UDC 330.34:004.77

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DOI: 10.25313/2520-2294-2024-9-10338

A METHODOLOGICAL APPROACH TO THE ASSESSMENT OF DIGITAL BUSINESS TRANSFORMATION EFFECTIVENESS

МЕТОДИЧНИЙ ПІДХІД ДО ОЦІНЮВАННЯ ЕФЕКТИВНОСТІ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ БІЗНЕСУ

Summary. *Introduction. The problems of methodological support for digital business transformation are particularly important in the context of the development of the global technology market based on intellectualisation and globalisation. The level of validity of forecasting its development and, consequently, the efficiency of production and economic activity in general, depends on the methods and models used by business entities in assessing transformation and strategic planning. However, there is still no adequate and sufficient methodological support to help companies effectively assess the level of digital transformation, taking into account both the peculiarities of the modern market and the factors of their production and economic activity. As a result, the development of management decisions and the justification of appropriate scenarios for digital business transformation are difficult.*

Objective. To substantiate a methodological approach to assess the level of digital business transformation, which would take into account the impact of the external and internal environments of the company.

Materials and methods. The work of scientists and practitioners on the issue of assessing the digital transformation of business; analytics of organisations in the subject area; the results of the authors' research. General scientific research methods have been used.

Results. The existing methodological support for the measurement of the processes of the digital transformation of business has been studied. The indicators and their parameters aimed at determining the level of business transformation in the context of digitalisation are substantiated. The mathematical apparatus for determining the level of digital business transformation is selected. Based on the selected mathematical apparatus, the author's own methodological approach to assessing the level of business transformation in the context of digitalisation is developed.

Prospects. Prospects for further research are the development of management decision-making systems based on the results obtained using the author's methodological approach.

Key words: *business ttransformation, digitalisation, indicator system, method, model.*

Анотація. *Вступ. В умовах поступу світового ринку технологій на засадах інтелектуалізації та глобалізації особливого значення набувають проблеми методичного забезпечення цифрової трансформації бізнесу. Від методів і моделей, застосовуваних суб'єктами господарювання під час оцінювання трансформації та стратегічного планування, залежить рівень обґрунтованості прогнозування їхнього розвитку і, відповідно, ефективності виробничо-господарської діяльності в цілому. Однак, досі не розроблено у необхідній і достатній кількості методичного забезпечення, яке би допомагало компаніям ефективно оцінювати рівень цифрової трансформації, враховуючи як особливості сучасного ринку, так і фактори їх виробничо-господарської діяльності. Це ускладнює розроблення управлінських рішень та обґрунтування відповідних сценаріїв для провадження цифрової трансформації бізнесу.*

Мета. Обґрунтування методичного підходу до оцінювання рівня цифрової трансформації бізнесу, що враховував би вплив зовнішнього та внутрішнього середовищ компанії.

Матеріали та методи. Доробок науковців і практиків за проблематикою оцінювання цифрової трансформації бізнесу; аналітика організацій предметної сфери; результати досліджень авторів. Використано загальнонаукові методи дослідницької роботи.

Результати. Опрацьовано наявне методичне забезпечення з вимірювання процесів цифрової трансформації бізнесу. Обґрунтовано показники та їхні параметри, спрямовані на визначення рівня трансформації бізнесу в умовах цифровізації. Обрано математичний апарат для встановлення рівня цифрової трансформації бізнесу. На основі обраного математичного апарату розроблено авторський методичний підхід для оцінювання рівня трансформації бізнесу в умовах цифровізації.

Перспективи. Перспективами подальшого дослідження є розроблення систем управлінських рішень на основі результатів, отриманих за авторським методичним підходом.

Ключові слова: *трансформація бізнесу, цифровізація, система показників, метод, модель.*

Problem Statement. In recent years, as the global technology market has developed on the basis of intellectualisation and globalisation, the problems of methodological support for digital business transformation have become particularly important. The methods and models used by business entities to assess transformation and strategic planning determine the level of validity of their development forecasts and, consequently, the efficiency of production and economic activity in general. The importance of this is confirmed by *McKinsey's* research [1], which states that 70% of digital transformation initiatives fail to achieve their goals due to insufficient strategic planning and methodological support. Companies with a clear methodical approach to digital transformation are 50% more likely to succeed. Organisations that use a sound methodological framework to plan and evaluate their initiatives are twice as likely to succeed in digital transformation.

According to *PwC* [2], companies that use tailored methodologies to assess the effectiveness and plan for digital transformation can reduce operating costs by up to 45% through process automation and resource optimisation. *Deloitte's* analysis [3] shows that companies with a high level of digital maturity, supported by a methodological framework, generate 26% more profit than companies that implement digital transformation without a systemic vision. According to a study by the *Boston Consulting Group* [4], companies that implement digital solutions using a structured approach see a 20–30% increase in productivity. This is the result of a concerted effort where methodological support helps to avoid mistakes and use digital technologies effectively.

An analysis of the current theoretical and methodological frameworks for assessing the effectiveness of digital business transformation shows that, despite the proliferation of approaches, methods and indicators in this area, it is becoming increasingly difficult to obtain sound analyses of the digital progress of companies and markets. The nature and methods of digital transformation are constantly evolving due to the rapid development of innovative technologies in the world. On the one hand, methods of measuring the effectiveness of digital transformation of enterprises should meet modern market requirements, take into account the latest trends and patterns of digital progress, since the results obtained can be used to forecast the future development of business entities, markets, regions and the country. On the other hand, such methods should meet the requirements for the effectiveness of production and economic activities of enterprises in the context of digital transformation. This complexity of the methodological approach to assessing the effectiveness of digital transformation of business will allow its integration into the model of managing the innovative development of the region.

Research and Publications Analysis. The issue of assessing the effectiveness of business transformation in the context of digitalisation is widely represented in modern science and practice. In particular, a thorough review of digital transformation issues has been carried out by scientists [5; 6], and institutional prospects for its development have been highlighted by authors [7–9]. Practical aspects of solving the problems of digital transformation are presented in [10; 11]. Researchers [12; 13] propose to consider this issue on the example of various industries, and [14] — in the context of the concept of sustainable development. The author's original visions in this field are presented in [15]. The paper [16] discusses the development of digital transformation of business models based on the creative industries.

Despite the considerable amount of work on business transformation in the context of digitalisation, the literature still does not provide methodological support that would help companies to effectively assess the level of digital transformation, taking into account both the peculiarities of the modern market and the factors of their production and economic activity. This significantly complicates the development of management decisions and the substantiation of appropriate scenarios for the digital transformation of the company.

Study Purpose. The purpose of the study is to substantiate a methodological approach to assessing the level of digital business transformation, which would take into account the impact of the company's external and internal environment.

Key Material Presentation. The results of the study indicate that the measurement of digital business transformation should be expressed by an integral indicator that includes a number of parameters. They determine the level of digital business transformation from the perspective of the impact of the company's external and internal environment. In order to substantiate such parameters, the following have been developed:

– approaches, methods and models of the leading research organisations in this field (*McKinsey & Company, WEF, PwC, Forrester, Deloitte, OECD, Boston Consulting Group, Harvard Business School,* etc.);
– indices, parameters, indicators and their systems used in the science and practice of modern business;
– professional comments from stakeholders on measuring the effectiveness of digital business transformation;
– the experience of the team of authors and their reflections based on consultations with representatives of innovative companies on business transformation in the context of digitalisation.

In order to assess the level of effectiveness of digital business transformation, an integral indicator (K) is proposed, consisting of:

– *indicator of the impact of the external environment on the digital business transformation,* K_1 (to represent the evolution of the market situation in the context of the spread of digitalisation);
– *indicator of the impact of the internal environment on the digital business transformation,* K_2 (to measure the effectiveness of the digitalisation of an enterprise at the micro level).

These indicators and the parameters included in them with their respective characteristics are shown in Figs. 1–2.

Given that the parameters reflecting the impact on the digital transformation of the business are multidimensional and characterised by a complex level of mutual correlation, it is likely that there will be difficulties in their mathematical justification. Moreover, the impact of these first-order integral indicators on the second-order integral indicator is not always certain. These and other issues significantly complicate the creation of a model for measuring business transformation in the context of digitalisation. In practice, however, experts tend to simplify different types of indicators and often even neglect their interrelationships. This reduces the effectiveness of the measurement and leads to unreliable conclusions and predictions based on it.

In addition, the knowledge sought in the development of intelligent evaluation systems is not always complete and absolutely accurate. Even the quantitative estimates of the above system of integral indicators K_1 and K_2, obtained through precise experiments, have statistical probability estimates. In addition to quantitative indicators, the system should also include qualitative, heuristic rules, etc. When processing data based on formal logic approaches, there is a tension between fuzzy knowledge and clear logical conclusions. In such cases, it is recommended to use fuzzy set methods, which allow an adequate formalisation of various economic dependencies.

The foundations of fuzzy set theory and fuzzy logic were laid at the end of the 1960s by the American mathematician L. Zadeh (scientific paper *"Fuzzy Sets"*, published in the journal *"Information and Control"*, 1965), who based his theory on approximate reasoning, which is used to describe processes, systems, objects, etc. The mathematical theory of fuzzy sets and fuzzy logic is based on the theory of approximate reasoning.

The mathematical theory of fuzzy sets and fuzzy logic is a generalisation of set theory and formal logic, and is separate from them and from Aristotelian logic. In general, the models of fuzzy set theory by Larsen, Tzukamoto, Mamdani, Sugeno and others are widely used in economics. Fuzzy set methods are considered useful in the absence of precise mathematical models for describing systems. The theory of fuzzy sets facilitates the use of subjective expert judgement without the need for formalisation. Its application makes it possible to solve problems involving conflicting decision criteria, to provide a linguistic description of complex and deep processes, and to establish fuzzy dependencies. This makes it possible to model system behaviour, develop alternative solutions, etc.

Thus, in the case of measuring business transformation in the context of digitalisation (which is a multi-iterative process for which there is no simple mathematical model), it is advisable to apply the methods of fuzzy set theory. According to the theory of fuzzy sets, the effectiveness of measuring business transformation in the context of digitalisation is expressed by maximising the degree of suitability of the indicators obtained for a particular market development scenario.

Let us consider the measurement of the indicator of business transformation in the context of digitalisation on the basis of integral indicators (the impact of internal and external environments on the digital transformation of the company) on the basis of the *Mamdani* model, which, unlike other models, includes fuzzy values (membership functions) in the conventions of its rules.

The process of measuring business transformation in the context of digitalisation based on the use of fuzzy set theory is divided into components:

– fuzzification — matching a set of values x with its membership function $M(x)$, thus converting the values of x into a fuzzy format (setting the values of linguistic variables and creating a database of fuzzy description rules, setting quantitative values or their ranges of values; determining extreme values of parameters and forming membership functions, developing fuzzy rules);

– defuzzification is the opposite process to phasing. Fuzzy logic systems work on the principle that measurement data is phased (converted into a fuzzy

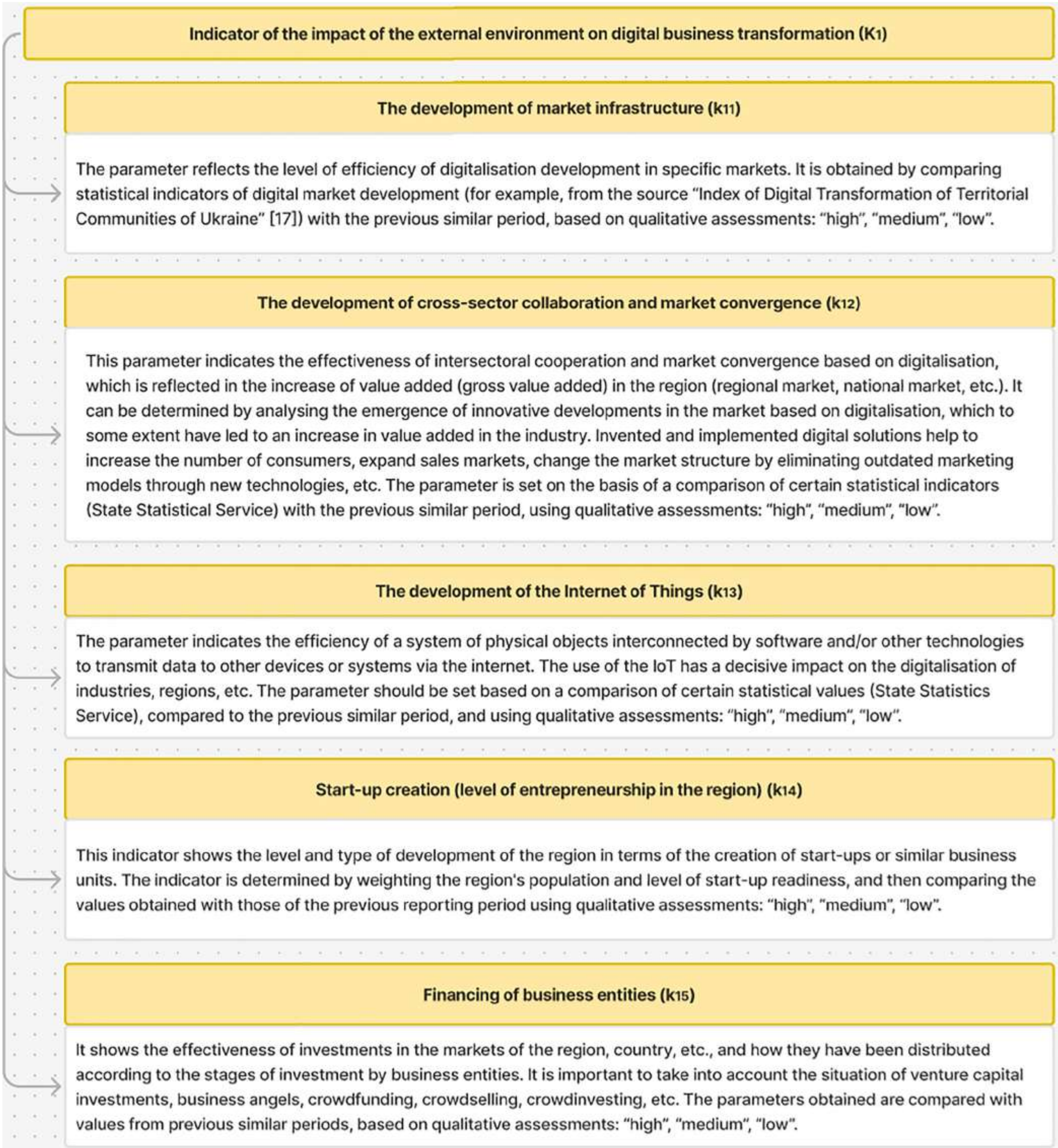

Fig. 1. Parameters of the impact of the external environment on the digital business transformation, K_1

Source: compiled by the authors

Indicator of the impact of the internal environment on digital business transformation (K2)

The implementation of digital solutions by a business entity (k21)

The purpose of this indicator is to analyse the effectiveness of digital solutions implemented by the company. For example, the launch of a website or mobile application may significantly increase sales of products and even cause changes in the market structure, create new markets, etc. The parameter can be determined based on the change in the entity's net profit (income) before and after the implementation of the digital solution. It is advisable to give the result a qualitative efficiency rating: "high", "medium", "low".

Increase in the level of digital awareness of the company's employees (k22)

This indicator shows the qualitative development of the digital skills of the company's employees, including their mastery of e-commerce tools, online skills, digital skills in the area of business analysis, remote working and information and communication skills, the ability to create digital content, the use of contactless payment, identification using smart ID, and so on. This parameter can be correlated with the rate of adoption of digital solutions. It is analysed over time, based on data on the past and current state of employees' digital literacy. The parameter is determined through qualitative assessments: "high", "medium", "low".

The development of use of (increased access to) e-banking and other e-services by an entity (k23)

The parameter indicates the efficiency of the business unit's use of digital services that allow it to increase the efficiency of its business activities (e-banking, e-commerce services, mobile money, e-document flow, etc.), develop its business, increase its profitability and optimise its business processes with the help of e-services. It is analysed on the basis of data on the past and current use of e-services by the business unit. The parameter is determined by qualitative assessments: "high", "medium", "low".

Increase the level of automation, including the introduction of industrial robots (k24)

This parameter indicates the effectiveness of the automation solutions implemented by the company (in particular, software updates, new technologies, automated management systems, etc.), which lead to the improvement of business processes and bring the company to a higher level of business activity. This parameter is determined on the basis of a comparison of data on the past and current state of the company's use of automation solutions, assigning qualitative ratings to the level: "high", "medium", "low".

The application of AI and machine learning algorithms in the work of a business entity (k25)

The parameter indicates the effectiveness of the company's use of artificial intelligence and machine learning algorithms in its operations. The use of these capabilities brings the company to a qualitatively new, more efficient level of work due to the optimisation of time, financial and other resources. The parameter is determined based on a comparison of data on the past and current state of the company's use of artificial intelligence and machine learning algorithms, assigning qualitative scores to the level: "high", "medium", "low".

The use of cloud computing (k26)

The parameter indicates the effectiveness of the use of cloud services by business entities for secure data storage or other activities, and is a significant competitive advantage of modern competitive business processes. Cloud platforms create a consolidated set of resources of autonomous management systems in organisational systems. This parameter is determined on the basis of data on the past and current state of the entity's use of cloud computing services, using qualitative ratings: "high", "medium", "low".

Fig. 2. Parameters of the impact of the internal environment on the digital business transformation, K_2
Source: compiled by the authors

format), processed, defuzzified and sent to actuators in the form of familiar signals;
– degree of membership — the value of the membership function *M(x)* is set based on a priori knowledge, expert opinion, etc.

The hierarchy of the proposed indicators and parameters, their impact on the indicator of business transformation in the context of digitalisation, is shown in Fig. 3.

According to Figure 3, we interpret the indicators and parameters as follows:
– K is a relative indicator of business transformation in the context of digitalisation (hierarchical top), defined by the boundaries: $[K_1; K_2]$;
– K_1, K_2 — integral indicators of the impact of the internal and external environment of the company on the indicator of its transformation in the context of digitalisation (thermal peaks), units;
– k_{11}; k_{12}; k_{13}; k_{14}; k_{15} та k_{21}; k_{22}; k_{23}; k_{24}; k_{25}; k_{26} — parameters of the impact factors of the business transformation indicator in the context of digitalisation. Reductions f_K, f_{K1}, f_{K2} are carried out on the basis of logical inference from fuzzy knowledge bases.

A fuzzy subset of K is defined as the set of ordered pairs, де — is a characteristic membership function that takes a value from some ordered set M = [0, 1] — the membership set. In this case, the function indicates the degree to which the element x belongs to the subset A and is a tool for converting linguistic variables into mathematical language for further application of the fuzzy logic method. Let's assign linguistic values to the selected indicators and their parameters — Table 1.

Using the formed group of terms, an array of possible variants of the ratio of the parameters of the indicator of the impact of the external environment on the digital transformation of business (K_1) and the impact of the internal environment on the digital transformation of business (K_2) (rule base) is compiled. Some variants use the weight of the rule (range [0…1]), which indicates the level of significance of the corresponding variant. These rule bases and features are introduced into the algorithm of the *Mamdani* model (*Fuzzy Logic Toolbox* component of the *MATLAB* software package). For the *Mamdani* model, a triangular distribution function (trimf) of the input values of the features was chosen (Figs. 4–5).

The functions of membership of fuzzy subsets to the fuzzy set of the above integrated indicators of business transformation in the context of digitalisation are compiled in such a way that their values are in the range [0 … 100]. The defuzzification was carried out using the "centre of gravity" method.

The modelling of the integral indicators K_1 and K_2 made it possible to obtain a series of visualisations, examples of which are shown in Figs. 6–7. The surfaces obtained are the reference ones in this system.

The obtained relative indicator of business transformation in the context of digitalisation (K) is determined by the boundaries $[K_1; K_2]$, which indicate the level of transformation. Accordingly, the scenarios of its implementation will correspond to this level. In order to

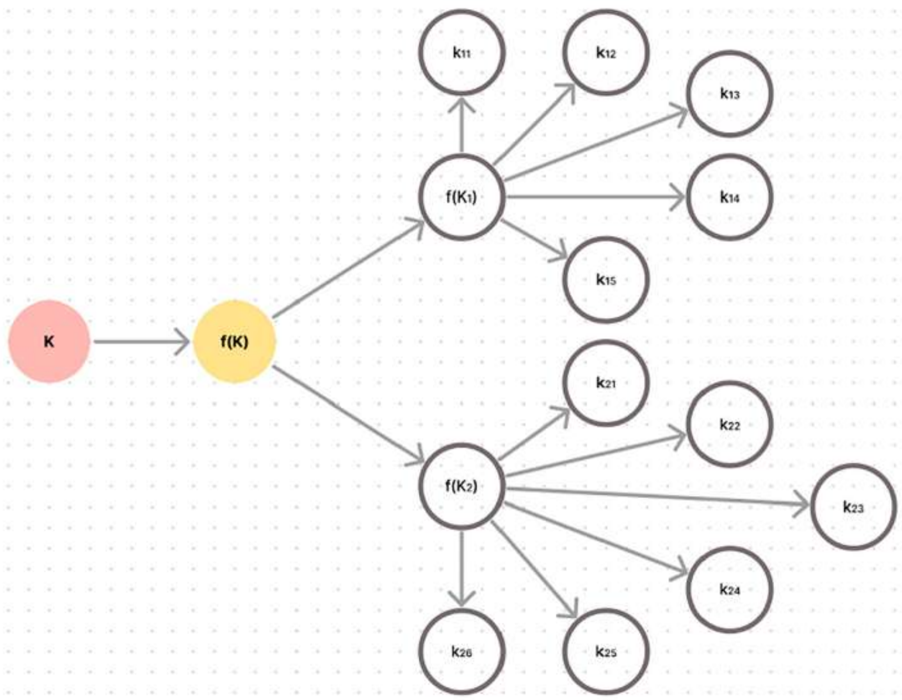

Fig. 3. Hierarchy of proposed indicators and parameters, their impact on the business transformation indicator in the context of digitalisation

Source: created by the authors

Table 1

Meanings of linguistic terms of indicators and their parameters of business transformation in the context of digitalisation

Designation	Indicators and their parameters	Linguistic terms
K_1	**Integral indicator of the impact of the external environment on digital business transformation**	(*External environment*): Low, [0; 15; 30]; Tolerable, [30; 40; 50]; Admissible, [50; 60; 70]; H, high, [70; 85; 100].
k_{11}	The development of market infrastructure	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
k_{12}	The development of cross-sector collaboration and market convergence	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
k_{13}	The development of the Internet of Things	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
k_{14}	Start-up creation (level of entrepreneurship in the region)	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
k_{15}	Financing of business entities	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
K_2	**Integral indicator of the impact of the internal environment on digital business transformation**	(*Internal environment*): Low, [0; 15; 30]; Tolerable, [30; 40; 50]; Admissible, [50; 60; 70]; H, high, [70; 85; 100].
k_{21}	The implementation of digital solutions by a business entity	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
k_{22}	Increase in the level of digital awareness of the company’s employees	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
k_{23}	The development of use of (increased access to) e-banking and other e-services by an entity	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
k_{24}	Increase the level of automation, including the introduction of industrial robots	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
k_{25}	The application of AI and machine learning algorithms in the work of a business entity	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])
k_{26}	The use of cloud computing	“High”, “Medium”, “Low” (Low [0; 15; 30], Middle [30; 50; 70], High [70; 85; 100])

Source: compiled by the authors

interpret this indicator, it is advisable to use matrix approaches, in particular those based on coordinate systems. This makes it possible to differentiate more precisely between digital business transformation scenarios. The *GE/McKinsey* matrix, adapted by scientists [18] to substantiate the directions of business process management, is one of the best for this case. This matrix makes it possible to specify the state of business

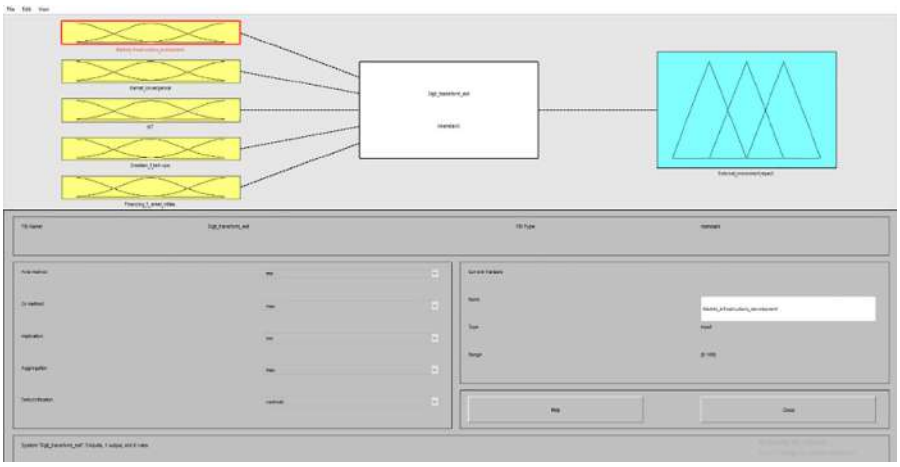

Fig. 4. The Mamdani model for the determination of the integral indicator of the impact of the external environment on digital business transformation (K_1)

Source: compiled by the authors

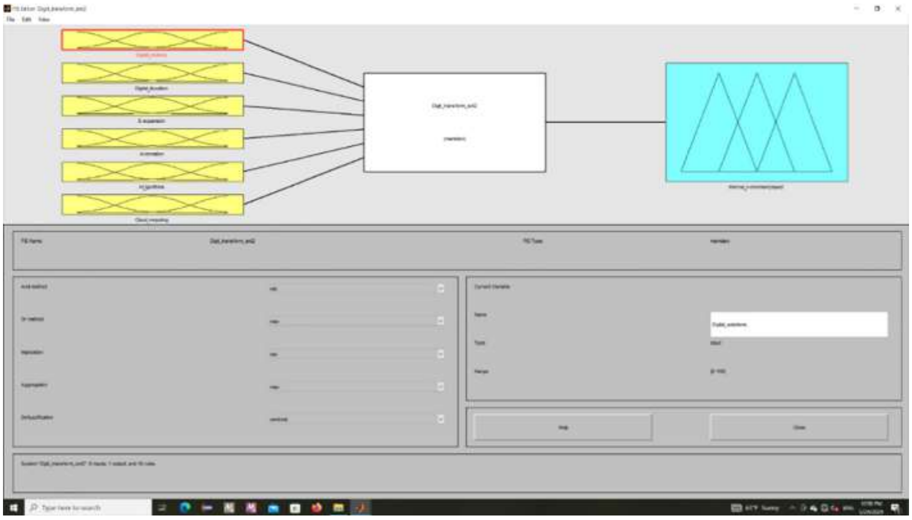

Fig. 5. The Mamdani model for the determination of the integral indicator of the impact of the internal environment on digital business transformation (K_2)

Source: compiled by the authors

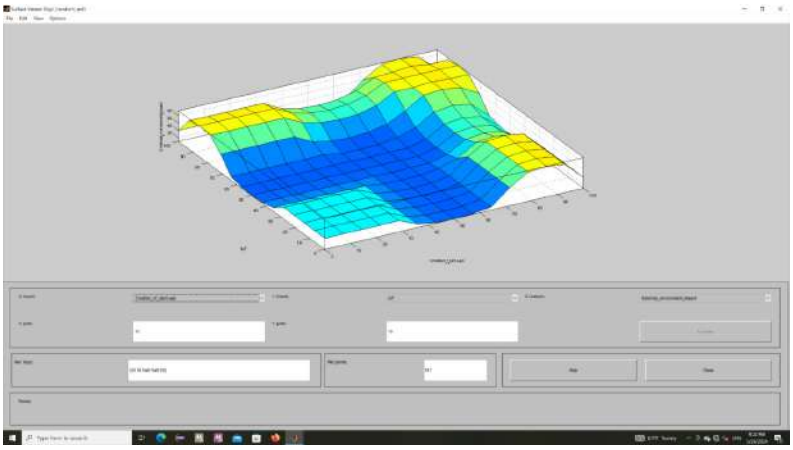

Fig. 6. Visualisation of the results of modelling the dependence of the indicator of the level of "The development of the Internet of Things" and the indicator of "Start-up creation (level of entrepreneurship in the region)" (by the ratio of features)

Source: compiled by the authors

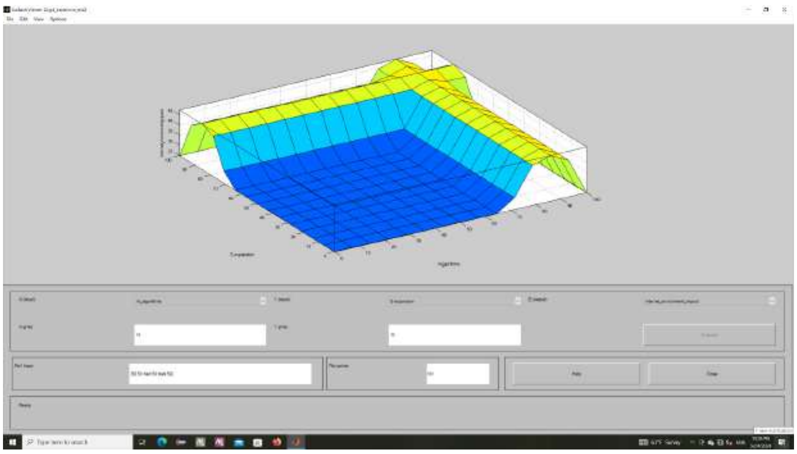

Fig. 7. Visualisation of the results of modelling the dependence of the indicator of "The development of use of (increased access to) e-banking and other e-services by an entity" and the indicator of "Application of AI and machine learning algorithms in the work of a business entity" (by the ratio of features)

Source: compiled by the authors

transformation in the context of digitalisation with greater precision, particularly on the basis of reflection, and to formulate appropriate management decisions.

Conclusions and Proposals. The values obtained by using the author's methodological approach are qualified by a fuzzy number in the range, which makes it possible to operate not with probabilistic estimates, but with project estimates. This makes it possible to achieve a higher accuracy of the business transformation indicator in the context of digitalisation.

The positive aspects of the methodological approach developed on the basis of fuzzy set theory are:

– the possibility of using not only known estimates, but also planned data on the ranges of features;
– the application for indicators characterised by a diverse composition of features that determine the main indicator;
– the efficiency from the point of view of the economic interpretation of the formalised estimates.

The main disadvantages of the developed approach are that the initial set of fuzzy rules formulated by the expert may be characterised by incomplete data, contain questionable correlations, etc. The type and parameters of the membership functions describing the input and output variables of the system are often determined subjectively, which leads to an unreliable reflection of reality.

The study made it possible to develop a model for measuring business transformation in the context of digitalisation based on the theory of fuzzy sets, which, unlike the existing ones, is based on integral indicators of internal impact (the development of market infrastructure, the development of cross-sector collaboration and market convergence, the development of the Internet of Things, start-up creation (level of entrepreneurship in the region), financing of business entities) and external impact (the implementation of digital solutions by a business entity, increase in the level of digital awareness of the company's employees, the development of use of (increased access to) e-banking and other e-services by an entity, increase the level of automation, including the introduction of industrial robots, the application of AI and machine learning algorithms in the work of a business entity, the use of cloud computing) which, through the use of fuzzy logic algorithms, ensures the aggregation of a set of different types of parameters and is suitable for strategic planning of business development of business entities.

The proposed model will facilitate effective economic modelling in the face of variability. Prospects for further research include the development of management decision-making systems based on the results obtained using the author's methodological approach.

Literature

1. *McKinsey & Company.* URL: https://www.mckinsey.com/ (access date: 20.09.2024).

2. *Pw C.* URL: https://www.pwc.com/gx/en.html (access date: 18.09.2024).

3. *Deloitte.* URL: https://www.deloitte.com/global/en.html (access date: 15.09.2024).

4. *Boston Consulting Group.* URL: https://www.bcg.com/ (access date: 21.09.2024).

5. Kraus S., Jones P., Kailer N., Weinmann A., Chaparro-Banegas N., Roig-Tierno N. Digital Transformation: An Overview of the Current State of the Art of Research. *Sage Open.* 2021. 11(3). https://doi.org/10.1177/21582440211047576.

6. Vaska S., Massaro M., Bagarotto E. M. and Dal Mas F. The Digital Transformation of Business Model Innovation: A Structured Literature Review. *Front. Psychol.* 2021. 11:539363. https://doi.org/10.3389/fpsyg.2020.539363.

7. Bresciani S., Huarng K.-H., Malhotra A. and Ferraris A. Digital transformation as a springboard for product, process and business model innovation. *Journal of Business Research*. 2021. 128. P. 204–210. https://doi.org/10.1016/j.jbusres.2021.02.003.

8. Hinings B., Gegenhuber T. and Greenwood R. Digital innovation and transformation: An institutional perspective. *Information and Organization.* 2018. 28(1). P. 52–61.

9. Колещук О., Гарматій М. Аспекти інноваційної сприйнятливості підприємств: дефініції та складові. *Адаптивне управління: теорія і практика. Економіка*. 2021. 10(20). https://doi.org/10.33296/2707-0654-10(20)-04.

10. Ivančić L., Vukšić V. Bosilj and Spremić M. Mastering the Digital Transformation Process: Business Practices and Lessons Learned. *Technology Innovation Management Review*. 2019. 9(2). P. 36–50. http://doi.org/10.22215/timreview/1217.

11. Hossain M., Heidemann Lassen A. Q&A. How Do Digital Platforms for Ideas, Technologies, and Knowledge Transfer Act as Enablers for Digital Transformation? *Technology Innovation Management Review.* 2017. 7(9). P. 55–60. http://doi.org/10.22215/timreview/1106.

12. Llopis-Albert C., Rubio F. and Valero F. Impact of digital transformation on the automotive industry. *Technological Forecasting and Social Change*. 2021. 162. 120343. https://doi.org/10.1016/j.techfore.2020.120343.

13. Burton-Jones A., Akhlaghpour S., Ayre S., Barde P., Staib A. and Sullivan C. Changing the conversation on evaluating digital transformation in healthcare: Insights from an institutional analysis. *Information and Organization.* 2020. 30(1). 100255.

14. Bican P. M., Brem A. Digital Business Model, Digital Transformation, Digital Entrepreneurship: is there a Sustainable "Digital"? *Sustainability.* 2020. 12. 5239. https://doi.org/10.3390/su12135239

15. Kitsios F., Kamariotou M. Artificial Intelligence and Business Strategy towards Digital Transformation: A Research Agenda. *Sustainability.* 2021. *13.* 2025. https://doi.org/10.3390/su13042025

16. Feng Li. The digital transformation of business models in the creative industries: A holistic framework and emerging trends. *Technovation*. 2020. 92–93. 102012. https://doi.org/10.1016/j.technovation.2017.12.004.

17. Індекс цифрової трансформації територіальних громад України. URL: https://hromada.gov.ua/index (access date: 08.09.2024).

18. Мрихіна О. Б., Богдан П. І., Косач А. І. та Козевич Р. І. Методичне забезпечення управління бізнес-процесами компаній на засадах рефлексивного підходу. *Грааль науки.* 2024. 43. URL: https://archive.journal-grail.science/index.php/2710-3056/issue/view/06.09.2024 (access date: 08.09.2024).

References

1. *McKinsey & Company.* URL: https://www.mckinsey.com/.

2. *Pw C.* URL: https://www.pwc.com/gx/en.html.

3. *Deloitte.* URL: https://www.deloitte.com/global/en.html.

4. *Boston Consulting Group.* URL: https://www.bcg.com/.

5. Kraus S., Jones P., Kailer N., Weinmann A., Chaparro-Banegas N. and Roig-Tierno N. Digital Transformation: An Overview of the Current State of the Art of Research. *Sage Open.* 2021. 11(3). https://doi.org/10.1177/21582440211047576.

6. Vaska S., Massaro M., Bagarotto E. M. and Dal Mas F. The Digital Transformation of Business Model Innovation: A Structured Literature Review. *Front. Psychol.* 2021. 11:539363. https://doi.org/10.3389/fpsyg.2020.539363.

7. Bresciani S., Huarng K.-H., Malhotra A. and Ferraris A. Digital transformation as a springboard for product, process and business model innovation. *Journal of Business Research*. 2021. 128, 204–210. https://doi.org/10.1016/j.jbusres.2021.02.003.

8. Hinings B., Gegenhuber T. and Greenwood R. Digital innovation and transformation: An institutional perspective. *Information and Organization.* 2018. 28(1), 52–61.

9. Koleshchuk O., Harmatii M. Aspekty innovatsiinoi spryiniatlyvosti pidpryiemstv: definitsii ta skladovi [Aspects of innovative susceptibility of enterprises: definitions and components]. *Adaptive Management: Theory and Practice. Series Economics*. 2021. 10(20). https://doi.org/10.33296/2707-0654-10(20)-04 [in Ukrainian].

10. Ivančić L., Vukšić V. Bosilj and Spremić M. Mastering the Digital Transformation Process: Business Practices and Lessons Learned. *Technology Innovation Management Review*. 2019. 9(2), 36–50. http://doi.org/10.22215/timreview/1217.

11. Hossain M., Heidemann Lassen A. Q&A. How Do Digital Platforms for Ideas, Technologies, and Knowledge Transfer Act as Enablers for Digital Transformation? *Technology Innovation Management Review.* 2017. 7(9), 55–60. http://doi.org/10.22215/timreview/1106.

12. Llopis-Albert C., Rubio F. and Valero F. Impact of digital transformation on the automotive industry. *Technological Forecasting and Social Change*. 2021. 162, 120343. https://doi.org/10.1016/j.techfore.2020.120343.

13. Burton-Jones A., Akhlaghpour S., Ayre S., Barde P., Staib A. and Sullivan C. Changing the conversation on evaluating digital transformation in healthcare: Insights from an institutional analysis. *Information and Organization.* 2020. 30(1), 100255.

14. Bican P. M., Brem A. Digital Business Model, Digital Transformation, Digital Entrepreneurship: is there a Sustainable “Digital”? *Sustainability.* 2020. *12,* 5239. https://doi.org/10.3390/su12135239.

15. Kitsios F., Kamariotou M. Artificial Intelligence and Business Strategy towards Digital Transformation: A Research Agenda. *Sustainability.* 2021. *13,* 2025. https://doi.org/10.3390/su13042025.

16. Feng Li. The digital transformation of business models in the creative industries: A holistic framework and emerging trends. *Technovation*. 2020. 92–93, 102012. https://doi.org/10.1016/j.technovation.2017.12.004.

17. Indeks tsyfrovoi transformatsii terytorialnykh hromad Ukrainy [Index of Digital Transformation of Territorial Communities of Ukraine]. URL: https://hromada.gov.ua/index [in Ukrainian].

18. Mrykhina O. B., Bohdan P. I., Kosach A. I. and Kozevych R. I. Metodychne zabezpechennia upravlinnia biznes-protsesamy kompanii na zasadakh refleksyvnoho pidkhodu [Methodical management of business processes of companies based on a reflexive approach]. *Grail of Science*. 2024. 43. URL: https://archive.journal-grail.science/index.php/2710-3056/issue/view/06.09.2024 [in Ukrainian].