Scientific Center of Innovative Research OÜ

ECONOMICS, FINANCE AND MANAGEMENT REVIEW (EFMR)

Issue 3 (15)

2023

e-ISSN 2674-5208
print-ISSN 2733-2101
DOI: 10.36690/2674-5208-2023-3

International databases and directories indexing publications:

- CrossRef (DOI: 10.36690);
- ISSN International Centre;
- Google Scholar;
- National Library of Estonia;
- The ESTER e-catalog;
- PKP-Index;
- Eurasian Scientific Journal Index;
- Academic Recourse Index (ResearchBib);
- Advanced Science Index (Germany);
- ICI World of Journals (Poland);
- Open Ukrainian Citation Index (Ukraine);
- Directory of Research Journals Indexing (India);
- OpenAIRE;
- Dimensions;
- ORCID

Economics, Finance and Management Review. DOI: 10.36690/2674-5208-2023-3

The third issue contains articles by scientists from different countries, prepared on the basis of their scientific work. It is designed for university teachers, graduate students, undergraduates, practitioners in economics, finance, accounting and auditing, as well as other branches of economics.

EDITORIAL TEAM

CONTENTS

CHAPTER 1
CURRENT TRENDS IN ECONOMIC DEVELOPMENT 4

Patterns of individuals' security-oriented economic behavior under the risk of displacement in bani world and war conditions
Nataliia Zachosova 4
Strategic management of a business entity in the context of ensuring the state economic security: an innovative aspect
Mykola Denysenko, Svitlana Breus 17
Ensuring the economic security of customers and contractors during the elimination of the consequences of armed aggression
Lesya Sorokina, Ljudmila Shumak, Oleksandr Filippov 24

CHAPTER 2
DEVELOPMENT OF FINANCE, ACCOUNTING AND AUDITING 39

Financial aspects and financial risk disclosure: evidence from Vietnam
Hong Duc Bao 39
Debt structure and firm performance in Vietnamese stock market
Hoang Oanh Thoa, Hoang Thi Nga 49

CHAPTER 3
MODERN MANAGEMENT TECHNOLOGIES 59

The role of well-being in sustainable corporate development of companies
Grzegorz Konieczny, Paulina Kolisnichenko, Magdalena Górska, Tomasz Górski 59
Measuring digital advertising effectiveness on Facebook as part of a national brand advertising campaign
Bohdan Kolesnyk, Iuliia Kostynets 68
Introduction of the intellectual capital management mechanism at machine-building enterprises
Zinaida Zhyvko, Maryna Derzhevetska 83
The economic potential growth management for real estate development company through automation and artificial intelligence technologies
Andrii Rosynskyi 99

CHAPTER 1
CURRENT TRENDS IN ECONOMIC DEVELOPMENT

PATTERNS OF INDIVIDUALS' SECURITY-ORIENTED ECONOMIC BEHAVIOR UNDER THE RISK OF DISPLACEMENT IN BANI WORLD AND WAR CONDITIONS

Nataliia Zachosova[1]

[1]*Doctor of Science (Economics), Professor of the Department of Management and Public Service, Bohdan Khmelnytsky National University of Cherkasy, Cherkasy, Ukraine, e-mail: natazachosova@gmail.com, ORCID: https://orcid.org/0000-0001-8469-3681*

Citation:
Zachosova, N. (2023). Patterns of individuals' security-oriented economic behavior under the risk of displacement in bani world and war conditions. *Economics, Finance and Management Review*, (3), 4–16. https://doi.org/10.36690/2674-5208-2023-3-4-16

Received: July 11, 2023
Approved: September 21, 2023
Published: September 30, 2023

Abstract. *Factors affecting economic behavior of a person are systematized, and the importance of education for the rationalization of economic decisions in the conditions of BANI World is characterized. It was established that the war had an impact on the economic behavior of Ukrainians, and two almost equal, but differently directed vectors of such an impact were clearly identified: a reduction in costs and an increase in costs to meet needs and realize economic interests. The respondents characterized their patterns of economic behavior as: 38% - active economic behavior; 22% - passive economic behavior; 40% - restrained economic behavior. Four main types of economic behavior in the conditions of BANI World, under the influence of war and the risk of displacement, are offered: emotional, episodic (active type, high level of irrationality); analytical, evaluative (restrained (active/passive) type, high level of rationality and effectiveness); strategic/tactical (passive type, focus on meeting needs in the future); search type - type focused on existing and potential opportunities (active type, diversification of goals, variability of behavior). The definition of the concept of "security-oriented economic behavior" is proposed - as such an algorithm for making an economic decision by a person, which aims to achieve and preserve its financial independence and develop its economic potential at the expense of existing or potentially available resources, which involves the assessment of information on which the possible the result of decision-making, analysis of alternatives, forecast of scenarios of expected results from an economic decision and consideration of risks when choosing the final option of economic action or inaction of a person in the specific conditions. It has been established that transformations of economic behavior under the influence of various challenges and threats, as well as taking into account the theory of generations, have led to a fundamental change in the focus of human economic behavior: middle-aged and elderly people choose a vision - what I have now and how to use it to meet existing needs; young people choose behavior in the context: what do I need and how to get it (at the expense of which resources, skills). Characterized patterns of economic behavior according to each characteristic of BANI World, taking into account the peculiarities of the wartime economy and the risk of displacement.*

Keywords: *behavioral economics, war, displacement, risk, BANI World, security-oriented economic behavior.*

JEL Classification: D11, D91, J10

Formulas: 0; fig.: 3; tabl. 2; bibl.: 19

Introduction. Behavioral economics has become a stimulus for the emergence and development of new economic models and systems. Green, circular, digital economies are based on human behavior – their worldview and attitude to the environment, resources, their willingness to meet their own needs or the ability to give up their usual or preferred way of life in favor of the common good. These aspects make the study of people's economic behavior interdisciplinary, implying the need to study public opinion, psychological aspects of economic decision-making, as well as monitoring and researching risks and threats that affect or potentially affect a person's economic life. In Ukraine in 2022-2023, a situation arose that created an unprecedented set of challenges for the normal life of citizens, and the actual word "norm" here also needs some explanation. War, the progressive transition to Industry 4.0, which leads to the displacement of people from many production operations and business processes, and therefore to individual economic instability in the future for many workers in various sectors of industry, trade, financial markets, etc., primarily there, where automation and digitization have reached the greatest scale, the concept of BANI World, as a set of characteristics of the environment in which modern people have to live and build their economic present and future, the global pandemic of COVID-19 – all these factors have created an atmosphere of "deviation from the norm" unseen to this day and instability.

Such a state of economic security of a person can be considered normal, which is characterized by the presence of a permanent source of income, material wealth sufficient to satisfy the need for comfortable living, the possibility of investing part of the income with the risk of its non-return without the threat of losing one's financial independence. For displaced persons, usually all three named basic parameters are not inherent. For part of the displaced persons, the complete dependence of the satisfaction of basic economic needs on the financial and material assistance of government structures, international organizations, sponsors, volunteers, or relatives who have such an economic opportunity is characteristic. In such a situation, people's economic behavior models undergo changes, and their main priority becomes maintaining at least a minimum level of their own economic security.

Literature review. In 2022, the territory of Ukraine became a platform for full-scale military operations, with all possible tragic and destructive consequences for its inhabitants and their usual way of economic and social life. Also in 2022, the BANI World model [1-10] began to be actively discussed in scientific circles, the public mention of which, according to one source, first took place in 2016 [11], and according to another – in 2020 [12]. Moacir Fernandes de Godoy, Durval Ribas Filho pointed out: «In more recent times, especially with the Covid-19 Pandemic, we live in what the anthropologist, historian, and futurologist Jamais Cascio called BANI World, an acronym for the terms Brittle, Anxiety, Non-Linearity and Incomprehensible» [13]. The author of the BANI World concept himself admits that he actively started

working on this idea and building its structure in 2018 [1]. In previous studies, we considered certain aspects of the influence of BANI World on the circumstances of people's economic life and business functioning [14]. The scientific results presented in this article are concretized patterns of individual's security-oriented economic behavior under the risk of displacement in BANI World and war conditions.

Experts call the characteristic features of BANI World chaotic, unpredictable, changeable and so on. The change of place of residence, which has become a sudden necessity for many citizens of Ukraine, "fits" well into the triangle of the mentioned characteristics. In Ukraine, the wave of displacement was caused by military actions, however, the intensification of migration movements, which occur even without such radical reasons as war, are observed all over the world. Thus, the scientific results obtained within the scope of this research can be used in peacetime and will have a wide geographical application.

Aims. The purpose of the study is to establish the characteristics of the economic behavior of people living in the territories under the threat of active military operations and their consequences, as well as to determine the influence of the characteristics of the BANI world on the patterns of economic behavior of people.

Methodology. The research is based on the use of the content analysis method, which was used to process materials from available information resources in order to clarify the characteristics of BANI World from the positions of various researchers and their real and potential impact on people's economic behavior. The monographic method was applied during clarification of the content essence of the concept of safety-oriented personality behavior and delineation of its characteristic features. Methods of analysis and synthesis made it possible to identify patterns of modern economic behavior of people who are at risk of displacement. Materials for analysis were obtained by means of a questionnaire; 105 respondents took part in the survey. The graphic method made it possible to systematize and visualize the main results of the conducted research, including presenting survey and questionnaire data, demonstrating the impact of education on the economic behavior of a person. The generalization method made it possible to form concise conclusions and recommendations based on the materials of the analytical work.

Results. According to the team of scientists, which included Neva R. Goodwin, Jonathan M Harris, Julie Nelson, Brian Roach, Mariano Torras, Frank Ackerman, Thomas E. Weisskopf, the model of economic behavior is built on the results of the study of such parameters as: choice of goals, the actions people take to achieve these goals, and the limitations and influences that affect their choices and actions [15, p.147]. Researchers also emphasize the influence of time and emotions on economic decision-making [15, p.149-151]. In the conditions of BANI World, both of these parameters are extremely

important: the fragility, anxiety and incomprehensibility of the future encourages quick, often impulsive decisions, dictated by desires and random opportunities, rather than planned and set goals, which must be achieved in a structured and step-by-step manner.

O.B. Petinova notes: "Scientists associate the explanation of the concept of socio-economic behavior with such features as rationality, which is based on the principle of maximization (achieving the maximum of success, benefit with the minimum expenditure of internal and external resources); pragmatic motivation of human activity (in the forms "to be in order to have" and "to have in order to be"); the relation of socio-economic exchange (socio-generating and socio-actualizing mechanisms of life activities of an individual and society) [16, p.61]. Adding to this statement the characteristics of the society that has developed, guided by the theory of generations, we get a conclusion that economic behavior is largely determined by the age parameter – the former worldview, habits, the level of desired or achieved comfort that one does not want to lose. Previously, a person's age could be considered a limiting factor regarding the realization of the possibility of acquiring new knowledge, skills, and abilities. But in today's world, in light of the spread of the concept of Long Life Learning, increasing the level of accessibility of informal education, as well as total information openness, we get atypical and unexpected combinations of economic solutions for people of different age categories. Education can restrain the impulsive economic behavior of young people, but give the courage to take risks and deviate from established plans to older people.

"Making an economic decision can be rational, pragmatic or intuitive. A rational decision does not depend on past experience; it is based on analytics... A pragmatically oriented decision is based on knowledge and experience, that is, it is a choice based on knowledge and experience... An intuitive decision is made from a sense of its correctness, without analyzing all the pros and cons" [17, p.56]. Scientists include vigilance, avoidance, hypervigilance, procrastination as factors of economic decision-making [18, c.203-204]. For rational and pragmatic decisions, education is the element of the behavioral portrait that provides tools for analysis, evaluation of positive and negative probable consequences of decision-making, as well as obtaining relevant knowledge and experience for choosing the correct behavioral alternatives. Without education or at least an understanding of the methodology for obtaining the necessary analytical information, most economic decisions are made intuitively or not independently.

Figure 1 demonstrates how the level of education and other factors mentioned in this study affect the pattern of economic behavior of a person.

O. B. Petinova defines economic behavior as "behavior associated with the selection of rational, pragmatic or socially oriented economic alternatives with the aim of solving economic problems at all stages of the economic cycle – production, distribution, exchange and consumption" [16, p.64]. In the

publication [19, p.25] the economic behavior of a person is defined as «a set of motives and economic decisions made by a person under their influence, which determine the priority and degree of importance of satisfying economic needs, and the means and tools that will be used to cover them». We propose to consider the following algorithm of economic decision-making by a person as security-oriented economic behavior, which aims to achieve and preserve its financial independence and develop its economic potential at the expense of existing or potentially available resources, which involves the assessment of information on which the possible outcome of decision-making depends, analysis alternatives, the forecast of scenarios of expected results from an economic decision and taking into account risks when choosing the final option of economic action or inaction of a person in the specific conditions (in the context of this study, the characteristics of security-oriented economic behavior in the conditions of the spread of BANI World trends are considered and described).

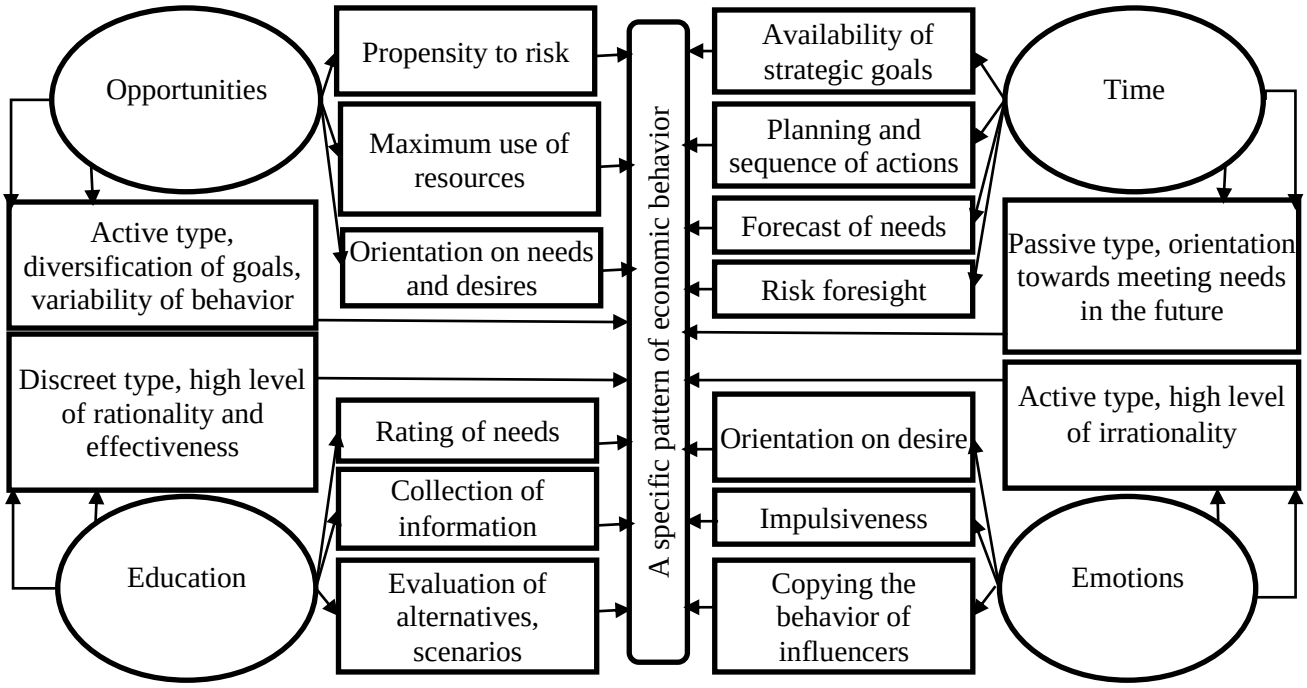

Figure 1. The influence of education on the pattern of economic behavior of a person

Source: developed by the author

According to Fig. 1, several basic patterns of economic behavior can be formed, with a focus on the dominance of a specific behavioral factor:

- *emotional, episodic* (active type, high level of irrationality) – characteristic of people who are exposed to targeted advertising, actively use social networks and have free financial resources; it is often found among

young people, or persons who are dependent and do not have to worry about meeting basic economic needs (food, accommodation, payment of utilities, transportation costs, etc.); on the other hand, this type of behavior can be formed in people who have dependents – for example, parents who occasionally buy toys or other unplanned in the family budget items to amuse their children;

- *analytical, evaluative* (restrained (active/passive) type, high level of rationality and effectiveness); this type of behavior is formed in people who have an education and, therefore, possess knowledge, skills and competences that make it possible to analyze their own needs and capabilities, assess the current economic situation and find the best ways to satisfy personal economic interests; it is not necessarily to have formal economic education – it means the ability to think critically, evaluate judgments, search for relevant information, form plans and forecasts of the development of events taking into account existing and potential risks – usually, such skills are acquired in the process of obtaining an education, such as at least at the bachelor's level;

- *strategic/tactical* (passive type, focus on satisfying needs in the future) – the time factor can be taken into account both for the vision of future economic needs and as a risk of loss of economic opportunities in the future; people prone to this type of behavior usually have a financial plan – a family budget or a similar tool for predicting and controlling personal financial income and expenses; they also have long-term financial goals, the implementation of which requires the passage of certain stages, successive steps – acquisitions, investments, finding sources of additional income; they are not characterized by impulsive financial decisions, and they may show a tendency towards an analytical type of behavior, however, adepts of the analytical/evaluative type are less inclined to deal with forecasts and more often focus on current economic needs;

- *searching type – a type focused on existing and potential opportunities* (active type, diversification of goals, variability of behavior) – people of this type are constantly in search of opportunities to satisfy their own needs; they also strive to make maximum use of the resources available to them at a certain point in time to satisfy existing economic interests, as well as to multiply resources and expand the limits of their consumption in the future.

All described types of economic behavior are often combined and form various variants of a mixed type of economic behavior.

The basic psychological law proposed by M. Keynes states that "people tend to increase their consumption as income increases, although not to the extent that income increases [18, p.193]. In the conditions of BANI World, the propensity to consume is reduced, at least for that part of the economic resources that are obtained as a result of receiving active income. Regarding displaced persons, there is an increase in the level of consumption of resources received in the form of charitable assistance, from volunteers, etc. Such resources cannot be characterized as income, however, they demonstrate a

person's tendency to easily spend what did not take much time and effort to acquire. There is no emotional connection with such a resource, and therefore the factors of time and emotions, which influence the economic behavior of a person, are of minimal importance.

In 2023, we conducted a survey of young people, including internally displaced persons and those young men and women who are or have been abroad for some time after the start of the full-scale war in Ukraine, with the aim of establishing changes in their economic behavior. Answers were received from 105 respondents of different ages and genders (Fig. 2), as well as educational levels (from those who only receive a bachelor's degree to those who obtain the degree of Doctor of Philosophy).

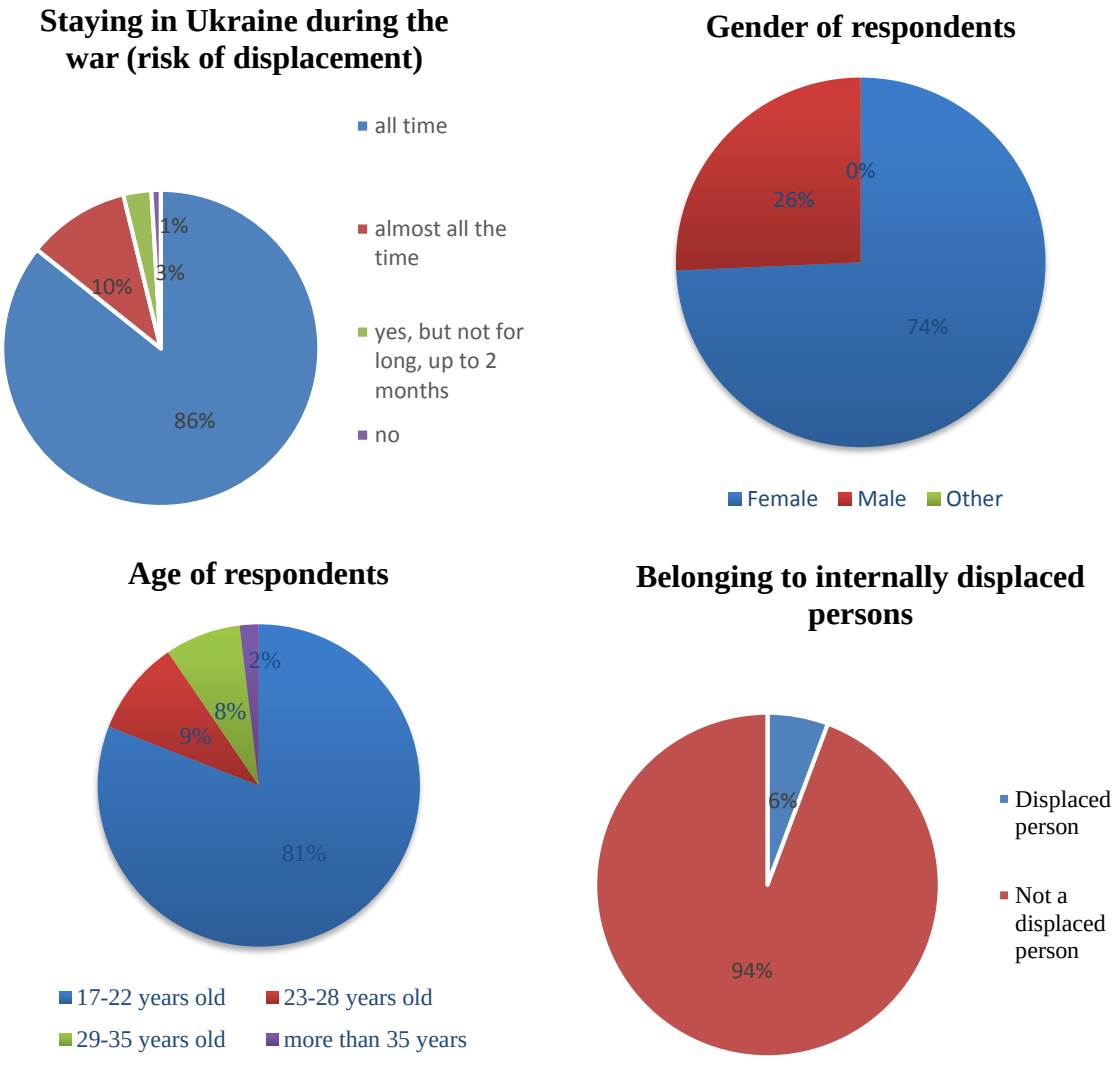

Figure 2. Characteristics of respondents in the survey on changes in economic behavior under the risk of displacement in conditions of BANI World

Source: developed by the author according to survey data

According to the results of the questionnaire, it was established that there is a lack of an appropriate level of financial literacy and knowledge of the economic nature of the phenomena and things of the surrounding world; it was found that economic decision-making by young people, regardless of the tendency towards autonomy and independence in everything related to their lives, takes place under the influence or with the consent of their parents or other relatives, and also has an impulsive nature, characterized by a high level of emotionality.

Survey results show that young people overwhelmingly remained in Ukraine when the war began, and are still at risk of displacement, given the fact that military operations continue and the destruction of critical infrastructure and shelling of the civilian population in various regions, even far from the front line, continue. At the same time, 6% of the respondents are internally displaced persons who have to rebuild their lives, including its economic component, under new conditions and have to find sources for obtaining means of subsistence and meeting their own needs.

The economic behavior of people at risk of displacement in the conditions of BANI World is aimed at achieving a state of personal economic security, however, in the conditions of chaos, unpredictability and anxiety of the surrounding world, this goal becomes increasingly unrealistic without flexible economic thinking, the availability of savings and the development of a personal financial plan for the short term perspective.

Discussion. With the war beginning, the pattern of economic behavior of young people has changed. Willingness to save, prudence, evaluation and research of alternative options for spending financial resources are demonstrated in order to find the optimal one way of making economic decision (for example, purchasing the necessary asset at a discount, on sale, etc.). In addition, the recognition of the need for basic or additional economic education to make sound economic decisions becomes undeniable.

Fig. 3 presents the results of surveys that relate to the pattern of economic behavior of people at risk of displacement during the war. 60% of respondents indicated that the war had an impact on their economic behavior, and it is interesting to note that almost half (30%) of the changes were due to increased spending after the start of hostilities, and the other half (40%) – to a decrease in consumption and spending. The increase in costs is associated with the need to rent housing (in case of relocation), the increase in prices for food products and services (occurred due to the destruction of the logistics structure, the destruction of business in certain regions, bankruptcy and the termination of the activities of economic structures in the occupied territories). The decrease in costs is explained by the tendency to save financial resources due to the general uncertainty of the situation in the country and the probability of unforeseen losses, an increase in the level of unemployment, loss of sources of income.

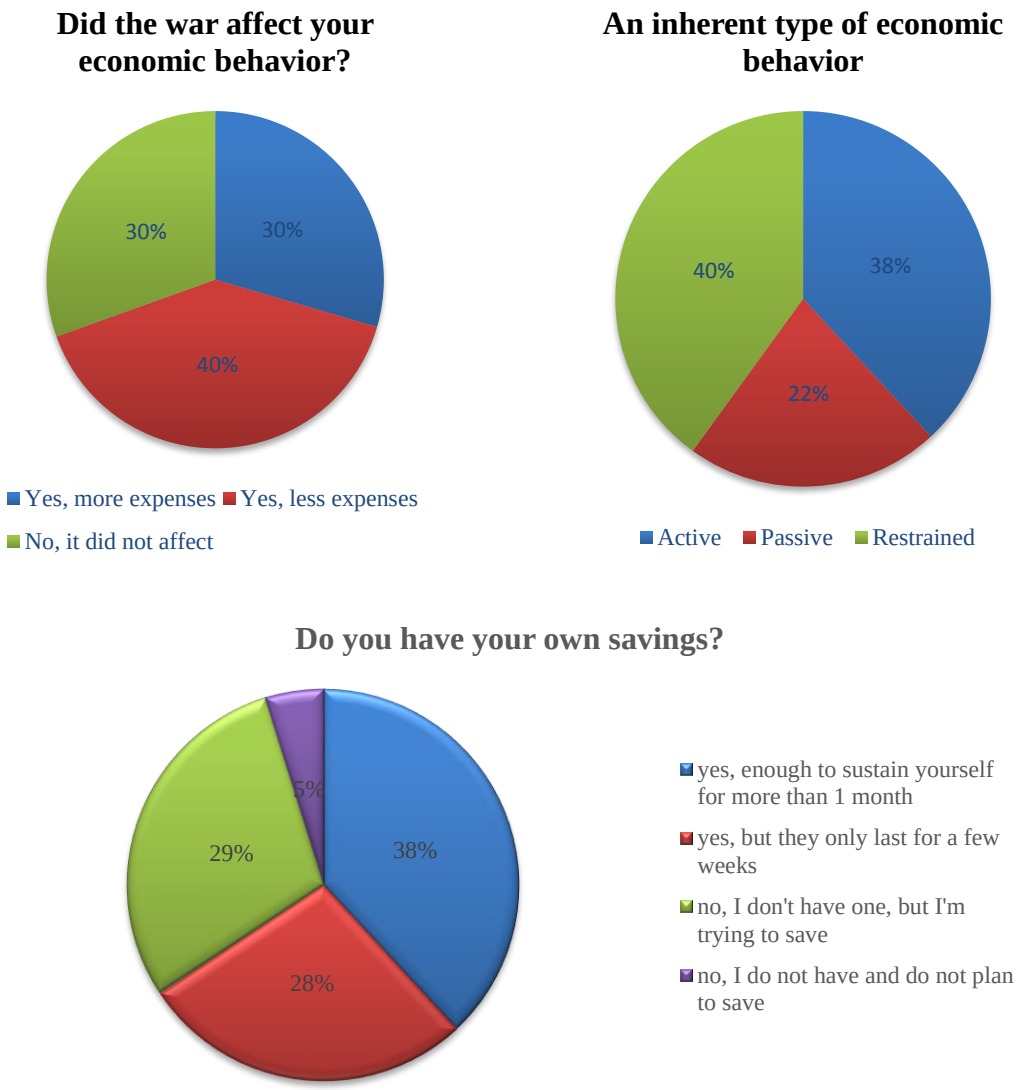

Figure 3. Survey results on the pattern of economic behavior under the risk of displacement in a wartime

Source: developed by the author according to survey data

At the same time, 30% of respondents noted that the war did not affect their economic behavior at all. That is, even before the start of the war, they had their own economic path and vision of their future and continued to move towards the chosen financial goals.

Respondents were asked to determine what type of economic behavior is typical for them. We have the following results:

– 38% – active economic behavior – this type is characterized by the presence of active sources of income and the constant search for additional sources of income, making necessary expenditures to meet all personal needs (if possible);

– 22% – passive economic behavior – characterized by the statement "I have everything I need, I need to save, it is not easy with sources of income now, so it is better if possible to save money for future";

– 40% – restrained economic behavior – characterized by a reaction in the search for opportunities to finance needs in the event of their occurrence, in the absence of urgent needs and desires – economic priorities are reassessed and the search for alternative ways of satisfying one's own interests begins.

A problematic methodological aspect and challenge within this study is determining which changes in economic behavior are caused by the transition to the BANI World model and which are caused by military action and the risk of displacement. Note that the survey, the results of which are presented within this study, took place in 2023, that is, already in the conditions of the spread of BANI World trends, and since 30% of respondents noted that the war did not affect their economic behavior in any way, we can talk about general patterns of economic behavior of Ukrainians under the influence of fragility (brittle), anxiety, non-linearity and incomprehensibility of the world around them, increased risks of war (Table 1).

Table 1. Patterns of behavior in BANI World: Ukrainian experience in wartime

Indicator	Youth	Older people
Brittle	The minimum amount of financial savings and the lack of intentions to make them, increasing interest in credit services, trying to satisfy one's own needs as much as possible "here and now"	Reduction of current expenses, active attempts to save money to meet current needs, refusal of investments in real estate, in projects with a long payback period
Anxious	Efforts to minimize risks and ensure one's own financial independence through the intention of opening one's own business, finding a permanent job or working as a freelancer	Constant search for sources of additional income, mainly traditional (renting property, additional work, often unofficial, sale of home-grown products, etc.)
Nonlinear	Active use of digital financial services, search for sources of financial income in the digital economy segment	Increasing the level of confidence in the preservation of assets in cash and other forms available for quick settlement
Incomprehensible	The desire to increase the level of one's own financial literacy, positive economic expectations in the future (economic optimism)	Attempts to combine various sources of obtaining financial resources and various forms of their preservation, negative economic expectations (economic pessimism)

Source: compiled by the author

Presented in the Table 1 data, as well as the facts obtained as a result of the conducted survey, demonstrate signs of security-oriented economic behavior of modern Ukrainians. In particular, only 21.9% of respondents believe that higher education, even of an economic orientation, has no effect on the rationality of economic behavior. Young people are ready to reduce expenses and find new forms of income generation, seek to increase the level of their own financial

literacy, acquire additional competencies and skills for opening a business and creating new forms of income in the digital space.

They are capable of taking risks but understand that risks must also be managed; they prefer to get rich, however, they study the possibilities before making economic decisions (Table 2).

Table 2. Features of individuals' security-oriented economic behavior

Factors influencing economic behavior	Features of security-oriented economic behavior	
	In an economically stable world	In the world of BANI
Opportunities	They are fully used, new ways of increasing economic potential are sought, the main goal is maximum profit with minimal risks of loss	Being wary of existing or potential opportunities without sufficient information; at the same time, the tendency to take excessive risks in pursuit of large profits, readiness to incur losses
Time	Economic decisions are made carefully, after analysis and evaluation of existing alternatives and scenarios; financial strategies and long-term financial plans are formed	Quick economic decisions, short-term financial plans, flexibility in the formation of economic goals, their dynamic change in accordance with the conditions that have arisen
Emotions	Emotions determine risk appetite, shape economic desires and interests that need to be satisfied, but are restrained during economic decision-making	It is the cause of impulsive, unconscious economic decisions that lead to overspending of resources due to the satisfaction of non-priority needs
Education	Forms the ability to make rational economic decisions based on knowledge about financial opportunities, products and services	It is important for acquiring the skills of searching for information and analyzing data, necessary for evaluating alternatives and choosing the least risky economic decision
Risks	Insignificant, well forecasted, structured, well amenable to insurance, diversification; their consequences are predictable and can be minimized; they are acceptable and taken into account, but are not a reason to reject an economic decision	Significant, unpredictable, with the probability of large losses - not amenable to a reliable forecast and assessment, therefore measures are taken to compensate or reduce their impact on the state of individual economic security

Source: compiled by the author

Transformations of economic behavior under the influence of various challenges and threats, as well as taking into account the theory of generations, have led to a fundamental change in the focus of human economic behavior: *middle-aged and elderly people choose a vision – what do I have now and how can I use it to satisfy the existing needs; the younger generation prefers the model: what do I need and how can I get it (at the expense of what resources, skills, etc.).*

Conclusion. Conducted research of economic behavior and economic security of an individual in the conditions of war risks made it possible to draw such important conclusions.

1. The economic behavior of a person determines the level of his well-being, the ability to quality and comfortable survival in conditions of limited resources and the difficulty of access to them due to the emergence and spread of numerous challenges, threats and risks. In Ukraine, war is a source of danger not only for economic life, but also for the biological survival of its inhabitants from February 2022. Active and aggressive military actions in the territories of a large concentration of population formed a tendency to move people, both internally – to safer regions, and externally, first of all, to European countries.

2. We propose to consider the following algorithm of economic decision-making by a person as security-oriented economic behavior, which aims to achieve and preserve its financial independence and develop its economic potential at the expense of existing or potentially available resources, which involves the assessment of information on which the possible outcome of decision-making depends, analysis of alternatives, forecast of scenarios of expected results from an economic decision and consideration of risks when choosing the final option of economic action or inaction of a person in the specific conditions.

3. Patterns of economic behavior of youth and older people are characterized. The economic behavior of young people is characterized by the following: a minimum amount of financial savings, efforts to minimize risks and ensure their own financial independence, active use of digital financial services, and a desire to increase their level of financial literacy. For older people (over 35 years old) – the reduction of current expenses, active attempts to save money to meet daily needs, constant search for sources of additional income, preservation of assets in cash, persistent attempts to combine various sources of obtaining financial resources and various forms of their preservation are typical. Restraint in spending, frugality, the desire to get more information before making a responsible economic decision are signs of security-oriented economic behavior, which were formed as a reaction to the spread of BANI World trends in the situation of active military actions on the territory of Ukraine.

4. It was established that transformations of economic behavior under the influence of various challenges and threats, as well as taking into account the theory of generations, led to a fundamental change in the focus of human economic behavior: middle-aged and elderly people choose a vision – what I have now and how use it to meet existing needs; the younger generation chooses a different path: what do I need and how to get it (at the expense of which resources, skills).

Acknowledgements. This work is the result of the research supported by the CEFRES, UAR 3138 CNRS–MEAE.

References:

1. Cascio, J. (2022). Human Responses to a BANI World. Retrieved June 11, 2023, from: https://medium.com/@cascio/human-responses-to-a-bani-world-fb3a296e9cac.
2. Chaliuk, Y.O. (2022). *Hlobal'nyy sotsial'no-ekonomichnyy rozvytok v umovakh VUCA, SPOD, DEST ta BANI svitu* [Global Socio-Economic Development in Vuca, Spod, Dest and Bani World]. *Ekonomika ta suspil'stvo*. Retrieved June 12, 2023, from: https://ssrn.com/abstract=4102455
3. Dudnyeva, YU., & Dolhopolov, V. (2022). *Osoblyvosti pidpryyemnyts'koyi diyal'nosti v konteksti vyklykiv BANI-svitu* [Peculiarities of entrepreneurial activity in the context of the challenges of the BANI world]. *Adaptyvne upravlinnya: teoriya i praktyka. Seriya Ekonomika,* 14 (28). Retrieved June 10, 2023, from: https://amtp.org.ua/index.php/journal2/article/view/477. https://doi.org/10.33296/2707-0654-14(28)-09.
4. Morrison, G. The Role of Joy, in a BANI World. (n.d.). Retrieved June 10, 2023, from: https://sandownbusinessschool.com/the-role-of-joy-in-a-bani-world/.
5. Being brilliant in a BANI world: Awesome fad or awakened focus? (2022). Retrieved June 12, 2023, from: https://www.ft.lk/columns/Being-brilliant-in-a-BANI-world-Awesome-fad-or-awakened-focus/4-743204.
6. Costa, F. (2022). From VUCA to BANI: the new global environment that is challenging your organization. Retrieved June 12, 2023, from: https://thechangelab.cl/en/2022/02/01/de-vuca-a-bani-el-nuevo-entorno-global-que-esta-desafiando-a-tu-organizacion/.
7. Hoekstra, J. (2022). Dealing with change in a BANI world. Retrieved June 12, 2023, from: https://resources.kenblanchard.com/blanchard-leaderchat/dealing-with-change-in-a-bani-world.
8. S. Shyam, P. (2022). BEAT the VUCA or BANI world: A responsive framework. Retrieved June 12, 2023, from: http://www.marketexpress.in/2022/04/beat-the-vuca-or-bani-world-a-responsive-framework.html.
9. Terrar, D. (2022). Think beyond VUCA to BANI in framing what business needs today. Retrieved June 15, 2023, from: https://www.bloorresearch.com/2022/08/think-beyond-vuca-to-bani-in-framing-what-business-needs-today/.
10. Melnick, M. (2022). The BANI World Is a New World That Has Replaced the World of VUCA. Retrieved June 14, 2023, from: https://hackernoon.com/the-bani-world-is-a-new-world-that-has-replaced-the-world-of-vuca.
11. Johnson, C. (n.d.). Feeling Barmy in a BANI World? Retrieved June 14, 2023, from: https://www.challengeofchange.co.nz/article/feeling-barmy-in-a-bani-world.
12. Guthridge, L. (2022). Why you want to use BANI, not VUCA, to deal with today's constant chaos. Retrieved June 14, 2023, from: https://connectconsultinggroup.com/why-you-want-to-use-bani-not-vuca-to-deal-with-todays-constant-chaos/.
13. De Godoy, M. F., & Filho, D. R. (2021). Facing the BANI World. International Journal of Nutrology, 14(02), e33-e33. https://doi.org/10.1055/s-0041-1735848.
14. Zachosova, N.V., & Kutsenko, D.M., & Koval, O.V. (2022). Strategy and mechanism of enterprises financial and economic security management in the conditions of war, Industry 4.0 and BANI world. *Financial and credit activity: problems of theory and practice*, 4(45), 223-233. https://doi.org/10.55643/fcaptp.4.45.2022.3819.
15. Goodwin, N. R., & Harris, J. M., & Nelson, J., & Roach, B., & Torras, M., & Ackerman, F., & Weisskopf, T. E. (2014). Economic Behavior and Rationality. Microeconomics in Context. *M.E. Sharpe,* 145-157.
16. Petinova, O. B. (2018). *Ekonomichna povedinka: do pytannya eksplikatsiyi ponyattya* [Economic behavior: to the question of the explanation of the concept]. *Hrani,* 21/2, 60-65.
17. Bazetska, H. I. (2021). *Ekonomichna povedinka v umovakh nevyznachenosti [Economic behavior in conditions of uncertainty]. Ekonomichna teoriya ta pravo,* 4 (47), 52-72. DOI: 10.31359/2411-5584-2021-47-4-53.
18. Kononovych, T.O., & Nepokupna, T.A., & Myasoyid, K.P. (2019). *Ekonomichna povedinka i pryynyattya rishennya: Case Study* [Economic behavior and decision making: Case Study]. *Psykholohiya i osobystist,* 1 (15), 192-210.
19. Zachosova, N. (2023). Economic behavior and economic security of an individual in the conditions of war risks. *Economics, Finance and Management Review*, 13–27. https://doi.org/10.36690/2674-5208-2023-1-13.

STRATEGIC MANAGEMENT OF A BUSINESS ENTITY IN THE CONTEXT OF ENSURING THE STATE ECONOMIC SECURITY: AN INNOVATIVE ASPECT

Mykola Denysenko[1], Svitlana Breus[2]

[1]*Doctor of Economic Sciences, Professor, Doktor habilitovanyi nauk ekonomichnykh, Profesor nauk ekonomichnykh, Professor of the Department of Management and Entrepreneurship, Volodymyr Vynnychenko Central Ukrainian State University, Kropyvnytskyi, Ukraine, e-mail: profden3@gmail.com, ORCID: https://orcid.org/0000-0001-8767-9762*

[2]*Doctor of Economics, Professor, Professor of the Department of Management and Innovative Providing, European University, Kyiv, Ukraine, e-mail: breus.svitlana@gmail.com, ORCID: https://orcid.org/0000-0003-0624-0219*

Citation:
Denysenko, M., & Breus, S. (2023). Strategic management of a business entity in the context of ensuring the state economic security: an innovative aspect. *Economics, Finance and Management Review*, (3), 17–23. https://doi.org/10.36690/2674-5208-2023-3-17-23

Received: August 14, 2023
Approved: September 23, 2023
Published: September 30, 2023

Abstract. *The study of the role and significance of innovations in the strategic management of business entities is especially relevant in the conditions of a full-scale russian invasion of Ukraine, while an important task at all levels of management is not only ensuring the country's survival, but also ensuring its prosperity and accelerating the recovery of the economy in the post-war period. The purpose of the article is to develop a set of measures to increase the innovative development of economic entities in the context of implementing their strategic management in order to speed up the recovery of Ukraine's economy in the post-war period. The object of the study is the process of strategic management of innovations in the conditions of a full-scale war between russia and Ukraine. The methodological basis of the article is the use of general scientific and special methods that serve as confirmation of the reliability of the obtained results and conclusions: in particular, such as: analysis, synthesis, structural-logical, terminological, statistical analysis, system-structural analysis, systematization and generalization, etc. Innovations as an important tool for the strategic development of business entities and their management for the future in the context of their adaptation to the conditions of a turbulent environment was conducted for a full-scale russian invasion of Ukraine. It was determined that they are the main aspect and component of the process of ensuring the economic security of the state and its management, in particular in the context of balanced strategic management of economic entities. It is proposed as recommendations to use a binary approach to the activation of innovative activities of enterprises, which involves the use of a tolerant type of adaptation in combination with innovations, which are classified according to the type "by type" (product, technological, raw material, organizational, sales and infrastructural) in combination with typical procedures for the formation of innovation management strategies by economic entities within the framework of strategic management.*

Keywords: *innovation, strategy, competition, competitiveness, adaptation, strategic management, turbulent environment, business entity, state economic security.*

JEL Classification: A10, A11, A19, E22, G11, G17, G19, O10, O30

Formulas: 0; fig.: 1; tabl.: 0; bibl.: 15

Introduction. In today's conditions of a full-scale invasion of Russia into Ukraine, an important task of the state is not only survival, but also ensuring future prosperity in order to ensure a sustainable trend of economic growth. At the same time, innovations and innovative activities of various sectors of the economy are the main aspect and component of the process of ensuring the economic security of the state and its management, in particular in the context of balanced strategic management of business entities. The objective grounds for this are the following: innovations in general and innovative activity of business entities are an important component of the process of ensuring their successful functioning; innovations are a basic element of an effective innovation strategy of business entities within their strategic management; innovation is an important tool for creating and maintaining competitive advantages of business entities both on the domestic and international markets of innovative products.

Literature review. Separate issues related to the definition of the essence of innovations and their role in ensuring the economic development of the state and business entities are considered in the works of a large number of scientists, in particular such as: V. Aleksandrova, Yu. Bazhal, A. Halchynskyi, V. Heiets, S. Illiashenko, M. Kondratiev, O. Lapko, B. Santo, V. Semynozhenko, B.Tviss, M. Tuhan-Baranovskyi, M. Chumachenko, Y. Shumpeter. However, paying tribute to the scientific achievements of the authors in terms of research issues, it should be noted that in modern economic science, issues related to the definition of the relationship between innovations and the innovative development of business entities in the context of strategic management with the provision of economic security management have not been comprehensively covered state. The existing proposals for solving the mentioned problematic issues, as a rule, represent multi-directional recommendations that are not considered in a complex, which is the basis for formulating the goal of the research on this issue.

Aims. The purpose of the article is to develop a set of measures to increase the innovative development of economic entities in the context of implementing their strategic management in order to speed up the recovery of Ukraine's economy in the post-war period.

Methods. The methodological basis of the article is the use of general scientific and special methods that serve as confirmation of the reliability of the obtained results and conclusions: in particular, such as: analysis, synthesis, structural-logical, terminological, statistical analysis, system-structural analysis, systematization and generalization, etc.

Results. The key to the upward trend of the economic development of the state and individual economic entities is the introduction of innovations and the stimulation of their innovative activities, which acquires particular relevance in the conditions of a full-scale war between russia and Ukraine. In general, the ability to generate and implement the achievements of scientific and technical

progress is one of the most important conditions for ensuring the competitiveness of both the national economy in a global competitive environment and individual product manufacturers in specific markets [1].

The term "innovation" comes from the English word innovation, which in translation means "the introduction of innovations" or "the embodiment of a scientific discovery." The term "innovation" as a new economic category was introduced into scientific circulation by Y. Shumpeter at the beginning of the 20th century, in the work "Theory of Economic Development" he first considered the issue of new combinations of changes in economic development and gave a complete description of the innovation process [2]. He singled out the following types of new combinations of changes or innovations [3]: production of a new product or a known product in a new quality; introduction of a new production method; attraction of new sources of raw materials for the production process; development of a new sales market; introduction of new organizational forms.

The problems of innovation began to be actively addressed in the 60s of the 20th century. Even in today's conditions, they are an important tool for the strategic development of a business entity, as well as its future management in the context of its adaptation to the conditions of a turbulent environment. However, it should be noted that currently there is no single generally accepted definition of the term "innovation" in modern scientific literature (it is multi-faceted, multi-vector, taking into account the evolutionary processes occurring in society) and their single classification, which significantly affects the formation of different approaches to its consideration and models of enterprise adaptation. Formation in the process of evolution of various approaches (as a process) is subject, first of all, to the law of survival. As the experience of economically developed countries shows, the evolutionary process is carried out through innovations. They, like a locomotive, entail the modernization and structural restructuring of the entire economic system; act as the main measure of ways of development of society. Therefore, the country that stands aside from "innovation competitions" remains the last in the hierarchy of development of the world community [6]. The undisputed leader in these competitions today is the United States, as over 60% of all technical innovations have been accounted for over the last half century. This country has become one of the richest in the world primarily due to the best organization of the innovation process and the effective use of technological innovations in production [4].

Yu. Bazhal [5] is relevant, according to which innovations are systematized according to the following characteristics:

1. By type: product, technological, raw material, organizational, sales and infrastructure;
2. By innovative function: basic, improving and pseudo innovations;
3. According to the novelty of the place of implementation: new industry

(new production), existing industry (existing production).

In general, the peculiarity of innovative activity as one of the varieties of entrepreneurial activity is that it is accompanied by increased risk, compared to usual entrepreneurship. Such a risk is due to the novelty, creative nature of scientific and technical work, the possibility of obtaining both positive and negative results [2]. However, in the conditions of martial law, the activation of innovative activities of business entities is an important aspect of their survival, which, in turn, requires the adaptation of their strategies to modern realities, taking into account all the peculiarities of the functioning of the economy.

In general, adaptation is understood as an adequate change in the current state of any object for the implementation of an innovative process under the influence of changing conditions of its environment [6, p. 94].

In this context, it is relevant to classify the types of adaptation by characteristics, taking into account the characteristic features of the manifestation in the innovation process [6, p. 94-95]:

1. By defining the purpose and subject of adaptation:

- private (linear) – separate factors of innovative development (various innovative projects) are considered without their mutual agreement, does not require a fundamental restructuring of the existing scheme of the object's functioning;

- systemic (multilevel) – all factors of the innovation process at the enterprise are considered as a whole, having an impact on the implementation of innovation processes in relation to the object of adaptation; requires changing the existing approach to solving problems, redefining priorities, establishing new relationships, replanning operations.

2. By initiation and objective signs:

- problematic – "Initiator" of the adaptation process - a formalized problem on the way to the implementation of innovations, therefore, this "stimulus" must be neutralized, eliminated or adapted to it;

- complex - "Initiator" of the adaptation process - the very object of adaptation, when innovations cannot be started without prior preparation, therefore the solution to the adaptation task lies in the field of reengineering, in particular, it is related to the processes of structural reorganization of the enterprise;

- product – "Initiator" of the adaptation process - a production product offered on the market by the enterprise itself, therefore, changes in the internal environment are necessary to obtain the expected level of results at the output of the production system.

3. According to the approach to solving the adaptation problem:

- "classical" – the influence of the external environment on the object of innovation adaptation prevails, therefore the corresponding reaction is the traditional approach associated with the change of its internal environment;

- program – the aggressive influence of the external environment can be

compensated due to the internal activity of the object of adaptation, which allows it to approach the desired state through the use of the known and currently existing influence of external environmental factors;

- tolerant – the object, possessing everything necessary, can simultaneously act as a management subject. This will allow him to implement an approach based on the prediction of events and the prediction of the future situation during the warning time and forecasting the dynamics of changes in the situation and the state of the object as a system.

Innovations are the main aspect and component of the process of ensuring the economic security of the state and its management, in particular in the context of balanced strategic management of economic entities, the objective reason for which is that as a result of the use of innovations, the quantitative and qualitative characteristics of the spheres of production and consumption, economic development is accelerated, intensification of social production is ensured. Therefore, it is considered relevant and such that it can have a practical focus in the conditions of full-scale aggression of russia against Ukraine to use a binary approach to the activation of innovative activities of economic entities [7-15], which involves the use of a tolerant type of adaptation in combination with innovations, which is systematized "by type" (product, technological, raw material, organizational, sales and infrastructural) in combination with typical procedures for forming an innovation management strategy by business entities within strategic management.

Taking into account the fact that the expediency and possibility of introducing innovations by a business entity is always related to its current state, technical-technological and financial base and is implemented within the framework of strategic management, then the possibility, as well as the expediency of developing and implementing an innovation management strategy can be considered a special study that has its own typical procedures, an approximate list of which is shown in fig. 1.

Taking into account the above, it should be noted that the selection of an innovation management strategy within the framework of strategic management should be carried out according to standard procedures (Fig. 1) taking into account a number of criteria that serve as indicators to substantiate the feasibility of its development and implementation: compatibility with financial resources, which can be directed to the development of an innovative product; the effectiveness of the strategy – the agreement of the results and the real costs for their achievement; certainty in terms of the achievement of the established goal; optimality of the combination of the expected achievement of the desired profitability and the possible riskiness and uncertainty of the future period; compatibility of the planned investments with the general economic conditions of the external environment for the business entity.

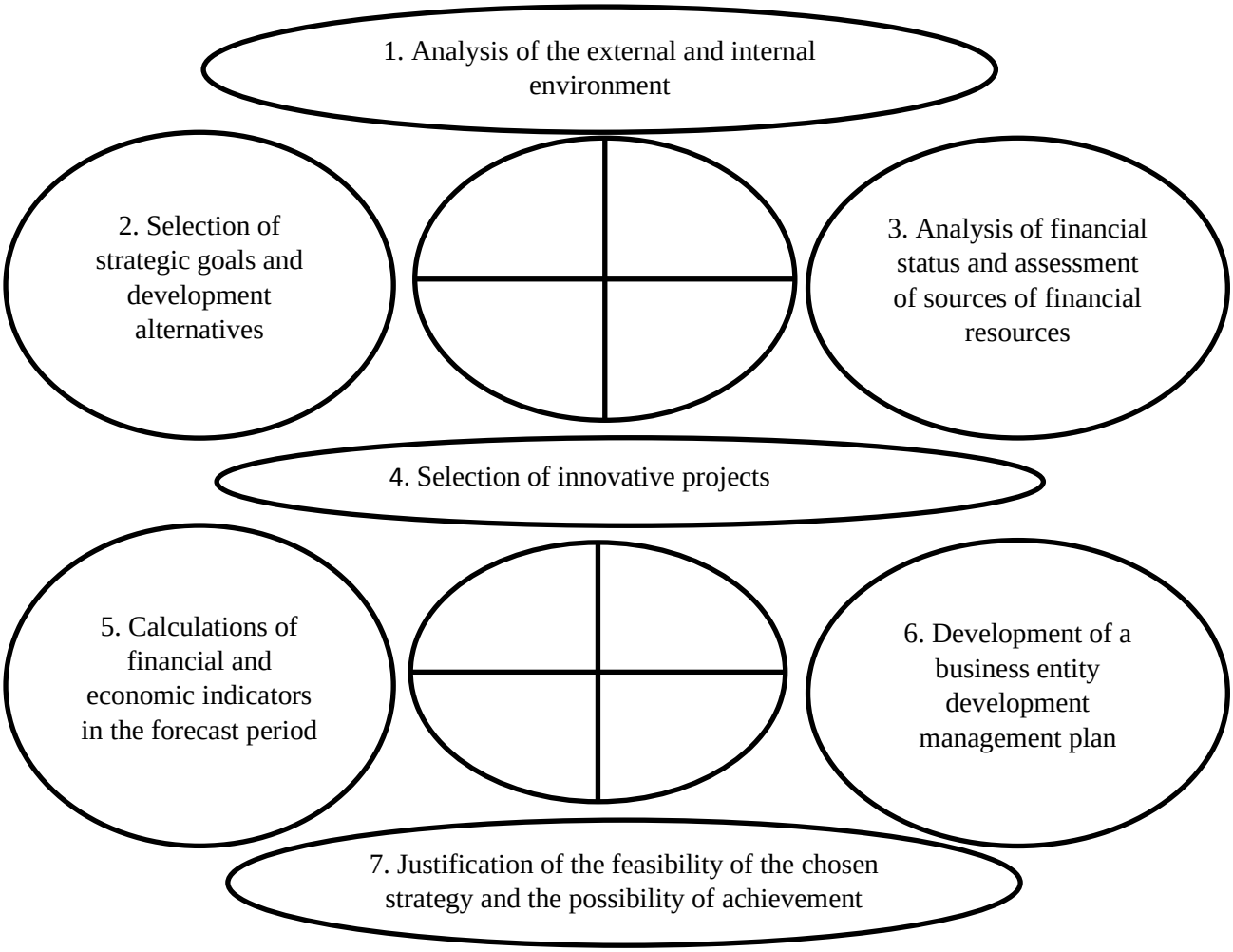

Figure 1. Formation of innovation management strategy by business entities

*Source *. Formed on the basis of own research.*

In this context, the implementation of balanced support of business entities at all levels of management has a significant impact on the level of socio-economic development of the state and its economic security.

Conclusion. Taking into account the above, it can be stated that in the conditions of a full-scale invasion of russia into Ukraine, it is considered expedient to use a binary approach in the field of strategic management of a business entity by combining a tolerant type of adaptation with product, technological, raw material, organizational, sales and infrastructure, using at the same time typical procedures for the formation of innovation management strategies by business entities within the framework of strategic management.

Realization the aforementioned will contribute not only to the fact that the business entity will be able to survive on the market, but also to its future prosperity in order to restore the economy in Ukraine in the post-war period. Prospects for further research consist in the development of theoretical and

practical recommendations based on the best global practices of foreign countries in the context of research issues in the field of strategic management of a business entity. The practical implementation of the aforementioned requires conducting in-depth research on the better management of innovations, taking into account their role and importance in the implementation of balanced and purposeful management of the economic security of the state [7-15], which becomes especially relevant in the conditions of the russian-Ukrainian war and in the post-war period in the context of the restoration of the national economy.

Author contributions. The authors contributed equally.

Disclosure statement. The authors do not have any conflict of interest.

References:

1. Lepenchuk, P., Popovych, T. (2003). Support of innovative activity. Experience of economically developed countries and Ukraine. *Juridical journal*, no. 12, pp. 68–71.

2. Pokropyvnyi, S. F. (1995). Innovative management in the market economy system. *Economy of Ukraine*, no. 2, pp. 24–31.

3. Shumpeter, Yozef A. (2011). The Theory of Economic Development: A Study of Profits, Capital, Credit, Interest, and the Economic Cycle. K : Kyievo-Mohylianska akademiia Publishing House.

4. Antoniuk, L. L., Poruchnyk, A. M., Savchuk, V. S. (2003). Innovations: theory, mechanism of development and commercialization: monograph. K : KNEU.

5. Bazhal, Yu. M. (1996). Economic theory of technological changes: training. a guide for universities. K.: Zapovit.

6. Hrynko, T. V. (2011). Basics of management of adaptive innovative development of the enterprise. *The Problems of Economy*. no. 3, pp. 94–97.

7. Breus, S. V. (2019). *Management of economic security of the system of domestic institutions of higher education:* monograph. Kyiv : KNUTD.

8. Denysenko, M. P., Breus, S. V. (2022). Theoretical Foundations in Economics and Management: collective monograph / Toporkova O., Lytovchenk O., etc. *The definition of "economic security" and its development in modern economic conditions* (pp. 147–154). International Science Group. Boston : Primedia eLaunch. doi: 10.46299/ISG.2022.MONO.ECON.2

9. Denysenko, M. P., Breus, S. V. (2017). Theory and practice of enterprise activity: monograph: in 2 vols. Vol. 1; in general ed. L. M. Savchuk, L. M. Bandorina, *Characteristics of the concept of "economic security" as a category* (pp. 131–146), Dnipro, Porogy.

10. Breus, S. V. (2017). Economic security as a category. *Problems of innovation and investment development*, no. 12, pp. 140–149.

11. Denysenko, M. P. (2020). Commercialization of innovations: monograph / by general ed. S. M. Illiashenko, O. A. Bilovodska, *Characteristic features of innovative processes in the economy of Ukraine (pp. 21-28).* Sumy : Trytoriia.

12. Denysenko, M. P., Breus, S. V. (2021). Management, finance, economics: modern problems and ways of their solutions : collective monograph / Zhydovska N., etc., *Basic aspects of economic security management at different hierarchical levels* (pp. 99–105). International Science Group. Boston : Primedia eLaunch.

13. Denysenko, M. P., Breus, S. V. (2021). Trends in scientific thought in economics and management : collective monograph / Galushkina T., Butrym O., Baranovska V., Afanasieva O., Zaruba D., etc., *The main priorities for the implementation of innovative activities in Ukraine* (pp. 71–78). International Science Group. Boston : Primedia eLaunch.

14. Denysenko, M. P., Breus, S. V. (2022, February 6-8). Investment of the national economy: world experience and possibilities of its implementation in Ukraine. *Scientific Collection «InterConf», (41): with the Proceedings of the 7 th International Scientific and Practical Conference «Scientific Horizon in The Context of Social Crises»,* February 6-8 (pp. 153–157). Tokyo, Japan: Otsuki Press.

15. Denysenko, M. P., Yurynets, Z. V., Yurynets, R. V., Kokhan, M. O. (2020). Competitiveness of entrepreneurship in the conditions of innovation and investment modernization of economy. *Ekonomika ta derzhava*, no. 4, pp. 19–24. doi: 10.32702/2306-6806.2020.4.19

ENSURING THE ECONOMIC SECURITY OF CUSTOMERS AND CONTRACTORS DURING THE ELIMINATION OF THE CONSEQUENCES OF ARMED AGGRESSION

Lesya Sorokina[1], Ljudmila Shumak[2], Oleksandr Filippov[3]

[1]*Doctor of Science (Economics), professor of the Department of Construction Economics, Kyiv National University of Construction and Architecture, Kyiv, Ukraine, e-mail: sorokina.lv@knuba.edu.ua, ORCID: https://orcid.org/0000-0002-9981-4615*

[2]*Postgraduate student, Department of Construction Economics, Kyiv National University of Construction and Architecture, Kyiv, Ukraine, e-mail: shumak-ljudmila@ukr.net; ORCID: https://orcid.org/0000-0002-5738-5744*

[3]*Postgraduate student, Department of Organization and Construction Management, Kyiv National University of Construction and Architecture, Kyiv, Ukraine, e-mail: fil_61@ukr.net, ORCID: https://orcid.org/0000-0002-4601-1966*

Citation:
Sorokina, L., Shumak, L., & Filippov, O. (2023). Ensuring the economic security of customers and contractors during the elimination of the consequences of armed aggression. *Economics, Finance and Management Review*, (3), 24–38. https://doi.org/10.36690/2674-5208-2023-3-24-38

Received: September 04, 2023
Approved: September 29, 2023
Published: September 30, 2023

Abstract. *Ukraine is trying with all its might not to sink under the weight of the war. In the event of hostilities, the construction industry, like other sectors of the economy, found itself in a difficult situation, on the verge of collapse. Nevertheless, the Ukrainians could not be defeated, and most of the Developers resumed construction on the spot. The article is devoted to the topic of ensuring the economic security of Customers and Contractors of the construction industry of Ukraine while eliminating the consequences of armed aggression, which reveals the global problem of restoring the wartime housing stock. The article presents the mechanism of movement of financial flows, which should also be taken into account during the post-war recovery. Previously existing methods were analyzed. Examples of current documents regarding the determination of issues of economic security of construction enterprises are given, in which various methods and tasks are applied. An approach for improving methodical support for economic security monitoring is proposed. Economic security in Ukraine is one of the most prioritized functional areas of security. This is the state of protection of the country's national economy from external and internal threats, which ensures the country's economic sovereignty, the unity of its economic space, and the conditions for the implementation of Ukraine's strategic national priorities. The construction sector occupies one of the leading places in the country's economy. It is a multifaceted and multifunctional structure. Any changes that occur in any of the interrelated sectors of the economy lead to a reaction from the market, which undoubtedly affects the construction sector. One of the main features of the modern industrial and construction sector is the ability to work in the face of threats to economic security. One of the main tasks facing the economy of Ukraine and requiring serious consideration is the implementation of measures aimed at stabilizing the work of construction enterprises, including design enterprises. A competently built system of ensuring economic security with the use of existing or built corporate resources is able to create the necessary conditions for achieving business goals and maximizing profits. It is not yet known how all the processes will proceed in the conditions of military and post-war conditions. Economic factors in the construction industry are regularly reviewed. And these questions remain unresolved and relevant to this day.*

Keywords: *economic security, investment and construction activity, risks, construction enterprises, national economy, monitoring, point evaluations, Fishburn weight formula.*

JEL Classification: H56, K22, N6, R31

Formulas: 2; fig.: 1; tabl. 2; bibl.: 35

Introduction. In Ukraine, the issues of economic security in investment and construction activities in the pre-war period are becoming more relevant and broad in connection with the development of economic and financial systems, an increase in the threat of factors that reveal them, as well as in connection with extremely contradictory trends in the modern world . Therefore, these issues require a more detailed study and global discussion. The development of the Ukrainian economy at that time took place in conditions of competition for sources of budget revenues, investments and human resources. The struggle to allocate funds from the state budget is one of the main directions. The desire to appropriate or squander the cash flow, which was initially aimed at the formation of a construction cluster, is one of the threats to economic security. In 2013, to replace the Methodology for calculating the level of economic security of Ukraine (2007), the Order of the Ministry of Economic Development and Trade of Ukraine approved "Methodological recommendations for calculating the level of economic security of Ukraine". The new document identifies possible threats to economic security in Ukraine. The Methodological Recommendations state that in the construction industry, recommendations can be used to determine the level of components of economic security when making management decisions regarding the analysis, prevention and prevention of real and potential threats to national interests. The components of economic security are: foreign economic security, investment and innovation security, production security, as well as financial, macroeconomic, energy, demographic, social and food security. The digital component of economic security — an important aspect of the construction industry's development — is not mentioned in the methodology. While the risks of digital transformation of various sectors of the economy, in particular the construction sector, are increasing as rapidly as the digitalization process itself. In the pre-war period, the direction of digitization of the economy, the modern blockchain system and cryptocurrencies attracted the attention of not only entrepreneurship, but also the state administration apparatus. At this stage of time, the presented spheres of activity are carefully studied by the scientific community, economists, computer technology specialists, legal scholars and are very relevant [32, 34].

Digitization is penetrating deeper and deeper into various spheres of human activity, that is, in the global society of information technologies, a new economic order is rapidly being born - the digital one. The formation of the digital economy makes it necessary and important to increase the requirements for personnel training and the level of their competencies. The relevance of issues related to the features of economic security in the conditions of digitalization at this stage acquires high significance. In order to build a security system, develop methods and goals, use resources, it is necessary, first of all, to understand the concept of security and what kind of base is laid in it.

The large-scale economic crisis of the pre-war years, rising costs and stagnation, rising interest rates on loans create additional risks for the economic security of the construction sector, in particular design and construction enterprises. To manage economic security in investment and construction activities, it is very important to better understand the short- and medium-term consequences of uncertainty for enterprises in the construction sector. As one of the most important interdisciplinary economic complexes, the construction industry is a subsystem of the national economy. It includes: branches of material production and project-exploration works that ensure the reproduction of fixed capital, and also performs a single technological cycle of production of construction products that meets the needs of the population. The characteristics of the system of the investment and construction complex include: structural elements may also belong to other production systems; a high degree of dependence of the final goal (result) on the organization of links (direct and reverse) in the chain of interaction of system and structural elements.

In pre-war Ukraine, design and construction enterprises that do not pay due attention to economic security are both internally and externally unprofitable and continue to operate in an unstable economic environment. They face a deep crisis, a decline in production, a critical condition or become bankrupt. Such a situation in the construction industry carries risks for the entire economy. Design and construction enterprises are able to cope with the shocks of uncertainty, provided that their management understands the features of economic security and is able to manage them under risk conditions. To measure the economic security of the construction sector, the system of indicators should include the following areas: analysis of financial and economic activity, analysis of cash flows, risks of economic activity and operational analysis. Monitoring, analysis and diagnosis of threats to the economic security of the construction industry are of primary importance based on indicators of the socio-economic development of the industry. Safety is a controlled risk. The main issue is the choice of the main risk management tools and their ratio, based on the features of the objects affected by the risks, which can be destroyed, changed or lost as a result of the implementation of the risk, and not just the acceptance and control of the acceptable level of risk [11].

Using the set of resources listed below, the enterprise provides economic security for itself:

Capital resource. The company's equity capital in combination with loan financial resources is the most important system of the company, which allows you to support and buy other corporate resources that the creators of this company initially lacked.

Resource of information and technology. The most expensive and valuable of the company's resources is information related to all aspects of the company's activities. New methods of business organization and management allow the enterprise to adequately and timely respond to any changes in the external

business environment, effectively plan and implement its economic activities. Scientific, technical and technological information about any aspects of this business, as well as information about changes in the political, social, economic and environmental situation, about the company's markets.

Personnel resource. The main, leading and connecting link connecting together all the factors of this business, which ensures the implementation of the business ideology, as well as the achievement of business goals, are the managers of the enterprise, the staff of engineering personnel, employees and production workers with their knowledge, experience and skills.

Resource of property rights. The role of this resource has increased dramatically with the increase in business value of intangible assets. Land use rights, rights to use intellectual property objects, licenses and quotas for the use of natural resources all include this resource. Gaining access to limited opportunities for business development, as well as the use of this resource, allows the enterprise to participate in advanced technological developments without conducting its own expensive scientific research.

Equipment and equipment resources. The enterprise acquires equipment that is necessary and available, based on available resources based on available financial, information technology and personnel capabilities.

Economic security of the enterprise (EBP) is the economic condition of the enterprise and the protection of its activities from both external and internal threats to ensure the stable functioning of the enterprise and its improvement. Functions of economic security:

1) forecasting, detection, prevention, mitigation of dangers and threats;
2) ensuring the security of the enterprise;
3) creation of a competitive environment;
4) liquidation of the consequences of damages.

Tasks of economic security of the enterprise:

- high liquidity indicators;
- detection of threats and threats;
- finding ways to prevent threats;
- finding means of ensuring the security of the enterprise;
- establishment of the security service of the enterprise;
- ensuring the competitiveness of the company's potential;
- creation of an enterprise management structure;
- monitoring of financial stability.

The financial component of the enterprise's economic security is directly related to working capital (hereinafter referred to as working capital), because working capital involves the movement of financial resources from the enterprise or to the enterprise (Figure 1).

In our opinion, this mechanism of movement of financial flows should be taken into account during the post-war recovery. In particular, in order to avoid inappropriate use of limited financial resources, we consider it necessary to

regularly monitor the economic security not only of the enterprise whose destroyed assets are being restored, but also of those business entities, in particular designers and contractors, directly involved in the revitalization process. And for this purpose, we offer a methodical approach, specially designed to account for military realities.

The continuous process of creating favorable conditions of activity under which the interests of the subject are realized and the goals set by him are realized, this is what ensuring the safety of the construction enterprise is. In order to achieve the highest level of economic security, the enterprise must monitor the provision of maximum security in terms of individual functional components of this system, as shown in the diagram (Figure 1).

All the listed functional components of economic security of the enterprise are characterized by their own content, methods of provision and a set of functional criteria.

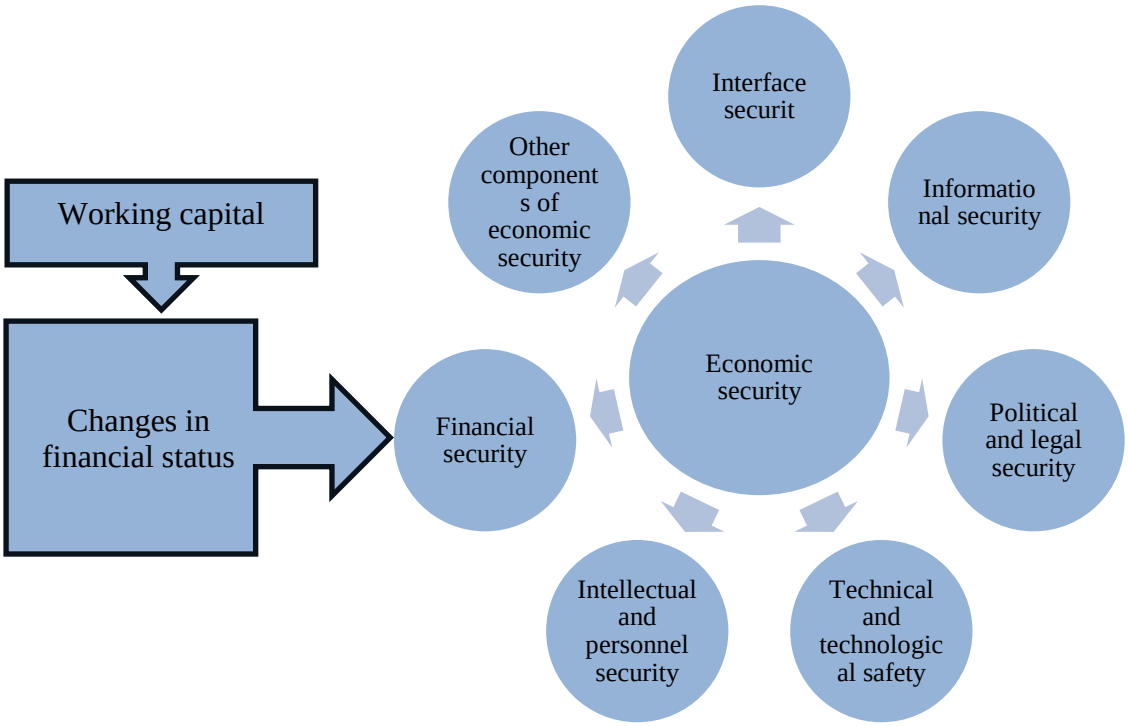

Figure 1. Scheme of influence of working capital on the financial component of the enterprise's economic security

Source: developed by the authors

Literature review. In Ukraine, many modern domestic scientists and specialists dealt with the economic safety of construction enterprises at certain time intervals, in particular: O. Belenkova [22, 23], O. Goyko [17], A. Hrytsenko, L. Husarova [1], Yu. Zapichna [22], K. Izmailova [18], K. Krikun, O. Rubtsova, L. Sorokina [17], S. Stetsenko [18], T. Tsyfra [21] and other scientists [5, 7, 11-15, 19, 20, 24, 25]. They performed a great deal of work in

the Monograph "Econometric tools for managing the financial security of construction enterprises". A theoretical and methodical analysis of the security of the country's national economy and construction enterprises was made. Diagnosis of the prerequisites, consequences, forms and methods of regulation of investment security at the macro- and micro-level was carried out. Attention is paid to the design of risk minimization algorithms at all stages of the investment and construction process, to the development of innovative models based on artificial intelligence for systemic countermeasures against the shortage of resource provision, debt and financial stability of contracting enterprises. The author's methodology for diagnosing the financial security of construction enterprises is proposed, as well as a complete set of criteria for the effectiveness of financial management of construction industry entities is substantiated [18]. But all their developments are intended for economic activity in peacetime. On the other hand, the need to restore the destroyed objects acutely arises even before the indisputable victory of Ukraine, so design and construction work has to be carried out now, simultaneously with the conduct of hostilities.

Article by Harkushi V. and Yershova N. investigated the historical course of awareness of the concept of "security". The main function of security within the modern discourse is determined by imbalances and dysfunctions in the process of functioning of the market economic mechanism. And the essential content of the category "security" in the field of science was also analyzed in order to establish a logical relationship between approaches to interpretation. The author's formulations of the essence of determining the economic security of an enterprise are systematized. Logical justifications are provided, and based on them, the author's definition of the term "economic security of the enterprise" is formulated as a result. The essence of this concept is revealed through "opportunity zones". They proceed from the fact that the economic security of the enterprise is a subjectively perceived state. It depends on the specific set of current threats to the enterprise. The proposed approach to understanding the economic security of the enterprise will further justify innovative methods of managing the economic security of the enterprise taking into account the areas of opportunity [4].

The analysis of research on the identification of risks and threats to the economic security of enterprises in the construction industry was carried out in their scientific works by such scientists as: Bolila N., Koba E., Volynets I., Dmytrenko V., Gordienko N., Azarova T., Zinenko K., Dyachenko K., Kovtunenko K., FilippenkovaO., Korobchynskyi O., Momot T., Pyryatynska I., Fedosova O., Chorna M., Mihus I. and others. (Table 1).

In our opinion, achieving the readiness of the economy to confront external and internal threats is one of the main tasks of managing the economy as a whole. The opinion about the need to ensure a high level of economic

development, which will allow to resist external and internal threats, in the specified definitions deserves a lot of attention.

Table 1. Analysis of studies on the identification of risks and threats to the economic security of enterprises in the construction industry

Author	Risks and threats to the economic security of construction enterprises
Volynets I.	Internal threats to the economic security of enterprises in the construction industry include: 1) increase in wear and tear of fixed assets of most construction enterprises; 2) inefficient management of assets and capital; 3) low competitiveness of construction products; 4) a long period of turnover of working capital; 5) incorrect sales policy; 6) uncertainty of goals; 7) unmotivated behavior of personnel; 8) low qualification of management personnel; 9) increase in personnel turnover. The author singles out the following as external threats: 1) political instability; 2) crisis state of the national economy; 3) high level of inflation; 4) imperfection of the current legislation; 5) lack of investments and quality domestic building materials; 6) development of the shadow sector in the field of construction; 7) exchange rate change; 8) energy dependence on other countries; 9) high level of credit rates; 10) low purchasing power of the population; 11) military conflicts, natural disasters; and so on. [3].
Dmytrenko V.	Summarizing the research of scientists, Dmytrenko V.I. identifies the following specific external and internal threats for enterprises in the construction industry: 1) causing damage to the construction object, equipment, deterioration of goods and material values; 2) the threat of marriage; 3) causing harm to personnel; 4) corrupt relations during the distribution of state orders; 5) commercial bribery when receiving orders; 6) unfair competition; 7) intensifying competition; 8) monopolization of the market by large construction companies [6].
Bolila N.	Bolila N. adds the following to this list: internal threats (risky financing policy; seasonal fluctuations in the construction sector; simple equipment; decrease in the quality of personnel potential). As well as external threats (weak technical regulation; crisis state of the national economy; decrease in the quantity and quality of labor resources; irregular supply, high price level, improper performance of contracts by suppliers, rupture of contractual relations by Customers) [1].
Kovtunenko K. and Filippenkova O.	In addition, unqualified accounting and unqualified auditing are identified as threats specific to construction enterprises.
Koba O.	Koba O. reveals the urgent issues of ensuring the economic security of the construction industry of Ukraine in the conditions of martial law. In her work, measures are indicated to strengthen the economic security of operating construction enterprises in timely conditions. Challenges and threats to the economic security of the construction industry of Ukraine related to the military situation are identified. The damage caused to the economy of Ukraine since the large-scale invasion of Russia was analyzed [10].
Mihus I.	Mihus I. analyzes a set of interdependent elements that allow managing the activities of a joint-stock company by minimizing the impact of internal and external threats on it and achieving its strategic goals [26, 27, 28].

Source: developed by the authors

The issue of economic security of enterprises, including construction enterprises, was not neglected and explored in their works by young scientists: Matsapura O., Ryzhakova G., Novak Y., Kalashnikov D., Zeltser R., Dubinin D., Vakhovich I., Dub B., Reznik M., Shevchenko Yu., Molodid O., Karpova K., Barabash N. and many others, whose scientific works also deserve attention [21, 22, 29, 30, 31].

It should be noted that, while paying tribute to the authors of scientific works, the results of which contributed to the process of establishing the economic security of economic entities as a science, unfortunately, the issue of the features of the construction of the system, which includes the economic security of enterprises in the construction industry, has not been studied in depth enough. Therefore, our goal is a thorough study of the essence and features of building a system of economic security of construction enterprises in Ukraine.

In a number of monographic works, publications, training manuals, methodological recommendations, dissertations, such topics as: - the management system of the enterprise, in particular the construction one, are considered in great detail; - organizational structure of the enterprise; - accounting; - managerial accounting; - audit; - risk management; - internal control; - controlling and other topics.

In most cases, they are considered without taking into account the need to ensure the economic security of the entire complex complex, which are modern enterprises. Specialists in the relevant fields in practice have to face the problem of ensuring economic security in one way or another. This is evidenced by the experience of the authors of scientific works. In the works of the mentioned authors, insufficient attention is paid to the industry specifics of ensuring the economic security of construction enterprises. In connection with the small presence of methodical developments that take into account organizational and management aspects and branch specifics of the activity of construction enterprises, it is difficult to solve a number of practical issues of ensuring economic security.

Different interpretations of the term "system of economic security of a construction enterprise" confirm the diversity of views of modern scientists on the essence of the concept. The issue of the essence and composition of the enterprise's economic security system does not have a clear universal formulation and has not yet found a final solution. Today, during the wartime, all these issues are difficult to solve, the country has suffered huge economic losses, in particular, design and construction enterprises.

Abroad, the problem of security of enterprises is traditionally given more importance, because in developed foreign countries, the experience of managing in the conditions of a market economy is much richer. The study of economic security is devoted to the work of such foreign scientists as: Arvai Ya., Blades D., Gutmann P., Dallago B., Feig E. and others [24, 33]. The following scientists have devoted their works to the study of theoretical issues of the

shadow economy: Blaydes D., McAfee K., Dallago B., Kazimier V., Lüttikhausen R., Frenz A., Gutmann P., Contin B., Kassel D. Research staff of the center Institute for International Governance Innovation (CIGI) Dan Ciuriak and Patricia Goff examine the relationship between Canada's domestic innovation and international trade and investment in their published paper, Economic Security and the Changing Global Economy. These include developing better indicators to assess the impact of Canada's trade agreements on innovation performance. Canada's position in the global economy is affected by rapid and disruptive global change. All over the world, these events made the economic dimension of national security and national economic security important topics of political debate [25].

Considering that the most economically independent countries in terms of GDP ($ million) are the USA - 20,494,100.00; China - 13,608,151.86; Japan - 4,970,915.56; Germany - 3,996,759.29; Great Britain - 2,825,207.95; France - 2,777,535.24; India - 2,726,322.62; Italy - 2,073,901.99; Brazil - 1,868,626.09; Canada - 1,712,510.03, then their experience in forming the economic security management mechanism is of particular interest for the construction of the Ukrainian management system. The analysis of existing foreign approaches to the definition of economic security demonstrates that simultaneously with its theoretical understanding, the mechanism of state management was formed and state economic strategies were developed. Depending on the continent, global integration processes and the mentality of the population, the specifics of economic development and priorities of national interests, the positions of countries in the sphere of ensuring economic security differ. Economies of the world are fundamentally different. Having its own idea of the final result and ways to achieve it, each state conducts its own policy. GDP indicators make it possible to compare whose policies are more successful and, accordingly, more correct. As we can see, the most developed and strongest economy in the world is in the United States of America. A stable increase in GDP is observed due to their influence on the world and the politics of countries. Demonstrating the real miracles of economic movement and development in recent decades, China is rapidly catching up with the United States. It can be understood that the development of the state depends on competent administrative management [16]. Such an example can be Japan - a country with high discipline and industriousness of its citizens, which made it possible to raise the economy to such a high level, to achieve great success in the field of technology and production. Modern leader Suzuki Kazuto in his article "The Kishida Fumio Government's Economic Security Strategy: Primarily a Toolkit of 'Defense'?" [8] draws our attention to the draft Law on Ensuring Economic Security for 2022, which is being submitted to lawmakers by the Cabinet of Ministers under the leadership of Prime Minister Kishida Fumio, making the Law a top priority. An important task for 2022, the Cabinet of Ministers of Japan announced the adoption of the legislative framework for strengthening measures to ensure

economic security. Kobayashi Takayuki, Minister for Economic Security, is a central figure in this work. The Kishida government's economic security strategy focuses on turning things around for the better where there are gaps in the Japanese system. And that's first of all. It is equally important for Japan to deserve to be recognized as a responsible member of the international community by other countries. In terms of introducing the appropriate system, Japan is trying to catch up with Western countries [8].

Richard and Susan Hayden Academy Fellow Theo Beale noted in his article, Economic Security - The Need for Renewed Global Efforts: There is a need for transparency and exchange of information between like-minded countries regarding their specific definitions of economic security and the strategic policies that underlie it. And this is the first step on the way to significant international cooperation in the field of economic security [2].

The analysis of modern domestic and foreign literature on the economic security of construction enterprises and the results of research allow us to conclude that there is no consensus among economists regarding the definition of the essence of economic security and its constituent elements. Without the creation of an effective mechanism for ensuring the economic security of the state, the further development of market relations is generally impossible.

Investment and construction activity is a key link in matters of ensuring improvement of people's quality of life, creation of a favorable production climate and acceleration of scientific and technical progress (STP) in a number of branches of material production. Without this, reproduction at a new, higher innovative level is impossible. The investment process in construction includes continuously repeating investment cycles: the birth of an idea, its implementation, and the achievement of specified project performance indicators. Economic security in the conditions of digitalization will receive special attention due to the fact that with the improvement of advanced technologies, it makes us more vulnerable. Digital media accompany the movement of real assets, the essence of production and social economic relations is changing. In these conditions, various abuses in the economy will be traced, the termination of which should be dealt with by specialists in economic security, and their services will be more and more in demand over time. In order to improve the methodical provision of economic security monitoring, we have proposed the following approach. Firstly, due to the need for its systematic analysis, an integral indicator should be used, which can be compared at different points in time. At the same time, we recommend checking the level of economic security according to this indicator at least once every 6 months. Secondly, the integral indicator should summarize all the components of economic security shown in fig. 1. However, despite the schematic representation in the form of equal segments of a circle, each of the components must be considered with the appropriate level of significance in the overall result. In turn, the significance is determined by the specifics of the operational

activities of enterprises participating in the revitalization process. Thus, for the Designer, who begins the restoration process, the economic security from Figure 1 should be arranged as follows:

1. Intellectual and personnel security as a result of the project being created is an intangible asset.

2. Financial security as a source of life-giving resources.

3. Information security, because the development of restoration projects requires taking into account all modern requirements for buildings, materials, structural products, and the cost of resources.

4. In our opinion, the technical-technological, interface and political-legal components are equivalent due to the objective need to preserve the business reputation and the ability of the project enterprise to adapt to the economic environment.

The given list is, in fact, a ranking of safety components, which allows applying the Fishburn weighting formula to justify the importance of individual components:

$$\alpha_j = \frac{2 \cdot (m - \bar{j} + 1)}{m \cdot (m+1)}, \quad (1)$$

where m is the number of components for which the weighting factor is determined, in this study it is the number of safety components; — rank number, that is, the position of a certain component in the overall ranking.

The method of using this formula for monitoring the economic security of a subcontractor is presented in Table 2.

Table 2. Evaluation of the importance of components of economic security

An integral component of economic security	Rank number	Weight calculation (1)	Validity, α
1. Intellectual and personnel security	1	$\frac{2 \cdot (5 - 1 + 1)}{5 \cdot (5+1)} = 0{,}333$	α_{ik}=0,333
2. Financial security	2	$\frac{2 \cdot (5 - 2 + 1)}{5 \cdot (5+1)} = 0{,}267$	α_{f}=0,267
3. Information security	3	$\frac{2 \cdot (5 - 3 + 1)}{5 \cdot (5+1)} = 0{,}200$	α_{i}=0,200
4.a Technical and technological safety	5=(4+5+6)/3	$\frac{2 \cdot (5 - 5 + 1)}{5 \cdot (5+1)} = 0{,}067$	α_{tt}=0,067
4.b Interface security	5=(4+5+6)/3	$\frac{2 \cdot (5 - 5 + 1)}{5 \cdot (5+1)} = 0{,}067$	α_{if}=0,067
4.c Political and legal security	5=(4+5+6)/3	$\frac{2 \cdot (5 - 5 + 1)}{5 \cdot (5+1)} = 0{,}067$	α_{pl}=0,067

Source: developed by the authors

From Table 2, it is noteworthy that the last three components have related ranks, that is, the same value, which corresponds to the averaging of the item numbers, which could be in the case of political and legal inequality , interface and technical-technological component.

Third, the proposed weighting factors should be applied to relative safety assessments, which should be determined by experts. Usually experts from economic security should be involved in the composition of expert groups. In our opinion, a 3-point rating system should be used: 1 - unsatisfactory security status, 2 - satisfactory security status, 3 - sufficient security status. As a possible option for the substantiation of the specified points, there may be an accounting of the number of threats in relation to each component of security. The set of factors that constitute threats, as well as their strength, which affects the score, should be determined by experts in economic security.

Thus, in order to calculate the integral indicator of economic security (ES), estimates of 1 or 2 or 3 points must be multiplied by the corresponding weighting factors (table 2) and find the sum of the resulting works:

$$ES=0,333 \cdot Xip+0,267 \cdot Xf+0,2 \cdot Xi+0,067 \cdot Xtt+ 0,067 \cdot Xif+0,067 \cdot Xpl, \quad (2)$$

where Xip, Xf, Xi, Xtt, Xif, Xpl are point estimates according to the intellectual and personnel, financial, informational, technical-technological, interface, political-legal component of economic security.

Discussion. The economic security of a complex system is based on the foundations of economic independence, the stability of the economic system as a whole and all its elements, the ability of the system to self-develop, the constant maintenance of a high level of self-sufficiency of the economy, inseparability from the process of economic growth. All these signs of economic security are inextricably linked with the investment security of economic systems. The decisive role in the process of growth of the national economy is played by enterprises of the investment and construction complex, whose activities ensure the creation of new production facilities, the installation of technological equipment, and its commissioning. In turn, high-quality and timely execution of construction works requires adequate capital equipment of contractors, which can be achieved in conditions of financial stability, economic stability and sufficient investment potential. Since the investment security of the national economy is possible only with the investment security of each individual construction enterprise, the problem of identifying threats of loss and the mechanism of restoring the latter is an urgent task of economic science [22]. In the case of a military situation, previously existing methods must be reviewed for suitability in a VUSA environment. In this, it is advisable to use the above methodical approach. Also, the prospects for further research in this

direction are the substantiation of the methods of determining point estimates of the components of economic security.

Conclusion. The state of protection from the negative impact of external and internal threats, destabilizing factors, which ensures the sustainable implementation of the main economic interests and goals of the design and construction enterprise — this is what the economic security of the enterprise is. The article is devoted to topical issues of ensuring the economic security of the construction industry of Ukraine in pre-war and military conditions. The risks and threats posed to Ukraine's economy since the large-scale invasion of Russia have been analyzed. In order to quickly restore and ensure the economic growth of the country's economy, the problems of construction enterprises, which require urgent solutions, have been identified. Measures to strengthen the economic security of operating construction enterprises in modern conditions are indicated, taking into account destroyed infrastructures, insufficient financial resources, loss of logistics connections, demand, suspension of many enterprises, reduction of labor potential, solvency of the population. It is expedient to formulate regulations concerning the necessary changes in the policy of business entities in the construction industry, and to substantiate the factors affecting the assessment of economic security. This contributes to increasing the stability of the economic security of this industry. The development and implementation of a complex system for ensuring the economic security of enterprises will allow to qualitatively influence the general financial condition of a specific project or construction enterprise. This will have a positive effect on the activities of the enterprise itself and will affect the recovery of the country's economy as a whole. Various abuses and their preventive measures in the economy will be dealt with by economic security experts in the future. Over time, their services will be more and more in demand. The search for ways to restore Ukraine has begun. In some regions of the country, the activities of design and construction enterprises have been resumed. In the process of recovery of the country, the role of the construction industry is crucial. Elimination of the consequences of the destruction of the country will give impetus to the development of all industries involved in construction. This will lead to the rapid development of the construction sector and requires the development of a mechanism for the implementation of measures necessary for development.

In the article, we proposed an approach for improving the methodical provision of economic security monitoring:

1) due to the need for its systematic analysis, an integral indicator should be used, which can be compared at different points in time;

2) the integral indicator should summarize all components of economic security;

3) the proposed weighting factors should be applied to relative safety assessments, which should be determined by experts.

For the suitability of the VUSA environment under the conditions of martial law, it is necessary to review the previously existing methods, which should become the subject of further research.

Author contributions. The authors contributed equally.

Disclosure statement. The authors do not have any conflict of interest.

References:

1. Bolila N.Y., Husarova L.V., Classification and systematization of threats to the economic security of construction enterprises. Ways to increase the efficiency of construction in the conditions of the formation of market relations. Kyiv. 40. 2019. https://core.ac.uk/download/pdf/322454275.
2. Bill T., Economic security - the need to renew global efforts, 2022.
3. Volynets I., Classification of threats and ways to ensure the economic security of construction enterprises. Scientific notes of the Lviv University of Business and Law. http://dx.doi.org/10.5281/zenodo.3900558.
4. Harkusha V.O., Yershova N.Yu., Theoretical and methodological principles of the formation of economic security of the enterprise. Black Sea Economic Studies. 2018. 27(1). Z. 106-112. (Date of application: 26.06.2021). URL: http://nbuv.gov.ua/UJRN/bses_2018_27%281%29__23.
5. Victoria Garkava, Alina Klishchevska, Formation and implementation of the concept of economic security in the management of the economy of the region, Economic Analysis, Volume 31. No. 2. 2021 From 14 to 24.
6. Dmytrenko V., Threats to the development of enterprises in the construction industry: theoretical aspect. Agromir. 11, 2020. Doi: 10.32702/2306-6792.2020.11.136.
7. Zaichko I.V., Financial stability of enterprises as a tool for realizing financial security "Young Scientist" 10 (74), 2019. KNUKiM pp. 651-656.
8. S. Kazuto, The economic security strategy of the Kishida Fumio government: primarily a toolbox of "defense"?, 2022. https://www.nippon.com/ru/in-depth/a07901/.
9. Kovtunenko K., Filippenkova A., Specific types of threats and features of the organization of ensuring financial and economic security of construction enterprises. V MNPIK Problems of the Market and Development of the Regions of Ukraine in the XXI Century, Odesa, 2014, p. 10-12, p. 20-22. https://economics.net.ua/files/science/ipreed/2014/t2/20.pdf.
10. Koba E., Economic security of the construction industry in the conditions of challenges and threats of martial law, J. Economy and Society 42 (2022). Doi: https://doi.org/10.32782/2524-0072/2022-42-9.
11. Korobtsova D., Legal provision of the financial security of the state under martial law, Report Analytical and comparative jurisprudence Section V. (2022) 141-146. Doi: https://doi.org/10.24144/2788-6018.2022.02.27.
12. Lytovchenko O., Ilyashenko O., Gordienko M., Stages of strategic planning of economic security of the enterprise. Economic Analysis, Volume 31, 2, 2021. Doi https://doi.org/10.35774/econa2021.02.98.
13. Lishenko O. M., Analysis of the financial stability of the enterprise as an element of ensuring the financial stability of the enterprise. Herald of Cherkasy University. Series: Economic Sciences. 2018. 2. P. 49-57.
14. Melnyk S., Management of financial security of enterprises: theory, methodology, practice, Lviv, 2020. ISBN 978-617-7864-31-7.
15. Osidach O.B., Sarnavskyi B.O. Financial security of small business: realities and problems "Young Learning" No. 10 (74) October, 2019. P. 692 - 696.) October, 2019) DOI: https://doi.org/10.32839/2304-5809/2019- 10-74-145.
16. Rating of the economy of the developed countries of the world, 2023. https://visasam.ru/emigration/vybor/ekonomika-stran-mira-2.html.
17. Sorokina L.V., Goyko O.F. Study of threats to investment security of construction enterprises. Construction production magazine, Kyiv. 2016. No. 61/2. - P. 10 - 21. P.
18. Sorokina L., Goyko O., Stetsenko S., Izmailova K., Econometric tools for managing the financial security of a construction enterprise. Monograph. Kyiv. KNUBA 2017. Bibliography P. 373 – 398. Kryvyi Rih. Publisher of FOP Chernyavskyi D.O. 2017. - 404 p. ISBN 978-617-7553-53-2.
19. Trots I.V. Ensuring economic security at the enterprise in order to prevent bankruptcy. Access mode: https://www.science-community.org/system/files/Trots.
20. Yurovych L. Economic security of the enterprise: essence, influencing factors, main problems. [Electronic resource]. (Yurovich, L. Economic security of enterprise: nature, factors of influence, main problems. Access mode: http://ena.lp.edu.ua:8080/bitstream/ntb/4894/1/95.pdf).
21. Shevchenko Yu., Bolila N., Tsyfra T., Effective use of working capital of the construction enterprise as a factor of economic security, Zh. Ways of increasing the efficiency of construction in the conditions of the formation of market relations 44 (2020). Doi: https://doi.org/10.32347/2707-501x.2020.44.133-146.
22. Bielienkova O., Novak Y., Matsapura O., Zapiechna Y., Kalashnikov D., Dubinin D. (2022). Improving Organization and Financing of Construction Project on Means of Digitalization, International Journal of Emerging Technology and Advanced Engineering, 12(8). Doi: 10.46338/ijetae0822_14.

23. Bielienkova O., Stetsenko S., Oliferuk S., Sapiga P., Horbach M., Toxanov S., Conceptual model for recognition of company competitiveness based on depth of logic: social and resource factors. *IEEE International Conference on Smart Information Systems and Technologies (SIST)*, 2021, pp. 1-5, Doi: 10.1109/SIST50301.2021.9465923.
24. Bijan P. Karimi, Security and prosperity: reexamining the relationship between economic, domestic and national security, J. NPS NDSC, Monterey, California, 2015, p. 157. https://www.hsaj.org/articles/8069.
25. Ciuriak D., Goff P., Economic Security and Changing Global Economy, J. RCNSS, 8 https://www.cigionline.org/static/documents/NSS_Report8_sS8s9ak.pdf.
26. Mihus, I. (2022). Corporate management evaluation tools in joint stock companies under economic uncertainty conditions, The economics of uncertainty: content, evaluation, and regulation: collective monograph, Tallinn, SCIR OU. Doi: https://doi.org /10.36690/EUCER-99-112.
27. Mihus, I., & Melko, L. (2022). Economic security system management of travel industry: making management decisions in crisis conditions. *Economics, Finance and Management Review*, (4), 96–102. https://doi.org/10.36690/2674-5208-2022-4-96.
28. Shemayeva, L., Hladkykh, D., Mihus, I., Onofriichuk, A., Onofriichuk V. (2021) Informational and Methodological Approach to Ensuring the Economic Security of the State in the Banking Sphere. IJCSNS International Journal of Computer Science and Network Security, VOL.21 No.12, December 2021.https://doi.org/10.22937/IJCSNS.2021.21.12.66.
29. Zeltser, R. Ya. Digital Transformation of Resource Logistics and Organizational and Structural Support of Construction. Science and Innovation. 15 (5). 38-51. (2019).
30. Ryzhakova H. V. et. "Modern structuring of project financing solutions in construction", 2022 IEEE International Conference on Smart Information Systems and Technologies (SIST), 2022.
31. Reznik, N., Ijaz, Y., Kushik-Strelnikov, Y., Barabash, N., Stetsko, M., Bielienkova, O.: Systems Thinking to Investigate Archetype of Globalization. Springer International Publishing https://doi.org/10.1007/978-3-031-08087-6_9 (2022).
32. Project Plan vidnovlennia Ukrainy [Draft Plan for Recovery of Ukraine] / Natsionalna rada z vidnovlennia Ukrainy vid naslidkiv viiny – national collective for the reconstruction of Ukraine in Consequences of the War, 2022. URL: https://www.kmu .gov.ua /storage/app/sites/1/recoveryrada/ru/functioning-of-the-financial-system.
33. Y. Fernando, M. Shaharudin, A. Abideen, Circular economy-based reverse logistics: dynamic interplay between sustainable resource commitment and financial performance, European Journal of Management and Business Economics, 2022, https://doi.org/10.1108/ - 08-2020-0254.
34. NSDC approved, Zelenskyi signed. The Economic Security Strategy until 2025 was implemented in Ukraine On August 11, 2021; President Volodymyr Zelenskyi signed a decree that implemented the decision of the NSDC on the Economic Security Strategy of Ukraine for the period until 2025.
35. Bielienkova O., Moholivets A., Loktionova Y. Measurement of the level of economic security of enterprises by the indicator of the attractiveness for hostile takeovers. *Baltic Journal of Economic Studies*, 2021, 7(5), 29-40.

CHAPTER 2
DEVELOPMENT OF FINANCE, ACCOUNTING AND AUDITING

FINANCIAL ASPECTS AND FINANCIAL RISK DISCLOSURE: EVIDENCE FROM VIETNAM

Hong Duc Bao[1]

[1]*Ho Chi Minh City Industry and Trade College (HITC), Ho Chi Minh City, Vietnam, e-mail: hongducbao@hitu.edu.vn*

Citation:
Hong Duc Bao. (2023). Financial aspects and financial risk disclosure: evidence from vietnam. *Economics, Finance and Management Review*, (3), 39–48.
https://doi.org/10.36690/2674-5208-2023-3-39-48

Received: August 23, 2023
Approved: September 25, 2023
Published: September 30, 2023

Abstract. *This study delves into the dynamic relationship between profitability, liquidity, and financial risk disclosure within the context of the Vietnamese business landscape. Employing a comprehensive dataset spanning the period from 2011 to 2020, encompassing 350 publicly listed companies, we scrutinize the intricate interplay of these critical financial factors. Our investigation reveals significant insights into the influence of profitability and liquidity on the extent of financial risk disclosure by Vietnamese listed firms. Through rigorous statistical analysis and econometric modeling, we establish a clear and robust link between these variables. The findings underscore the pivotal role played by profitability and liquidity as determinants shaping the propensity of firms to disclose information pertaining to their financial risks. As Vietnam's financial landscape continues to evolve and integrate within the global economy, the implications of our research offer valuable insights for regulators, investors, and corporate decision-makers alike. By shedding light on the nuanced relationship between profitability, liquidity, and financial risk disclosure, this study contributes to a deeper understanding of the mechanisms that underpin corporate financial reporting practices in an emerging market context. In essence, this research adds a significant layer of knowledge to the discourse surrounding financial risk disclosure, offering both theoretical and practical insights that contribute to the advancement of corporate governance, risk management, and financial reporting practices.*

Keywords: *financial aspect, financial risk, Vietnamese listed firms.*

JEL Classification: G11, G14, G15, G20, O53

Formulas: 1; fig.: 0; tabl.: 3; bibl.: 41

Introduction. Risk disclosure involves the deliberate endeavor to elucidate and communicate to stakeholders the risks that have been effectively addressed, as well as the strategies devised to oversee potential future risks. The act of disclosing risks assumes significance due to its role in imparting insights into how organizational leadership navigates these risks and the consequent implications for the company's ongoing viability. Effective risk management necessitates the development of a well-crafted approach, which encompasses a cohesive array of analyses, principles, strategies, justifications, and measures, aimed at providing adept responses to formidable high-risk situations (Almustafa et al., 2023; Elamer et al., 2020; Knechel & Willekens, 2006; Nguyen, 2023a, Nguyen 2023b). A company's proficiency in risk management can serve to mitigate the repercussions emanating from these risk factors.

Risk disclosure is very important for listed firms. Risk disclosure plays a pivotal role for listed firms, serving as a cornerstone of transparent and responsible corporate governance. By openly communicating potential risks and uncertainties, listed companies provide investors, shareholders, and stakeholders with a comprehensive understanding of the inherent challenges they face. This transparency fosters trust and confidence in the company's operations, enabling investors to make well-informed decisions. Informed stakeholders can assess the potential impact of these risks on the company's financial performance and strategic direction, thereby facilitating more accurate risk assessment and effective risk management. Moreover, robust risk disclosure aids in compliance with regulatory requirements, ensuring the company's adherence to legal obligations and safeguarding against potential legal liabilities (Balachandran et al., 2020; Dang et al., 2020; Dang & Nguyen, 2021a). Overall, risk disclosure enhances accountability, strengthens investor relations, and contributes to the company's long-term sustainability in the competitive landscape of the capital markets.

Furthermore, effective risk disclosure directly influences a listed firm's access to capital and market perception. Investors and lenders seek comprehensive and accurate information to evaluate risk-return trade-offs before committing resources. Transparent risk disclosure not only attracts a broader range of potential investors but also bolsters investor confidence in the firm's ability to manage challenges. This, in turn, can lead to a more stable shareholder base and improved access to capital for growth and strategic initiatives. Beyond financial implications, risk disclosure encourages proactive risk management by necessitating a thorough evaluation of potential threats. This process empowers management to formulate and implement robust strategies that minimize the impact of identified risks, ultimately enhancing the firm's resilience and adaptability in an ever-evolving business environment (Abid et al., 2021; Dang & Nguyen, 2021a).

The guidelines pertaining to the disclosure of risks are outlined in IFRS 7, which pertains to the revelation of information related to financial instruments.

This standard mandates companies to unveil financial particulars to facilitate shareholders' assessment of the nature and magnitude of risk associated with a financial instrument. The disseminated financial details encompass both qualitative and quantitative disclosures. Under qualitative disclosure, companies are obligated to unveil their risk exposure, delineate the origins of risks, expound on objectives, elucidate risk management strategies and procedures, and outline methodologies for measurement. In contrast, quantitative disclosure necessitates companies to divulge at a minimum the credit risk, liquidity risk, and market risk, including the conduct of sensitivity analyses for each risk category. The aim of IFRS 7 is to enhance transparency within the banking system, contending that amplified revelation of financial risks tends to diminish the degree of uncertainty, thus conferring benefits upon investors and aiding firms in the more effective allocation of resources.

Literature review. Agency theory delineates the contractual rapport existing between the principal and the agent (Al-Hadi et al., 2016; Dang et al., 2022; Ho et al., 2023). This contractual framework elucidates the entitlements and duties binding the principal and the agent. The principal assumes the role of an overseer, conferring authority upon the agent to make optimal judgments for the benefit of both the agent and corporate management (Jensen 1993). The interplay between the principal and the agent can lead to a conflict termed agency conflict. Agency conflict arises when discrepant interests and information asymmetry persist between the principal and the agent (Ettredge et al., 2011; Lang & Lundholm, 1993; Nguyen & Dang, 2020; Nguyen, 2020). Instances of conflicting interests emerge when management, entrusted with the responsibility of steering corporate affairs, veers away from the principal's interests. The principal seeks to maximize profits, while the agent seeks to satisfy personal economic and psychological needs (Nguyen, 2021, 2022c). Another facet of agency conflict surfaces from management's superior comprehension of the company compared to shareholders (Dang & Nguyen, 2021a, 2021b), engendering information asymmetry stemming from disparities in information acquired by management (the purveyors of information) and shareholders (the consumers of information).

The agency theory concept forms the bedrock for comprehending risk disclosure practices, illuminating how management furnishes information to users via the provision of dependable data. The primary objective of risk disclosure is to mitigate information asymmetry between the principal and the agent (Nguyen, 2021, 2022c). As the entity endowed with a more comprehensive grasp of the company's status, management should institute risk disclosure by furnishing pertinent information to substantiate the agent's actions align with the principal's interests. The data disseminated by corporate management assumes a paramount role in shaping investment decisions.

As stated by Nguyen (2022b), signal theory elucidates how an enterprise can shape stakeholders' impressions, cultivate a competitive edge, and bolster its

overall corporate perception. Companies employ signal theory to elucidate how financial reports are leveraged to convey favorable or adverse messages to parties with vested interests. Within the domain of risk disclosure, signal theory finds application in expounding how management communicates information to stakeholders concerning the company's encountered risks. This serves as a means to convey the underlying quality of the company's risk management to external entities, signaling the company's adeptness in safeguarding and augmenting value for its investors (Dang & Nguyen, 2022; Nguyen, 2022a, 2022d).

Profitability garners significant attention from potential investors and shareholders, given its connection to share prices and dividend payouts. The extent of achieved profitability often influences the breadth of a company's risk disclosure practices, as it seeks to assure stakeholders of its adeptness in capital utilization. Enhanced profitability is frequently indicative of proficient management (Colbert & Jahera Jr, 1988; Nguyen & Dang, 2022a; Saltaji, 2013). Enterprises operating from a position of profit are more inclined to unveil a greater volume of information, substantiating their performance to captivate the interest of investors, creditors, and other stakeholders. Among these disclosures, risk disclosure stands out, with companies proficient in risk management reaping superior advantages and showcasing their managerial competence (Jiraporn et al., 2008; Jizi et al., 2014; Nguyen & Dang, 2022b, 2023; Nier, 2005; Watts & Zimmerman, 1983). In this study, the researchers gauge profitability through the employment of the Net Profit Margin (NPM) formula.

Numerous investors, creditors, and governmental bodies closely monitor a company's ability to ensure its viability, with liquidity serving as a pivotal metric in evaluating susceptibility to insolvency (Haniffa & Cooke, 2002; Roberts, 2005; Wu & Bowe, 2010). This inclination prompts companies to expand their disclosure practices to engender stakeholder confidence. The divulgence of such risk-related details can yield advantages for the company, notably in attracting fresh potential investors.

A company's financial performance is enhanced with higher levels of profitability. Increased profitability has the potential to yield substantial returns for investors (Ashfaq & Rui, 2019). Knechel and Willekens (2006) research outcomes indicate a notable impact of profitability on the disclosure of risks. According to agency theory, when profitability levels are elevated, company executives are more inclined to provide comprehensive risk-related information and extensive risk management details within their annual reports. This disclosure serves the purpose of minimizing information imbalances between management and stakeholders, while also elucidating managerial accomplishments to shareholders. Demonstrating effective risk management, as demonstrated by Forker (1992), instills stakeholder confidence in the company's sustainability, thereby potentially translating into increased remuneration for

management based on performance (Ettredge et al., 2011; Knechel & Willekens, 2006).

Liquidity stands as a metric utilized by both investors and governmental bodies to assess a company's capacity for sustained viability, while also serving as a crucial gauge in appraising the risk of bankruptcy (Chang et al., 2017; Chebbi et al., 2021; Hassan et al., 2019; Zona, 2012). This circumstance incentivizes management to extend the scope of risk information disclosure to engender stakeholder confidence. In line with signal theory, liquidity levels serve as a noteworthy indicator for stakeholders, particularly investors, in their deliberation of investment choices. The extent of liquidity serves as a reliable indicator for stakeholders, signifying the company's adeptness in managing corporate debt in contrast to enterprises with lower liquidity. Management's propensity to disclose an increased amount of risk-related information correlates with higher liquidity ratios. This practice is rooted in the aim of showcasing their prowess in navigating liquidity risk, particularly when juxtaposed with firms possessing lower liquidity ratios. Furthermore, this effort seeks to furnish stakeholders with a comprehensive account of the company's circumstances.

Aims. The purpose of the paper is to investigate the dynamic relationship between profitability, liquidity and financial risk disclosure in the context of the Vietnamese business environment.

Methodology. The study was carried out focusing on mining firms that are publicly listed on the Vietnamese Stock Exchange. The subsequent section provides a description of the variables that were employed in the research.

The model that we use as follow:

$$FRD = \alpha_0 + \alpha_1 PRF + \alpha_2 LID + \alpha_i Control \qquad (1)$$

Table 1. Definitions of Operational Variables

Variable	Measurements
Profitability	Profit After Tax/Sales
Liquidity	LID=Current Assets/ Current Liabilities
Board of commissioner's size	$\sum$ Board of Commissioners
Audit committee	$\sum$ Audit Committee
Financial risk disclosure	The calculation of FRDI items uses a dichotomous approach, namely by giving a value of 1 to items that are disclosed and 0 if they are not disclosed. Each item will be added up to get the total number of FRDIs for a company. The following is the formula for calculating the FRDI variable used: FRDI = Number of Disclosure Items/Total Financial Risk Disclosure Items

As per Amran et al. (2017), various criteria are employed to determine if the provided information qualifies as a risk disclosure statement. This entails informing the reader about potential opportunities, hazards, losses, and threats that have affected or could potentially impact the company in the future. It also encompasses the management of each opportunity, potential, threat, or exposure to potential losses. A disclosure is not categorized as a risk disclosure if it lacks specificity. Moreover, each instance of reiterated disclosure is presented as a distinct sentence each time it is elucidated. The presentation of risk disclosures can encompass positive risks, negative risks, or uncertainties.

Results and discussion. Table 2 present the descriptive statistics. Descriptive statistics have the objective of furnishing an encompassing portrayal of a data variable employed in this study. This is achieved through an examination of key summary measures including mean, maximum, minimum, and standard deviation values. Presented below are the outcomes derived from the analysis of descriptive statistics.

Table 2. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Profitability	472	0.001	13.971	0.229	3.232
Liquidity	472	0.214	8.216	1.931	1.431
Board of Commissioners Size	472	4.000	12.000	5.23	1.612
Audit Committee Size	472	3.000	9.000	3.11	0.211
Financial Risk Disclosure	472	0.209	0.491	0.299	0.148

Our study delved into the intricate relationship between Profitability and financial risk disclosure within the context of Vietnamese listed firms and estimation results are presented in Table 3. Through meticulous analysis and examination, we unearthed a notable finding: Profitability, rather intriguingly, exhibited a tendency to curtail the extent of financial risk disclosure. This discovery challenges conventional assumptions and warrants careful consideration. At first glance, one might anticipate that higher Profitability would be associated with greater transparency in risk disclosure, as a robust financial position might ostensibly imply a company's capacity to manage risks adeptly. However, our findings suggest an alternative narrative. It appears that firms with elevated Profitability levels might perceive a reduced need to extensively disclose financial risks, possibly due to a sense of resilience stemming from their financial strength. This intriguing phenomenon prompts us to question whether the perception of lower vulnerability, stemming from higher profits, might inadvertently lead to a reduction in perceived disclosure requirements. This raises important considerations for both practitioners and researchers alike, urging a deeper exploration into the nuanced interplay between financial health, perceived risk exposure, and the extent of risk disclosure.

In conclusion, our research offers a novel perspective on the relationship between Profitability and financial risk disclosure, revealing a counterintuitive pattern where higher Profitability is associated with reduced disclosure. As we navigate the implications of this unexpected result, we encourage further investigation into the underlying mechanisms at play. This finding holds potential implications for corporate disclosure practices, investor decision-making, and regulatory frameworks, highlighting the need for a nuanced understanding of how Profitability interacts with risk communication strategies in the dynamic landscape of listed firms.

Table 3. Estimation Results

Model	Coeff	t	Sig.
(Constant)	1.235	3.971	0.000*
Profitability	-0.358	-2.064	0.001*
Liquidity	0.458	0.606	0.001*
Board of Commissioners Size	0.235	0.377	0.305
Audit Committee Size	0.235	2.717	0.000*

In addition, we find that liquidity appears to have a positive association with the extent of financial risk disclosure. This finding, which may initially appear counterintuitive, demands a thoughtful examination to unravel its underlying implications.

On the surface, the connection between higher liquidity and increased financial risk disclosure might appear perplexing. One might surmise that companies with greater liquidity, bolstered by their enhanced ability to meet financial obligations, would potentially perceive lower risk exposure. However, our study suggests an alternative interpretation. It is plausible that companies endowed with ample liquidity might adopt a proactive stance, recognizing the importance of transparently communicating their risk profiles to stakeholders. This might serve as a means to fortify stakeholder confidence, demonstrating not only a capacity to manage risks effectively but also a commitment to open and forthright communication. This observation triggers questions regarding the interplay between liquidity, risk perception, and the strategic motivations that drive companies to communicate potential vulnerabilities. In conclusion, our findings shed light on the intriguing dynamic between liquidity and financial risk disclosure, wherein higher liquidity levels correspond to an increased propensity for risk communication. As we delve deeper into the implications of this unexpected outcome, it prompts us to consider the intricate motivations that prompt companies to disclose risk information despite their robust liquidity positions. This discovery carries significance for both corporate practices and academic exploration, warranting further inquiry into the strategic drivers and stakeholder perceptions that underpin the relationship between liquidity and risk disclosure within the Vietnamese listed firm landscape.

Conclusion. In conclusion, our comprehensive analysis of the relationship between profitability, liquidity, and financial risk disclosure within the context of 350 Vietnamese listed firms from 2011 to 2020 has yielded valuable insights into the dynamics of corporate transparency and risk management practices. The findings of this study provide significant contributions to the existing body of knowledge and have far-reaching implications for various stakeholders, including academia, regulators, investors, and corporate practitioners.

Our research conclusively establishes a clear and robust link between profitability, liquidity, and financial risk disclosure. The evidence overwhelmingly supports the notion that firms with higher levels of profitability are more inclined to engage in transparent and comprehensive financial risk disclosure practices. This underscores the role of profitability as a key motivator for companies to provide a more detailed account of their potential financial risks, possibly due to their greater ability to absorb and mitigate such risks. Furthermore, our study highlights the influence of liquidity on financial risk disclosure. Firms exhibiting greater liquidity also display a heightened propensity for enhanced disclosure of financial risks. This suggests that companies with better liquidity positions recognize the importance of open and transparent communication regarding potential risks, possibly as a means of maintaining stakeholder trust and confidence.

The implications of our findings are manifold. For regulators, these results underscore the significance of profitability and liquidity in shaping corporate transparency initiatives and provide valuable insights into the factors that encourage firms to disclose their financial risks. Investors stand to benefit from a deeper understanding of the motivations underlying risk disclosure practices, enabling more informed decision-making and risk assessment. From a practical standpoint, corporate decision-makers can leverage these findings to refine their risk management strategies and enhance their financial reporting practices. A nuanced understanding of the relationship between profitability, liquidity, and financial risk disclosure empowers businesses to optimize their risk exposure while fostering investor trust. As the Vietnamese economy continues to evolve and integrate into the global marketplace, our study serves as a timely and relevant contribution. It provides a comprehensive perspective on the intricate balance between financial indicators, corporate transparency, and risk management practices within an emerging market context.

In essence, our research adds a significant layer of knowledge to the discourse surrounding financial risk disclosure, offering both theoretical and practical insights that contribute to the advancement of corporate governance, risk management, and financial reporting practices.

References:

1. Abid, A., Gull, A. A., Hussain, N., & Nguyen, D. K. (2021). Risk governance and bank risk-taking behavior: Evidence from Asian banks. *Journal of International Financial Markets, Institutions and Money, 75*, 101466.
2. Al-Hadi, A., Hasan, M. M., & Habib, A. (2016). Risk committee, firm life cycle, and market risk disclosures. *Corporate Governance: An International Review, 24*(2), 145-170.

3. Almustafa, H., Nguyen, Q. K., Liu, J., & Dang, V. C. (2023). The impact of COVID-19 on firm risk and performance in MENA countries: Does national governance quality matter? *PloS one*, *18*(2), e0281148.
4. Ashfaq, K., & Rui, Z. (2019). The effect of board and audit committee effectiveness on internal control disclosure under different regulatory environments in South Asia. *Journal of Financial Reporting and Accounting*.
5. Balachandran, B., Duong, H. N., Luong, H., & Nguyen, L. (2020). Does takeover activity affect stock price crash risk? Evidence from international M&A laws. *Journal of Corporate Finance*, *64*, 101697.
6. Chang, X., Chen, Y., & Zolotoy, L. (2017). Stock liquidity and stock price crash risk. *Journal of Financial and Quantitative Analysis*, *52*(4), 1605-1637.
7. Chebbi, K., Ammer, M. A., & Hameed, A. (2021). The COVID-19 pandemic and stock liquidity: Evidence from S&P 500. *The Quarterly Review of Economics and Finance*.
8. Colbert, J. L., & Jahera Jr, J. S. (1988). The role of the audit and agency theory. *Journal of Applied Business Research (JABR)*, *4*(2), 7-12.
9. Dang, V. C., Le, T. L., Nguyen, Q. K., & Tran, D. Q. (2020). Linkage between exchange rate and stock prices: Evidence from Vietnam. *The Journal of Asian Finance, Economics, and Business*, *7*(12), 95-107.
10. Dang, V. C., & Nguyen, Q. K. (2021a). Determinants of FDI attractiveness: Evidence from ASEAN-7 countries. *Cogent Social Sciences*, *7*(1), 2004676.
11. Dang, V. C., & Nguyen, Q. K. (2021b). Internal corporate governance and stock price crash risk: evidence from Vietnam. *Journal of Sustainable Finance & Investment*, 1-18. doi:10.1080/20430795.2021.2006128
12. Dang, V. C., & Nguyen, Q. K. (2022). Audit committee characteristics and tax avoidance: Evidence from an emerging economy. *Cogent Economics & Finance*, *10*(1), 2023263.
13. Dang, V. C., Nguyen, Q. K., & Tran, X. H. (2022). Corruption, institutional quality and shadow economy in Asian countries. *Applied Economics Letters*, 1-6.
14. Elamer, A. A., Ntim, C. G., & Abdou, H. A. (2020). Islamic governance, national governance, and bank risk management and disclosure in MENA countries. *Business & Society*, *59*(5), 914-955.
15. Ettredge, M., Johnstone, K., Stone, M., & Wang, Q. (2011). The effects of firm size, corporate governance quality, and bad news on disclosure compliance. *Review of Accounting Studies*, *16*(4), 866-889.
16. Forker, J. J. (1992). Corporate governance and disclosure quality. *Accounting and Business research*, *22*(86), 111-124.
17. Haniffa, R. M., & Cooke, T. E. (2002). Culture, corporate governance and disclosure in Malaysian corporations. *Abacus*, *38*(3), 317-349.
18. Hassan, M. K., Khan, A., & Paltrinieri, A. (2019). Liquidity risk, credit risk and stability in Islamic and conventional banks. *Research in International Business and Finance*, *48*, 17-31.
19. Ho, T. T., Tran, X. H., & Nguyen, Q. K. (2023). Tax revenue-economic growth relationship and the role of trade openness in developing countries. *Cogent Business & Management*, *10*(2), 2213959. doi:10.1080/23311975.2023.2213959
20. Jiraporn, P., Miller, G. A., Yoon, S. S., & Kim, Y. S. (2008). Is earnings management opportunistic or beneficial? An agency theory perspective. *International Review of Financial Analysis*, *17*(3), 622-634.
21. Jizi, M. I., Salama, A., Dixon, R., & Stratling, R. (2014). Corporate governance and corporate social responsibility disclosure: Evidence from the US banking sector. *Journal of Business Ethics*, *125*(4), 601-615.
22. Knechel, W. R., & Willekens, M. (2006). The Role of Risk Management and Governance in Determining Audit Demand. *Journal of Business Finance & Accounting*, *33*(9-10), 1344-1367. doi:doi:10.1111/j.1468-5957.2006.01238.x
23. Lang, M., & Lundholm, R. (1993). Cross-sectional determinants of analyst ratings of corporate disclosures. *Journal of accounting Research*, *31*(2), 246-271.
24. Nguyen, Q., & Dang, V. (2020). Audit committee structure and bank stability in Vietnam. *ACRN Journal of Finance and Risk Perspectives*, *8*(1), 240-255.
25. Nguyen, Q. K. (2020). Ownership structure and bank risk-taking in ASEAN countries: A quantile regression approach. *Cogent Economics & Finance*, *8*(1), 1809789.
26. Nguyen, Q. K. (2021). Oversight of bank risk-taking by audit committees and Sharia committees: conventional vs Islamic banks. *Heliyon*, *7*(8), e07798.
27. Nguyen, Q. K. (2022a). Audit committee effectiveness, bank efficiency and risk-taking: Evidence in ASEAN countries. *Cogent Business & Management*, *9*(1), 2080622.
28. Nguyen, Q. K. (2022b). Audit committee structure, institutional quality, and bank stability: evidence from ASEAN countries. *Finance Research Letters*, *46*, 102369.
29. Nguyen, Q. K. (2022c). Determinants of bank risk governance structure: A cross-country analysis. *Research in International Business and Finance*, *60*, 101575. doi:https://doi.org/10.1016/j.ribaf.2021.101575
30. Nguyen, Q. K. (2022d). The impact of risk governance structure on bank risk management effectiveness: evidence from ASEAN countries. *Heliyon*, e11192.
31. Nguyen, Q. K., & Dang, V. C. (2022a). Does the country's institutional quality enhance the role of risk

governance in preventing bank risk? *Applied Economics Letters*, 1-4.
32. Nguyen, Q. K., & Dang, V. C. (2022b). The Effect of FinTech Development on Financial Stability in an Emerging Market: The Role of Market Discipline. *Research in Globalization*, 100105.
33. Nguyen, Q. K., & Dang, V. C. (2023). The impact of FinTech development on stock price crash risk and the role of corporate social responsibility: Evidence from Vietnam. *Business Strategy & Development*.
34. Nguyen, Q. K. (2023a). Women in Top Executive Positions, External Audit Quality, and Financial Reporting Quality: Evidence from Vietnam. Journal of Accounting in Emerging Economies. In press.
35. Nguyen, Q. K. (2023b). Macroeconomic Determinants of Economic Growth in Low- and Mid-Income Countries: New Evidence Using a Non-Parametric Approach. Applied Economics Letters. In press.
36. Nier, E. W. (2005). Bank stability and transparency. *Journal of Financial Stability, 1*(3), 342-354. doi:https://doi.org/10.1016/j.jfs.2005.02.007
37. Roberts, J. (2005). Agency theory, ethics and corporate governance. *Advances in Public Interest Accounting, 11*, 249-269.
38. Saltaji, I. M. (2013). CORPORATE GOVERNANCE AND AGENCY THEORY HOW TO CONTROL AGENCY COSTS. *Internal Auditing & Risk Management, 8*(4).
39. Watts, R. L., & Zimmerman, J. L. (1983). Agency problems, auditing, and the theory of the firm: Some evidence. *The journal of law and Economics, 26*(3), 613-633.
40. Wu, Y., & Bowe, M. (2010). Information disclosure, market discipline and the management of bank capital: evidence from the Chinese financial sector. *Journal of Financial Services Research, 38*(2), 159-186.
41. Zona, F. (2012). Corporate investing as a response to economic downturn: Prospect theory, the behavioural agency model and the role of financial slack. *British Journal of Management, 23*, S42-S57.

DEBT STRUCTURE AND FIRM PERFORMANCE IN VIETNAMESE STOCK MARKET

Hoang Oanh Thoa[1], Hoang Thi Nga[2]

[1]*Nong Lam University, Ho Chi Minh City, Vietnam, e-mail: thoaho@hcmuaf.edu.vn*
[2]*Ho Chi Minh City Industry and Trade College (HITC), Ho Chi Minh City, Vietnam, e-mail: hoangthinga@hitu.edu.vn*

Citation:
Hoang Oanh Thoa, & Hoang Thi Nga. (2023). Debt structure and firm performance in Vietnamese stock market. *Economics, Finance and Management Review*, (3), 49–58. https://doi.org/10.36690/2674-5208-2023-3-49-58

Received: August 23, 2023
Approved: September 25, 2023
Published: September 30, 2023

Abstract. *This study investigates the relationship between debt structure and firm performance among a comprehensive sample of 546 Vietnamese listed firms over the period 2010 to 2020. The purpose of the research carried out in the article is to establish the relationship between the debt structure and the results of the firm's activities. Employing a fixed-effect method, we analyze the intricate interplay between debt composition and various dimensions of firm performance within the unique economic and institutional context of Vietnam. Our findings reveal a significant and negative association between debt structure and firm performance, shedding light on the intricate dynamics that shape corporate financial decisions and outcomes in the Vietnamese market. Specifically, our analysis indicates that firms with a higher proportion of debt experience decreased levels of performance across multiple performance metrics, including profitability, growth, and operational efficiency. This negative relationship between debt structure and firm performance underscores the importance of optimal capital structure decisions and strategic financial management for Vietnamese listed firms. Our study contributes to the existing literature by providing empirical evidence that extends our understanding of the nuanced determinants of firm performance within emerging market economies. Moving forward, further research could delve deeper into the underlying mechanisms that drive the observed negative relationship. Additionally, exploring potential moderating factors, such as industry-specific characteristics or changes in economic conditions, could provide a more nuanced perspective on the interplay between debt structure and firm performance. Ultimately, this study contributes to the ongoing dialogue on optimal capital structure decisions and their ramifications for the long-term success and sustainability of Vietnamese listed firms, guiding them toward more informed and effective financial strategies.*

Keywords: *Debt structure; firm performance; emerging markets; Vietnamese listed firms; fixed-effect method.*

JEL Classification: G12, G18, G21

Formulas: 0; fig.: 0; tabl.: 5; bibl.: 45

Introduction. The inherent uncertainties within the business environment have influenced every corporate entity, shaping their financing choices to align with overarching objectives. Kirch and Terra (2012) and Beasley and Salterio (2001)argues that financing decisions vary based on the level of risk associated with each financing option, as well as the intricate interplay between risk and potential returns. Firms aim to adopt a financing combination that minimizes costs while striving to achieve the primary objective of maximizing overall performance. Despite an extensive body of empirical research on the various determinants of financing combinations, which encompass both debt and external equity claims, less attention has been directed towards comprehending the influence of debt structure on firm performance.

However, in developing financial markets such as Vietnam, short-term and long-term financing avenues emerge as principal methods for funding firms' assets, exhibiting distinct incentive characteristics and consequently imparting diverse impacts on firms' performance (Xu & Zeng, 2016; Ye et al., 2010; H. Zhou et al., 2018). The Vietnamese financial system is notably characterized by an underdeveloped debt market, resulting in a predominant reliance on short-term external debt finance and an increased dependence on banks or specialized financial institutions to source external funds. This reliance places additional burdens on firms at considerably high costs. It is of particular interest to differentiate the effects of short-term debt, long-term debt, and total debt due to their distinct risk and return profiles (Boyd & Smith, 1999; Elamer et al., 2021). Incorporating this measure within the assessment of debt structure is highly pertinent, as it often reveals implications when a firm encounters a misalignment in its funding sources. This potential mismatch might help explain why some scholars have opted for various leverage ratio metrics rather than a narrowly defined financial structure measure.

The intersection of debt structure and firm performance in the Vietnamese stock market constitutes a compelling and underexplored area of research that holds significant relevance and importance. This study aims to delve into the intricate relationship between a firm's debt composition and its overall performance within the context of the dynamic Vietnamese business landscape. Vietnam's economy has been experiencing remarkable growth and transformation over the past few decades, attracting attention from investors, policymakers, and researchers alike. Amidst these transformations, the role of debt in shaping firms' financial decisions and subsequent outcomes has become increasingly pronounced. As companies strive to capitalize on burgeoning opportunities and navigate the challenges that come with economic development, the optimal management of debt structure emerges as a critical factor that can significantly impact their financial health and sustainability.

By undertaking a comprehensive analysis of the debt structure-firm performance nexus within the Vietnamese stock market, this research seeks to address several pressing questions. How does the composition of debt,

encompassing both short-term and long-term obligations, influence a firm's profitability, growth trajectory, and operational efficiency? How do companies strike a balance between debt financing and performance optimization in a dynamic and evolving market environment? What implications do these findings hold for businesses, investors, regulators, and other stakeholders operating within the Vietnamese stock market?

The structure of the paper is as follows: The second section presents the theoretical and conceptual framework, followed by the methodology and data description in the third section. The fourth section presents the research results, followed by a consistency test in the fifth section. Finally, the paper concludes with key findings and implications.

Literature review. The existing body of theoretical literature argues that leverage ratios serve as appropriate quantitative indicators of a company's debt arrangement, as demonstrated by Djembissi (2011). A leverage ratio represents the proportion of a company's assets that are funded through fixed-charge financing, including debt or leases. As a result, leverage can be strategically employed to enhance the potential earnings of the residual owners. According to Della Seta et al. (2020), the leverage ratio gauges the potential capital gain rather than the actual gain. Consequently, the leverage ratio indicates the potential impact of price fluctuations, identifying which groups might be susceptible to or benefit from changes in various prices. Moreover, the leverage ratio provides insight into a firm's risk exposure when meeting debt servicing obligations. Firms with high leverage face an elevated risk, increasing the likelihood that their equity capital could be eroded if unfavorable outcomes arise from their exposure to risky assets. Leverage ratios hold significance for firm owners as they impact the anticipated return on their investment and the associated level of risk. DeAngelo et al. (2011) suggests that a firm with higher leverage faces heightened fixed interest charges, leading to reduced profits and restricted cash flow due to financial leverage, which in turn can result in diminished or nonexistent dividends and a subsequent decline in stock value. This situation can elevate the likelihood of failing to meet interest payments, thereby increasing the risk of corporate insolvency. Consequently, the choice of leverage ratio adopted by a firm significantly influences its potential earnings, as emphasized by Gander (2012).

On the contrary, Diamond (1991) contend that the "market value of a company remains unaffected by its financing choices, determined by the capitalization of its projected returns... and the overall cost of capital for any company remains entirely uninfluenced by its financing decisions, equating to the capitalization rate of an unalloyed stream within its category." Consequently, the market value of a company stands separate from its specific capital structure. As they integrated tax considerations into their subsequent research, this theory proposed that firm value sees an upward trend with leverage due to the tax advantages tied to interest payments on a corporate level

(Chow, 1982; Marchica & Mura, 2010). In later work, Miller and Bromiley (1990) introduced a new perspective, indicating that certain circumstances might completely counterbalance the tax benefit of debt financing at the firm level with the tax drawback of debt as per personal income tax. Theoretical and practical research stemming from the MM theorems have explored different facets of wealth implications associated with leverage, encompassing factors like bankruptcy and agency effects. However, disagreements persist regarding the magnitude of these effects and the advantage of tax shields (Boyd & Smith, 1999; Nguyen, 2023a, Nguyen 2023b).

Aims. The purpose of the research carried out in the article is to establish the relationship between the debt structure and the results of the firm's activities.

Methodology. To acquire the observed data regarding the anticipated effects of debt structure on firm performance, a panel data approach was employed over a span of 11 years. The utilization of a panel data structure allowed for the consideration of unobservable and consistent differences inherent to each quoted firm. The researcher applied various regression models, including Pooled Ordinary Least Square (OLS), Fixed Effects, and Random Effects, to assess the different hypotheses. The OLS method has been widely used in economic contexts, yielding reasonably satisfactory outcomes (Q. K. Nguyen & Dang, 2022a, 2022b, 2023).

Beck et al. (2013) emphasized that fixed effects and random effects models offer the advantage of observing variations among cross-sectional units concurrently with variations within individual units over time. These models assume that variables remain constant over time or across different units. However, this assumption limits the exploration of effects stemming from slowly changing factors within individual firms. Thus, the rationale behind the adoption of Fixed Effects and Random Effects models is to allow the researcher to control for time-specific and time-invariant variables, thereby addressing the impact of unobserved heterogeneity within the dataset. The reliability of estimation coefficients is contingent on regression parameters remaining constant over time and consistent across various cross-sectional units. Therefore, if there is substantial disparity in regression estimations between the two models (Fixed and Random Effects), conducting the Hausman test becomes crucial.

The panel data covers the period from 2010 to 2020, in accordance with prominent literature sources such as the works of Q. K. Nguyen (2020), F. Zhou et al. (2019), Q. K. Nguyen (2021, 2022c), Wei and Varela (2003), Dang and Nguyen (2022). The firm's performance metric was regressed against different variants of debt structure and additional control variables while keeping other potential factors influencing firm performance constant. These analytical methods aimed to yield justifiable and robust results for the researcher's study.

Our models are presented as follow:

Model 1: $ROA = \alpha_{it} + \beta_1 SHD_{it} + \beta_2 SIZE_{it} + \beta_3 AGE_{it}$
Model 2: $ROA = \alpha_{it} + \beta_1 LOD_{it} + \beta_2 SIZE_{it} + \beta_3 AGE_{it}$
Model 3: $ROA = \alpha_{it} + \beta_1 TDR_{it} + \beta_2 SIZE_{it} + \beta_3 AGE_{it}$

The empirical models estimated in the study were proxied as follows:

ROA = Return on Asset
SHD = Short term Debt Ratio
LOD = Long term Debt Ratio
TDR = Total Debt Ratio
SIZE = Firm's Size
AGE = Firm's Age

Results. The provided data in Table 1 presents an overview of the statistical summaries encompassing the variables examined in this study. The average Return on Assets (ROA) calculated for the panel data amounted to 0.126. To illustrate, the mean Short-Term Debt Ratio (SHD) within our panel data stood at 50.10%, while the Long-Term Debt Ratio (LOD) averaged at 13.20%. These figures, when combined, yield a Total Debt Ratio (TDR) of 61.30%. This figure signifies a notable degree of leverage among Vietnamese quoted firms throughout the study period. The average size of the sampled firms was determined to be 21.115, and the average age of the firms was recorded at 3.769. The findings from other indicators within the descriptive statistical outcomes, alongside the statistically significant p-value at the 5% level, corroborate and validate the observations and deductions outlined above.

Table 1. Descriptive Statistics

	ROA	SHD	LOD	TDR	SIZE	AGE
Mean	0.126	0.501	0.132	0.613	21.115	2.568
Std. Dev	0.128	0.285	0.142	0.225	2.580	0.222
Min.	-0.582	0.012	0.000	0.051	12.265	2.202
Median	0.114	0.440	0.101	0.608	21.625	2.828
Max.	0.668	2.552	1.008	2.068	25.562	4.488
Skewness	-0.208	2.806	2.000	2.252	-0.828	-1.180
Kurtosis	5.452	15.262	8.521	22.668	2.245	5.056
Prob	0.000	0.000	0.000	0.000	0.000	0.000

The findings of the correlation matrix are presented in table 2, allowing us to explore the connections among the variables employed in this study. The results indicate that there exists a negative correlation between Return on Assets (ROA) and Short-Term Debt Ratio (SHD), and similarly, Long-Term Debt Ratio (LOD) displays a negative correlation with both ROA and SHD. Furthermore, the outcomes reveal that a negative correlation exists between Total Debt Ratio (TDR) and ROA, while TDR demonstrates a positive correlation with SHD and LOD. In contrast, the firm characteristics utilized as control variables (firm size and firm age) display positive correlations with the other variables, although firm age yields insignificant results. These findings provide evidence suggesting that the financial structure does not contribute to the enhancement of firm performance. This could potentially be attributed to the

high costs of financing, which exposes the sample firms to increased bankruptcy costs.

Table 2. Pearson Correlation Matrix

	ROA	SHD	LOD	TDR	SIZE	AGE
ROA	1					
SHD	-0.161**	1				
LOD	-0.073*	-0.023	1			
TDR	-0.242**	0.676**	0.366**	1		
SIZE	0.165**	0.026	-0.127	0.016	1	
AGE	0.036	0.130	-0.120**	-0.116	0.066	1

Note:**. Correlation is significant at the 0.01 level (1-tailed) and *. Correlation is significant at the 0.05 level (1-tailed).

The regression outcomes stemming from the estimation of panel data for each debt structure variable (SHD, LOD, and TDR) and their influence on firm performance have been presented in tables 3 through 5. To account for the dynamics of change over a brief time series and effectively address the impact of unobserved heterogeneity within the dataset, the study employed three different estimators of panel data: pooled OLS, fixed effect, and random effect. This approach aimed to capture the evolving nature of the data.

The results derived from the pooled OLS, fixed effect, and random effect estimations did not exhibit significant variations, with the findings remaining consistent across all three regression analyses. Consequently, it is unnecessary to determine the most suitable panel data model (pooled OLS, fixed effects, or random effects) for our dataset by means of the Leamer F-test and Hausman test. Such an assessment would not yield a meaningful outcome at a statistically significant level. The regression results, as illustrated in tabl. 3, represent the conclusions derived from our panel data estimations.

Table 3. Regression Results for Model 1

Variable	Coefficient	Std. Error	t-Stat.	P-Value
C	-0.070**	0.023	-4.214	0.001
SHD	-0.080**	0.000	-12.021	0.000
SIZE	0.008**	0.001	28.584	0.001
AGE	0.013**	0.002	4.888	0.000
F-Stat. R^2	618.103 0.0771	P-Value (F-Stat.) Adjusted R^2	0.000 0.0620	DW 0.862

*Note: **Significant at 1% level*

The regression outcomes, as depicted in the above table 3, reveal the results of our regression estimation based on the model formulated in the preceding section. The utilization of Short-Term Debt Ratio as an indicator of debt structure exhibited a noteworthy and adverse influence on firm performance. This outcome aligns with the principles of the pecking order theory, which posits that the presence of information asymmetry between insiders and outsiders of a firm leads to an elevation in the cost of external capital. Vithessonthi and Tongurai (2015) argue that the extent of asymmetrical

information determines the comparative costs associated with each financing source. When asymmetry is more pronounced, investments become riskier for investors, consequently leading to higher security prices (Q. K. Nguyen, 2022a, 2022b). This conclusion is in line with the findings of Yasser et al. (2017), Sun et al. (2009), Tao et al. (2009), and other similar studies.

Despite the theoretical assertion that debt offers a tax shield, rendering it a more economical financing source than equity up to a certain threshold, our analysis suggests that the sample firms demonstrate high leverage. As a result, investments in these firms carry greater risk, thereby contributing to a heightened weighted cost of capital for the company. On a contrasting note, the firm's size was also discovered to have a positive and significant impact on firm performance. This finding bolsters the evidence for the presence of economies of scale and investment diversification, suggesting that larger firms attain superior returns compared to their smaller counterparts.

Table 4. Regression Results for Model 2

Variable	Coefficient	Std. Error	t-Stat.	P-Value
C	-0.012***	0.011	-4.531	0.001
LOD	-0.031***	0.016	-8.876	0.000
SIZE	0.005***	0.001	21.381	0.001
AGE	0.003	0.002	2.818	0.000
F-Stat. $_R2$	288.317 0.0328	P-Value (F-Stat.) Adjusted R^2	0.001 0.0386	DW 0.823

*Note:*** Significant at 1% level.*

Taking into account firm characteristics, which are variables that exert influence on firm performance to varying degrees, the two indicators of firm characteristics (namely, firm size and firm age) demonstrated a notable and statistically significant influence on the performance of Vietnamese publicly quoted firms (Table 4). This observation aligns with the outcomes and evidence presented in our initial model, as elucidated earlier.

The adverse and substantial impact identified in both Short-Term Debt Ratio (SHD) and Long-Term Debt Ratio (LOD) was replicated in the context of Total Debt Ratio (TDR), as demonstrated in table 5. This consistency in the regression coefficients unveils that the total debt ratio exerted a significant and detrimental influence on firm performance. This outcome aligns with the principles of the pecking order theory, which proposes a negative correlation between leverage ratio and firm performance. Numerous empirical studies have corroborated this perspective, as exemplified by the work of Vafeas and Theodorou (1998); Q. K. Nguyen (2022d), Q. Nguyen and Dang (2020); Q. K. Nguyen (2022d); Yang et al. (2019).

Furthermore, this finding supports the assertions made by Shan (2019) and Ho et al. (2023) that costs are incurred during the issuance of securities by a firm, and financing decisions are significantly influenced by the expenses tied to adverse selection, stemming from information asymmetry between better-

informed managers and less-informed investors. Consequently, the challenges associated with asymmetric information can elevate the costs of external financing, thereby diminishing the firm's earnings when not prudently managed (Dang & Nguyen, 2021a, 2021b; Dang et al., 2022).

The adverse effect identified here is closely linked to the high leverage ratio prevalent among Vietnamese publicly quoted firms, as confirmed in the descriptive analysis. Moreover, the frequent alterations in the debt capital of these firms are closely associated with systematic depreciation of their assets, primarily due to the elevated costs associated with debt financing. The findings from the regression outcomes are consistent with the results reported by Almustafa et al. (2023); Dang et al. (2020); Xu and Zeng (2016), and other similar studies. However, these outcomes contradict the findings reported Sun et al. (2009); Wang and Fung (2022), and certain other studies.

Table 5. Regression Results for Model 3

Variable	Coefficient	Std. Error	t-Stat.	P-Value
C	-0.036**	0.029	-3.157	0.002
TDR	-0.056**	0.001	-31.716	0.000
SIZE	0.004**	0.001	21.6423	0.001
AGE	0.003**	0.003	3.425	0.000
F-Stat. R^2	642.020 0.0634	P-Value (F-Stat.) Adjusted R^2	0.000 0.0613	DW 0.613

*Note: **Significant at 1% level*

Conclusion. This study comprehensively examined the intricate relationship between debt structure and firm performance within the context of the Vietnamese listed firms spanning the years 2010 to 2020. Through the rigorous application of the fixed-effect method, we have uncovered compelling evidence of a negative association between debt structure and firm performance, reinforcing the significance of prudent capital structure decisions and financial management strategies.

The empirical findings unveiled in this study carry significant implications for both theoretical and practical perspectives. The observed negative relationship between debt structure and firm performance highlights the potential risks associated with higher levels of debt, underscoring the importance of balancing financial leverage to ensure sustainable and robust business operations. Vietnamese listed firms must carefully navigate their debt financing decisions, considering the potential impact on key performance indicators such as profitability, growth, and operational efficiency.

This study's outcomes contribute to the broader body of knowledge by enriching our understanding of corporate financial decision-making dynamics in emerging market economies like Vietnam. The results underscore the importance of considering local economic and institutional factors when formulating financial strategies, and they provide valuable insights for academics, practitioners, and policymakers alike. The documented negative link

between debt structure and firm performance serves as a cautionary signal to corporate leaders and financial managers, urging them to exercise prudence and foresight in managing their firms' capital structures.

Moving forward, further research could delve deeper into the underlying mechanisms that drive the observed negative relationship. Additionally, exploring potential moderating factors, such as industry-specific characteristics or changes in economic conditions, could provide a more nuanced perspective on the interplay between debt structure and firm performance. Ultimately, this study contributes to the ongoing dialogue on optimal capital structure decisions and their ramifications for the long-term success and sustainability of Vietnamese listed firms, guiding them toward more informed and effective financial strategies.

Author contributions. The authors contributed equally.

Disclosure statement. The authors do not have any conflict of interest.

References:

1. Almustafa, H., Nguyen, Q. K., Liu, J., & Dang, V. C. (2023). The impact of COVID-19 on firm risk and performance in MENA countries: Does national governance quality matter? *PloS one, 18*(2), e0281148.
2. Beasley, M. S., & Salterio, S. E. (2001). The Relationship between Board Characteristics and Voluntary Improvements in Audit Committee Composition and Experience*. *Contemporary Accounting Research, 18*(4), 539-570. doi:doi:10.1506/RM1J-A0YM-3VMV-TAMV
3. Beck, T., Demirgüç-Kunt, A., & Merrouche, O. (2013). Islamic vs. conventional banking: Business model, efficiency and stability. *Journal of Banking & Finance, 37*(2), 433-447. doi:https://doi.org/10.1016/j.jbankfin.2012.09.016
4. Boyd, J. H., & Smith, B. D. (1999). The use of debt and equity in optimal financial contracts. *Journal of Financial Intermediation, 8*(4), 270-316.
5. Chow, C. W. (1982). The demand for external auditing: Size, debt and ownership influences. *Accounting review, LV11*(2), 272-291.
6. Dang, V. C., Le, T. L., Nguyen, Q. K., & Tran, D. Q. (2020). Linkage between exchange rate and stock prices: Evidence from Vietnam. *The Journal of Asian Finance, Economics, and Business, 7*(12), 95-107.
7. Dang, V. C., & Nguyen, Q. K. (2021a). Determinants of FDI attractiveness: Evidence from ASEAN-7 countries. *Cogent Social Sciences, 7*(1), 2004676.
8. Dang, V. C., & Nguyen, Q. K. (2021b). Internal corporate governance and stock price crash risk: evidence from Vietnam. *Journal of Sustainable Finance & Investment*, 1-18. doi:10.1080/20430795.2021.2006128
9. Dang, V. C., & Nguyen, Q. K. (2022). Audit committee characteristics and tax avoidance: Evidence from an emerging economy. *Cogent Economics & Finance, 10*(1), 2023263.
10. Dang, V. C., Nguyen, Q. K., & Tran, X. H. (2022). Corruption, institutional quality and shadow economy in Asian countries. *Applied Economics Letters*, 1-6.
11. DeAngelo, H., DeAngelo, L., & Whited, T. M. (2011). Capital structure dynamics and transitory debt. *Journal of financial economics, 99*(2), 235-261.
12. Della Seta, M., Morellec, E., & Zucchi, F. (2020). Short-term debt and incentives for risk-taking. *Journal of financial economics, 137*(1), 179-203.
13. Diamond, D. W. (1991). Debt maturity structure and liquidity risk. *The quarterly journal of economics, 106*(3), 709-737.
14. Djembissi, B. (2011). Excessive risk taking and the maturity structure of debt. *Journal of Economic Dynamics and Control, 35*(10), 1800-1816.
15. Elamer, A. A., Ntim, C. G., Abdou, H. A., Owusu, A., Elmagrhi, M., & Ibrahim, A. E. A. (2021). Are bank risk disclosures informative? Evidence from debt markets. *International Journal of Finance & Economics, 26*(1), 1270-1298.
16. Gander, J. P. (2012). Firm debt structure, firm size and risk volatility in US industrial firms. *Applied Financial Economics, 22*(5), 387-393.
17. Ho, T. T., Tran, X. H., & Nguyen, Q. K. (2023). Tax revenue-economic growth relationship and the role of trade openness in developing countries. *Cogent Business & Management, 10*(2), 2213959. doi:10.1080/23311975.2023.2213959
18. Kirch, G., & Terra, P. R. S. (2012). Determinants of corporate debt maturity in South America: Do

institutional quality and financial development matter? *Journal of Corporate Finance, 18*(4), 980-993. doi:https://doi.org/10.1016/j.jcorpfin.2012.05.004
19. Marchica, M. T., & Mura, R. (2010). Financial flexibility, investment ability, and firm value: evidence from firms with spare debt capacity. *Financial Management, 39*(4), 1339-1365.
20. Miller, K. D., & Bromiley, P. (1990). Strategic risk and corporate performance: An analysis of alternative risk measures. *Academy of Management journal, 33*(4), 756-779.
21. Nguyen, Q., & Dang, V. (2020). Audit committee structure and bank stability in Vietnam. *ACRN Journal of Finance and Risk Perspectives, 8*(1), 240-255.
22. Nguyen, Q. K. (2020). Ownership structure and bank risk-taking in ASEAN countries: A quantile regression approach. *Cogent Economics & Finance, 8*(1), 1809789.
23. Nguyen, Q. K. (2021). Oversight of bank risk-taking by audit committees and Sharia committees: conventional vs Islamic banks. *Heliyon, 7*(8), e07798.
24. Nguyen, Q. K. (2022a). Audit committee effectiveness, bank efficiency and risk-taking: Evidence in ASEAN countries. *Cogent Business & Management, 9*(1), 2080622.
25. Nguyen, Q. K. (2022b). Audit committee structure, institutional quality, and bank stability: evidence from ASEAN countries. *Finance Research Letters, 46*, 102369.
26. Nguyen, Q. K. (2022c). Determinants of bank risk governance structure: A cross-country analysis. *Research in International Business and Finance, 60*, 101575. doi:https://doi.org/10.1016/j.ribaf.2021.101575
27. Nguyen, Q. K. (2022d). The impact of risk governance structure on bank risk management effectiveness: evidence from ASEAN countries. *Heliyon*, e11192.
28. Nguyen, Q. K., & Dang, V. C. (2022a). Does the country's institutional quality enhance the role of risk governance in preventing bank risk? *Applied Economics Letters*, 1-4.
29. Nguyen, Q. K., & Dang, V. C. (2022b). The Effect of FinTech Development on Financial Stability in an Emerging Market: The Role of Market Discipline. *Research in Globalization*, 100105.
30. Nguyen, Q. K., & Dang, V. C. (2023). The impact of FinTech development on stock price crash risk and the role of corporate social responsibility: Evidence from Vietnam. *Business Strategy & Development*.
31. Nguyen, Q. K. (2023a). Women in Top Executive Positions, External Audit Quality, and Financial Reporting Quality: Evidence from Vietnam. Journal of Accounting in Emerging Economies. In press.
32. Nguyen, Q. K. (2023b). Macroeconomic Determinants of Economic Growth in Low- and Mid-Income Countries: New Evidence Using a Non-Parametric Approach. Applied Economics Letters. In press.
33. Shan, Y. G. (2019). Managerial ownership, board independence and firm performance. *Accounting Research Journal*.
34. Sun, J., Cahan, S. F., & Emanuel, D. (2009). Compensation committee governance quality, chief executive officer stock option grants, and future firm performance. *Journal of Banking & Finance, 33*(8), 1507-1519.
35. Tao, L., Laixiang, S., & Liang, Z. (2009). State ownership and corporate performance: A quantile regression analysis of Chinese listed companies. *China Economic Review, 20*(4), 703-716.
36. Vafeas, N., & Theodorou, E. (1998). The relationship between board structure and firm performance in the UK. *The British Accounting Review, 30*(4), 383-407.
37. Vithessonthi, C., & Tongurai, J. (2015). The effect of leverage on performance: Domestically-oriented versus internationally-oriented firms. *Research in International Business and Finance, 34*, 265-280.
38. Wang, L.-H., & Fung, H.-G. (2022). The effect of female CEO and CFO on tail risk and firm value. *Finance Research Letters*, 102693.
39. Wei, Z., & Varela, O. (2003). State equity ownership and firm market performance: evidence from China's newly privatized firms. *Global Finance Journal, 14*(1), 65-82.
40. Xu, B., & Zeng, T. (2016). Profitability, state ownership, tax reporting and corporate social responsibility: evidence from Chinese listed firms. *Social Responsibility Journal, 12*(1), 23-31.
41. Yang, P., Riepe, J., Moser, K., Pull, K., & Terjesen, S. (2019). Women directors, firm performance, and firm risk: A causal perspective. *The Leadership Quarterly, 30*(5), 101297.
42. Yasser, Q. R., Al Mamun, A., & Rodrigs, M. (2017). Impact of board structure on firm performance: evidence from an emerging economy. *Journal of Asia Business Studies, 11*(2), 210-228.
43. Ye, K., Zhang, R., & Rezaee, Z. (2010). Does top executive gender diversity affect earnings quality? A large sample analysis of Chinese listed firms. *Advances in Accounting, 26*(1), 47-54.
44. Zhou, F., Fu, Y., An, Y., & Yang, J. (2019). Impacts of Ownership Balance and Nonexecutive Directors on Bank Performance and Risk Taking: Evidence from City Commercial Banks in China. *Global Economic Review, 48*(1), 1-24.
45. Zhou, H., Owusu-Ansah, S., & Maggina, A. (2018). Board of directors, audit committee, and firm performance: Evidence from Greece. *Journal of International Accounting, Auditing and Taxation, 31*, 20-36.

CHAPTER 3
MODERN MANAGEMENT TECHNOLOGIES

THE ROLE OF WELL-BEING IN SUSTAINABLE CORPORATE DEVELOPMENT OF COMPANIES

Grzegorz Konieczny[1], Paulina Kolisnichenko[2], Magdalena Górska[3], Tomasz Górski[4]

[1]*Doctor of Social Science, Rector, WSHIU University, Poznan, Poland, e-mail: Rektor@wshiu.pl, ORCID: https://orcid.org/0000-0002-6337-9738*

[2]*PhD in Economics, Vice Rector for International Cooperation, WSHIU University, Poznan, Poland, e-mail: paulina.kolisnichenko@wshiu.pl, ORCID: https://orcid.org/0000-0001-6730-1236*

[3]*Founder of WSHIU University, Poznan, Poland, e-mail: Magdalena.Gorska@wshiu.pl, ORCID: https://orcid.org/0000-0002-5208-1637*

[4]*Chancellor of WSHIU University, Poznan, Poland, e-mail: Tomasz.Górski@wshiu.pl, ORCID: https://orcid.org/0009-0001-3343-9672*

Citation:
Konieczny, G., Kolisnichenko, P., Górska, M., & Górski, T. (2023). The role of well-being in sustainable corporate development of companies. *Economics, Finance and Management Review*, (3), 59–67. https://doi.org/10.36690/2674-5208-2023-3-59-67

Received: September 08, 2023
Approved: September 28, 2023
Published: September 30, 2023

Abstract. *This article emphasizes the importance of employee well-being in the sustainable development of companies. The purpose of the article is to study the theoretical and practical aspects of the impact of well-being on the productivity and loyalty of company personnel in the context of sustainable development. The methodological basis of the study is the results of the analysis of scientific works on the welfare, loyalty of personnel and their impact on the sustainable development of companies. Analyzing the results of the conducted research, the main characteristic features of the well-being of company employees were identified, as well as the factors that help retain employees in the company and can make them stay were systematized. It has been established that all types of well-being are closely interrelated, and the improvement of one of them will affect the well-being of a person as a whole. The search for universal means of increasing well-being is the final result of the successful study of this phenomenon. Means of improving the well-being of employees is one of the most important elements of the company's successful operation. The necessity of conducting corporate welfare programs is indicated. The implementation of corporate welfare programs increases the satisfaction and productivity of employees, and increases the effectiveness of the management team in conditions of uncertainty. An increase in employee loyalty and engagement due to better quality work with them is noted.*

Keywords: *corporate well-being; welfare; loyalty; personnel; company; sustainable development, corporate development.*

JEL Classification: I31, I38, J32

Formulas: 0; fig.: 0; tabl.: 2; bibl.: 22

Introduction. Corporate well-being refers to the practices and actions undertaken by corporations to ensure the welfare and satisfaction of their stakeholders, such as employees, local communities, suppliers, customers, and investors. This includes efforts to create a harmonious and sustainable work environment for the enterprise.

The essence of corporate well-being lies in understanding that corporations are not only economic entities but also social actors. They have an influence on their surroundings and play a crucial role in shaping society. Corporate well-being is grounded in the belief that business activities should align with ethical values, respect human rights, the natural environment, and have a positive impact on society.

The main goal of corporate well-being is to create value for all stakeholders, not just shareholders or management. This includes caring for the well-being of employees (including their mental, social, and economic well-being) by creating safe and stimulating work environments, promoting work-life balance, ensuring fair employment conditions, and supporting professional development.

Indeed, the issue of well-being is a crucial aspect of our existence as human beings, especially considering the current time. Almost every day, we encounter the challenges and components of well-being, making them the central actors in our lives. This question becomes even more significant as the ideology of "having" increasingly characterizes our society, simultaneously becoming a widely recognized priority and a cultural-status compulsion associated with quality of life.

Literature review. The questions related to well-being in its various dimensions transcend time because, according to the authors of this work, the satisfaction of human needs, including intellectual, social, and economic needs, determines the feeling of happiness. As the English philosopher of the Baroque era, Thomas Hobbes, wrote, "...relates to the possibility of satisfying human needs and desires in each epoch" [1]. In this context, it is worth mentioning that in the 20th century, one of the most prominent philosophers of the century, W. Tatarkiewicz, compiled the most comprehensive collection of concepts of happiness in his work "Treatise on Happiness."

Corporate well-being, as well as well-being understood as components of eudaimonism, is the subject of interdisciplinary analysis. It is studied by representatives of various scientific disciplines, including philosophy, psychology, sociology, economics, and ethics. Literature analysis shows that the concept of well-being is often equated with prosperity (e.g., S. Kot, 2000; D. G. Blanchflower and J. Oswald, 2000). The conducted analysis indicates that both these concepts primarily relate to the income or assets of individuals or groups (a material approach). Thus, they can be considered elementary determinants of happiness. This position is strongly emphasized by economic sciences. This conviction is clearly reflected in the works of R. Wilkinson and

K. Pickett: "The Spirit Level: Why Greater Equality Makes Societies Stronger" (2011), where it is argued that where equality prevails, everyone lives better.

Furthermore, a detailed analysis of the works of French sociologist P. Bourdieu, such as "Practical Reason; On the Theory of Action" (2009) or "Sociology in Question" (1995) published by Sage Publications, convincingly argues that components of well-being, using Bourdieu's terminology, can also be socially distinctive features. On the other hand, well-being is typically a subjective matter that is not solely tied to a material approach. This position is shared by E. Diener, who in one of his works states that "well-being refers to an individual's experience of happiness and life satisfaction. The assessment of well-being, typically referred to as subjective well-being (SWB), is subjective in nature and is based on two categories: the experience of positive and negative affect and the aforementioned life satisfaction" [2].

Returning to the analysis of the rudimentary concept in this work, namely corporate well-being, it should be noted that it is closely linked to social activities such as investing in local communities, supporting charitable programs, environmental protection, promoting sustainable development, and ethical business practices. In other words, it is the aspiration for harmonious coexistence of business, people, and the planet [3].

It is important to understand that corporate well-being is not a one-time or marketing strategy. It is a long-term approach that emphasizes continuous improvement and refinement of business practices in a way that yields positive outcomes for both the corporation and stakeholders.

Furthermore, corporate well-being plays a crucial role in the modern business landscape, impacting not only the corporation itself but also society and the natural environment. In recent years, there has been an increased interest in studying the impact of proper governance and corporate responsibility on financial performance, employee engagement, company reputation, and long-term business success.

Aims. The purpose of the article is to study the theoretical and practical aspects of the impact of corporate welfare programs on the productivity and loyalty of personnel.

Methodology. The methodological basis of the study is the results of the analysis of scientific works on the welfare, loyalty of personnel and their impact on the sustainable development of companies.

Results. According to Gallup research, psychological distress will soon be one of the top causes of unemployment in the world, and the world economy will lose $295 billion due to reduced productivity [11].

That is, a clear relationship can be traced: a decrease in the level of anxiety or stress - an increase in involvement in work processes and the life of the company - an improvement in the quality of work, which, as a result, significantly affects the financial indicators of the company. In other words, corporate well-being is not another tribute to fashion, but a key factor in the

successful development of business today [1, 8, 9].

It is believed that well-being consists of five components (Table 1).

Table 1. Five components affecting the well-being of a person

Emotional well-being	Physical well-being	Professional well-being	Financial well-being	Social well-being
predominantly positive emotional background; a dominant state of calm, contentment and confidence; subjective experience of happiness	a sense of confidence in the future, security and medical care. This is proper nutrition and sufficient physical activity	it is clear where to grow, how to apply your competences, experience and knowledge; growth prospects, the possibility of self-realization	the opportunity to take care of yourself and your family, the opportunity to fully cover your needs and rest normally	good relationships in the family and in the team, balance between work and personal life, contribution to a common cause
- belonging and self-esteem; - goals and success; - principles; - stress resistance	- living conditions; - sleep and rest; - physical activity; - health and energy	- trainings and development; - engagement and productivity; - recognition and achievements	- preparation; - planning; - protection; - seminars / webinars / coaching sessions on financial literacy	- environment; - family; - friends; - colleagues

Source: summarized by the authors based on [1, 8, 9]

If at least one of the listed factors "decreases", a person is not able to devote himself 100% to work. Hence the conclusion: if the company helps to improve the level of well-being of employees, their involvement will increase, and business indicators will also increase [14, 15].

Here are some of the factors that help keep employees at a company and can make them stay:

- a healthy working environment;
- recognition and praise;
- flexibility;
- opportunities for growth and development;
- healthy relationship with the manager;
- competitive compensation [16].

The well-being program is a serious advantage of the company as an employer on the labor market. It is the program, not separate actions. Today, there are many solutions that do not cost a lot of money, but can be very useful for maintaining the productivity of employees and increasing their engagement at work [4, 5, 6].

The well-being of employees is becoming a trend - a sustainable trend that is gaining momentum and is gradually coming to Ukraine. According to the Social Progress Index (summary for 2020, includes 163 countries) on international trends in personnel management in 2020, many companies are implementing the integration of well-being into the work process [17].

Another trend in well-being is caring not only for the employee, but also for his immediate environment. In many companies, welfare programs can be used by family members of an employee. These are cases when, for example, DMS (voluntary health insurance) applies to the closest relatives. Approaches to this can be different: corporate discounts that also apply to family members, payment of part of the DMS program from the company, etc. [3, 16].

For example, you can hold health weeks on a regular basis and offer master classes on healthy eating to employees, conduct yoga classes, and implement practices to relieve stress and balance the emotional state. Another option: to use meditation as a way to achieve a balanced state and increase the clarity of the mind - to make the right decisions [1, 4, 5].

From the point of view of business, employee well-being affects the indicators presented in the table. 2.

Table 2. The influence of a person's well-being on business processes

Indicator	Characteristic
Productivity	When employees feel good, they make better decisions and work with greater dedication. Well-being increases productivity and efficiency. When employees feel good, they lead healthier lifestyles and make better decisions.
Team spirit/morale	Employees feel more valued when their needs are met on all levels, including physical, mental and financial. Employees feel more competent and valued when their needs are met on all levels, including physical, mental and financial.
Company reputation, talent attraction and retention	If an employer is known for respecting and helping to maintain work-life balance, then, other things being equal, they will attract more applicants. If your company has a good reputation in the market as an employer that respects and supports work-life balance, you are more likely to attract qualified candidates and retain your employees for a longer period.
Customer orientation	Happy employees are the best brand ambassadors who are determined to provide great customer service. Happy employees are the best brand ambassadors. If you treat them well, employees will be interested in understanding products and services and better meeting customer needs.

Source: summarized by the authors based on [1, 4, 5]

This is the development of healthy habits, reducing the risk of cardiovascular diseases, improving the quality of sleep and rest, increasing self-control and the ability to cope with stress - and, as a result, reducing the likelihood of burnout at work and the occurrence of mental problems. After all, such a strategy is necessary at least in order for employees to see that they are valued and supported at work! It increases the involvement of employees and motivates the achievement of the set goals of the team at the scale of the company, forms factors that contribute to the emergence of staff loyalty to this

organization [12].

Hidden disloyalty manifests itself as follows: people correctly fulfill the rules and requirements that are assigned, but the reason for this behavior is not a positive attitude, but a fear of punishment or an expectation of reward.

The first level of loyalty consists of external attributes that indicate belonging to the company. This is a formal, material level that speaks only about the expected behavior of a person who owns or uses a particular attribute of the company. There is no question of loyalty here yet.

Loyalty is only at the level of actions and behaviors associated with the observance of rituals, traditions, and customs in the company. Such traditions can be a special tone in dealing with customers, formal and informal gatherings (parties), etc. Employees who are loyal to the company at this level enthusiastically or at least without difficulty participate in such events.

Loyalty at the level of beliefs is not achieved by most of the company's employees. Employee loyalty at the level of beliefs alone is of great value to the company with its positive impact on professional motivation. Loyal employees devote themselves to their work as much as possible, intolerant of violations of other people's rules. They are active in solving problems, can be initiators of improving activities, are able to defend constructive proposals [2, 7].

Loyalty at the level of identity alone is the highest level. Apparently, this kind of loyalty is called devotion, fidelity. And here a person maximally identifies himself with the object of loyalty. Three components of loyalty: trust of the staff in the management of the company; the fairness of the employee's relationship with representatives of the enterprise's administration; job satisfaction [2].

There is no doubt that employers should provide their employees with the necessary support and care for their physical and mental health. And yet many organizations still don't have a well-being strategy in place. After all, such a strategy is necessary at least in order for employees to see that they are valued and supported at work. It increases the involvement of employees and motivates the achievement of the set goals of the team at the company scale [10, 13].

It is obvious that the well-being of employees is the foundation of any organization. Regardless of the size and industry of your company, there are many effective ways to improve the quality of life of everyone who works there. Get proactive about your employees' well-being and you'll find yourself improving (and maybe even saving) their lives. Corporate well-being is not financial compensation, but the employer's participation in creating opportunities that contribute to the psychological, financial, physical and social well-being of employees.

Discussion. The main characteristics of well-being that indicate its importance for companies are the following:

1) Corporate well-being leads to increased employee engagement. Creating an attractive and healthy work environment is one of the key aspects of

corporate well-being [17]. Corporations that invest in the well-being of their employees, such as health or wellness programs, career development opportunities, and creating a friendly work environment, typically experience higher levels of employee engagement. Their employees tend to be more productive, loyal to the company, and contribute to achieving better financial outcomes. Therefore, corporate well-being can be seen as a business energy that mobilizes employees to fully realize their potential.

2) Corporate well-being contributes to the formation of a positive company image. Corporations that prioritize ethical standards and social responsibility often gain a reputation as responsible market players. Investments in corporate well-being, such as social programs, environmental protection, or community involvement, enhance the company's positive image. Consumers, investors, and other stakeholders increasingly prefer companies that operate in line with social and environmental values. Therefore, corporate well-being is a business energy that attracts customers, investors, and other partners, thereby increasing the company's competitive advantage.

3) Corporate well-being contributes to increased operational efficiency and productivity in organizations. By improving working conditions, addressing work-life balance for employees, and investing in competency development and training, there is greater employee engagement and better financial performance for the company [18].

4) Corporations that prioritize employee well-being create a positive workplace atmosphere, which, in turn, leads to increased motivation, greater creativity, and innovation. This positive climate fosters the development of talents and skills among employees, which is a key driving force for business success.

5) Corporate well-being as a business energy is an important factor in attracting and retaining talented employees. Organizations that provide favorable working conditions, professional development opportunities, and a sustainable work environment have a better chance of attracting and retaining the best talents in the job market.

6) Implementing a sustainable development strategy and corporate social responsibility (CSR) as part of proper corporate behavior contributes to increased trust from customers and potential clients towards the brand. The awareness that a company engages in social and environmental initiatives appeals to consumers who are more likely to support such organizations [19].

7) Corporate well-being as a business energy leads to enhanced reputation of the organization in the market. The positive impact on employees, local communities, and the natural environment creates a strong foundation of trust, which translates into long-term success and competitiveness of the company [20].

8) There is a synergy between social good and financial performance. Research shows that corporations that invest in employee well-being, social

sustainability, and environmental conservation achieve better financial indicators and long-term profitability [21].

9) Corporate well-being as a business energy is a key factor in building sustainable relationships with stakeholders such as employees, investors, suppliers, customers,and the local community.

Employees who experience corporate well-being feel valued and therefore are dedicatedto the company's goals. This increases their trust in the organization and leads to greater loyalty and long-term collaboration. The stability and continuity of work also ensure the preservation of knowledge and expertise within the company, which is a strategic competitive advantage.

In turn, investors who see that the company strives for corporate good have greater confidence in its growth potential and profitability. For this reason, they are more willing to invest their financial resources and engage in long-term business partnerships. Thus, corporate well-being becomes a key factor in attracting capital and driving business development.

And conversely, suppliers who work with a corporation that prioritizes employee well- being have greater confidence that their interests will be respected. A good corporate reputationtranslates to increased reliability and trust in commercial relationships, fostering long-term partnerships and mutual benefits. Turning to customers, those who see that a company strives for corporate good feel more trust in its products or services. Commitment to sustainable development, corporate social responsibility, and ethical business practices attract customers who are more likely to support the brand loyally and recommend it to others.

As for the local community in which the company operates, it benefits from corporate well-being through investments in social projects, charitable activities, and involvement in local initiatives. As a result, corporations become integral parts of the community, strengthening trust, support, and a positive image. This, in turn, leads to an enhanced reputation and lasting relationships with local stakeholders [22].

Conclusions. Based on the presented theses, the following conclusion can be drawn: corporate well-being has a broad impact on the success of a business. It is an elemental energy for business that contributes to increased employee engagement, motivation, customer loyalty, reputation growth, and attracting investors. Companies that attach significant importance to this opus magnum, which is corporate well-being, thereby establish long-lasting relationships with stakeholders and gain a competitive advantage in markets that are becoming increasingly socially conscious. Moreover, it not only contributes to improving working conditions and employee well-being but also provides significant driving energy.

Author contributions. The authors contributed equally.

Disclosure statement. The authors do not have any conflict of interest.

References:

1. Diener E., (1984) *„Subjective well-being".* Psychological Bulletin 95 (3)
2. Kim, Y., Park, J.E., Wier, B. (2012) *"IsFirm-Specific CSR Sustainable? A Longitudinal Analysis."* Journal of Business Ethics, 110 (3)
3. McWilliams A., Siegel D. (2001) *„Corporate Social Responsibility: A Theory of the Firm Perspective."* Academy of Management Review, 26 (1)
4. Beaumont Jen Measuring National Well-being – Older people and loneliness. The Office for National Statistics. Electronic data. Newport, 2013. URL: http://www.ons.gov.uk/ons/dcp171766_304939.pdf
5. Burlakova, I., Sheviakov, O., Kondes, T. (2021). Coaching as a tool for the formation of corporate well-being Scientific Center of Innovative Researches. P.306. URL: https://conf.scnchub.com/index.php/ICEAF-2021/paper/viev/
6. Burlakova, I., Sheviakov, O., Kondes, T. (2020). Cognitive approach to corporate well-being management International conference on economics, accounting and finance academy of economics and pedagogy July 2, 2020 – July 4, 2020 at the Prague, Czech Republic, 2020. P. 29 – 30.
7. Burlakova, I., Sheviakov, O., Kondes, T. (2020). Features of corporate well-being.-Corporate management: from creation to success: monograph. Tallinn. Scientific Center of Innovative Researches OÜ. 2020. 352 p. P. 142 – 154. DOI: https://doi.org/10.36690/CMCS-142.
8. Capnary, M.C., Rachmawati, R., Agung, I. (2018). The influence of flexibility of work to loyalty and employee satisfaction mediated by work life balance to employees with millennial generation background in Indonesia startup companies. Business: Theory and Practice, 19, 217-227.
9. Culbertson, S. (2010). Feeling good and doing great: The relationship between psychological capital and well-being. Journal of Occupational Health Psychology. Vol.15. № 4, pp. 421 – 433.
10. Enhancing well-being at work: The role of emotion regulation skills as personal resources / G. Buruck, D. Dorfel, J. Kugler, S. Brom // Journal of Occupational Health Psychology. – 2016. – Vol. 21 (4). – P. 480-493.
11. Gorgenyi-Hegyes E, Nathan RJ, Fekete-Farkas M. Workplace Health Promotion, Employee Wellbeing and Loyalty during Covid-19 Pandemic—Large Scale Empirical Evidence from Hungary. Economies. 2021; 9(2):55. https://doi.org/10.3390/economies9020055
12. Harter, J.K., Schmidt, F.L. and Keyes, C.L. (2003) Well-Being in the Workplace and Its Relationship to Business Outcomes: A Review of the Gallup Studies. In: Keyes, C.L.M. and Haidt, J., Eds., Flourishing: Positive Psychology and the Life Well-Lived, American Psychological Association, Washington DC, 205-224. http://dx.doi.org/10.1037/10594-009
13. Mazur-Wierzbicka E. Determinants of Employee Loyalty from the Perspective of Employees of Socially Responsible Organizations European Research Studies Journal Volume XXIV, Issue 4B, 202 pp. 713-722.
14. Mihus, I., Laptev, S., Parashchenko, L., Koval, Y., Odarchyk, K., & Panchenko, O. (2021). The impact of the COVID-19 pandemic on the loyalty of employees. Ad Alta-Journal of Interdisciplinary Research, 38-41. URL: http://www.magnanimitas.cz/ADALTA/110117/papers/A_07.pdf.
15. Mininni, G., Manuti, A., Scardigno, R., & Rubino, R. (2010). Subjective wellbeing between organizational bonds and cultural contaminations. World Futures: The Journal of Global Education. 66(6), 387–397.
16. Moen, P., E. L. Kelly, W. Fan, S.-R. Lee, D. Almeida, E. E. Kossek, and O. Buxto, Does a Flexibility/Support Organizational Initiative Improve High-Tech Employees' Wellbeing? Evidence from the Work, Family, and Health Network, American Sociological Review, 81(1), 134-164, 2016.
17. Mohr, L.A., Webb, D.J., Harris, K.E. (2001). *„Do Consumers Expect Companies to be Socially Responsible? The Impact of Corporate Social Responsibility on Buying Behavior."*Journal of Consumer Affairs, 35(1).
18. Orlitzky M., Schmidt F.L., Rynes S.L. (2003) *„Corporate Social and Financial Performance: A Meta-Analysis."* Organization Studies, 24(3).
19. Porter, M.E., Kramer, M.R. (2006) *„Strategy & Society: The Link Between Competitive Advantage and Corporate Social Responsibility."* Harvard Business Review, 84(12).
20. Ryan RM, DeciEL (2001) "On happiness and human potentials: A review of research on hedonic and eudajmonic research". *Annual Review of Psychology*.
21. Sen A. (2015) „*Nierówności. Dalsze rozważania*", Wydawnictwo Znak; Fundacja im. Stefana Batorego, Kraków
22. Konieczny, G.; Kolisnichenko, P.; Gorska, M.; GorskI, T. (2023). Corporate well-being as the energy of business. *International Conference on Corporation Management.* DOI: https://doi.org/10.36690/ICCM-2023-78-81.

MEASURING DIGITAL ADVERTISING EFFECTIVENESS ON FACEBOOK AS PART OF A NATIONAL BRAND ADVERTISING CAMPAIGN

Bohdan Kolesnyk[1], Iuliia Kostynets[2]

[1]*Postgraduate student, Kyiv National University of Technologies and Design, Kyiv, Ukraine, e-mail: bogkolesnik@gmail.com, ORCID: https://orcid.org/0000-0003-0912-3835*

[2]*Doctor of Science (Economics), Associate Professor, Professor of the Department of Marketing, Economics, Management and Administration, National Academy of Management (Kyiv, Ukraine); Visiting Researcher at the Department of Business Administration, esp. Marketing, Heinrich-Heine-Universität (Düsseldorf, Germany), e-mail: yulia.kostinets@gmail.com, ORCID: https://orcid.org/0000-0001-6427-675X*

Citation:
Kolesnyk, B., & Kostynets, I. (2023). Measuring digital advertising effectiveness on facebook as part of a national brand advertising campaign. *Economics, Finance and Management Review*, (3), 68–82. https://doi.org/10.36690/2674-5208-2023-3-68-82

Received: September 07, 2023
Approved: September 29, 2023
Published: September 30, 2023

Abstract. *The subject of the study is the problem of assessing the effectiveness of digital activations (advertising campaigns) on Facebook and social media in general; finding ways to measure the impact of digital activations and the causal link of online information campaigns on a brand. The purpose of the study is to find out whether it is possible to reach the necessary target groups as part of a national brand image campaign using Facebook advertising; to monitor key indicators, results, and outcomes; to formulate key Facebook indicators that can be demonstrate the effectiveness of online campaigns; to study the issues of assessing the effectiveness of such digital advertising campaigns. This paper uses the dialectical method of scientific cognition, the method of analysis and synthesis, the comparative method, the method of data generalization, the method of expert evaluation, and the monitoring method. This paper defines the place and role of Facebook activations in the digital toolkit as part of a national advertising campaign in the context of the war in Ukraine and uncertainty in society. On the example of a relevant advertising campaign of an international brand present on Ukrainian market, the authors outline strategies and approaches to conducting national campaigns to inform and improve the brand image. The study also considers assessment of the brand impact of a Facebook advertising campaign, provides examples of efficiency assessment and proposals for conducting relevant marketing research. The authors characterize Facebook metrics, its algorithm for evaluating advertising on this platform and conduct a comparative analysis of approaches to Facebook advertising methods based on the experimental experience of cooperation with representatives of medium and large businesses. Proposals for analysing the effectiveness of digital campaigns on Facebook are presented. The results of the study are as follows: a set of strategies for effective conduct of a national digital advertising campaign on Facebook is identified, which can be applied to international brands in the face of market uncertainty; possible measures for analysing the effectiveness of a campaign are proposed.*

Keywords: *Facebook advertising campaign, digital marketing, image advertising, brand management, measuring advertising effectiveness.*

JEL Classification: M30, M37

Formulas: 0; fig.: 1; tabl.: 3; bibl.: 19

Introduction. Social media campaigns have become particularly relevant due to their ability to reach millions of people quickly and inexpensively. Digital campaigns are typically distributed in the form of ads on social media sites such as Facebook, Instagram, TikTok, Twitter (less popular in Ukraine but also worthy of attention), YouTube and LinkedIn, or through ads placed on websites or search engines. The ubiquity and versatility of social media allows organisations to reach their chosen target audience and, using the right marketing and communication tools, not only deliver information but also build relationships with customers, establish a dialogue, and offer products or services that best suit their individual and ever-changing needs. It is known that almost 50% of the world's population uses social media – more than 3 billion users worldwide (Hootsuite, 2021). Each user spends an average of 2 hours and 25 minutes on social media and messaging (Mander, 2019). Due to the novelty and dynamism of the subject, it is difficult for researchers to agree on a single approach. Researchers can assess and interpret the factors that influence the effectiveness of social media advertising campaigns in different ways. Hence, the question is: how to analyse the results and measure national digital campaign effectiveness on Facebook in relation to marketing communications and brand management? This issue needs to be researched.

Literature review. The problematics of advertising campaigns that use digital marketing tools is considered by scientists and industry experts in Ukraine and, primarily, in developed countries in various aspects: studying social networks and advertisers' opportunities to use their advertising platforms (C. Ashley, 2015; T. Tuten, 2015; R. Felix, 2017; P. A. Rauschnabel, 2017; C. Hinsch, 2017; J. Penni, 2017; G. Killian, 2015; K. McManus, 2015), the effectiveness of measuring the results of social media campaigns (A.B. Albarran, 2017; J.H. Liu, 2017; O.A. Elrahman, 2017; X. Ban, 2017), relationship marketing and brand management on social networks (K. Keller, 2009; P. Kotler, 2009; M. Sudha, 2017; K. Sheena, 2017; S. Khamis, 2017; L. Ang, 2017; R. Welling, 2017), measuring the advertising effect and comparing the effectiveness of advertising media (R. Benes, 2023; R.A. Lewis, 2013; D. T. Nguyen, 2014). At the same time, given the lack of a systematic study of digital marketing strategies, including the processes of managing and evaluating advertising campaigns focused on the use of Facebook, the subject requires further research.

Aims. The purpose of this paper, as a part of scientific research, is to define the stages of a national digital advertising campaign on Facebook, study the problems of applying appropriate marketing strategies, and compare the effectiveness of advertising tools within such a campaign.

Methodology. In circumstances of the war in Ukraine, which are associated with uncertainty in society and overload in the information space, examples of national image campaigns include a developed volunteer programme of Kyivstar cllular operator with a corresponding tariff plan; the

sale of a limited edition of salt in Rozetka online store with a significant share of profits going to help the army; the initiative of Nova Poshta logistics company to open its postal departments in the de-occupied territories as soon as possible, etc.

Let's focus on the latter initiative, as the results of Nova Poshta have become public in the media. A surge of posts about the reopening of company's offices immediately flooded social media. Positive posts included happy feedback, support, and gratitude from citizens, while neutral posts included news about the event. Analytical systems report 3.7 thousand mentions of the initiative by social media users, 67% of which were positive, with a total engagement of 89.5 thousand (Yasko, 2023). The Nova Poshta initiative prompted the spread of joke posts about a "competition" between Nova Poshta and Ukrposhta to be the first to reopen postal offices in the liberated territories. In total, more than a thousand posts were published about the "competition" between the postal services, with the vast majority on Twitter.

Corporate social responsibility in times of war has become mandatory for big business and their brands. The public is already asking companies what they are doing to support Ukraine and will certainly be interested in this in the future. In particular, this is evidenced by the results of a study conducted by Google's industry unit and research company Kantar. The study showed that more than 40% of respondents consider transferring funds for humanitarian aid, supporting IDPs, and participating in volunteer activities to be extremely important components of a brand's activities (Borodii, 2023). Today, when choosing a brand, the most important factors for consumers are a brand's relationship with aggressor countries, price, and support for the Ukrainian army. At the same time, only a third of respondents consider availability of a product line with Ukrainian symbols or a use of patriotic attributes when choosing a product; 51% of respondents consider practical actions of brands (e.g., volunteering) to be more valuable than symbolic actions, such as a use of Ukrainian attributes. In summary, the emphasis can be made on the importance of digital advertising within brand management and the significant impact of social media on marketing communications, including in conditions of a full-scale war.

The following pilot study aims to provide an initial understanding of the following questions:

- what is the best way to measure the impact of digital information campaigns;
- how to assess the effectiveness and causal impact of digital information campaigns;
- whether Facebook advertising reaches the necessary target groups as part of a national image campaign.

Practitioners, experts, and academic researchers often have different understandings of what impact means and how to measure it. There are various ways to evaluate the results of digital campaigns, which differ in complexity, reliability, and purpose. Evidence-based impact evaluations are an ideal tool for

measuring the "quantitative" impact of a specific activity on a clearly defined target group. They help to answer the question of what would have happened if an advertiser's intervention had not taken place. This approach, which can be called an experimental method of establishing causality, requires several rounds of data collection over time and a comparison group (Gertler et al, 2016).

The lack of experimental research on digital campaigns is partly due to the difficulty of measuring the impact of social media campaigns (López, 2019). Typically, impact evaluation begins with a baseline survey of the participating and non-participating groups to understand who these people are and how they think before they are exposed to the information campaign. Then, after receiving the data, people are tested (sometimes once, sometimes again after a few months) to see if there has been any change in their attitudes, awareness, or planned behaviour. However, transferring this research design to social media campaigns is usually not possible due to the way social media advertising platforms are designed.

An intervention in the information space (such as a digital campaign) does not always lead to immediate, visible impact. When assessing impact, it is important to outline a logical chain and identify key inputs, outputs, outcomes, and long-term impact (fig. 1).

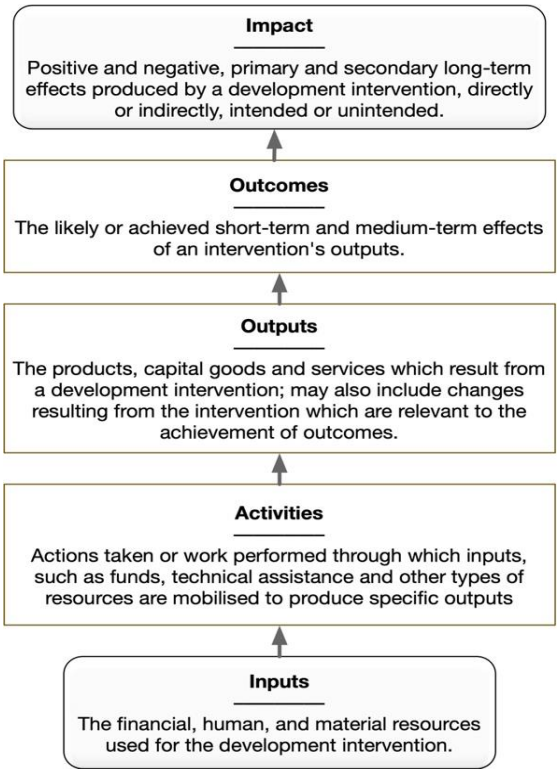

Figure 1. Chain of assessment components, based on materials of Organisation for Economic Co-operation and Development [OECD], 2013

The outcomes and impact of a campaign can be difficult to define and measure objectively. Therefore, evaluation of this type of intervention should

include monitoring of key inputs, outputs, and impacts. Every Facebook ad campaign can be measured through engagement analytics (number of views, clicks, interactions with ads, etc.), but one of the best ways to assess the impact on the behaviour or attitudes of a target group is through online surveys.

If the logical chain of an offline campaign is translated to a digital campaign on Facebook, its various components can be described as follows:

1. Resources: the budget allocated for the production, development, and distribution of a campaign content on social media;

2. Activities: creation of photo and video materials, coordination and monitoring of social media accounts, as well as interaction with beneficiaries;

3. Output: videos, static images and other media content used for a campaign;

4. Results: interaction with the campaign content: number of people watching a video, number of likes, clicks and people watching a video, other engagement indicators;

5. Impact: changes in attitudes, awareness, and behavioural changes (directly related to the campaign).

Academics and media market researchers are trying to find the best way to measure the impact and effectiveness of online advertising. Traditional market research initially relied on methods such as phone calls to survey a sample of people about brand awareness and recognition or knowledge of a particular product or advertising campaign. With the development of Internet and social media, some experts in the field have moved on to so-called "intercept surveys", which is typically a banner that appears every time a user visits a website and invites them to take part in an online survey. However, researchers have expressed concern that this method leads to user fatigue (overuse has led to fewer people clicking on ads, with academic literature detailing the phenomenon of "banner blindness"), as well as potential response bias that comes from conducting a survey on a page that displays ads (Gluck, 2011).

There are other ways to measure online performance, such as the engagement metrics provided by Facebook's advertising analytics (tabl. 1 for Facebook metrics and their definitions). Compiled by the authors based on "Glossary of Meta Ad Terms", Facebook, n.d.

These are also indicators that should be mentioned:

- sentiment analysis, i.e., how people discuss content;
- conversion rate, which is whether advertising leads to a measurable result.

Businesses usually measure conversions in purchases. One of the most common types of measurement is the "conversion lift" of advertising. For instance, when it comes to product advertising, this is the percentage of people who saw an ad, clicked on it, went to another page, and made a purchase. A similar concept can be applied to an informing image campaign, which shows a picture or post that encourages people to go to an external page. There are many

examples of campaigns that use Facebook or Instagram posts to lead people to a page with more detailed information;

- advertising recall, i.e., how many people remember seeing an advert. This metric exists on Facebook and shows how many people, according to the platform, will remember an ad within two days of viewing it, based on information collected by the social network about user behaviour;
- brand awareness, increasing awareness of a particular communication message. This can also apply to image campaigns; for example, if a campaign is associated with a particular initiative, whether it leads to people becoming more aware of that initiative.

Table 1. Facebook metrics and their definitions

Metric	Definition
Amount spent	Estimated total amount of money spent on a campaign, ad set or individual ad during the display schedule.
Frequency	An average number of times each person saw an ad. Frequency is calculated as a share of impressions divided by reach; on average, it ranges from 1 to 2 per ad set. It can be much higher depending on a budget, audience size, and schedule.
Impressions	The number of times that any content from a company (community) page or about page is displayed on a user's screen. Some users may see an ad more than once.
Reach	The number of unique users who have seen an ad at least once. Reach differs from impressions, which may include multiple views of an ad by the same people.
Potential reach	An estimate of the size of an audience that can see an ad. It is based on targeting criteria, advertising locations, and the number of people who have been exposed to an ad in Facebook apps and services in the last 30 days. It is not an estimate of how many people will see an ad, and this number may change over time.
Clicks on the link	The number of clicks on links in an ad that lead to places on Facebook or websites outside of Facebook.
Post engagement	The total number of ad-related actions that people take. This includes ad reactions, comments, shares, responses to an offer, photo or video views, and link clicks.
Reactions to a post/advertisement	The number of reactions to an ad. Facebook reactions include: "Like", "Love", "Care", "Haha", "Wow", "Sad", "Angry". This metric counts all the reactions that people have left during the ad.
Results	The number of times an ad has achieved a result based on the selected goal and settings.
Video that played to 100% completion	The number of times a video was played for 100% of its length, including plays that were skipped to the final part.
ThruPlay views	The number of times a video was played to the end (97%) or for at least 15 seconds.

Online evaluation should include monitoring key indicators, outcomes, and outputs. Facebook's key metrics can be indicators of the effectiveness of online campaigns. While Facebook metrics such as reach are important for understanding campaign outcomes (e.g., how many people saw the ad), engagement metrics such as reactions to a post, clicks on links, and video views are particularly important for understanding results of a national image campaign.

The use of "digital footprints" and "big data" is becoming increasingly popular among researchers and advertisers alike (Cesare et al, 2018). However, what makes social networks such as Facebook attractive for online information campaigns also makes them difficult to evaluate, and using advertising to reach target audiences or collect samples for surveys has several important limitations (López, 2019). A way to test the impact of advertising that is often used by marketers is to take a sample of the population and divide it equally, randomly, into treatment and control groups. The intervention group is shown the relevant ad, while the control group is shown an irrelevant ad that is not related to the main campaign. But as many social media advertisements now rely on automatic corrective algorithms that use zero or irrelevant ads as a control group, this method is no longer practical. For example, Facebook will show ads selectively or increasingly to people who are more likely to click on them, thus introducing additional bias into an experiment. In this way, an advertising platform can create an endogeneity problem that introduces additional bias and makes it difficult to determine whether an observed effect was caused by the intervention or by some other unrelated factor. In other words, in evaluating digital advertising on Facebook, there is a limited control over who is exposed to an ad and how many times the user sees the ad.

Facebook's advertising algorithm makes it difficult to conduct a randomised controlled trial, as it leads to problems with selection bias. Facebook's platform optimises a given campaign goal (e.g., clicks or conversions) and selectively shows ads to people who are more likely to click on them. This prevents creation of a true random distribution of exposure and also makes it possible for parallel campaigns to show ads to different groups at the same time, leading to potential cross-over errors. The problem with selection bias has important implications and makes it difficult to control for unobserved differences between target groups. As Lewis and Rao (2015) note: "These biases exist primarily because advertising is not inherently random" (p. 1941).

Facebook's user base is not necessarily representative of a country's population, which is a problem for a national campaign. Although Facebook boasts an impressive number of users (more than 2.5 billion), they are unevenly distributed across the world. As for the penetration of this social network in Ukraine, it has 16 million users (PlusOne, 2021). This social network is also characterised by the fact that advertising using its platform allows expanding an audience through traditional means of online marketing, although the advertising platform's tools are insufficient for Instagram, a social network with a higher average ER (engagement rate), greater coverage of Ukrainian residents under 31, and a larger number and weight of "opinion leaders" (PlusOne, 2021). At the same time, the total audience of Instagram in Ukraine is only 1 million less (and this gap is closing) and amounts to 15 million users, many of whom also use Facebook.

The people who use Facebook may also differ from an average citizen of a particular country, depending on their income, education, internet access, language skills, etc. For instance, younger audiences are increasingly using other social media and platforms such as Instagram or TikTok (DataReportal, 2023). In addition, Facebook estimates that 5% of monthly active users worldwide are fake accounts, and 11% of monthly active users worldwide are duplicates of existing accounts (Hootsuite, 2023), which can lead to potential errors in an entire sample. In addition, the composition of the platform's users, the size of individual segments, and usage patterns change over time; in other words, Facebook users in the same area may be more or less "representative" of people living in that area when surveyed at different times. Ad repetition cannot be completely avoided or eliminated, and therefore the target group may see an ad several times, which can lead to a decrease in interest in it as people feel oversaturated at some point. This is especially true in rural areas, where the potential audience is smaller, and the frequency of ad impressions can be much higher than in urban areas (Facebook frequency is the number of times an individual has seen an ad; it is calculated as the proportion of ad impressions divided by reach). In addition, if you do not provide a sufficient time gap between ad impressions, people may feel tired of an ad and complain about it.

The goal of image advertising campaigns is usually to change the audience's perception, knowledge, or attitude towards brand-related issues. In conventional (offline) research, these results can be measured by commissioning a survey. However, in digital research, the standard metrics provided by Facebook do not provide insight into these results. Facebook's metrics are mostly limited to "engagement", i.e., the degree to which users respond to ads. Measuring brand management-related outcomes solely through Facebook would require addition of a special online survey, which creates a number of new challenges. Advertising impact assessments require surveying the same audience at least twice over time. On Facebook, it is extremely difficult to track people who participate in online experiments because audience members are always anonymised. This makes it difficult to assign people to target or control groups. People may use different devices, and one device may be shared by several people, such as family members. In addition, new privacy technologies make it easier to disguise identity online, making it harder to trace an individual. Internet cookies are often used as the best way for advertisers to identify users online. Internet browsers store data about a user on specific websites so that sites can use this data when the user returns.

However, cookies are easily deleted, and changes in legislation in the EU and other developed countries are making it more difficult for websites to track cookies in certain circumstances (European Commission, n.d.).

Of course, to support a digital campaign, there is a practice of taking auxiliary measures to promote a brand message through marketing communications. A company can use BTL tools or change product packaging

so that it includes a call to join social networks via a QR code, for example. Traditional events and exhibitions, conferences, expert appearances on the radio, and joint live broadcasts via online platforms can also be a source of new followers (although holding events with a physical presence is complicated by martial law or quarantine restrictions in other countries). In addition, if a company has an electronic customer database (for example, in a CRM system), it can send out email newsletters, etc. However, in many cases, direct mail, packaging changes or large ATL advertising campaigns are not possible. In case of using internet marketing, the following can be used:

- interaction with bloggers (influencers);
- interaction with partners;
- own interactive formats;
- targeted advertising.

Let's take the example of the national digital campaign by brand "A", which was conducted using Facebook. Company "A" is a real organisation, but the name has been changed for commercial security reasons. Among the above methods, Company "A" chose targeted advertising using the Facebook online marketing platform to conduct a national digital campaign promoting its social initiative. For the advertising campaigns, similar audiences were generated based on Company "A" databases, which include installers, architects and designers, and salespeople; the audience sizes with a 2% similarity rate accounted for 445.4, 438.7, and 444.8 thousand, respectively. In Facebook advertising account, it is possible to create an advertising campaign using the "reach and frequency" buying type, which in turn allows to choose a fixed CPM (cost per thousand) value depending on the audience to accurately estimate the amount of costs before booking a campaign. Advertisers can also predict reach of the selected audience, set the number of ad impressions, and specify on which days, at what time, and in what order to display ads.

Thus, it is possible to book campaigns with the "reach and frequency" buying type up to 90 days in advance, 6 months before the start of displaying. When creating such a campaign, Facebook's system helps determine which audiences and targeting settings will be most effective. In this way, advertisers can organise a media planning process comparable to ordering TV, print, outdoor and similar types of advertising. Previously, this type of ad-buying was limited to advertisers with a budget of USD 50,000 or more, but this restriction is no longer in force. Nevertheless, this format of ad-buying was impossible for Company "A" since the activation (digital campaign) in question was planned for a period shorter than 2 months. In total, during the reporting period, Company "A" created 10 advertising campaigns using traditional "auction" buying type. With the aim of maximising reach, the company chose a strategy of increasing frequency of ad impressions. Table 2 shows results of the campaigns for the period from 01.02.2023 to 31.03.2023.

Table 2. Results of advertising campaigns on Facebook

Campaign, objective	Bidding strategy	Budget, USD (excl. VAT)	Reach, results	ThruPlay views (15+ sec.)	Impressions	Frequency	Price per result, USD	Page engagement
1. Installers, engagement, video	video views	600	148 920	333 330	387 504	2.60	2/1000 ThruPlay	366 401
2. Installers, reach, images	max. reach	600	696 553	-	1 514 958	2.17	0.86/1000 reached	3 696
3. Architects and designers, engagement, video	video views	500	145 307	287 542	339 192	2.33	2/1000 ThruPlay	321 234
4. Architects and designers, reach, images	max. reach	500	686 441	-	1 474 608	1.15	0.73/1000 reached	3 893
5. Salespeople, engagement, video	video views	400	119 356	221 105	256 109	2.15	2/1000 ThruPlay	241 527
6.1 Salespeople, reach, video	max. reach	600	471 794	-	885 981	1.88	0.56/1000 ThruPlay	158 273
6.2 Salespeople, reach, images	max. reach		583 278	-	1 133 276	1.94	0.57/1000 ThruPlay	1 934
7. Public institutions, traffic	clicks on the link	500	138 095, 100 leads	-	727 860	5.27	0.11/ click on the link	4 080
8. Public institutions, leads	Facebook form completions	200	49 748, 230 leads	-	140 407	2.82	1.18/lead from Facebook	1 977
9. Followers, post with video	video views	100	27 104	53 949	63 684	2.35	2/1000 ThruPlay	60 237
10. Підписники, post with images	max. reach	70	338 199	-	537 595	1.59	0.21/1000 reached	78 941

It is worth noting that the campaigns for receiving applications (leads) through the Facebook form and the form on the company's website were tested separately, which made it possible to compare the results.

Despite better performance of the Facebook form campaign (230 leads from the Facebook form versus 160 from the company's website), this advertising campaign was forced to be suspended due to technical issues with uploading collected data from the questionnaire forms. At the same time, this type of campaign demonstrated the effectiveness of Facebook targeting in Ukraine using the characteristics of "officials" and "civil servants", with an audience size of 35.5-41.8 thousand, which was dynamically expanded by Facebook algorithms to 11.4 million whether necessary (Advantage+ automatic expansion of detailed targeting).

The goals of these advertising campaigns were reach and engagement through video views, as this was in line with goals of the digital campaign as a whole. The "traffic to the website" strategy was not chosen due to organisational reasons, namely the inability to set up Facebook analytics on the corporate website, which would have made it difficult to measure the results. From this study, it has been experimentally proven that within one advertising campaign, dividing ad groups into those consisting of dynamically combined photos and those with video only is more effective than creating separate campaigns: the total reach of 1.05+ million for $600 of advertising campaign targeted to salespeople (see 6.1, 6.2 in tabl. 2) versus 830+ thousand for $1,000 in two advertising campaigns targeted to architects and designers (see 3, 4 in tabl. 2), despite the potential audience overlap (when groups of ads compete for the same audience, reducing overall results). Although one of the advertising campaigns targeted to architects and designers had "video views" objective, this did not increase its reach substantially, which proves that advertisers' high expectations of strategies focused on Facebook video are unreasonable. In this context, it is also important to remember Facebook's manipulation with overstated performance from video campaigns, which has been proven in court (The Atlantic, 2018; Graham, 2021).

Advertisers should take into account that advertising campaigns in category "social issues, elections and politics" (which include those launched by Company "A" as part of its national initiative) cannot be subject to automatic optimisation and have limited A/B testing. This is especially important for Ukrainian advertisers in the context of promoting socially important initiatives during the war.

In total, the national campaign in question reached 3.40 million people with an average frequency of 2.39, total engagement of the company's Facebook page amounted to 1.24 million; 20,370 sessions were registered on the "A" company's website during the reporting period (before the campaign it stood at 3,350 for the same period); more than 300 leads combined were registered from the website and Facebook advertising platform. However, these results should be interpreted with caution. Indicators such as reactions or clicks are low-engagement forms and do not give a clear picture of the impact of content on users, as people can react or click on a post without even reading or viewing its content. Therefore, it is not a proof that someone has actually changed their attitude towards Company "A" after learning about its social initiative. Ultimately, it is the results of further surveys, which the

authors believe should be conducted among industry representatives and other target groups, that will determine the actual effectiveness of the advertising reach and its impact on the brand image.

The difficulty of measuring effectiveness of Facebook advertising campaigns is related to the nature of the so-called "unique metrics" used by the system. These metrics do not indicate the number of actions, but the number of people who performed them. These are approximate metrics; they are based on a sample and depend on factors such as the number of accounts used by one person on Facebook services (which include Facebook, Instagram, WhatsApp, and Facebook Messenger). When one person performs actions from different accounts (for example, likes a photo or leaves comments), Facebook can attribute these actions to different people. Facebook also has various systems in place to help detect and remove fake accounts; in some cases, actions of fake accounts can affect unique metrics (e.g., size of the projected audience). At the same time, some metrics on Facebook are unsampled and use all available data (such as Impressions and Clicks). Nevertheless, Facebook uses more than 30 "unique metrics", including unique click-through rate, unique content views, unique link clicks, unique purchases, unique completed sign-ups, projected audience size, reach, and others ("Unique Metrics", Facebook, n.d.). Also, many Facebook metrics are constantly "in development" and their accuracy is not guaranteed. The presence of a large number of approximate metrics, as well as different conditions for their display for a particular advertising campaign, increases the complexity of assessing overall performance. It is worth noting that Facebook metrics are significantly different from those used, for example, in Google's advertising tools.

Although digital campaigns are relatively low-cost, partly due to savings in logistics and staffing costs, advertisers pay a high price for this: their results and impact in the context of brand management are not always clearly measurable, especially without involvement of research organisations.

In addition, tests within the national campaign of Brand "A" showed no evidence that static images receive significantly less engagement and reach than video. Other findings include the fact that Facebook allows an international brand to reach a fairly wide audience on a small budget, but effective targeting requires customised audiences from customer databases, including for promoting posts in the community (on the brand's page). Although the experiment with targeting civil servants and officials allowed us to reach a sufficient number of these categories of people, usually targeting with Facebook tools without a component of audience similarity to existing customers is not as effective. Another conclusion of the pilot study is that Facebook form-based lead advertising can be very effective and geo-targeted (which is especially useful for local initiatives and programmes targeting specific regions affected by the war), but lead data is difficult to process due to technical and organisational limitations. Facebook advertising is particularly useful for brand image campaigns because, unlike search advertising on Google, an advertiser does not work with demand, and therefore does not need to select queries with a formed demand. Also, unlike search, banner, and other digital advertising, in

the case of Facebook advertising, an advertiser has constant feedback from an audience through reactions and comments that can be left to ads or community posts. This feedback can also be considered one of the most effective and cheapest methods of A/B testing, while negative, unconstructive comments on Facebook can be easily hidden or deleted (unlike on other social networks, such as Twitter).

Results and discussion. Evidence of the digital campaigns' effectiveness is growing, but data on digital campaigns is still rarely systematically documented and published. Today, many campaigns, such as the national advertising campaign of Brand "A", include non-digital marketing communications, but also have an online component. Although numerous brands, government organisations and politicians run or fund digital campaigns on Facebook and other social media, there is still little empirical evidence of their effectiveness; this is partly due to the difficulty of measuring an impact of social media campaigns. Intervening in the information space with a digital campaign does not always lead to immediate, tangible results. Although platforms like Facebook are attractive to advertisers because they allow them to reach millions of people for little money, the way these platforms are designed makes it extremely difficult to measure the effectiveness of advertising in reaching the target audience. Based on the results of this study, several advantages and disadvantages of digital brand promotion campaigns on Facebook have been identified, as shown in tabl. 3.

Table 3. Effectiveness of digital advertising on Facebook and assessment of brand impact

Advantages	Disadvantages
- Reach a large audience at low cost - Easy to measure user engagement based on various metrics (clicks, shares, views, likes, comments, etc.) - The ability to vary headlines, sizes, images, videos, and text, which helps to increase traffic to other brand-related web pages and community pages - Large user base in Ukraine and developed countries - Ability to target people based on specific demographics such as gender, age, location, behaviour (based on customer databases) and occupation - Easy setup and quick launch on 4 social platforms at once (Facebook, Instagram, WhatsApp, Facebook Messenger)	- Lack of clarity on whether the audience of ad represents the target audience - Engagement rates cannot be representative of changes in perceptions, attitudes, and behaviour, which are the overall goals of awareness campaigns - Difficulty in measuring changes over time (it is impossible to get a reaction from the same user twice), need for follow-up surveys outside of Facebook - Types of interventions in the information space are limited to posts with short messages, images or videos - Not relevant in low-income countries where Facebook penetration is low, with slow internet or electricity problems. Also, in underdeveloped countries, the composition of users may change over time (one device for several people), while many users from developed countries have multiple accounts - Ethical issues related to potential targeting of vulnerable groups (for social campaigns) or government officials; acute data privacy issues - Oversaturation of campaigns with ads with "reach" objective can lead to loss of user interest or complaints against an advertiser; inflexible settings of the frequency of ad display - Costs in relation to brand image impact remain unclear; small difference in cost compared to other digital marketing mediums

This study can only be the first step in a broader process of studying the effectiveness of digital campaigns aimed at brand management on a national scale. Research on the effectiveness of digital campaigns should not be limited to A/B testing; further experiments should be conducted, including analysing data from Facebook APIs (software tools for greater integration of websites and mobile apps with Facebook). Many brands should also consider other social networks and platforms that are becoming increasingly popular among young people to broaden their reach and better analyse target groups (Kemp, 2020).

Conclusions. This paper defines the place and role of Facebook activations in the digital toolkit as part of a national advertising campaign in the context of the war in Ukraine and uncertainty in society. On the example of a relevant advertising campaign of an international brand present on Ukrainian market, the authors outline strategies and approaches to conducting national campaigns to inform and improve the brand image. The study also considers assessment of the brand impact of a Facebook advertising campaign, provides examples of efficiency assessment and proposals for conducting relevant marketing research. The authors characterize Facebook metrics, its algorithm for evaluating advertising on this platform and conduct a comparative analysis of approaches to Facebook advertising methods based on the experimental experience of cooperation with representatives of medium and large businesses. Proposals for analysing the effectiveness of digital campaigns on Facebook are presented. The results of the study are as follows: a set of strategies for effective conduct of a national digital advertising campaign on Facebook is identified, which can be applied to international brands in the face of market uncertainty; possible measures for analysing the effectiveness of a campaign are proposed.

Author contributions. The authors contributed equally.

Disclosure statement. The authors do not have any conflict of interest.

References:

1. Hootsuite. (2021). *TikTok Hits 1 Billion Users – Faster Than Facebook*. URL: https://blog.hootsuite.com/simon-kemp-social-media/.
2. Mander, J. (2019). *Daily Time Spent on Social Networks*. GlobalWebIndex. URL: https://blog.gwi.com/chart-of-the-day/daily-time-spent-on-social-networks/
3. Yasko, A. (2022, December 1). *Biznes pid chas viiny: reaktsii na initsiatyvy brendiv*. YuSKAN Ukraina. [Business in time of war: reactions to brand initiatives] URL: https://youscan.io/ua/blog/biznes-pid-chas-viini-yak-ukrayinci-reaguyut-na-iniciativi-brendiv/
4. Borodii, A. (2022, October 25). *Reklama pid chas viiny: shcho pratsiuie, a shcho ni – doslidzhennia Kantar*. RAU. [Advertising in times of war: what works and what doesn't –Kantar research] URL: https://rau.ua/novyni/reklama-na-vijni-kantar/
5. Gertler, P. J. et al (2016). *Impact Evaluation in Practice*. The World Bank, Washington, D.C.
6. López, G. (2019). Online migration campaigns: promises, pitfalls and the need for better evaluations. *Migration Policy Practice – A Bimonthly Journal for and by Policymakers Worldwide*, *9*(3), 20–25.
7. *Development Results: An Overview of Results Measurement and Management*. (2013). Organisation for Economic Co-operation and Development (OECD), Paris.
8. Gluck, M. (2011). *Best Practices for Conducting Online Ad Effectiveness Research*. Interactive Advertising Bureau, New York.
9. *Glossary of Meta Ad Terms*. (n.d.). Facebook. URL: https://www.facebook.com/business/help/447834205249495
10. Cesare, N. et al (2018). Promises and pitfalls of using digital traces for demographic research. *Demography, 55*(5), 1979–1999.
11. Lewis, A., & Rao, J.M. (2015). The unfavorable economics of measuring the returns to advertising. *The Quarterly Journal of Economics*, *130*(4), 1941–1973.

12. *Facebook ta Instagram v Ukraini*. (2021). PlusOne. [Facebook and Instagram in Ukraine] URL: https://plusone.ua/research/en/
13. *Top digital trends in 2023*. (n.d.). DataReportal – Global Digital Insights. URL: https://datareportal.com
14. *Facebook Demographics to Inform Your Strategy in 2023*. (n.d.). Hootsuite. URL: https://blog.hootsuite.com/facebook-demographics/
15. *Cookies webguide*. (n.d.). European Commission. URL: https://commission.europa.eu/resources-partners/europa-web-guide_en
16. *How Facebook's Chaotic Push Into Video Cost Hundreds of Journalists Their Jobs*. (2018). The Atlantic. URL: https://www.theatlantic.com/technology/archive/2018/10/facebook-driven-video-push-may-have-cost-483-journalists-their-jobs/573403/
17. Graham, M. (2021). *Facebook knew ad metrics were inflated, but ignored the problem to make more money, lawsuit claims*. CNBC. URL: https://www.cnbc.com/2021/02/18/facebook-knew-ad-metrics-were-inflated-but-ignored-the-problem-lawsuit-claims.html
18. *Unique Metrics*. (n.d.). Facebook. URL: https://www.facebook.com/business/help/283579896000936
19. Kemp, S. (n.d.). *Digital 2020: Global Digital Overview*. DataReportal – Global Digital Insights. URL: https://datareportal.com/reports/digital-2020-global-digital-overview

INTRODUCTION OF THE INTELLECTUAL CAPITAL MANAGEMENT MECHANISM AT MACHINE-BUILDING ENTERPRISES

Zinaida Zhyvko[1], Maryna Derzhevetska[2]

[1]Doctor of Science (Economics), Professor, Academy of Economics and Pedagogy, Prague, Czech Rebublic, e-mail: professor2007@ukr.net, ORCID: https://orcid.org/0000-0002-4045-669X

[2]Ph.D. (Economics), Lecturer at the Department of Digital Technologies and Project-analytical Solutions, Technical University "Metinvest Polytechnic" LLC, Ukraine, e-mail: marina_d.a@ukr.net, ORCID: https://orcid.org/0000-0002-9952-4992

Citation:
Zhyvko, Z., & Derzhevetska, M. (2023). Introduction of the intellectual capital management mechanism at machine-building enterprises. *Economics, Finance and Management Review*, (3), 83–98. https://doi.org/10.36690/2674-5208-2023-3-83-98

Received: August 26, 2023
Approved: September 28, 2023
Published: September 30, 2023

Abstract. *Intellectual capital plays a significant role in the activities of machine-building enterprises. The purpose of the article is to study the main approaches to the structure of intellectual capital at machine-building enterprises; The methodology of the conducted research involves the use of a complex scientific approach to the study of intellectual capital with the use of information systems for its management. The article examines the structure of intellectual capital, the main approaches to determining the structure of intellectual capital. The analysis of various intellectual capital management systems made it possible to propose such an intellectual capital management system of a machine-building enterprise, which is considered from the point of view of a combination of formalized elements, actions that are included in the management subsystem of structural internal and external (relational) capital and the human capital management subsystem. The introduction of cyber-physical systems into the practice of machine-building enterprises and their further integration into a single network is considered. Such unification is a key stage in the creation of industrial SMART enterprises within the framework of the fourth industrial revolution. Given that the management of intellectual capital is one of the elements of structural capital management, the formalization of the main elements and the data processing of these elements using appropriate mathematical models were investigated. With the help of analytical and simulation modeling, we came to the conclusion about the need for a scientific and practical approach to the implementation of the intellectual capital management mechanism at machine-building enterprises. It is proposed to modernize the operational decision-making algorithm based on the analysis of the dynamics of the main indicators of the financial state of the enterprise, as well as the components of intellectual capital, which may lead to the need to reconstruct modes and forms of work. of the entire enterprise. The organizational and information provision of the intellectual capital management mechanism of machine-building enterprises has been improved and expanded.*

Keywords: *intellectual capital, informatization, quantitative and qualitative indicators of intellectual capital, cyber-physical systems, structural capital, intellectual capital assessment, intellectual capital management mechanism.*

JEL Classification: M12, M14

Formulas: 14; fig.: 8; tabl.: 2; bibl.: 27

Introduction. With the global transition from industrial to intellectual economy, significant industrial changes are taking place. The modern era of innovation, in which advanced technologies are rapidly changing the direction and target sectors of the economy, is called Industry 4.0. In the process of these changes, a completely new type of control in industrial production is emerging, based on so-called Big Date and its analysis, full automation of production (cyber -physical systems), technologies of additional reality, Internet of Things (Internet of Things, IoT).

The special value in this process belongs to intellectual capital (IC) which essentially influences branch structure of the industry, quality, manufacturability, innovativeness of production and services, and also defines efficiency of functioning of the enterprises. Thus, the development of intellectual work and the degree of its participation in industrial processes become the most important factors determining the competitiveness of the country in the international market, its export potential and share in world production.

Literature review. In the structure of Ukrainian industry the machine-building is one of the main branches of national economy, reflects the level of scientific and technical condition and defense capabilities of the country. Specificity of activity of the machine-building enterprises, high level of knowledge intensity and complexity of their manufacture, the qualitative requirements shown to production of branch in the domestic and international markets, condition an urgency of demand for studying of a question of the intellectual capital of the machine-building enterprises and search of new modern methods of management of it. Besides, in spite of the increased attention which is given to scientific bases of management of intellectual capital of the industrial enterprises, in particular the enterprises of mechanical engineering, absence of unity in definition of its substantial structure, underlines the second component of an urgency of a theme of research - an urgency of the offer.

Many works of Ukrainian and foreign scientists are devoted to the conceptual provision on the essence, evaluation and management of intellectual capital of industrial enterprises, namely: G. Becker [1], E. Brooking [2], P. Drucker [3], S. Diatlov [4], L. Edvinsson [5], O. Kolomina [6], L. Fernström [7], V. Shkola [8], K. Yagelska [9] and others.

A great contribution to the development of the theme of management of industrial enterprises, including the intellectual capital of industrial enterprises have made the collectives of Ukrainian economic schools under the leadership of V. Porokhnya [10], A. Kendiukhov [11], A. Hilukha [12] and others, the results of scientific development of which were reflected in monographs and collections of scientific papers.

Despite the large number of studies on the management of intellectual capital of industrial enterprises, its structure and evaluation, some issues remain open in fragments. In particular, there is no unambiguous scientific approach to the interpretation of the content and formation of the structure of intellectual capital, up to the end the process of transition of management technologies to a new level of SMART enterprises is not studied, and also the system of express estimation of intellectual capital of industrial enterprises and express management of it in

connection with such transition is not considered. The need for further research in this area led to the choice of the topic for our article.

Intellectual capital belongs to new forms of capital and acts as one of the main factors in the development of both the state economy as a whole and a single enterprise. This type of capital corresponds to a high degree of development, because it is characterized by new knowledge and high technologies.

Despite a large number of studies and scientific discussions, as well as by the very definition of intellectual capital, scientists did not agree on its structure, what elements are part of it and what is the difference between "intellectual capital" and traditional "intangible assets".

The heterogeneity of the structure of intellectual capital is connected with many approaches to the definition of this structure.

According to the classic concept, as noted by O.V.Popelo, it is still accepted to consider the concept proposed by L. Edvinsson in his book "Corporate Longitude", which was part of intellectual capital includes the following elements: "human capital, as the competences and experience of the company's employees who are lost from the departure of their employees, and structural capital, which belongs to the company as a whole, although it is the product of its employees' activity, including the value of relations with clients (client capital), the value of intellectual property products (ideas, patents, licenses, etc.) (innovative capital), as well as the value of the company's infrastructure (process capital)" [13, pp. 66-78; 17]. This division was based on property relations. This statement can be interpreted in such a way that human capital is embodied in the employees of the organization, and structural in the organization itself. L. Edvinsson paid more attention to structural capital, trying to combine in it both internal elements (organizational capital) and elements related to the external environment (client's capital).

The disadvantage of such a structure is not enough emphasis on human capital, as well as the fact that in such a definition of the structure of intellectual capital there is no explanation of how all these components interact, perceiving each of the elements of the structure as separate capital.

The co-author of this approach is M. Malone. The classic approach to defining the structure of intellectual capital proposed by them is shown in Figure 1. They considered the market property of Swedish insurance company Skandia, dividing it into financial capital and intellectual capital. Intellectual capital consists of two components: human and structural capital, which in turn is divided into consumer and organizational capital. The latter includes innovative and process capital.

Based on the structure of L. Edvinsson's intellectual capital, in 1989 C.E. Sweiby tried to eliminate the above disadvantages, and also suggested using a system of quantitative indicators to evaluate each component of intellectual capital. A.D.Bazylevych noted that K.E.Sweiby also identified the concept of intellectual capital with intangible assets and described such a structure in which he singled out individual competence (namely, education, experience, skills and abilities of employees of the company), internal (patents, information networks, processes and procedures of the organization) and external structure (links between enterprises that

can be both customers and suppliers of necessary products) [13, p. 63]. According to other scientists, the proposed structure had to be improved.

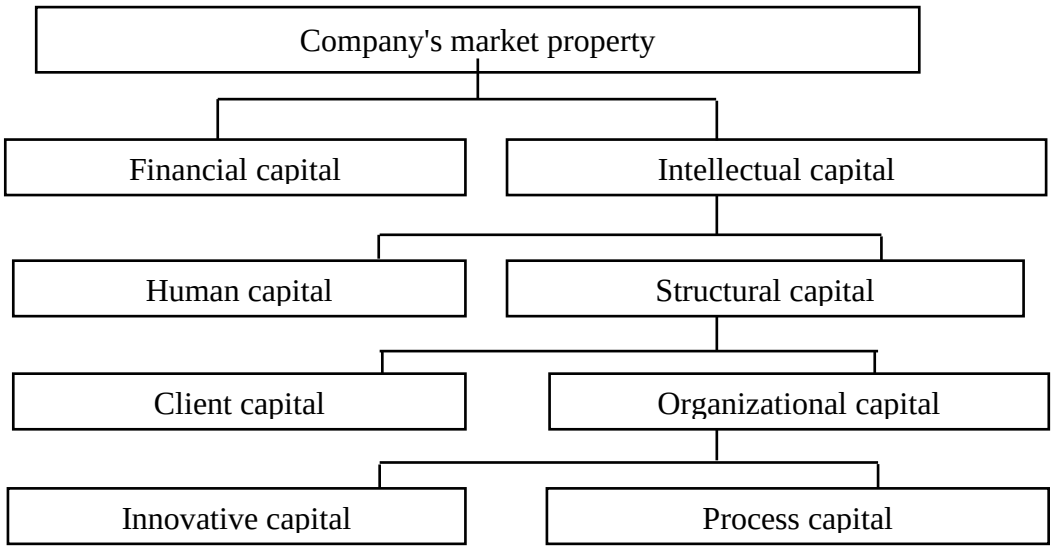

Figure 1. The structure of intellectual capital in the "Skandia Value Scheme" model by L. Edvinsson and M. Malone [5]

In further research, the structure of intellectual capital has been presented in three- and four-component models. And the three-component models mainly consider traditional components of intellectual capital: human, structural and client. And there is the interaction of these components. Another type of capital is usually added to the Four Component models - partnership capital. The authors also introduce the notion of structuring, i.e. the ability of capital to stay in the company even in case of loss of an employee or partner. Structural capital is considered the most structured, while client capital is considered the least structured [15-21].

Since 1990, T. Stewart's work has included the distribution of intellectual capital into human capital (the existing knowledge of workers and the ability to use it), structural capital (methods that enable the collection, storage and filtering of existing knowledge), and consumer capital (relations with the external environment that can be converted into money). He pointed out that it is necessary to balance between its components, as excessive development of individual components may not lead to productivity growth, but rather to a decrease in productivity [22].

Later on, X. St. Aunge also refined L.Edvinsson's approach left in the structural capital innovative and process capitals, and the client's one put next to human and structural capitals (fig. 2) [23].

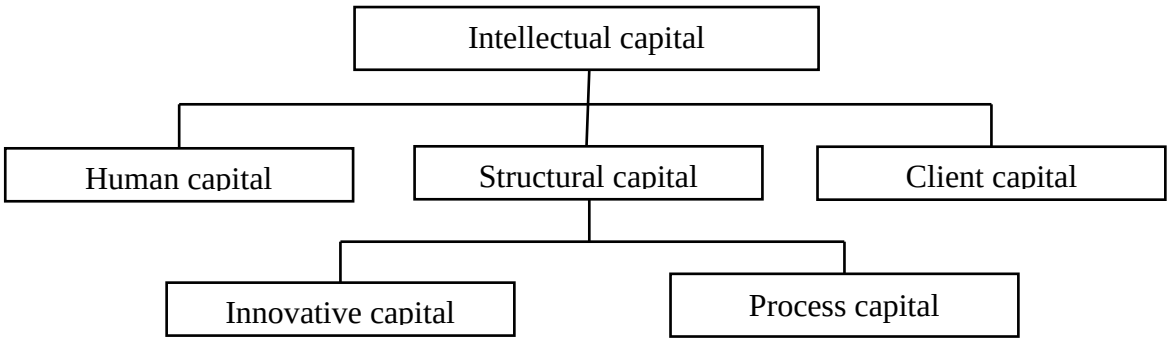

Figure 2. Structure of intellectual capital of H. Saint-Ange [23]

In E. Brookings' works, four components of intellectual capital are already distinguished and each of the structures is added with new components (Fig. 3).

In contrast to previous specialists, E. Brookings represents intellectual capital by various assets. If we consider capital in the economy, it should be noted that it is an indicator of production in the form of value, which can bring profit or loss.

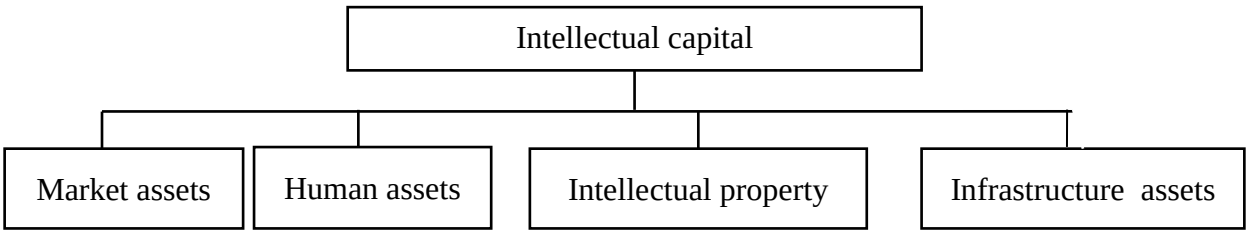

Figure 3. Structure of Intellectual Capital E. Brookings [3]

As far as assets are concerned, this is what the enterprise owns, so these two concepts can be equated in connection with "intelligence", because the previous interpretation makes economic sense, and the second one contains its accounting aspects.

Market assets are the potential provided by intangible assets associated with market transactions (brand names, purchase attachment, corporate name, order book, etc.).

Human assets are the aggregate of knowledge of employees of an enterprise, their creative abilities, managerial, leadership and entrepreneurial qualities, behavior in various situations.

Intellectual property as an asset is a tool to protect various corporate assets (know-how, patents, copyrights, trade and production secrets, etc.).

Infrastructure assets are technologies, methods and processes that make the work of an enterprise possible (corporate culture, risk assessment methods, financial structure, databases, etc.).

As already mentioned, the models of intellectual capital for different enterprises may vary, hence the number of its components and their name.

Thus I. Ruus, S. Pike and L. Fernstrom use "intellectual resources" instead of "intellectual capital" (Fig. 4). Resources can be interpreted as factors of production

that lead to the provision of goods and services. "Client capital" has been replaced by the notion of "relational" resources, covers relations with suppliers and other partners in addition to relations with buyers, and intellectual capital has been considered as a part of a company's resource portfolio and presented the interaction of all its components in a tree structure [24].

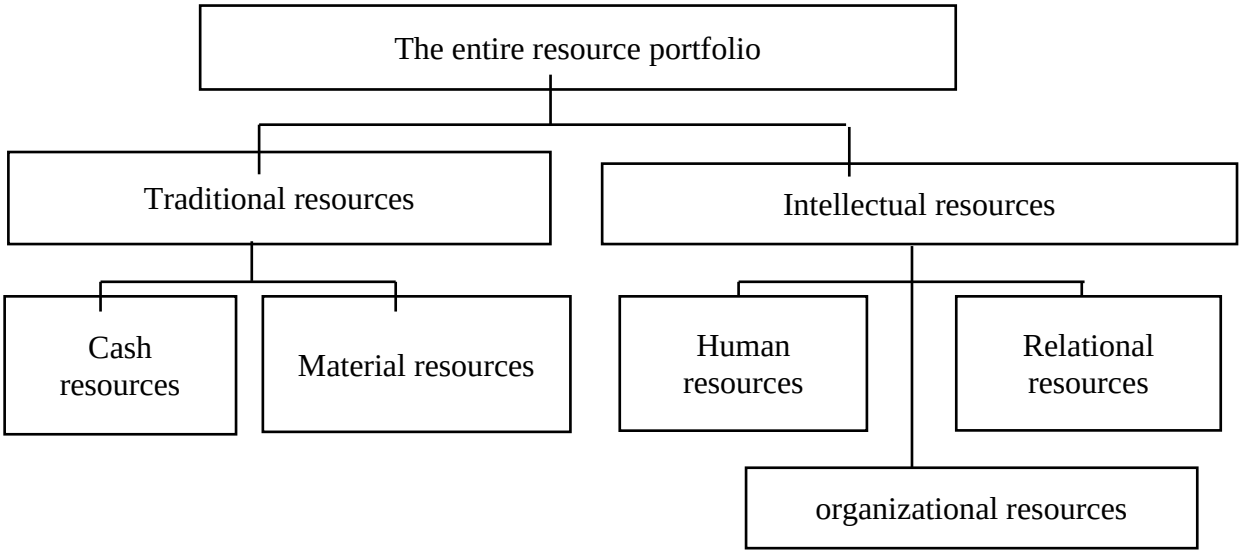

Figure 4. Structure of Intellectual Capital as a Component of Resource Portfolio
Sources: proposed by I. Ruus, S. Pike and L. Fernstrom [24]

Methodology. The machine-building industry is highly complex and knowledge-intensive. With the development of scientific and technical progress of mechanical engineering is becoming more and more technological and requires compliance with the realities of time, which is due to the increasing frequency of introduction of cyber-physical systems at the enterprises of the machine-building complex.

Development and introduction of such systems in practice of functioning of the machine-building enterprises and their subsequent association in a uniform network is a key stage of creation of industrial SMART-enterprises within the limits of the fourth industrial revolution. Such association can be reached by formalization of key parameters of each of the designated systems to provide possibility of transfer on a network of the corresponding data for the further processing and the analysis by other elements of system within the limits of SMART-enterprise.

Formalization of the main elements and processing of data of these elements is provided by using appropriate mathematical models. Intellectual capital management is one of such elements.

Industry 4.0's vision is to digitize all physical assets and integrate them into the digital ecosystem with partners (suppliers or customers) who are involved in the value chain. This industrial revolution is characterized by new digital technologies, namely: cloud services; mobile devices; augmented reality; Internet of things; geolocation, that is, location; advanced interfaces of interaction between an individual and a computer; authentication and detection of fraud; 3D-printing;

technologies within the framework of artificial intelligence; analysis of large data and advanced algorithms; personalization by client profile.

In connection with the aspiration of the enterprise to have advantages among competitors there is a necessity to computerize its activity, namely to automate the process of intellectual capital management. The scientific and practical approach to introduction of the intellectual capital management mechanism at machine-building enterprises is shown in Figure 5.

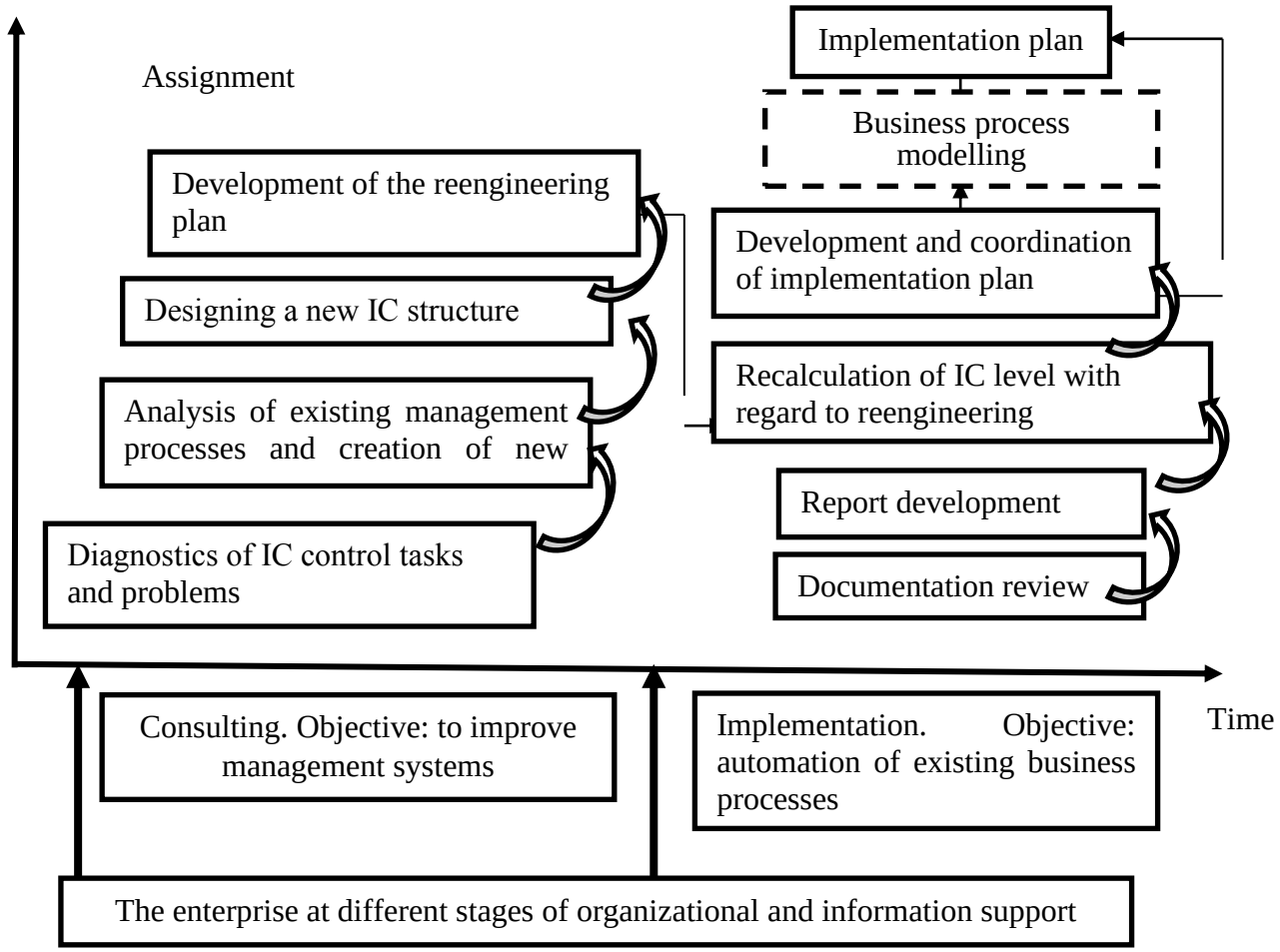

Figure 5. Scientific and practical approach to implementation of intellectual capital management mechanism at machine-building enterprises

The main task of quality management is that it must be done in real time, that is, it is necessary to modernize the algorithm of operational decision-making based on the analysis of the dynamics of the main indicators of the financial condition of the enterprise, as well as the components of intellectual capital, which may lead to the need to restructure modes and forms of operation of the entire enterprise.

The implementation of a full-scale information system for the automation of intellectual capital management at an enterprise is a rather time-consuming process that requires detailed planning.

At the initial stage of creating an information system it is desirable to have a reasonable goal and calculations of cost efficiency for automation. It is necessary to

conduct simultaneously consulting works on improvement of management systems and automation of existing business processes. Consulting is explained as an activity on consulting of managers, managers on a wide range of issues in the field of financial, commercial, legal, technological, technical, expert activity, which turns out to be external specialists to solve this or that problem. The purpose of consulting is to provide assistance for management (management) in achieving the stated objectives. The main task of consulting is to analyze, justify the prospects of development and use of scientific, technical and organizational-economic solutions, taking into account the subject area and problems of the client.

In a competitive market environment, even strong and developed enterprises often experience difficulties that may be caused by both external and internal circumstances. Fluctuations in exchange rates and prices for raw materials, the emergence of new laws and regulations, changes in government policy in any area of the economy, as well as decisions made on the international arena can affect many business processes.

The situation of imbalance in the enterprise can be created by strained relations between employees and changes in management, partners and customers. When all these problems cannot be solved by the enterprise on its own, the way out of the situation is to turn to professional consultants.

There are the following types of consulting services, which are the most common:

- general management of evaluation activities, building the organizational structure, withdrawal of the enterprise from the crisis situation, it is possible to search for new partners;
- administration of document management, office management and control of other internal organizational aspects;
- financial management is control over taxation and financial reserves, cost reduction and profit increase;
- HR management HR consulting (assistance in personnel search and selection), formation of corporate culture, creation of incentive program, conducting trainings [28];
- market analysis market research and adaptation of the company to market standards (pricing adjustments, product upgrading);
- production acceleration of the company's production cycle and productivity increase, production automation, industrial engineering;
- information technology development, restoration and audit of the company's information systems;
- specialized services engineering, environmental, legal, information consulting, telecommunications consulting, electricity management consulting, public sector consulting.

In this case you can use the following services: general management - to improve the structural internal capital, personnel consulting - to improve human capital, market analysis to stabilize the structural external or relational capital, as well as information technology.

Management information technologies are used to manage a machine-building enterprise, to reduce transaction costs by collecting information, analyzing it, further negotiating and coordinating it, adjusting expenses on marketing and promotion of goods on the market.

The main purpose of information technologies in management processes of machine-building enterprise is formalization of business processes into the information system of the enterprise. Accordingly, employees of the enterprise (human capital) develop business processes in accordance with the objectives of the enterprise, choose the necessary software and hardware (structural internal capital), organize the implementation, operation and maintenance of information system of machine-building enterprise.

Accordingly, given the role of information technologies as general-purpose technologies, the formation of intellectual capital is possible only with simultaneous changes in organizational assets (business processes) and development of human assets in the field of information technologies.

The introduction of an information system of a machine-building enterprise is always accompanied by the process of adaptation of the enterprise to new working conditions. This process includes changes in both the technologies of business processes and the accumulation of knowledge by employees to work with them, which also has the appropriate motivation.

First of all, it concerns accumulation of employees' knowledge on work with management business processes of the enterprise, secondly - increase of employees' competence on support and operation of information system of machine-building enterprise.

If we do not get the effect from the operation of the enterprise information system, this is due to the lack of coordinated changes in human capital, structural internal and external (relational) capital and information technologies.

In a market economy it is not always intellectual capital that increases the value of enterprises. Many enterprises become bankrupt, in fact, assuming a negative value of intellectual capital, with a minus in the formula of the value of the enterprise. From the point of view of the exchange, this means that investors are not sure that the enterprise management system is capable of storing and increasing the existing value of the enterprise.

The final of the consulting work is the development of the plan of reengineering the enterprise (improvement of qualitative and quantitative factors of intellectual capital), is the impetus for recalculating the level of intellectual capital of the enterprise. From the point of view of the exchange, this means that investors are not sure that the enterprise management system is capable of storing and increasing the existing value of the enterprise.

Results. After that the detailed plan of introduction of the mechanism of increase of intellectual capital level is developed and coordinated. For a substantiation of efficiency of the offered introductions business processes by means of use of system dynamics are developed because components of the intellectual

capital are subject to influence of casual factors. After that the decision on introduction of the intellectual capital management plan is made.

Use of models of system dynamics for management of intellectual capital of the machine-building enterprise has following advantages:

- possibility to use multipurpose criteria when constructing and investigating models;
- carrying out researches on the basis of the incomplete information;
- the simulation model is the most suitable for research of a dynamic situation when system and environment parameters change in time;
- research of the system's behavior by revealing cause-and-effect relations and interactions of feedback loops manifested in the peculiarities of its structural organization;
- good interpretation of system stream diagrams, gives the chance of carrying out of joint expert audits at discussion of problems, formation of mental model and working out of the coordinated decisions;
- the simulation model is a convenient tool for experimental reproduction of a large number of "what-if" scenarios;
- the technology of scenario study using a simulation model does not provide for active participation of the expert in the process of mental model formation and decision making.

The main method of research of organization of production systems management is the construction of various models and their analysis [25].

A model is a system, represented or materially realized system, which reflects an object of research and is able to replace it so that its study provides adequate information about the object's behavior.

Modeling is one of the ways to solve problems arising in the real world [25]. Modeling is used when experiments with real systems or their prototyping are impossible or too valuable. It covers reflection of the problem from real world to the world of models (abstraction process), analysis and optimization of the model, finding the solution and displaying the solution back to the real world.

A distinction is made between analytical and simulation modeling. In an analytical model, the output is functionally dependent on the input (parameter set) and, in this sense, it is static; such a model can be implemented in the form of spreadsheets. This requires the analyst to own only commonly used software such as Excel. Analytical solutions do not always exist, and existing solutions are not always easy to find. And then analysts use simulation modeling, which in contrast can be called dynamic.

The simulation model can be considered as a set of rules (differential equations, state maps, automatic machines, networks) that determine which state the system will move to in the future from the given current state. This is a process of "executing" the model, which guides it through (discrete or continuous) state changes in time. In general, for complex problems where time and dynamics are important, simulation modeling is a more powerful tool for analysis.

Such behavior is conditioned both by the size and complex structure of systems and by the large amount of information that is generated in such systems by the processes that take place. Such information in most cases cannot be adequately evaluated without the use of information analysis and information technologies. And it can be extremely necessary in the conditions of "unique choice", the mistakes of which in the modern world can cost very much.

The developed model for obtaining the forecast value will contain key steps:

1. Prediction of the model input parameters using the Monte Carlo method.
2. Prediction of the value of intellectual capital.
3. analysis of the simulation results obtained.

Statistical testing using the Monte Carlo method is the simplest simulation without any rules of conduct. Obtaining Monte Carlo samples is the basic principle of computer simulations of systems containing stochastic or probabilistic elements.

Application of Monte Carlo method allows to study very complex systems consisting of thousands or millions of elements, or very long intervals of model time (in this case modeling can be several seconds).

Monte Carlo calculations are based on a random selection of numbers from a given probability distribution. In practical calculations, these numbers are taken from tables or obtained through some operations, the results of which are pseudo-random numbers with the same properties as those obtained by random sampling.

Business process modeling will be carried out for PJSC "Novokramatorsky machine-building plant", where the level of intellectual capital was the highest.

Based on the calculation of intellectual capital proposed in Formula 1, variations in the distribution of the number of employees with higher education (X_2), advanced training of managers, specialists and employees (X_5), investment in personnel development (X_9), investment in enterprise development (X_{18}) are considered in more detail.

$$Y = 0{,}03766 + 1{,}1844 \cdot X_2 - 3{,}4133 \cdot X_5 + 1{,}8419 \cdot X_9 + 1{,}596 \cdot X_{18} \quad (1)$$

These indicators are subject to the influence of random factors. So, to predict these values, it is reasonable to use a simulation modeling method based on the assumption of independence and normal distribution of key variables.

To confirm independence of key variable distributions X_2, X_5, X_9, X_{18}, a correlation analysis is performed.

Average values are calculated for each parameter

$$\bar{x}_m = \frac{\sum_{i=1}^{n} x_{m,i}}{n}, \; \bar{x}_{m+1} = \frac{\sum_{i=1}^{n} x_{m+1,i}}{n}, \quad (2)$$

where m – is a parameter number.

Then the correlation coefficient for each pair of parameters is calculated directly:

$$r_{m,m+1} = \frac{\sum_{i=1}^{n}(x_{m,i} - \bar{x}_m)\cdot(x_{m+1,i} - \bar{x}_{m+1})}{\sqrt{\sum_{i=1}^{n}(x_{m,i} - \bar{x}_m)^2}\cdot\sqrt{\sum_{i=1}^{n}(x_{m+1,i} - \bar{x}_{m+1})^2}}. \quad (3)$$

By the properties of the correlation coefficient, if:

$0{,}9 < |r| \le 1$, - is a strong connection;

$0{,}6 < |r| \le 0{,}9$ – is a sufficient connection.

$0{,}3 < |r| \le 0{,}6$ – is a weak connection.

$|r| \le 0{,}3$ – no connection.

The adoption of a normal law of distribution of random variables does not contradict the generally accepted position on its practical application for economic calculations and can be used to determine the real law of distribution of input parameters of the simulation.

The algorithm consists, firstly, in determining the normal distribution density [26]:

$$\varphi(x; a, \sigma^2) = \frac{1}{\sqrt{2\pi}\cdot\sigma} e^{\frac{-(x-a)^2}{2\sigma^2}}. \quad (4)$$

Secondly, the function of distribution of a normal random value:

$$F(X; A, \sigma^2) = P\{\xi(a, \sigma^2) \langle x\} = \frac{1}{\sqrt{2\pi}\cdot\sigma}\int_{-\infty}^{x} e^{\frac{-(t-a)^2}{2\sigma^2}} dt, \quad (5)$$

where a and σ^2 – are the law parameters: average value and dispersion of a random value; $\xi(a, \sigma^2)$ – is a random variable.

To simplify the calculations, the normal distribution is brought to a standard form by the Laplace theorem:

$$Z = \frac{X - a}{\sigma}. \quad (6)$$

Then you select a random value Z and a value X. It is characteristic of the standard law that the mathematical value Z of the magnitude is equal to zero, and its average square deviation is one.

The density of the normalized value distribution Z and the normalized (standard) distribution function have the form:

$$\varphi(z) = \frac{1}{\sqrt{2\pi}} e^{\frac{-z^2}{2}} \quad (7)$$

$$F(z) = \int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}} e^{\frac{-z^2}{2}} dz = 0{,}5 + \Phi(z), \quad (8)$$

where Φ(z) -is the Laplace function:

$$\Phi(z) = \frac{1}{\sqrt{2\pi}} \int_0^z e^{-\frac{z^2}{2}} dz \,. \qquad (9)$$

Thus, the choice of a random value is reduced to obtaining a random value R' (from 0 to 1) and the value X is chosen as the formula (11):

$$X = F^{-1}(R'), \qquad (11)$$

where F^{-1} *- is a function, reverse function* F *.*

Then we get:

$$R' = 0{,}5 + \Phi(Z).$$

Where from

$$Z = \Phi^{-1}(R' - 0{,}5).$$

To finally get random values, expression 12 is used:

$$X = \sigma \cdot \Phi^{-1}(R' - 0{,}5) + a, \qquad (12)$$

where R' *- is a normally distributed random value.*

As a result of the simulation model application there are interval values of the number of employees with higher education, advanced training of managers, specialists and employees, investment in personnel development, investment in the development of the enterprise, on the basis of which the calculation of the intellectual capital itself is carried out.

At the next stage, the results of simulation modeling are analyzed [27].

According to the formula 13 is the average value of weighty indicators. Then the value of standard deviation, which shows how the values in the sample are distributed relative to the average:

$$\sigma_m = \sqrt{\frac{\sum_{i=1}^{n} (x_{m,i} - x_m)^2}{n}}. \qquad (13)$$

The next stage of the analysis to determine the value of the coefficient of variation, reflects what proportion of the average value of the parameter is its average spread:

$$\text{cov}_m = \frac{\bar{x}_m}{\sigma_m}. \qquad (14)$$

The results of the simulation analysis are given in Table 2.

Table 2. Results of analysis

Indexes	Number of employees with higher education	Professional development of managers, specialists and employees	Investing in personnel development	Investing in enterprise development	Intellectual capital
Average value	0,49	0,49	0,52	0,49	0,32
Standard deviation	0,29	0,28	0,29	0,28	1,13
Variation coefficient	0,59	0,57	0,56	0,57	3,50
Minimum	0,00	0,00	0,00	0,00	-2,31
Maximum	1,00	1,00	1,00	1,00	3,08
Number of cases where intellectual capital < 0					139

Within the framework of approbation of the proposed scientific provisions at CJSC "Novokramatorsky machine-building plant" the following results of intellectual capital were obtained (fig. 7).

Discussion. At application of the simulation model the interval values of the weighted quantitative indicators received at the correlation-regression analysis on which basis the further calculation of intellectual capital is carried out are found.

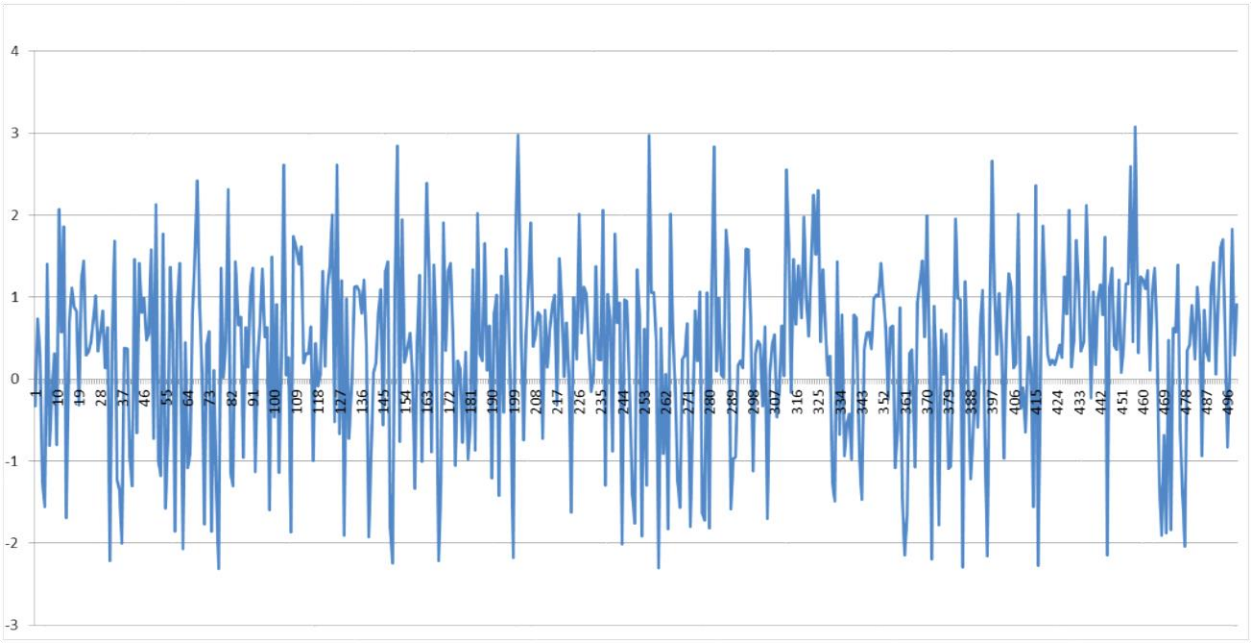

Figure 7. Modeling of intellectual capital value for CJSC "Novokramatorsky machine-building plant"

The next step is to analyze the results of simulation modeling.

The analysis of simulation results showed that the probability of obtaining a negative value of intellectual capital does not exceed 25%.

Since the intellectual capital of machine-building enterprise is accepted as one of the most important indicators of competitiveness of the enterprise, it is necessary to pay special attention to the positive value of intellectual capital (with the probability of about 76%).

Statistical analysis of the simulation results showed that the probability of obtaining intellectual capital in the interval from 0 to M (IK) is 15.8%, where M (IR) is the average value of intellectual capital.

The probability of getting the value of intellectual capital in the interval [M (IK) M (IR) + G] is 35.1%, and in the interval [M (IR) + G; max] - 25.0%, where G is the standard deviation and max is the maximum value of intellectual capital of an engineering enterprise.

Probabilities of hitting the value of intellectual capital in the specified intervals are shown in Figure 8.

The proposed mechanism can be used as a regulator of effective enterprise management. The calculations confirm that all indicators of intellectual capital are quantifiable, i.e. the selected levers, the obtained intellectual capital assessment and

scientific and practical approach to the implementation of the intellectual capital management mechanism at machine-building enterprises can be applied in real time in the enterprise conditions.

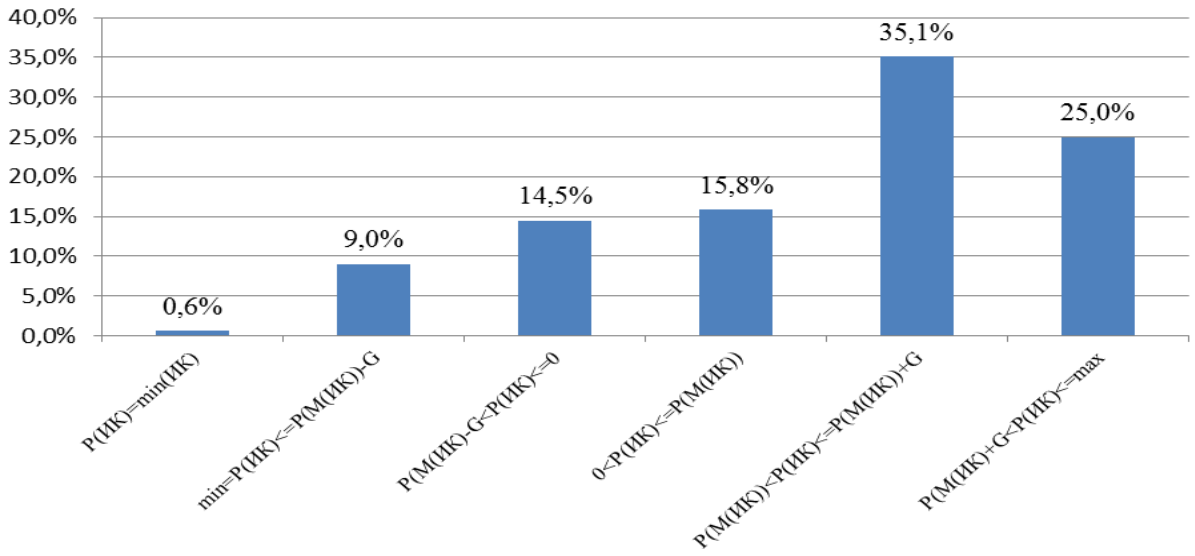

Figure 8. Distribution of intellectual capital across value ranges

Competitive advantages and financial well-being of enterprises will depend on how effectively the intellectual capital management process is implemented.

Conclusions. So, in the process of research the elements of management system of intellectual capital of machine-building enterprises were formalized and the mechanism of management of intellectual capital of machine-building enterprises was improved.

The improved mechanism of management of intellectual capital of the machine-building enterprise causes perception of intellectual capital as an integral value, which components are interconnected elements of intellectual capital, management of which requires an integrated approach. It includes subjects of management, goals and objectives, functions, principles and elements of management system, approach to assessment of management efficiency, which contributes to the implementation of measures to increase the level of intellectual capital and, on this basis, the efficiency of the entire machine-building enterprise.

Author contributions. The authors contributed equally.

Disclosure statement. The authors do not have any conflict of interest.

References:

1. Becker G.S. Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education. 3-d Edition. Chicago and London: The University of Chicago Press, 1993. 412 p.
2. Brookings E. Intellectual Capital, 2011. 288 p.
3. Drucker P. Classical works on management, 2017. 218 p.
4. Dyatlov S. A., Selishcheva T. A. Transformation of Forms of Capital under Growth of Economic Informatization. Scientific works of DonNTU. Series: economic, 2006. Issue 103-1. P. 137-143.
5. Edwinsson L. Corporate Longitude: Navigation in Knowledge-based Economy, 2005. 247 p.
6. Kolomina O.B. Approaches to Defining Intellectual Capital and its Essence. Economics: realities of time. 2014. № 6 (16). P. 206-211. URL: http://economics.opu.ua/616-2 (circulation date 15.02.2017).
7. Ruus I., Pike S., Fernström L. Intellectual capital: management practice, 2008. 436 p.

8. Shkola V.Yu., Shcherbachenko V.A. Intellectual capital management levels. Mechanism of management of potential of innovative development of industrial enterprises: monograph / edited by ... Candidate of Science, doc. Yu. Sums of LLC "DD" Papyrus ", 2012. P. 235-242.
9. Yagelskiy K.Y. Innovation and Intellectual Capital in the System of Factors of Advanced Economic Development. Theoretical and practical aspects of economics and intellectual property, 2013. Episode 235-242. 1 (2). P. 155-158.
10. Porokhnya V.M., Los V.O. Modeling the infusion of intellectual capital into innovation development of enterprise: monograph, 2008.
11. Kendukhov A.V. Efficient management of intellectual capital: monograph. Donetsk: NAS of Ukraine. Institute for Industrial Economics DonUEP, 2008. 359 p.
12. Hiluha A.A. Kuzmin A.E., Lipich L.G. Intellectual capital management at machine-building enterprises: theoretical and applied provisions: monograph. Lutsk: The Tower-Druk, 2014. 200 p.
13. Popelo A.V. Intellectual capital: theoretical aspect and modern trends in Ukraine. Economics and region. Poltava: PoltNTU. 2015 №2 (51). P. 66-78.
14. Bazylevich V.D. Intellectual property: textbook. 2nd ed. Kiev: Knowledge, 2008. 431 p.
15. Chuhno, A.A.; Leonenko, P.M.; Yukhimenko, P.I. Institutional-information economy: a textbook / edited by A.A. Chuhno, NAS of Ukraine. Kiev: Knowledge, 2010. 687 p.
16. Roos G., Roos J. Measuring Your Company "s Intellectual Performance. Long Range Planning, 1997. Vol. 30. № 3. - P. 413-426. URL: http://www.sciencedirect.com/science/journal/00246301/30/3 (circulation date 18.02.2017).
17. Bratnicki M., Stryżyna J., Butrym K. Przedsiębiorczość i kapitał intelektualny / pod red. M. Bratnickiego, J. Stryżyny. Katowice: Wydawnictwo Akademii Ekonomicznej w Katowicach, 2001. 70 p.
18. Zelisko I.M., Ponomarenko G.J. Intellectual capital management of enterprises: monograph. Kiev, 2015. 280 p.
19. Zinaida Zhyvko, Iryna Hetman, Marina Derzhevetska, Liliia Kukharska. Organizational and informational Support for the intellectual Capital Management Mechanism of machine-building Enterprises corporate management: from creation to success: monograph. Tallinn. Scientific Center of Innovative Researches OÜ, 2020. P.50-66
20. Zhyvko Z.B., Podra O.P., Kopytko M.I. Innovative development as a determinant of intellectualization of Ukraine's economy. Current Problems of Economy. № 8 (218) 2019. P.28-42. URL: https://eco-science.net/archive/2019/APE-08-2019/8.19_topic_Zhyvko%20Z.pdf
21. Zinaida Zhyvko, Liliia Kukharska, Viktoriia Melnykovich . Significant Components of intellectual Capital. *Materials Global Challenges and Threats to National Economies Nowadays. 19, 20, 21 February 2021*. 23rd FAI-ICS 2021 is focused on Emerging Trends & Adaptation of Spirituality in Management, Artificial Intelligence, Education, Health, Tourism, Science & Technology Pp. 40-42. URL: https://www.faterindia.org/
22. Stuart T. Intellectual capital. A new source of organizational wealth. New Post-industrial Wave in the West: Anthology, 1999. C. 372-401.
23. Saint-Onge H. Knowledge Management. URL: www.knowinc.com/saint-onge/primer/hso1.htm (circulation date 27.02.2017).
24. Ruus, I.; Pike, S.; Fernström, L. Intellectual capital: management practice (in English), 2008. 436p.
25. Coyle R.G. Management system dynamics. L. etc. Willey, 1997. P. 156-163.
26. Ostankova L.V., Shevchenko N.Yu., Hetman M.A. Simulation modeling of the value of intellectual capital of an enterprise as a system factor of its competitiveness. Škola biznisa Serbia, 2014 №2. P. 77-84.
27. Alshunnaq, M. F., Alsabbagh, R.. B. I., & Alazzam, F. A. F. (2021). LEGAL PROTECTION OF INTELLECTUAL PROPERTY RIGHTS UNDER JORDANIAN LEGISLATION AND INTERNATIONAL AGREEMENTS. *Public Administration and Law Review*, (3), 18–32. https://doi.org/10.36690/2674-5216-2021-3-18.

THE ECONOMIC POTENTIAL GROWTH MANAGEMENT FOR REAL ESTATE DEVELOPMENT COMPANY THROUGH AUTOMATION AND ARTIFICIAL INTELLIGENCE TECHNOLOGIES

Andrii Rosynskyi[1]

[1]*Postgraduate Student, Assistant Lecturer of the Department of Construction Economics, Kyiv National University of Construction and Architecture, Kyiv, Ukraine, e-mail: rosynskyi.av@knuba.edu.ua, ORCID: https://orcid.org/0000-0003-4119-7463*

Citation:
Rosynskyi, A. (2023). The economic potential growth management for real estate development company through automation and artificial intelligence technologies. *Economics, Finance and Management Review*, (3), 99–114. https://doi.org/10.36690/2674-5208-2023-3-99-114

Received: August 30, 2023
Approved: September 28, 2023
Published: September 30, 2023

Abstract. *Constant changes in the economic environment of development companies, as well as a large number of impact factors on the economic results of these companies, complicate the management processes of their economic potential formation and growth. Optimization of the management system for the economic potential growth of development companies requires the implementation of multifactorial models of informed decision-making, built on algorithms of fuzzy logical inference. Based on this, the article develops a multifactorial input-output model of fuzzy logical inference regarding the primary real estate price of the development project. The model is dynamic because it includes the time impact factors on the resulting values, thus it can be used throughout the entire cycle of the development project implementation. It grants obtaining of two output price values: full and with the maximum possible discount, depending on the input data for a specific real estate object, which is a tool both for increasing the company's pricing policy management effectiveness, as well as for developing of a system for profitability maximization of each development project. In addition, the algorithm of this model application in the economic potential growth management system of the development company is proposed, as well as the spheres of its practical utilization at different levels of managerial decision-making are considered. Analysis of the developed model disadvantages led to the development of methods for their minimization through automation and artificial intelligence technologies. The application of the Simulink environment of the MATLAB software complex made it possible to develop a software implementation of the developed model, which allows not only to minimize the identified disadvantages but also to apply artificial intelligence technologies for its further improvement. The software implementation, taking into account the features of the model, is presented in the form of a hierarchical system consisting of three subsystems, each of which is not only a component mechanism for obtaining the model resulting values but also allows for obtaining intermediate values for each separate subsystem, which favor multi-level result analysis to make informed management decisions.*

Keywords: *economic potential, potential growth, real estate development company, development management, primary real estate price, fuzzy logic multifactor model, management automation, artificial intelligence technologies, informed management decisions, digitalization.*

JEL classification: C67, L85, R31

Formulas: 4; fig.: 5; tabl.: 0; bibl.: 22

Introduction. To achieve stable economic potential growth for a real estate development company, it is necessary to constantly improve methods and approaches to managing its development. It can be achieved, in particular, through the development and implementation of universal multifactorial models in management processes, which can be used dynamically, that is, during all stages of the company's development project implementation. The application of such models in the company's operational activities can become a valuable tool in the economic potential growth management system of the development company. At the same time, the complexity of such models, as well as the large amount of input and output data, makes its high-quality application impossible without the integration of automation and artificial intelligence technologies into its implementation.

Literature review. Theoretical studies of the artificial intelligence technologies application impact on the economy's growth were conducted by Aghion, Jones B., and Jones C. (2018) and Wang, Sarker, Alam, and Sumon (2021). Bresnahan (2021) also investigated aggregate growth prospects through artificial intelligence technologies. At the same time, Strusani and Houngbonon (2019) focused on determining the role of artificial intelligence technology applications in the development of emerging markets. The issue of real estate price forecasting using artificial intelligence technologies at the methodological level is considered in (Rossini, 2000) and (Niu, J., & Niu, P., 2019) and is mainly researched in a regional context. While the article (Ćetković et al., 2018) focuses on the study of the European real estate market, Park and Bae (2015) use housing data from Fairfax County in Virginia.

There is a difference in approaches as well: while the study (Wang X., Wen, Zhang, & Wang Y., 2014) examines the support vector machine and its particle swarm optimization, Xu and Zhang (2022) in their article suggest using neural networks for real estate price forecasting. On the other hand, Guan, Shi, Zurada, and Levitan (2014) offer a neuro-fuzzy model for analyzing massive data sets for real estate property value prediction. For the Ukrainian real estate market, the principles of using rating modeling were studied in (Shaposhnikova, 2019).

Pieces of research (Akselrod, Shpakov, & Ryzhakova, 2022) and (Stetsenko, Tytok, Emelianova, Bielienkova, & Tsyfra, 2020) focus attention on how the digitalization of the economy influences the management processes of construction enterprises. The implementation of digital technologies and automation in the management systems of construction enterprises is considered in (Bolila, 2022). The use of fuzzy logic tools to increase the effectiveness of change management at construction enterprises was studied in (Shpakov, Stetsenko, Shpakova, Sorokina, & Akselrod, 2021).

Several research papers (Stetsenko et al., 2021; Bielienkova, 2019; Shaposhnikova, 2020) are devoted to the problem of management and assessment of the competitiveness of construction enterprises, in particular development companies, using automation and artificial intelligence technologies.

Important in the context of this study is the article by Stetsenko, Bolila, Sorokina, Tsyfra, and Molodid (2020), which proposes a monitoring mechanism for

the resilience of the anti-crisis potential system of the construction enterprise in the long-term period.

The study by Bielienkova (2020) also deserves special attention, as it examines the competitive potential of a development company and proposes the use of artificial intelligence tools to improve its management mechanisms.

Despite many studies related to this research subject, the issue of using automation and artificial intelligence technologies for the economic potential growth management system of real estate development companies remains insufficiently disclosed. This study is a logical development and continuation of research (Rosynskyi, 2022), which considered the initial aspects of solving this complex problem.

Aims. This research aims to develop an optimizing mechanism for the development company's economic activity management and to find and implement possibilities for its improvement through automation and artificial intelligence technologies.

Methods. The study applies general scientific research methods, such as the system-structural method, abstraction, analysis, synthesis, modeling, and forecasting. Simultaneously, specific research methods used in the study are input-output modeling, correlation-regression analysis, multifactor modeling, fuzzy inference modeling, and coefficient method.

Results. The study of impact factors on the primary real estate price (Rosynskyi, 2022) allows the formation of a fuzzy logic multifactor model suitable for usage in real time throughout the project development cycle. For modeling, the price of 1 m^2 of an apartment area P_{m2} is proposed to be expressed as a dependence:

$$P_{m2} = \Psi \cdot P_{base}, \quad (1)$$

where P_{base} is the base (average) price of 1 m^2 of an apartment area, Ψ - the accumulated coefficient of transition from the base price of 1 m^2 of an apartment area to the actual one, which depends on the accepted impact factors on the price change during the project development cycle.

Meantime, the introduced accumulated coefficient Ψ is expressed as a dependence on group impact factors:

$$\Psi = BUILD \cdot APRTM \cdot TIME, \quad (2)$$

where BUILD is the group building impact factor, APRTM is the group apartment impact factor, TIME is a group time impact factor.

The implementation of calculations according to formulas (1) and (2) allows getting the "desired" economically justified price value of 1 m^2 of an apartment area at a specific time moment, provided that there is an expected demand for particular residential premises. In the absence of expected demand, wishing to enter into an investment agreement, the developer should anticipate the maximum possible discount value that can be offered to a real investor.

At the same time, information about the presence or absence of expected demand for specific premises is internal information of the development company and unknown to investors. Therefore, the calculation of the price with a discount is

offered not as a substitute for the main dependencies in formulas (1) and (2) but as an additional management tool that can provide sales department specialists with further options to support the level of sales and, as a result, the level of the development project economic potential.

Based on that, the presence of expected demand and consequently possible discount level are proposed to be estimated by introducing an additional group impact factor POSDISC. As a result, the price of 1 m^2 of an apartment area with the maximum permissible discount value $P_{m2,disc}$ can be expressed as a dependence:

$$P_{m2,disc} = \Psi^* \cdot P_{base}, \quad (3)$$

where P_{base} is the base (average) price of 1 m^2 of an apartment area, Ψ^* - the accumulated coefficient of transition from the base price of 1 m2 of an apartment area to the actual one, which depends on the accepted impact factors on the price change during the project development cycle, considering the maximum allowable discount value.

The accumulated coefficient Ψ^* in this case is determined as follows:

$$\Psi^* = \Psi \cdot POSDISC = BUILD \cdot APRTM \cdot TIME \cdot POSDISC, \quad (4)$$

where BUILD is the group building impact factor, APRTM is the group apartment impact factor, TIME is a group time impact factor, POSDISC is a group discount impact factor.

Every group impact factor is a defuzzified (clear) value of the logical fuzzy conclusion of the corresponding output linguistic variable, the analysis of which is of additional managerial interest when comparing different proposals, in particular, analyzing various development projects of one development company, or comparing offers of competing companies.

As a result, Fig. 1 displays the developed algorithm for determining the apartment (flat) price according to this model, which can serve as a tool for optimizing the management of the development company's economic activities. It allows obtaining not only the final result (the apartment price at a particular time moment) but also monitoring the influence degree of isolated impact factors (both individual and group) to obtain initial data for making strategic and operational management decisions both at the global level (the development company level) and the local level (the levels of an individual development project or its part).

The proposed algorithm (Fig. 1) is universal and flexible depending on its utilization tasks. From a practical point of view, the sequential execution of the first five steps of this algorithm allows an ordinary sales manager to get the necessary price characteristics of a particular apartment to present them to a potential investor. The sales manager concurrently receives two price values (full and maximum discounted, if possible) that allow building a corresponding communication strategy with the buyer with additional flexibility in formulating offers. Obtaining the value of $P_{m2,disc}$ or $P_{flat,disc}$ as a result of the algorithm utilization allows the manager to independently apply the proper discount without the need for coordination with supervisors, which increases the efficiency of working with clients and optimizes the working time of the development company management staff.

On the other hand, the economic department specialists and senior management staff can analyze the data obtained from the algorithm implementation, both resulting

and intermediate. It allows both to carry out obtained values diagnostics for the development projects in progress and to receive forecast values for future development projects. This information is necessary for the further construction of the company's marketing strategies and is also a tool for monitoring the effectiveness of the company's activities.

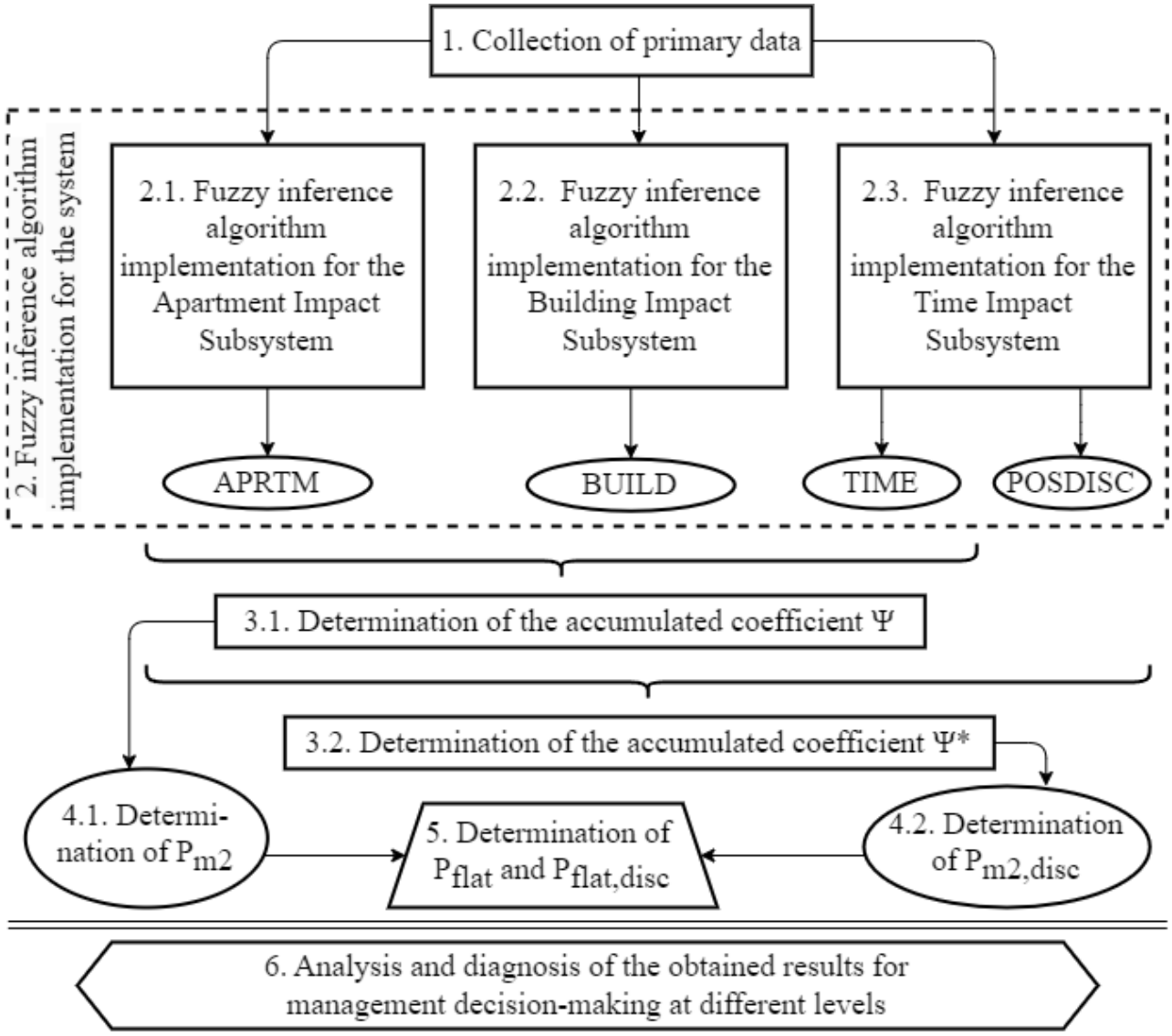

Figure 1. The apartment price determination algorithm following the multifactor model of fuzzy inference as an optimizing mechanism for the development company economic activity management

Source: developed by the author

In the meantime, if it is necessary to analyze and study only the building location and technical characteristics impact on the apartment price, step 2 of the algorithm can be limited only to the sub-step 2.2 execution with immediate proceeding to step 6. It allows not only to reduce the time for processing a large amount of information and to concentrate exclusively on the set tasks but also to perform them under conditions of limited initial data, which are either not relevant to

this task (input variables of other subsystems) or are not the subject of research and are deliberately excluded from the calculation (for example, the absence of a subway in the city or the absence of final information regarding the energy efficiency class of the designed building).

At the same time, algorithm utilization for forecasting also allows expanding the list of received fuzzy conclusion results. The IV stage of the fuzzy inference algorithm covered in (Rosynskyi, 2022) provides for obtaining only the centroid value of the accumulated figure obtained at the III stage of the corresponding algorithm as the desired clear value of the corresponding output variable. At the same time, prospective forecasting implementation following the algorithm makes it possible to expand the range of values obtained at this stage due to additional research and analysis of the accumulated figure for local maxima and minima. These values are economically justified limits of the corresponding output variable and suitable for modeling various scenarios ("most optimistic", "most expected", "most pessimistic", etc.) of the development project growth and their impact on the company's economic indicators. The same approach allows modeling and evaluating the impact of various management decisions on the development company's economic indicators.

Additionally, the model can be used for marketing research and as a supplementary tool in the marketing strategies construction and implementation. The obtained defuzzified values of each subsystem output variable allow the determination of linguistic descriptions of each output variable, depending on the terms that their defuzzified value satisfies. Thus, the analysis of the calculated values set for the apartment and building group impact factors allows for establishing a justified classification of buildings and apartments according to the degrees of accessibility and prestige, which should be considered when building marketing strategies and highlighting additional characteristics of the target audience.

The set of time impact group factor values is suitable for analysis in the context of planning and implementation of various marketing approaches to intensify demand in the most profitable periods of the development project and make appropriate decisions regarding real estate that does not enjoy the expected demand. The results of such an analysis allow the clustering of both the company's development projects and the totality of apartments to develop appropriate strategies for managing their development for different isolated clusters. This approach allows working more locally with each real estate cluster, thereby increasing the effectiveness of decisions and development strategies.

However, the developed models and algorithms, due to a relatively large number of input variables along with their universality and flexibility, have several characteristic disadvantages.

The developed model has a limited geography of use because it is based on a sample of development projects in Kyiv. In such a way, if it is necessary to expand its geography to several settlements or to adapt it to another one, an appropriate representative sample must be formed and analyzed, which will allow to single out

the relevant impact factors, based on which, according to the described methodology, it will be necessary to build a new model.

A similar problem arises since the primary real estate market is dynamic and sometimes quite volatile, which necessitates periodic screening and clarification of the actual data that became the model basis. Even if the list of impact factors remains constant, the influence degrees of these factors may change in response to market demands or changes in legislation.

In the case of the need to analyze a large amount of data, many results sets are obtained based on the outputs of the calculations, which require a competent storage structure development with the possibility of separating data that may require additional attention.

From the applied point of view, the results of calculations according to the algorithm have a limited shelf life because the output values are affected by constantly dynamic time factors. It requires conducting new estimations for the same apartment almost every time a potential buyer is interested in it or when it becomes the subject of analysis and diagnostics to make appropriate management decisions.

It is possible to neutralize or at least dramatically minimize the identified shortcomings by the automation of calculations and the involvement of artificial intelligence tools in their implementation. The advantage of the developed model is that it is suitable for this and, in addition to eliminating the shortcomings highlighted above, it significantly reduces the risks of human factor influence on the obtained results.

The developed model is a partial reflection of the life cycle simulation model of each development project concerning its price values, particularly their dynamics in time and space.

By setting the initial indicators obtained from the estimated construction documentation of the real estate object and dynamically changing them in case of changes, the model generates quantitative price indicators suitable for use by development companies in their operational activities.

The specified modeling implementation through automation and artificial intelligence allows not only to change the initial data but also to make corrections in the simulation of the resulting values, including in the analysis of the data obtained from the newly implemented development projects. In other words, it enables the model to "live", "learn" and "evolve" by increasing its base of raw data, as well as by aggregating data on "its" previous experience.

Thus, an essential step towards further improvement of the development company growth management is the automation and programming of the developed model. It can be achieved, for example, by using the functionality of the Simulink environment of the MATLAB software complex.

Figure 2 shows the software implementation front-end view of the developed multifactor model of fuzzy inference with an automated calculation based on input data described in (Rosynskyi, 2022).

The program implementation uses colored indicators, which do not affect the calculation process or its result, but serve as supplementary tools for analyzing the

program structure and additionally visualize individual components of the program system concerning the developed algorithms and grouping methods.

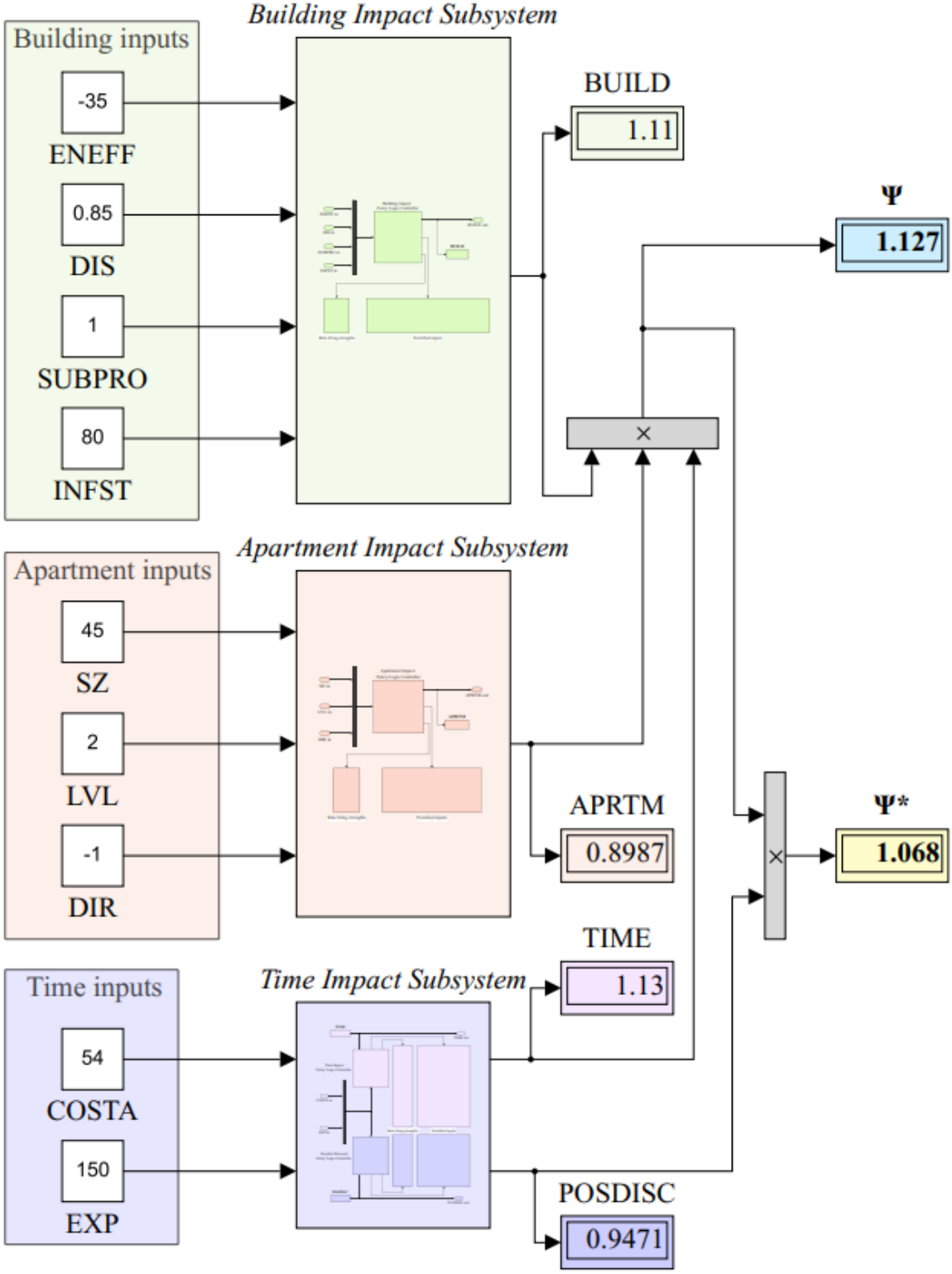

Figure 2. Software implementation of a multifactor model of fuzzy inference in the Simulink environment of the MATLAB software complex

Source: developed by the author

In particular, each subsystem has its own color indicator: the Building Impact Subsystem is painted in green, the Apartment Impact Subsystem - in peach color, and

the Time Impact Subsystem - in light purple. The resulting values of the accumulated coefficients Ψ and Ψ* are colored in blue and yellow, respectively.

The input variables for each subsystem are combined into blocks titled "Building/Apartment/Time inputs" and specified by “Constant” type blocks, which involve setting values in the block options.

Despite the use of this block type for input variables being quite limited and relatively unautomated, it was adopted deliberately as it offers the best visibility, which is most desirable when demonstrating the principles of the software product.

In the case of non-demonstration software product use, information for input variables should be filled automatically from pre-formed databases by linking the latter as sources for filling the corresponding blocks and/or creating the corresponding signals. In such case, the software product front-end view should not include the display of the list and values of each input variable, being limited only to the application of a single block type, e.g. "From File" or "From Spreadsheet".

Each subsystem in this program window is grouped separately to simplify the main interface of the software product, but if necessary, the structure of each subsystem can be expanded. Rather, using "Display" type blocks, the main screen shows output variables clear values of each subsystem, calculated by the entered input variables values. For instance, the value of the group apartment impact factor APRTM = 0.8987, which corresponds to the value obtained in the Rule Viewer dialog box of the Fuzzy Logic Designer environment in (Rosynskyi, 2022, Fig. 5). These blocks are informative, displaying only the final clear output values of fuzzy inference algorithm implementation for each subsystem.

Further, the obtained values are combined into the "Product" type blocks (marked in gray in Fig. 2) following formulas (2) and (4), the implementation results of which allow obtaining signals with the values of the calculated accumulated coefficients Ψ and Ψ*, the visualization of which in the software environment is ensured by the "Display" type blocks usage.

So, for the apartment under consideration, according to the results shown in Fig. 2, the value of Ψ = 1.127, and the value of Ψ* = 1.068. The software calculation results based on the entered values of the input variables make it possible to offer the buyer a discount of about 5%. The time and building group factors influenced the increase of the accumulated coefficient output value and, therefore, the price of the apartment. On the contrary, the apartment group factor influenced the decrease of the corresponding resulting values. If the building is in the design stage, it makes sense to check all apartments for the value of the relevant apartment group impact factors and, through their analysis, try to find opportunities to change the essential characteristics of each apartment, which will lead to increase of the APRTM factor value and, accordingly, this real estate object price.

Let us consider in more detail the software implementations of each subsystem. Fig. 3 shows the software implementation front-end view of the Building Impact Subsystem in an expanded form, that is, in a separate dialog box. All subsystem components have a corresponding coloring.

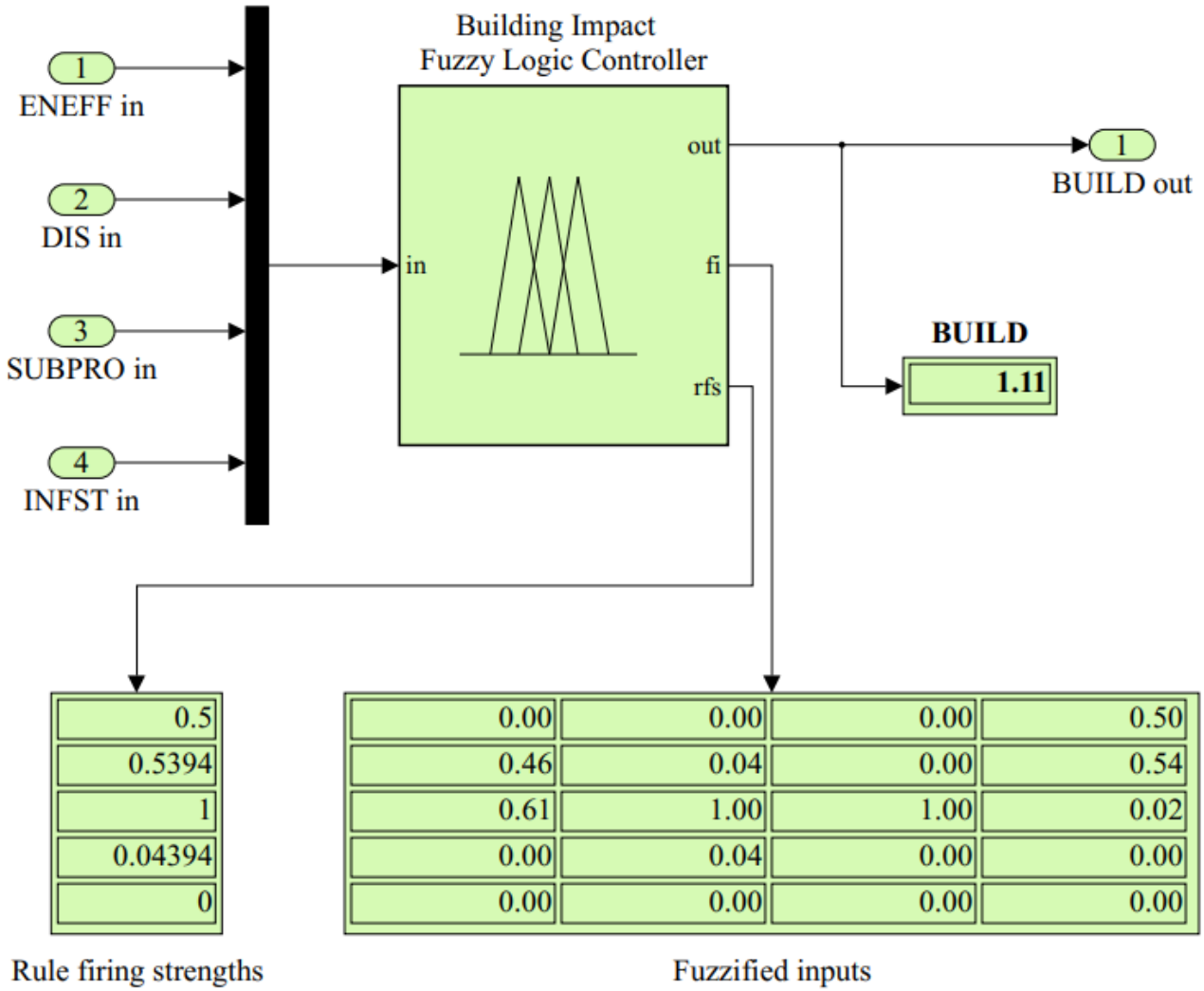

Figure 3. Software implementation of a multifactor model of fuzzy inference for the Building Impact Subsystem in the Simulink environment of the MATLAB software complex

Source: developed by the author

Hierarchically, any subsystem is a component of the overall system hence it must have inputs and outputs that link the system components with the corresponding subsystem blocks.

The input function is implemented by "Inport" type blocks, which carry signals from the corresponding blocks of the overall system (in this case, from the blocks with the input variables values of this subsystem). These blocks have an internal numbering for the subsystem (in this case, from 1 to 4) and are numbered and arranged in such a way that the signal of each input block gets to its designated place.

"Outport" type blocks transmit the output signal from the subsystem to the overall system. They also have their own end-to-end numbering. According to Fig. 3, the subsystem has only one "Outport" type block, which transmits to the overall system a signal with the value of the building group impact factor BUILD calculated in the subsystem. The numerical value of this factor is additionally duplicated inside the subsystem using a "Display" type block.

The main mechanism of the subsystem is a fuzzy logic controller represented by a "Fuzzy Logic Controller" block type. The presence of only one input port in this block ("in") requires the use of a "Mux" type block (shown by a black vertical rectangle in Fig. 3), which is designed to combine all input signals into a common one. Settings of the "Fuzzy Logic Controller" block provide for assigning to it the appropriate Fuzzy Inference System (FIS), an example and an algorithm for its development using the Fuzzy Logic Designer environment is discussed in (Rosynskyi, 2022). In addition, configuring a "Fuzzy Logic Controller" block consists of assigning which output signals the block will produce.

For example, the fuzzy logic controller in Fig. 3 produces three output signals. The first mandatory "out" one, which carries information about the calculated clear value of the output variable, is combined directly with the "Outport" type block discussed above. In addition, the controller is configured to provide additional output signals "fi" and "rfs", which are connected to the corresponding "Display" type blocks to analyze the received data arrays.

The "fi" signal transmits numerical information in matrix form with fuzzified values of all input variables following each knowledge base rule of the fuzzy logical inference subsystem. The matrix has dimension $n \times m$, where n is responsible for the number of the matrix rows and depends on the knowledge base rules number of the fuzzy inference subsystem, and m is responsible for the number of the matrix columns and depends on the number of input variables. In the fuzzy logical inference Building Impact Subsystem (Fig. 3), the knowledge base consists of 5 rules for 4 input variables. That is why the matrix «Fuzzified inputs» has the dimension $n \times m = 5 \times 4$. Numerical values that make up the matrix are nothing but the significance degree values of the input variables.

In turn, the "rfs" signal creates similar information but for the output variables. The matrix "Rule firing strength" will always have the same number of rows as the matrix "Fuzzified inputs", because it also displays the values for each knowledge base rule of the subsystem, which are common to the input and output variables. Meantime, the column number of the matrix "Rule firing strength" will correspond to the number of output variables. For example, the matrix «Rule firing strength» in Fig. 3 has only one column corresponding to the single output variable BUILD. The numerical values that make up this matrix are similarly the significance degree values of the output variables concerning every rule of the fuzzy inference knowledge base.

Figure 4 displays the Apartment Impact Subsystem software implementation in its expanded form. Its structure and construction principle correspond to the Building Impact Subsystem software implementation (Fig. 3). The values displayed in the corresponding data arrays of the "Display" blocks correspond to and, in a certain way, complement the graphic display of the execution of the fuzzy inference algorithm in the Rule Viewer dialog box of Fuzzy Logic Designer environment performed for this subsystem in (Rosynskyi, 2022). Thus, the software implementation of the algorithm makes it possible to obtain all the necessary results exclusively in its own environment, which removes the urgent need to use additional applications.

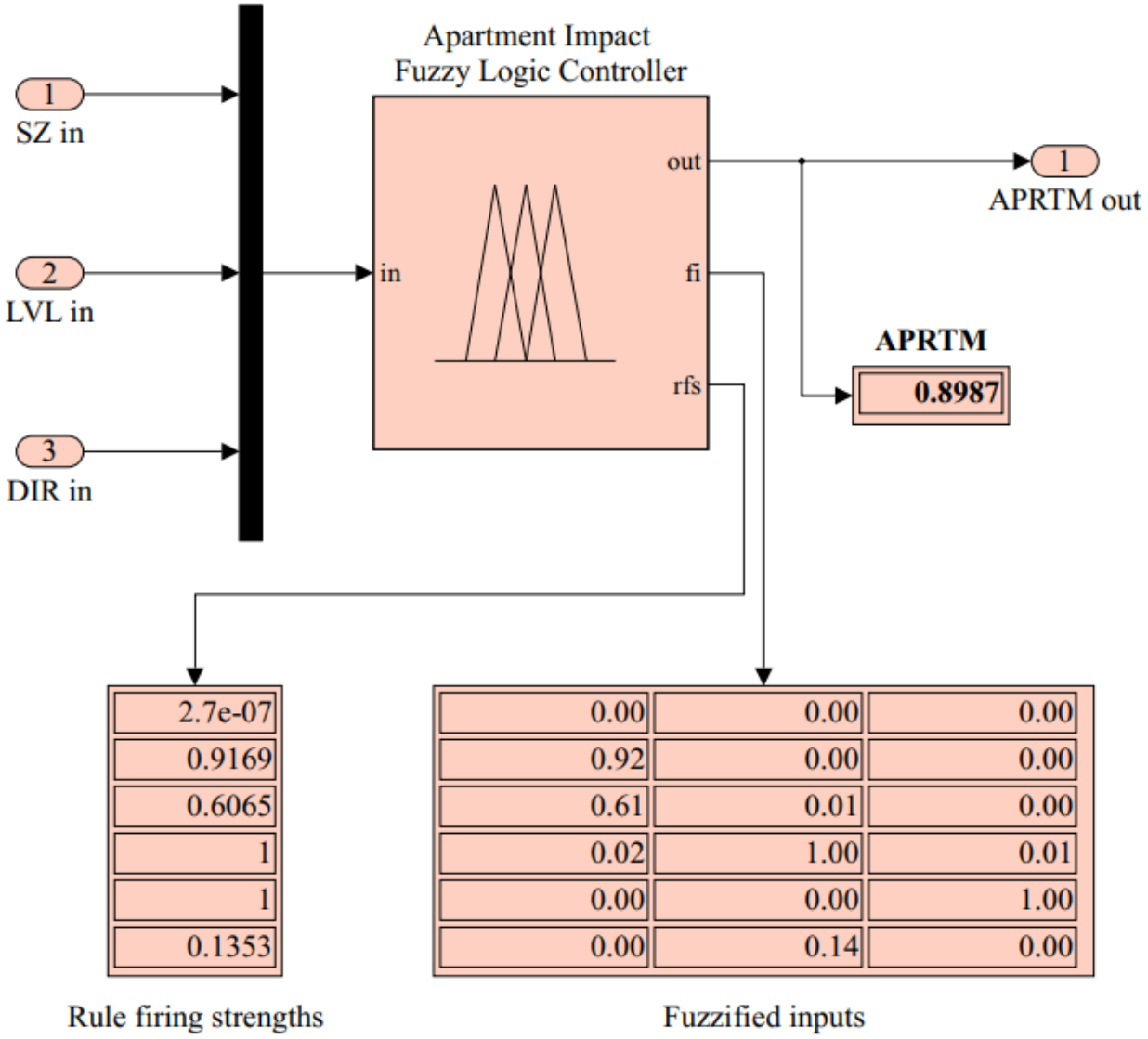

Figure 4. Software implementation of a multifactor model of fuzzy inference for the Apartment Impact Subsystem in the Simulink environment of the MATLAB software complex

Source: developed by the author

Time Impact Subsystem software implementation in expanded form deserves additional attention and is shown in Fig. 5.

Structural elements and the general principle of its construction coincide with previously considered subsystem software implementations but the appearance and structure are slightly different due to the peculiarities of the knowledge base construction of this subsystem described in (Rosynskyi, 2022). Thus, the Time Impact Subsystem software implementation (Fig. 5) includes two separate fuzzy logic controllers for each output variable. Visually, they are separated by color: the blocks related to the TIME output variable are colored pink, and the POSDISC output variable blocks are purple. These shades are preserved for the "Display" type block corresponding to clear values of this subsystem output variables in the overall system software implementation (Fig. 2). As expected, each fuzzy logic controller has its

own output signal, that is, the subsystem, unlike the others, has two "Outport" type blocks.

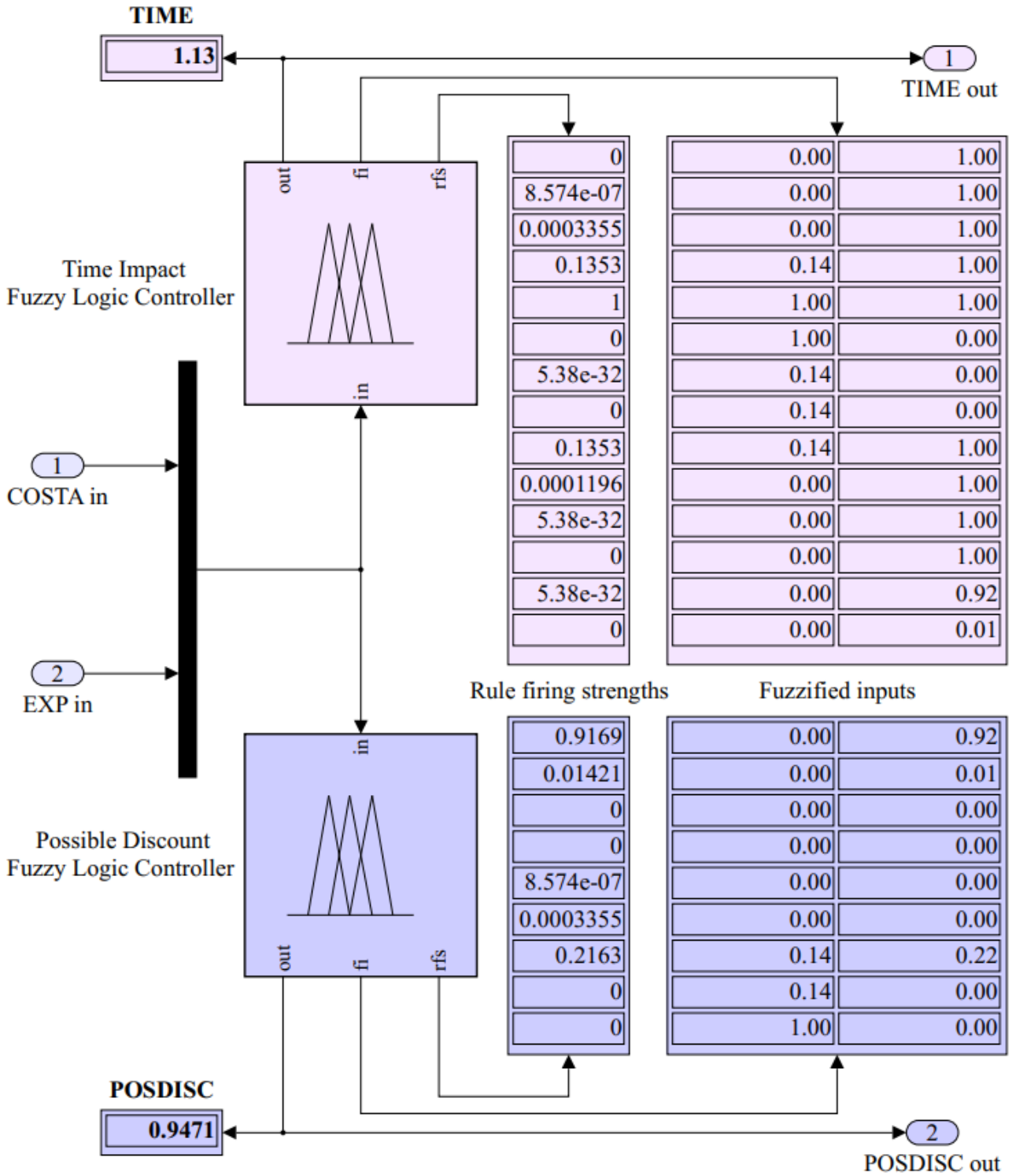

Figure 5. Software implementation of a multifactor model of fuzzy inference for the Time Impact Subsystem in the Simulink environment of the MATLAB software complex

Source: developed by the author

Input subsystem variables are common to both controllers and are represented by "Inport" type blocks, the signals of which are combined using a "Mux" type block into a single signal simultaneously branched to both controllers.

The number format and precision of values in all "Display" type blocks are customizable. For example, in Fig. 5, the number format in data arrays «Fuzzified inputs» is limited to the decimal system with two decimal places, while to demonstrate the functionality and the level of calculation accuracy, the corresponding setting was deliberately not performed for the values of the data arrays titled «Rule firing strength». The setting of these options depends on how the analysis of the obtained results is carried out, as well as how they are planned to be aggregated, segmented, and stored in the future.

The values obtained in automated calculation outputs can be sent to the corresponding blocks of the "Sinks" category, which allow, for example, visualization of numerical information in graphics of the same format and content that can be obtained in the Surface Viewer dialog box in Fuzzy Logic Designer environment (Rosynskyi, 2022, Fig. 6). For this, "Scope" or "XY Graph" block types can be used. It is also possible to redirect the resulting data signals to the appropriate databases for further processing. For this, it is worth using the "To File" block type.

Computerized maintenance of performed calculations' registers, sequential data accumulation, and their mutual exchange between the input and output databases of the model software implementation allows taking into account changes in trends and indicators and the software environment usage experience during modeling.

The artificial intelligence technologies integration into the proposed software stimulates model stable development and its independent updating due to the introduction of machine learning algorithms, as well as increasing the efficiency of management processes.

In particular, artificial intelligence technologies can perform analysis of databases and calculation results and notify the development company's management of identified trends and potential risks that require additional attention and deeper analysis. Retrospective analysis of implemented development projects' indicators allows artificial intelligence to distinguish the operational activity specifics of the respective development company, as well as to identify potential problems and risk areas. The results of such analyses, which artificial intelligence can conduct with a given frequency, are the basis for making informed management decisions.

Creating registers of decisions made in response to identified problematic trends is the next stage of artificial intelligence machine learning, which can create appropriate management decision-making systems that are able not only to highlight information about potential threats to management personnel but also to provide recommendations on optimal strategies for their resolution.

Given that the developed model is suitable for use in real-time, the functionality of artificial intelligence technologies can also be used for automatic continuous monitoring, analyzing input and calculated data in real-time. It allows quick response to any threats and predicts potential consequences.

In particular, the described monitoring system can be configured to detect signs of abuse and/or fraud by all development project stakeholders. The monitoring system's access to bank transactions on the company's accounts allows the detection of potentially threatening actions and even fraudulent schemes.

Discussion. The developed multifactor model of fuzzy inference and its improvement through automation and artificial intelligence technologies is an indispensable step towards further improvement of the development company growth management in a digitalized economic environment. At the same time, the use of artificial intelligence and automated calculations requires human supervision and expert analysis to prevent the presence of actual errors in the programmed system and to respond appropriately to possible failures and technical errors that can lead to information distortion that can serve as a basis for making incorrect management decisions.

Conclusion. The developed algorithm following the multifactor model of fuzzy inference in addition to the operational application, can be used as an optimizing mechanism for flexible economic forecasting and increasing the efficiency of construction development management.

Its improvement through automation and artificial intelligence technologies results in the minimization of human involvement in the calculation, analysis, and diagnosis processes, which reduces the risks of making incorrect management decisions, which is a positive factor influencing the economic potential growth of a real estate development company.

References:

1. Aghion, P., Jones, B. F., & Jones, C. I. (2018). Artificial intelligence and economic growth. *The economics of artificial intelligence: An agenda*, 237-282.
2. Akselrod, R., Shpakov, A., & Ryzhakova, G. (2022). Economic and management predictors of the transformation of operating systems for construction development in the context of digitalization of the economy. *Market relations development in Ukraine*, 12(247), 113–121.
3. Bielienkova, O. (2019). Klasternyi analiz rynku yak analitychna komponenta vyboru konkurentnoi polityky developera. *Actual problems of economics*, 6(216), 141-158.
4. Bielienkova, O. (2020). Vdoskonalennia mekhanizmu upravlinnia konkurentnym potentsialom developera zasobamy shtuchnoho intelektu. *Actual problems of economics*, 3, 107-122.
5. Bolila, N. (2022, March). Zaprovadzhennia tsyfrovykh tekhnolohii upravlinnia budivelnymy pidpryiemstvamy. In *Proceedings of the international conference Aktualni problemy suchasnoho biznesu: oblikovo-finansovyi ta upravlinskyi aspekty* (pp. 164-166).
6. Bresnahan, T. (2021). Artificial intelligence technologies and aggregate growth prospects. *Prospects for Economic Growth in the United States*. 132-170.
7. Ćetković, J., Lakić, S., Lazarevska, M., Žarković, M., Vujošević, S., Cvijović, J., & Gogić, M. (2018). Assessment of the real estate market value in the European market by artificial neural networks application. *Complexity*, 2018.
8. Guan, J., Shi, D., Zurada, J. M., & Levitan, A. S. (2014). Analyzing massive data sets: an adaptive fuzzy neural approach for prediction, with a real estate illustration. *Journal of organizational computing and electronic commerce*, 24(1), 94-112.
9. Niu, J., & Niu, P. (2019, December). An intelligent automatic valuation system for real estate based on machine learning. In *Proceedings of the international conference on artificial intelligence, information processing and cloud computing* (pp. 1-6).
10. Park, B., & Bae, J. K. (2015). Using machine learning algorithms for housing price prediction: The case of Fairfax County, Virginia housing data. *Expert systems with applications*, 42(6), 2928-2934.
11. Rossini, P. (2000, January). Using expert systems and artificial intelligence for real estate forecasting. In *Sixth Annual Pacific-Rim Real Estate Society Conference, Sydney, Australia* (pp. 24-27).
12. Rosynskyi, A. (2022). Fuzzy logic inference algorithms utilization in the economic potential growth management system of the real estate development company. *Shliakhy pidvyshchennia efektyvnosti budivnytstva v umovakh formuvannia rynkovykh vidnosyn*, 50, 180-202.

13. Shaposhnikova, I. (2019). Rating modeling of the primary residential real estate market of Ukraine. *Shliakhy pidvyshchennia efektyvnosti budivnytstva v umovakh formuvannia rynkovykh vidnosyn*, 40, 25–35.
14. Shaposhnikova, I. (2020). Modern approaches to the formation of a project for the development of construction enterprises. *Shliakhy pidvyshchennia efektyvnosti budivnytstva v umovakh formuvannia rynkovykh vidnosyn*, 46, 126-135.
15. Shpakov, A., Stetsenko, S., Shpakova, H., Sorokina, L., & Akselrod, R. (2021). Assessment of the Influence of Adaptability Factors on the Effectiveness of Managing Changes in Enterprises by Fuzzy Logic. *Scientific Horizons*, 24(10), 72-82.
16. Stetsenko, S., Bolila, N., Sorokina, L., Tsyfra, T., & Molodid, O. (2020). Monitoring mechanism of resilience of the anti-crisis potential system of the construction enterprise in the long-term period. *Economics, finance and management review*, 3, 31-42.
17. Stetsenko, S., Tytok, V., Emelianova, O., Bielienkova, O., & Tsyfra, T. (2020). Management of Adaptation of Organizational and Economic Mechanisms of Construction to Increasing Impact of Digital Technologies on the National Economy. *Journal of Reviews on Global Economic*, 9, 149-164.
18. Stetsenko, S., Sorokina, L., Izmailova, K., Bielienkova, O., Tytok, V., & Emelianova, O. (2021). Model of a Company Competitiveness Control by Means of Artificial Intelligence Tools. *International Journal of Emerging Trends in Engineering Research*, 9(2), 60-65.
19. Strusani, D., & Houngbonon, G. V. (2019). The role of artificial intelligence in supporting development in emerging markets. *EMCompass*, 69.
20. Wang, L., Sarker, P., Alam, K., & Sumon, S. (2021). Artificial Intelligence and Economic Growth: A Theoretical Framework. *Scientific Annals of Economics and Business*, 68(4), 421-443.
21. Wang, X., Wen, J., Zhang, Y., & Wang, Y. (2014). Real estate price forecasting based on SVM optimized by PSO. *Optik*, 125(3), 1439-1443.
22. Xu, X., & Zhang, Y. (2022). Residential housing price index forecasting via neural networks. *Neural Computing and Applications*, 34(17), 14763-14776.

Economics, Finance and Management Review

Issue 3 (15), 2023

Printed by: Scientific Center of Innovative Research OÜ, Ida-Viru maakond, Lüganuse vald, Püssi linn, Viru tn 8-33, 43221, Estonia
Number of copies: 300
First printing: September 30, 2023
Distributed worldwide by Scientific Center of Innovative Research OÜ - office@scnchub.com
Full text available online at https://scnchub.com/
DOI: 10.36690/2674-5208-2023-3