance with network etiquette (S_{ne})	0.12		
9	Security in the digital environment (S_{sde})	0.15		
10	Development of professional skills in the digital environment (S_{psd})	0.05		
	Organizational effect	1	–	The total result of the significance of factors to assess the level of knowledge and possession of digital competencies

Note: Determination of the importance of each factor is carried out by the method of expert evaluation or ranking (Delphi method), taking into account that the total coefficient of importance=1 for each group of factors
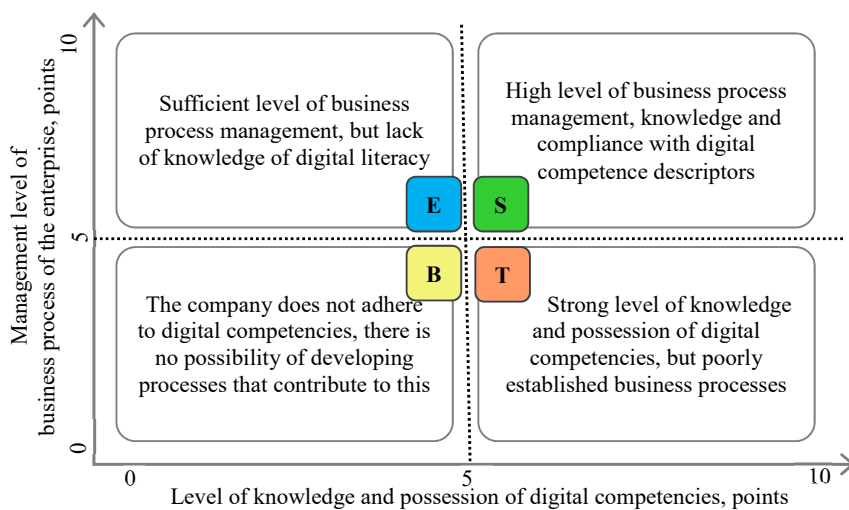

Fig. 6. Matrix for determining the level of knowledge and possession of digital competences "BEST"

According to the application of the "BEST" comprehensive method, it was established that the enterprises "Intercyclon" LLC, "ROSYCH PRIVATE" LLC, and "VEDARA TRADE" LLC (Ukraine) fell into the "B" segment due to low generalized results. This indicates a low level of business process management and a complete lack of knowledge about digital literacy. This may be related to the main activities of the enterprises. So, for example, "Intercyclon" LLC carries out trade in cars and passenger vehicles, but under the conditions of martial law in Ukraine, such goods are not a priority for consumers. LLC "ROSYCH PRIVAT" is a producer of cocoa, chocolate, and sugar confectionery, however, due to monopolists in the market, it lost the opportunity to go beyond Kyiv oblast, Bila Tserkva.
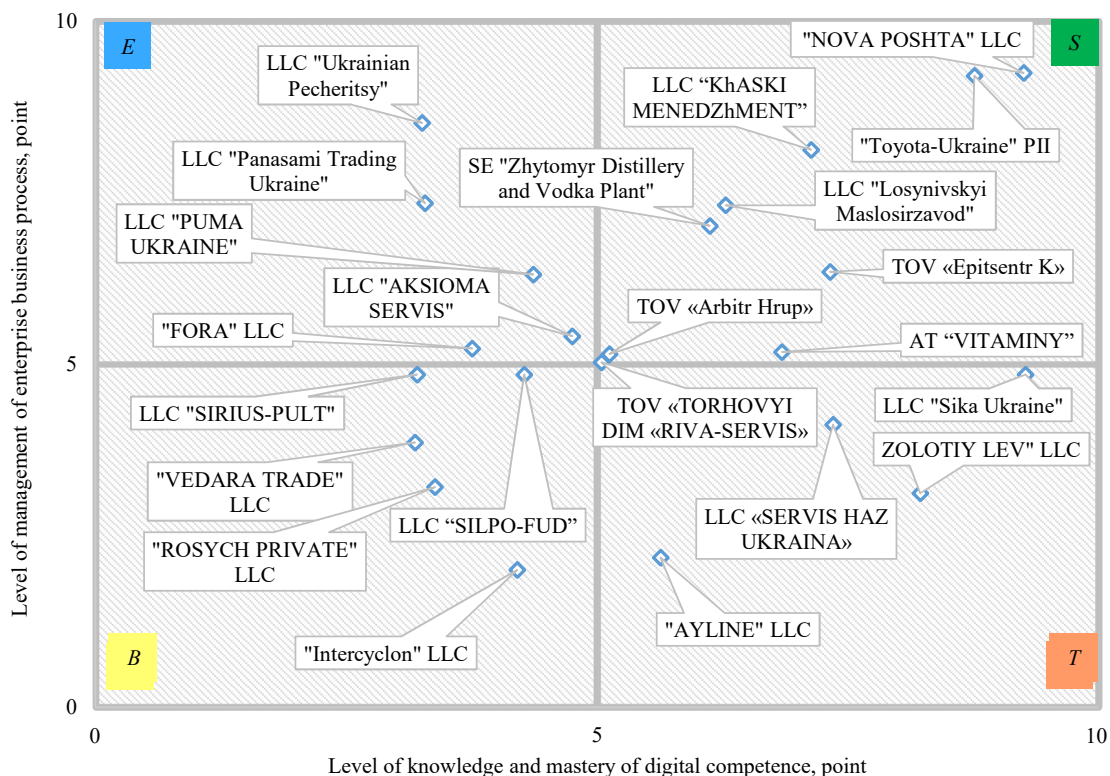
Fig. 7. Map of enterprise positioning according to the "BEST" matrix

LLC "Ukrainian Pecheritsy" and LLC "Panasami Trading Ukraine" clearly fall into the "E" segment. This indicates relatively smooth business processes, but weak mastery of the descriptors of digital competences, due to the lack of digital literacy training and insufficient attention to the formation of a positive digital image of the enterprise. "NOVA POSHTA" LLC and "Toyota-Ukraine" PII distinguished themselves in the "S" segment. Such enterprises have both a high level of management and exemplary compliance with digital competences based on the rules of cyber culture under the conditions of consumer satisfaction with the protection of their personal data.

LLC "Sika Ukraine" occupies a transitional position between segments "E" and "T", characterized by an average level of possession of descriptors of digital competences against the background of well-established business processes. "AYLINE" LLC and "ZOLOTIY LEV" LLC are relatively small enterprises and are oriented towards digital technologies, which is why they were distinguished by a sufficient level of digital literacy knowledge.

Thus, our results make it possible to form a program of measures to improve the company's activities, taking into account the improvement of business processes and digital literacy. Enterprises that are on the verge of transition from one segment to another have the opportunity to both improve and worsen the organizational effect of conducting core activities and adhering to digital competencies.

6. Discussion of results of investigating the integrated method of digital competence management

As a result of the conducted survey "Trust in digital technologies", the reasons for the lack of desire to cooperate with the enterprise were substantiated (Fig. 2). Fig. 3 shows the industries that do not inspire confidence from the point of view of countering data leaks or committing cyber attacks. Therefore, the development of digitalization of all spheres of life contributes to the fact that enterprises and ordinary citizens will increasingly suffer from the growth of cyber activity, for example, during the purchase of goods or banking transactions on the Internet.

In contrast to work [12], where the general mechanism of legal regulation of combating cyberthreats is defined, the ranking of measures from the point of view of their responsibility for the preservation of personal data of consumers (Fig. 4) shows that the trends of informatization have both constructive and destructive consequences. Among the positive aspects, it is worth highlighting the availability, speed of obtaining information, its use, awareness, which allows effective management decisions to be made. Negative manifestations include cybercrimes, computer piracy, the spread of computer viruses, criminal advertising, and hacking. But the formation of information culture appears as a kind of tool for fighting crime thanks to the formation of a fundamentally new worldview. A modern person does not think of himself outside of information technologies, they occupy a decisive place in his life.

The formed cascade of descriptors of the Digital Competence Framework (Fig. 5) has different components from the descriptors for EU citizens defined in work [16], or digital skills in Australia in work [20]. The basis of the cascade of digital competences is formed on the basis of descriptors defined by the Ministry of Digital Transformation of Ukraine [21]. The implementation of the specified descriptors for Ukraine makes it possible to eliminate threats (Fig. 3) directly in the activities of public sectors of the economy (Fig. 4) because they are adapted to the current legislation.

The devised "BEST" matrix (Fig. 6) will allow determining the level of knowledge and possession of digital com-

petencies based on the conducted survey, as well as obstacles in organizational processes. These results are consistent with studies conducted in [17, 18], where digital literacy assessment models are described. However, the presented models are mostly aimed at education and do not include digital competences as elements of digital literacy. The model in [19] allows for the assessment of digital competences in the general sense but does not take into account the digital descriptors that are defined in the Framework [16, 22]. Thus, the "BEST" matrix is universal and makes it possible to evaluate not only digital competences, but also changes in business processes due to non-compliance with digital literacy. Given that Table 1 defines and prescribes factors that can be changed depending on the activity of the enterprise, the presented methodology is relevant for any organization in accordance with the classification according to the current legislation. The described methodological approach to the formation of the "BEST" matrix involves the organization of a comprehensive study of any object. In fact, it is usually an interdisciplinary study devoted to the combination of issues of management, cyber security and public administration.

According to the matrix shown in Fig. 6, the enterprise is in a certain segment, which indicates the level of effectiveness of digital literacy. Thus, segment "B" is characterized by a weak level of knowledge of digital competencies and unregulated business processes. This indicates a low level of effectiveness and unstable performance indicators of the enterprise, lack of information protection, compliance with cyber culture and cyber security. Segment "E" implies a level of well-established business processes, but weak in terms of knowledge of digital competence descriptors. This makes it possible to conclude that there is no training in digital literacy, and to a certain extent attention is not paid to the formation of a positive digital image. Segment "S" – a high level of management is combined with ideal knowledge and observance of digital competences. This is the ideal state to which the enterprise should strive, consumers are satisfied with the protection of personal data, adhere to the rules of cyber culture due to effective management, in which business processes are clearly established. Segment "T" – a strong level of knowledge and possession of digital competences, but weakly established business processes. In such a situation, the company suffers losses and cannot maintain the market leader's position. Too much attention is paid to digital technologies, but the line is lost in the rational use of resources.

In [22], the relevance and component descriptors of digital competence are defined in various areas of digital literacy. This makes it possible to choose key competencies (when forming Table 1) for the study of an enterprise in any field, not just industry or trade, as indicated in [2, 3]. Determination of the effectiveness of the generalized results based on the methodology presented in Table 1 is due to the method of expert evaluations. To form a representative sample, it is necessary to take into account the field of activity of the enterprise in accordance with industry characteristics.

The possibility of applying certain methods during the research and selection of digital competencies depends on such factors as the market situation, the stage of the enterprise's life cycle, mission and strategy, technologies, personnel skills. If the company's goal is to take a leading position in the market, then it must quickly respond to external changes, adapting its internal business processes and resources to create conditions for effective functioning and development. Choosing a competitive strategy in combination with elements of innovation will help realize these intentions.

The proposed comprehensive method provides a set of methods and makes it possible to determine the level of knowledge and possession of digital competences of the staff. Our research has positive implications for both theory and practice. From a theoretical point of view, the knowledge and possibilities of forming the conceptual foundations of digital competence management have been expanded. Descriptors describe the basic content of the corresponding structural unit of the Framework. From a practical point of view, the proposed study provides an opportunity for the enterprise management apparatus to apply modern technologies and approaches to the development of digital literacy of the staff.

Considering Fig. 7, it should be noted that the enterprises were distributed across all segments, but there is an insufficient level of management of business processes of some enterprises (TOV "Intercyclon", LLC "ROSYCH PRIVAT" and LLC "VEDARA TRADE", LLC "AYLINE", LLC "ZOLOTIY LEV"). Enterprises of the industrial sector (PII "Toyota-Ukraine", LLC "Losynivskyi Maslosirzavod", SE "Zhytomyr Distillery and Vodka Plant", LLC "Ukrainian Pecheritsy") and the service sector (LLC "NOVA POSH-TA") showed the best results, but the management indicated that the most vulnerable aspects are the development of the IT sector, organizational development and design processes. In the context of possessing digital competences, enterprises in the "S" segment also demonstrated significant reserves regarding the creative use of digital technologies and ensuring security in the digital environment.

In addition, the monitoring showed a low level of information literacy, the ability to work with analytical data, weak problem-solving in the digital environment and insufficient development of professional skills for working in the digital environment in small and medium-sized enterprises. This once again confirms certain unused reserves regarding the management of business processes of the enterprise and the possession of digital competences at such enterprises as "Intercyclon" LLC, "AYLINE" LLC, "VEDARA TRADE" LLC, "ROSYCH PRIVAT" LLC, "FORA" LLC, TOV "PUMA UKRAINE".

Having tested the comprehensive method of managing digital competences to analyze changes in the market of digital technologies in the context of digital literacy, it was possible to identify «bottlenecks». The disadvantages of the study are that the monitoring of the assessment of the organizational effect of the enterprise's business process management and the level of knowledge and possession of digital competences (Table 1) involves filling out questionnaires and processing a large amount of data. This may require additional resources such as time, specialized knowledge of information technology and availability of software. It is also worth noting that secret information becomes the main tool of unfair competition of companies in the market, and therefore, in order to comply with trade secrets, it is more difficult to obtain reliable information or reports on the company's activities for additional conclusions.

The development of this study implies that the Framework of Descriptors is a dynamic structure that can be updated and adapted depending on the appearance of new factors. The transition from the fourth industrial revolution to the digital ecosystem contributes to the emergence of new digital technologies and resources, challenges and

opportunities, changing needs and the state of development of citizens' digital literacy. It differs from previous studies in that the described competencies can be attributed to different fields of activity, and if necessary, supplemented or expanded.

7. Conclusions

1. Threats in the case of lack of knowledge of digital competences by the personnel of the enterprise have been identified. The most common problem is attacks that occur due to the inept management of information and data. The transfer of personal data to a third party and the leakage of information as a result of which information is stolen account for more than 50 % of the surveyed respondents as a result of determining the reasons for the lack of desire to cooperate with the company. It has been established that the lack of skills in creating and managing digital content disrupts the operation of the enterprise's digital platforms. Modern information technologies require the use of innovative approaches to working with graphic materials and programming, the ability to work with video and photo editors (Canva, Figma, Photoshop) and basic copywriting skills. The data protection policy requires communication skills with the help of digital devices because it makes it possible to form and implement content plans for social networks: tracking trends, developing algorithms, conducting analytics. Violation of cyber hygiene and security rules prevents safe use of digital devices, avoiding risks and difficulties at work. Cyber security is able not only to respond to incidents, but also to prevent attacks before they start, using special technologies and accumulated knowledge.

2. The proposed cascade of descriptors of the Framework under the conditions of compliance with digital literacy will make it possible to substantiate the set of knowledge, abilities and skills of citizens, which they must possess to perform a given set of functions depending on functional responsibilities. It is appropriate to apply the components of the cascade in the formation of training programs and personnel development, as this will make it possible to solve the threats that arise due to the lack of digital competences. The presented cascade of descriptors of the Framework contributes to the development of digital competencies in the following areas: information management, collaboration, content and knowledge creation for the development of creativity, information ethics and responsibility, identification and problem solving, technology systems.

3. The comprehensive method of managing digital competences was tested at 23 enterprises, the management of which showed interest in determining the place of positioning on the "BEST" matrix. Based on the results, it was found that enterprises fall into different segments of the matrix, which makes it possible to identify shortcomings in business processes and digital competence management, taking into account different levels of research. This location on the "BEST" matrix makes it possible to make rational decisions in the management process, while ensuring the uniqueness of digital literacy in business management.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial, personal, authorship, or any other, that could affect the study and the results reported in this paper.

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Data availability

All data are available in the main text of the manuscript.

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