Digital capital as an indicator of the effectiveness of the use of digital technologies in the management of socio-economic systems

Galina Merzlikina[*], and *Natalya* Mogharbel

Volgograd State Technical University, Volgograd, Russia

Abstract. Digitalization (the use of digital technologies in the management of socio-economic systems) is currently recognized as a prerequisite for effective economic development and competitiveness. A comparative analysis of digitalization assessment methods has shown that in most cases the level of dissemination and application of digital technologies, provision of equipment, software products, Internet access, the possibility of forming and using databases is assessed. The methods do not involve evaluating the effectiveness of digitalization – comparing the result and the costs of digitalization. In this article, it is proposed to use digital capital as an indicator of the effectiveness of the use of digital technologies in the management of socio-economic systems. A comparative analysis of the definitions of "digital capital" proposed by various scientists is carried out and a refined definition is proposed: a set of tangible and intangible identifiable and unidentifiable (the concept of digital goodwill is proposed) digital assets and digital competencies of employees that allow them to successfully implement digital technologies and increase labor productivity. Possible methods of digital capital assessment and features of digital capital assessment of various socio-economic systems are considered.

1. Introduction

The purpose of the study. The study of the concept of "digital capital", the definition of the content and structure, the study of the possibility of using the indicator of digital capital to assess the effectiveness of digitalization, the use of digital technologies in the management of socio-economic systems.

To achieve the purpose of the study, the following tasks are set:

To conduct a comparative analysis of methods for evaluating the effectiveness and/or performance of digitalization, to clarify the content of the concept of "digital capital" and determine its structure, to consider possible methods for evaluating digital capital.

The object and subject of the study. As an object of the study, the authors consider socio-economic systems (countries, regions, enterprises) using digital technologies in their activities.

---

[*] Corresponding author: merzlikina@vstu.ru

The subject of this study is the process of clarifying the content of the concept of "digital capital", assessing the possibility of using the digital capital indicator as an indicator of the effectiveness of digitalization.

Relevance. Currently, the development of the management of socio-economic systems (country, region, enterprise) is carried out primarily in one direction – the wider use of digital technologies (digitalization). Digitalization, widespread use of Internet resources, provision with digital equipment and software products are becoming a prerequisite for development and competitiveness. However, the effectiveness of the use is not as high as expected, perhaps this is the influence of the digital lag and so far the result of digitalization has not yet simply matured. In addition, it is necessary to take into account possible unforeseen circumstances ("dark corners" [1]) that require improved management in the digital economy in favor of structural changes, including the capital structure of the enterprise. The process of digitalization itself is not always carried out "as planned"; it was assumed that digitalization would develop exponentially [2], become more active as the scale increases, but this did not happen; digital technologies are used quite actively by organizations and households (judging by statistical reporting and analytics), but the effectiveness of digitalization is still low. Process measurement tools are always important in management, perhaps in this case it is necessary to change the tools for measuring the effectiveness of digitalization? Many studies have been devoted to the study and evaluation of the effectiveness of the use of digital processes [3-10]; however, a detailed and comparative analysis of digitalization indicators has shown that they are all about the effectiveness of the digitalization process, i.e. about the implementation of the process, not about its performance and efficiency. There are some scientific papers on evaluating the effectiveness of digitalization [11-13], but either classical indicators of investment analysis or indicators based on expert assessments are used. In this article, it is proposed to use the digital capital indicator as an indicator of the effectiveness of the use of digital technologies. The concept of "digital capital" is considered in some scientific papers, its structure is determined [9-10,14-20]; summarizing various points of view, the authors propose a refined definition of the concept of "digital capital" as tangible and intangible identifiable assets and unidentifiable digital assets (digital goodwill and digital competencies of employees), allowing the implementation of digital technologies and contributing to the improvement of labor productivity; the concept of digital goodwill is proposed for the first time.

Possible methods of assessing digital capital are considered: from classical methods of assessing the value of a business, assessing excess profits to expert assessments of digital competencies. The features of digital capital assessment for different types of socio-economic systems (country, region, enterprise) are differentiated.

Thus, it is necessary to substantiate the use of digital capital as an indicator of the effectiveness of the use of digital technologies, clarify the content of the concept of "digital capital" and its structure, and further create methodological support for the assessment and management of digital capital.

2 Research methodology

This research is based on the use of the main provisions of the theory of economics and management of socio-economic systems at various levels (country, region, enterprise), the theory of digital economy, balanced development, scientific foundations of crisis management, the theory of valuation and management of business value and intangible assets, methods of statistical observation, analysis and measurement, the methodology of capital formation of the enterprise, presented in scientific publications of foreign and Russian scientists.

3 Research results

The article presents new scientific results:

- it has been revealed that the abundance of existing methods for assessing digitalization, the use of digital technologies does not solve the problem of evaluating the effectiveness of digitalization, since they are devoted to assessing the coverage of any socio-economic system (country, region, industry, enterprise) with digital technologies, and in Russia and abroad they assume an assessment of the provision of digital assets, Internet resources, software, however, purely statistical accounting of digital assets dominates;

- it is revealed that in some scientific papers the problem of evaluating the effectiveness of digitalization is considered, but classical methods of evaluating investment projects are proposed for use;

- it is proposed to use the concept/indicator of "digital capital" as an indicator of the effectiveness of the use of digital technologies in the management of socio-economic systems, as tangible and intangible identifiable assets and unidentifiable digital assets (digital goodwill and digital competencies of employees), allowing the implementation of digital technologies and contributing to increased productivity; the concept of digital goodwill is proposed for the first time;

- possible methods of digital capital assessment are considered;

- the features of digital capital assessment for various socio-economic systems (country, region, enterprise) are determined.

Further development of the theory of digital capital management involves the formation of methodological support (assessment tools and methods).

4 Discussion of results

4.1 Evaluation of the effectiveness of the use of digital technologies in the management of socio-economic systems

Digitalization, the use of digital technologies in the management of any socio-economic system (country, region, enterprise) gives positive results, manifested in the growth of labor productivity, cost reduction, expansion of opportunities to enter new markets, successful formation and use of large information arrays, which indicates a "multiplicative effect of economic development" [3]. The authors conducted a comparative analysis of performance assessment methods (this is what the use of digital technologies is about).

Our comparative analysis of methods for evaluating the effectiveness of digitalization [4-10]; all methods (and almost every work is a detailed and comparative analysis of Russian and foreign methods) involve an assessment of the level of digitalization, digital technology coverage of the activities of economic entities, region, country (Internet availability, cloud services, electronic planning systems, participation in electronic commerce). The disadvantages of the international digital economy development indices (namely, they are used as the main indicators) include the inability to take into account the peculiarities of individual countries, the methods evaluate the "technical side" [12] by determining the development of the digital economy by the development of digital infrastructure and the readiness of workers and the population to work in a "digital" format. But the use of digital technologies implies (and one should agree with this) deeper transformations and very diverse effects.

Scientific developments are also underway to improve the digitalization assessment indices, the most popular is the business digitalization index. Based on the principles of qualimetry, criteria for assessing the level of digitalization of socio-economic systems

(country, region, enterprise) are proposed (a set of indicators) [4]; resource (tangible and intangible resources) indicators of digitalization performance have been developed and an integral indicator of digitalization based on completeness, availability of data in open sources, absence of derivatives of GDP and GNP among the indicators [5] has been proposed.

There is a well-known business digitalization index based on five indicators of business use of information technologies: the share of organizations using broadband Internet, using cloud technologies, using RFID technologies, resource planning systems (Enterprise Resource planning or ERP), carrying out electronic sales[6]. Another business digitalization index [7] is based on the analysis of five auxiliary indices characterizing the channels of transmission and storage of information, human capital, information security, the use of digital tools for the development and promotion of the company, the level of implementation of digital technologies; note that the "attention zone" has been expanded to the concepts of human capital and information security. The World Bank offers 22 indicators for all socio-economic systems (country, region, enterprise) [8].

There have also been works on the assessment of a new concept – "digital maturity", a very indicative concept, since it essentially defines a "certain necessary requirement" for the development of digital technologies, a kind of "threshold" value, but, nevertheless, the level of development of digital technologies, not the effectiveness of their use. [9-10].

In all the methods considered, the level of development, digital technologies, coverage of territories with digital technologies is analyzed, which probably cannot be called the effectiveness of digitalization, it is rather the creation of conditions for digitalization.

4.2 Evaluation of the effectiveness of the use of digital technologies

There were also works on evaluating the effectiveness of the use of digital technologies in enterprise management; [11] presents a methodology based on the analysis of six enlarged business processes, each of which is refined by a number of subprocesses (personnel management, production, performance of works, provision of services, marketing, logistics, finance and accounting, general economic activity), the assessment is carried out based on the results of the survey; based on the results of the survey, an assessment is carried out according to the levels of digitalization: local, partial complex, smart, digital ecosystem, but economic financial evaluation of the results of digitalization is not supposed to be carried out.

In another work [12], a methodology is proposed for evaluating the effectiveness of the use of digital assets (we are talking about digital tangible assets) to assess the use of digital technologies in industry; moreover, it is noted that for different socio-economic systems, the tools for evaluating the effectiveness of digitalization should be different: the assessment of digitalization at the country, region level will be based on the gross domestic product (absolute value and share of the digital economy), and for industry, it is necessary to assess digitalization according to the readiness of industries and their current contribution (investment, development) to digitalization, in addition, it is necessary to take into account the so-called indirect effects of investments in digital assets, since they are significant, but do not fall into the "field vision" of the digitalization result. In [13], methodological approaches to assessing the effectiveness of digital transformation of one of the varieties of socio-economic systems - enterprises of high-tech industries are formulated; based on the analysis of eight domestic methods for evaluating the effectiveness of the use of digital technologies (investment analysis, dynamic models, value added calculation, expert), it is proposed to evaluate the effectiveness of digitalization taking into account the stages of the digital transformation strategy or taking into account the delayed time lag of the manifestation of the digitalization effect. It should be agreed with the author that the

efficiency assessment should take into account all the effects and all the costs of implementing digitalization projects.

Thus, a comparative analysis of methods and indicators for evaluating the efficiency and effectiveness of the use of digital technologies in the management of socio-economic systems (there are indeed many methods, more references to the literature used, since all scientific works include a detailed and comparative analysis of many Russian and foreign methods) showed that (generally) indicators are used as the main indicators providing digital technologies, if this is the purpose of digitalization, in increasing digital equipment, software availability, Internet usage activity – then the performance indicators of digitalization can be used. However, it is necessary to search for indicators of the efficiency of using digital technologies, comparing results and costs. In this paper, it is proposed to use the indicator of "digital capital" for this purpose.

4.3 Digital capital: concept and structure

Currently, there is a process of formation of new factors of production. Classical factors of production (fixed, working capital, human capital, entrepreneurship and information) retain their importance, but new ones are emerging to solve modern economic problems: innovative, intellectual, patent, social, environmental, capital and digital capital. Digital capital should be attributed to the most popular of the new factors of production; there is a lot of talk about it in the context of the need for total digitalization. However, the theoretical foundations of the formation and use of digital capital are only being developed and are at the stage of comprehension, refinement of the conceptual apparatus, formation of the evaluation methodology.

The definition of "digital capital" was first proposed by experts analysts of the McKinsey company, which was supposed to mean resources for the creation of new products and services in the digital economy. The definition of digital capital is vague, general, which does not allow not only to estimate, but also to assume the types of resources needed in the digital economy. Digital capital, in our opinion, can be used to assess the effectiveness of digitalization, since it is "capital" that will "combine" both the results achieved and the costs incurred for this (when forming a revenue stream, which will be capitalized to form the desired capital). In a certain sense, the use of digital capital is consonant with the cost approach of evaluating management efficiency based on the balanced scorecard of D. Norton and R. Kaplan.

Scientists are actively working on the formation of the theory of digital capital, its content and structure are being clarified, evaluation methods are being considered. In [14], digital capital is defined as working with Big Data, involving their processing and analysis, work on the formation of information systems; digital capital is considered as an opportunity to access the digital information environment and digital technologies [15].

Digital capital is proposed [16] to be represented as a system of accumulation of digital, information, digital communication competencies, digital security competencies and digital technologies. In [17], digital capital is already supposed to accumulate (creating capital!) due to the growth of digital competencies and the use of digital technologies, which can be isolated, so it can be identified, evaluated, and managed. In [18], it is noted that the organization of information technologies requires very significant capital resources and current costs, which can be represented, among other things, in the form of intangible, digital capital. Digital capital is considered [19] as a set of conditions that determine the ability of people to access, use and interact with digital services. They include in digital capital [20] all resources that are important for the development of new goods (products and services) (recall McKinsey's definition of digital capital), attention is drawn to the significant complexity of evaluating both tangible digital assets and even more intangible digital assets.

A brief overview of the definitions of the concept of "digital capital", its content and components, allowed the authors to propose their own definition of this concept: digital capital is tangible and intangible digital assets that allow the implementation of digital technologies and contribute to increasing labor productivity.

The proposal on the content of digital capital – tangible and intangible digital assets implies the need to allocate tangible identified digital assets – digital equipment, networks, communications, data processing, intangible identified assets (for example, software products), intangible unidentifiable digital assets (we propose to introduce the concept of digital image, digital reputation, digital goodwill) and digital competencies of employees (knowledge, experience, maintaining knowledge in force, return), as, probably, a new unidentifiable intangible digital asset.

The authors' proposal to introduce a new concept of "digital goodwill" is still only at the proposal stage, adapting the well-known definition of goodwill, we propose that "digital goodwill" is the good name of the company, consisting of the reputation of the company, prestige, customer relations, location, product range and others, based on the active use of digital technologies in management and providing a significant impact on its income.

In [17], the digital capital index is proposed to be determined on the basis of two indices – the index of the level of access to digital technologies and the index of digital competencies of digital technology users. That is, there are two main components of digital capital: tangible and intangible digital assets and digital competencies. Digital competencies of employees are still out of sight of the digitalization assessment procedure, and it is they who "revive" tangible digital assets and "make" them work.

Having considered the components of digital capital, we will clarify its definition, digital capital is tangible and intangible identifiable assets and unidentifiable digital assets (digital goodwill and digital competencies of employees), allowing the implementation of digital technologies and contributing to increased productivity.

4.4 Evaluation of digital capital

The authors found it necessary to at least briefly outline the main methods of assessing digital capital. Tangible (identifiable) digital assets can be evaluated by any methods of all three classical approaches to business valuation (costly, market, profitable), here there can be problems only in the formation of an information base and the collection and generalization of evaluation experience. To evaluate digital goodwill, you can try using the well-known Excess earnings method, but there may be problems in assessing the "normalization" (that's right!) of profits and the discount rate of excess profits due to simply lack of experience and information. The assessment of digital competencies of employees is not particularly difficult (there are various, as a rule, expert assessment methods), but the problem will be in the possibility of valuing this component of digital capital, since capital, although digital, requires a valuation. But this is further work on the formation of a methodology for assessing digital capital.

Features of digital capital assessment of various socio-economic systems. In this article, the authors intended to explore the possibility of using the concept/indicator of "digital capital" for any socio-economic system: country, region, enterprise. Although, it should be recognized that different types of socio-economic systems will require the use of different indicators; the digital capital of an enterprise can be evaluated first of all, other indicators will be needed to assess the digital capital of a region and a country. But the content of the concept of "digital capital" for any socio-economic system should be unchanged: tangible and intangible identifiable assets and unidentifiable digital assets (digital goodwill and digital competencies of employees), allowing the implementation of digital technologies and contributing to increased productivity.

5 Conclusion

The authors in their article came to the following conclusions:

- the methods currently used to assess digitalization, and there are quite a lot of them, do not imply an assessment of the effectiveness of the use of digital technologies, but only allow us to assess the coverage of digital assets, the availability of digital equipment, Internet resources, software, i.e. these are methods for evaluating the process, not the effectiveness of the process;

- several scientific papers have been identified that offer methods for evaluating the effectiveness of digitalization, but only methods and indicators for evaluating investment projects are offered;

- it is proposed to use the concept/indicator of "digital capital" as an indicator of the effectiveness of the use of digital technologies in the management of socio-economic systems, as tangible and intangible identifiable assets and unidentifiable digital assets (digital goodwill and digital competencies of employees), allowing the implementation of digital technologies and contributing to increased productivity; the concept of digital goodwill is proposed for the first time;

- possible methods of assessing digital capital are considered (business valuation methods and the method of excess profits for evaluating the digital goodwill indicator);

- the features of digital capital assessment for various socio-economic systems (country, region, enterprise) are determined.

Further development of the theory of digital capital management involves the formation of methodological support (assessment tools and methods).

References

1. O. Kovacs, Technology in Society **55**, 140 (2018). DOI: 10.1016/j.techsoc.2018.07.009

2. K. Mainzer, Foresight and STI Governance **14(4),** 10 (2020). DOI: 10.17323/2500-2597.2020.4.10.19

3. S.A. Starykh, S.V. Solovyov, A.A. Baroyan, Region: Systems, Economics, Management **2(49),**130 (2020)

4. A.V. Tebekin, *Qualimetric assessment of the level of digitalization of the economy in the Russian Federation*. https://vestnik.astu.org/temp/f6e4be5ee1fd3c982f83cd141ec79281.pdf

5. Ya. E. Pile, Economics, Entrepreneurship and Law **10(2)**, 253 (2020). doi: 10.18334/epp.10.2.100473

6. *Business Digitalization Index. Institute of Statistical Research and Economics of Knowledge of the Higher School of Economics*. https://issek.hse.ru/news/244878024.html

7. *NAFI and Otkritie Bank. The index of readiness of Russian business for the digital economy*. Nafi.ru. https://nafi.ru/en/projects/predprinimatelstvo/indeks-peremen-gotovnost-rossiyskikh-kompaniy-k-tsifrovoy-ekonomike/

8. *World Bank 2016, Digital Adoption Index*. https://www.worldbank.org/en/publication/wdr2016/Digital-Adoption-Index

9. G. Remane, A. Hanelt, G. Wiesboeck Remane, A. Hanelt, F. Wiesboeck, Lutz Kolbe, Twenty-Fifth European Conference on Information Systems (ECIS), (Guimarães, Portugal, 2017). https://www.researchgate.net/publication/316687803_DIGITAL_MATURITY_IN_TRADITIONAL_INDUSTRIES_-_AN_EXPLORATORY_ANALYSIS

10. T. A. Gileva, USNTU Bulletin. Science, education, economics. Economics series **1(27)**, 38 (2019). DOI: 10.17122/2541-8904-2019-1-27-38-52

11. I.Yu. Merzlov, E.V. Shilova, E.A. Sannikova, M.A. Sedinin, Economics, Entrepreneurship and Law **10(9)**, 2379 (2020). doi: 10.18334/epp.10.9.110856

12. E.A. Istomina, Bulletin of Chelyabinsk State University **12 (422),** Economic sciences. Issue **63**, 108 (2018). DOI 10.24411/1994-2796-2018-11212

13. T.V. Kokuitseva, O.P. Ovchinnikova, Creative Economy **15(6)**, 2413 (2021). doi: 10.18334/ce.15.6.112192

14. V.K. Krutikov, E.V. Geraeva, Economics and Entrepreneurship **3**, 703 (2018)

15. E.L. Vartanova, A.A. Gladkova, Mediascope **1**, (2020). DOI: 10.30547/mediascope.1.2020.8

16. M. Massimo Ragnedda, Telematics and Informatics **35(8)**, 2366 (2018). DOI:10.1016/j.tele.2018.10.006

17. M. Ragnedda, M.L. Ruiu, F. Addeo, New Media and Society **1**, 1 (2019) doi.org/10.1177/1461444819869604

18. Prasanna Tambe, Lorin Hitt, Daniel Rock,Erik Brynjolfsson,Prasanna Tambe, Lorin Hitt, Daniel Rock, Erik Brynjolfsson, Working Paper, 28285 (2020). DOI 10.3386/w28285

19. Sora Park Digital Capital. London: Palgrave Macmillan, (2017). DOI:10.1057/978-1-137-59332-0

20. Jacques Bughin, James Manyika, *Measuring the full impact of digital capital*. https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/measuring-the-full-impact-of-digital-capital