Vol. 18 • No. 2 • 2024

THE WORLD OF WNE NEW ECONOMY

ISSN 2220-6469 (Print)
ISSN 2220-7872 (Online)

WORLD OF NEW ECONOMY

JOURNAL OF SCIENTIFIC HYPOTHESES AND SUCCESSFUL BUSINESS DECISIONS

DOI: 10.26794/2220-6469

The edition is reregistered
in the Federal Service for Supervision
of Communications,
Informational Technologies and Media Control:
PI No. ФС77-82263
of 23, November, 2021

Publication frequency — 4 issues per year

Founder: Financial University

Indexed in databases: CrossRef, DOAJ, Ebsco, Dimensions, EconLit, EconBiz, RePec, eLibrary.ru, Russian Index of Science Citation (RINTs), etc.
A journal included in the first category of the List of the VAC's peer-reviewed scientific publications of the Higher Attestation Commission (K1) on scientific specialties:
5.2.1. — Economic theory (economic sciences),
5.2.3. — Regional and sectoral economics (economic sciences),
5.2.4. — Finance (economic sciences),
5.2.5. — World Economy (Economic Sciences),
5.2.6 — Management (economic sciences)
All articles of journal "The World of the New Economy" are published with a digital object identifier (DOI)
The Journal is distributed by subscription.
Subscription index: 42131 in the consolidated catalogue "The Press of Russia"

The journal is included into the list of periodicals recommended for publishing doctoral research results by the Higher Attestation Commission

Journal Certificate PI No. ФС77-82263. of 23, November, 2021. Issued since 2007. Founders: Financial University

Vol. 18, No. 1/2024

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Signed off to printing: 08.08.2024
Format 60 × 84 1/8
Order № 976
Printer's sheet 17,75

Printed in the Department of Polygraphy of the Financial University (Moscow, Leningradskiy prospekt, 51)

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-6-16
UDC 338.012(045)
JEL L11

Space Tourism: the Emerging Industry of the World Economy

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ABSTRACT

Relevance of the research topic: currently, space is considered as a new economic resource, the use of which can generate profit for companies that have access to it. The participation of private capital in space exploration contributes to the search for new business niches and the formation of new economic sectors, one of which is space tourism. **The purpose of the article** is to study the current state and development trends of a new branch of the world economy – space tourism. To conduct the study, general scientific methods were used: analysis, synthesis, deduction, comparative analysis, generalization, as well as special scientific methods: structural analysis, statistical method, grouping method, graphical method and SWOT analysis method. A review of scientific publications on the problems of space tourism development allowed the author to propose his own definition of this phenomenon and identify its main features at the present stage of development. The author identified and analysed the main types of space tourism (orbital, suborbital, lunar and stratospheric), identified the main participants in the global space tourism market, conducted a comparative analysis of the technologies used to provide services for sending tourists into space, and conducted a SWOT analysis of the development of the global space tourism industry, he also analyzed the state of space tourism in Russia. The results and conclusions of the article are of interest to researchers studying the development of economic sectors related to space activities, as well as to government agencies whose decisions affect the development of the space industry in Russia.

Keywords: space tourism; orbital tourism; suborbital tourism; lunar tourism; spacecraft aircraft; cost of space flight; space travel market; space technology

***For citation*: Efimova E.A. Space tourism: the emerging industry of the world economy. *The World of the New Economy*. 2024;18(2):6-16. DOI: 10.26794/2220-6469-2024-18-2-6-16**

INTRODUCTION

Space tourism as a branch of economy is still at the stage of formation. The time of its emergence can be considered 2001, when American multi-billionaire Dennis Tito made the first commercial flight into space. Until now, such flights remain very expensive and are available only to wealthy citizens. Nevertheless, the emergence of a number of private companies: SpaceX, Virgin Galactic, Boeing and Blue Origin, competing with each other, gives confidence that gradually the price of flights will decrease, and space tourism will become accessible to the majority of the Earth's inhabitants.

The theoretical basis of the research was the works of Russian and foreign scientists in the field of space tourism; the empirical base was the data of marketing reports of foreign companies: Polaris Market Research, Market.Us, Maximize Market Research, Precedence Research, Maximize Market Research, Vantage Market Research, as well as statistical data of Statista platform, which are in the public domain.

APPROACHES TO THE DEFINITION OF THE TERM "SPACE TOURISM"

The scientific literature has not yet developed a single definition of the concept of "space tourism". In this regard, the author considers it necessary to note some approaches to the interpretation of this term. A very simple definition was proposed by Sam Cole: "Space tourism is a term that has come to be used to denote ordinary members of the public who buy tickets to travel to space and back" [1, p. 133]. Here the emphasis is placed on the participant of the flight (he/she is not a professional astronaut), as well as on the source of funding for the trip (the participant buys the tickets himself/herself, which distinguishes him/her from astronauts, who not only do not pay for their flight into space, but are paid for it by national space agencies), but the purpose of the event is not taken into account.

Most often in scientific literature space tourism is considered through the target characteristic — as flights into space for entertainment or recreational purposes, paid from private funds [2–5]. A slightly broader interpretation is given by A.M. Yazici and S. Tiwari: "Space tourism is a commercial service provided by publicly funded organisations or private companies to their customers for their travel to space for various purposes such as recreation, business and research" [6, p. 40].

A.B. Zheleznyakov rightly points out that not every "space flight" is such in essence, in particular, travellers who only briefly "touch" the boundary of space at an altitude of 80 km or slightly more, he proposes to call "mesonauts", and "space tourists" — is applicable only to those who go into orbit around the Earth [7, p. 56].

V. Yu. Adygezalova and A.I. Dronov believe that these are "privately paid flights into space (to orbital systems and extra-terrestrial objects) for extreme-adventure, cognitive, research purposes, as well as visiting cultural and historical places and centres related to cosmonautics" [8, p. 55]. Thus, according to their approach, space tourism can have an "earthly" component. Indeed, Russia, which was the leader of the space race in the Soviet times, has a rich "space" history and ground-based space infrastructure, is now actively developing this direction, however, according to the author, this type of tourism refers not to space tourism, but to cultural, cognitive and excursion tourism.

E.F. Galiullin gives the following definition: "Tourism in space is a new direction in the industry, which provides an opportunity for mankind to expand its boundaries and learn more about the space environment" [9, p. 94]. That is, he does not consider space tourism as a new industry.

On the basis of the analysis, the author considers it possible to give her own definition: **Space tourism is the newest branch of the global economy related to the commercial activity of sending individuals into space for leisure and recreational purposes, as well as for gaining new knowledge, experiences and impressions.**

The author believes that space tourism should be considered as a *separate emerging industry*, rather

than as a type of extreme tourism, which belongs to the conventional tourism industry. Such an approach is conditioned by the fact that space tourism *unites enterprises* having *identical technologies* (allowing to deliver tourists to space and to support life support systems during the trip) and *specialisation*: they provide *similar economic benefits* (trips to space of different duration), use *similar resources* (in this case — space itself, as well as ground space infrastructure for launching and tracking flights) and satisfy *similar needs* of their customers (those wishing to get experience of space tourism). Thus, space tourism has features that allow it to be identified as a new branch of the economy.

PECULIARITIES OF THE SPACE TOURISM INDUSTRY

Space tourism as a branch of economy has a number of*features*, which, in the author's opinion, at the present stage include:

1. Heavy dependence on new technologies: rocket science, spacecraft design and launch systems.

2. Long period of project development and, as a consequence, payback of initial expenditures (investments). For example, Virgin Galactic planned to conduct the first tests of its rocket plane back in 2008, but it managed to do it only in 2013, and the first flight with tourists on board took place in 2021 [7, p. 53].

3. High level of risk: economic (it is difficult to find investors), technological (possible failures in testing new spacecraft), social (related to the health of tourists, because of which they need to pass a medical examination and preliminary training).

4. High cost of the final service (space travel), as the industry does not yet have economies of scale, and flights are of a one-off nature.

5. Elasticity of demand. Studies conducted in the USA and other countries show that many respondents would like to travel to space if the price was lower [3, 4, 10].

6. Financial and technological barriers to entry of new participants into the industry (lack of money for starting a business and developing own technologies).

TYPES OF SPACE TOURISM

The space tourism market is currently growing rapidly and is projected to exceed US$ 17 billion by 2032. (*Fig. 1*).

However, space tourism is not homogeneous. Two types are most often distinguished in scientific literature: *orbital* and *suborbital*. *Orbital tourism* is connected with flights to the International Space Station (ISS) and staying there for some time, usually from 7 to 14 days. The ISS orbit altitude is 330–430 kilometres above the Earth's surface, and the low-Earth space orbit altitude is 160–2000 kilometres. Accordingly, all flights above 160 km can be considered orbital flights.

Suborbital space tourism assumes that the flight takes place at an altitude of more than 80 kilometres above the Earth's surface, but without entering orbit.[1]In other words, suborbital flights take place beyond the boundary of the mesosphere. And here it is important to note another "space" boundary — between the Earth's atmosphere and space — which passes at an altitude of 100 km above sea level and is called the Karman Line — after physicist Theodore von Karman, who first raised the question about the boundary of the beginning of space, proposing to consider as such the height to which aeroplanes can rise due to the action of aerodynamic forces, and above it — only aircraft equipped with rocket engines [7, p. 53]. Currently, most of the flights within the framework of suborbital space tourism take place at an altitude of more than 80 and less than 120 km with take-off and landing in the same place.[2] That is why companies operating in this industry develop their own vehicles combining the properties of both aircraft and rocket.

The advantages and disadvantages that each of the mentioned types of tourism possesses are presented in *Table 1*.

[1] URL: https://www.maximizemarketresearch.com/market-report/space-tourism-market/203605/ (accessed on 14.02.2024).

[2] Ibidem.

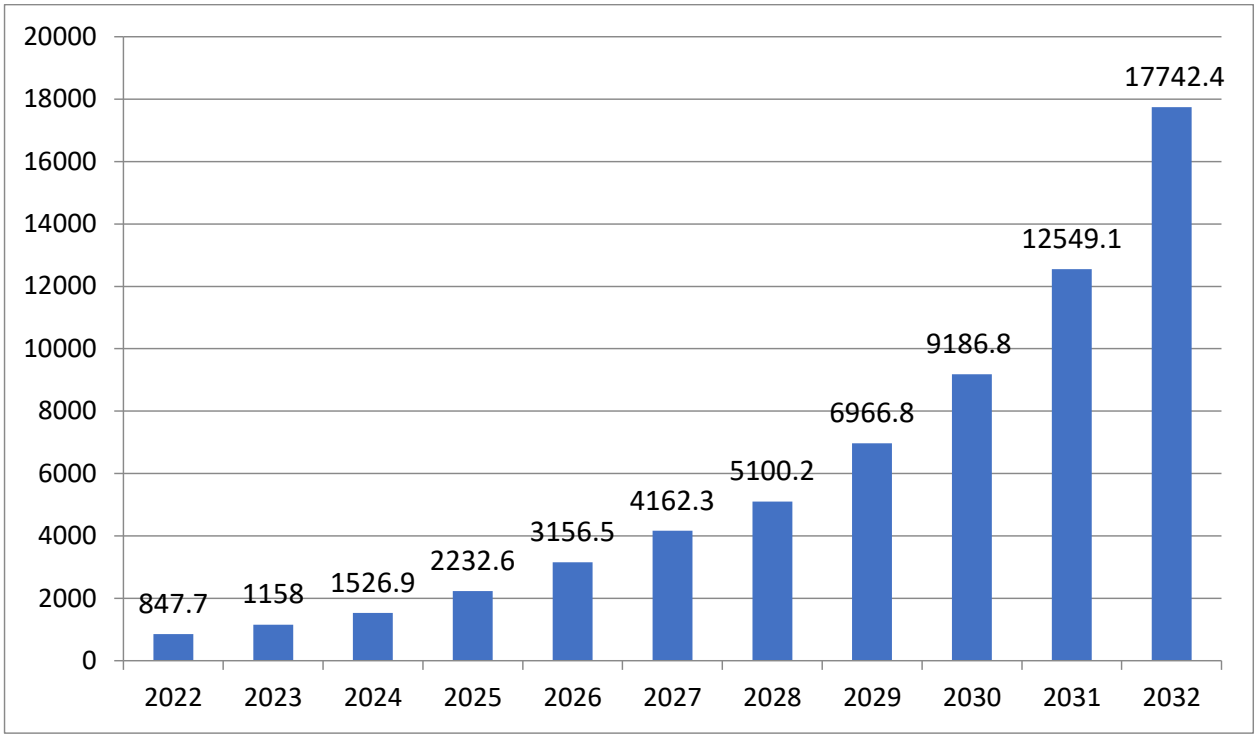

Fig.1. **Volume of the global space tourism market, million dollars**

Source: URL: https://market.us/report/space-tourism-market/

In 2022, the suborbital segment of space tourism accounted for the largest market share of $ 446.7 million (52.7% of the market). At the same time, it is expected to grow to $ 8.7 billion by 2030, a compound annual growth rate of 37.8%.[3]

The volume of the orbital space tourism market will also grow by 2030 (*Fig. 2*).

The increasing number of private space companies promotes competition between them and expands the possibilities for ordinary citizens to choose a travel organiser. Some companies are planning to organise flights in the stratosphere (18–50 km above the Earth's surface), to the edge of the mesosphere, which is much more comfortable and less dangerous for tourists. Such journeys are still being planned, but tickets for them can be purchased already now (*Table 2*).

Space Perspective's "Neptune" and World View Enterprises' "Explorer" spacecraft are being developed in the form of capsule-shaped spheres or balloons that, although they do not rise to a high altitude above the Earth's surface, allow you to see it and experience the darkness of space, and most importantly, they are designed to make space tourism as comfortable as possible. In particular, they are supposed to have a catering system, as well as bars with drinks, restrooms, cocktail tables, panoramic windows, mobile communications and other amenities to provide a luxurious travelling experience.

Lunar tourism is now beginning to develop. For example, in 2007, Space Adventures Ltd. offered its customers the opportunity to visit the lunar orbit for $ 100 million. In 2017, SpaceX also announced such a trip for $ 70 million. [6]. A number of companies are developing new spacecraft for this kind of tourism (*Table 3*).

DEVELOPMENT OF SPACE TOURISM BY MACRO-REGIONS OF THE WORLD

North America was the leader in space tourism in 2022, accounting for more than 39.8% of the market. This is attributed to the activi-

[3] URL: https://market.us/report/space-tourism-market/ (accessed on 14.02.2024).

Table 1

Comparative analysis of orbital and suborbital space tourism

Type	Advantages	Disadvantages
Orbital tourism	- The opportunity to fly in space as a professional astronaut; - the opportunity to see the Earth from different angles; - availability on the market for the delivery of tourists to orbit of proven vehicles that have proven their reliability in the process of operation (Russian Soyuz spacecraft)	- High cost for travellers; – Mandatory lengthy training (approximately 6 months); – Significant health risks for travellers; - risk of ineligibility for flight due to health reasons
Suborbital space tourism	- The opportunity to see space and experience weightlessness; - shorter and less complicated flights with fewer health risks for tourists; - relatively low cost and therefore more accessible; - do not require lengthy and elaborate training; - reusability of space vehicles	- The probability of seeing only certain angles of the Earth, as determined by the flight path; – The flight is often carried out on newly developed vehicles, which significantly increases the technical risks of their use

Source: compiled by the author.

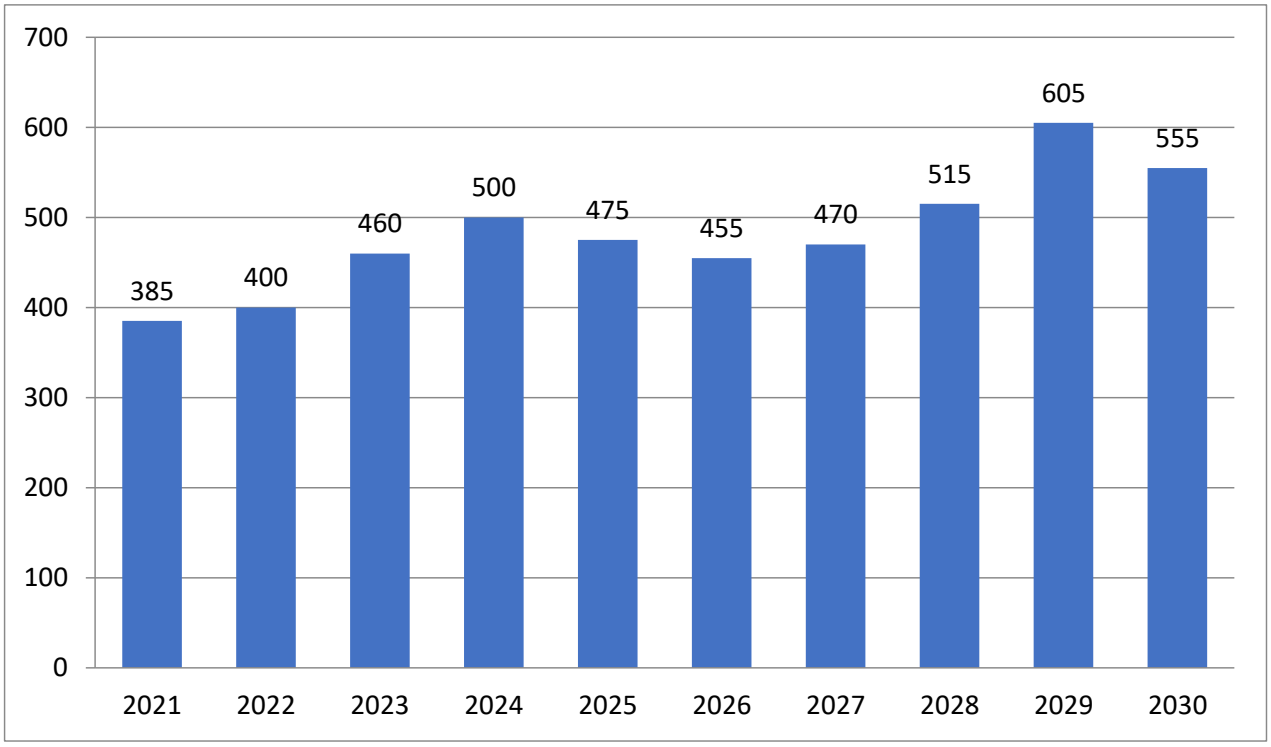

Fig. 2. **Volume of the global orbital space tourism market (million dollars)**

Source: URL: https://www.statista.com/statistics/1239530/orbital-space-tourism-and-travel-revenue-forecast-worldwide/

Table 2

Comparative characteristics of the main participants in the space tourism market and the declared price of their travel in 2023

The spacecraft and development company	Type of space tourism and number of persons on board	Year of the beginning of the organisation of space travel	Maximum flight altitude above the Earth's surface, km	Duration of the journey	Flight price, in millions of USD
SpaceShipTwo (VirginGalactic)	Suborbital. 6 tourists and 2 crew members	2021	82–110	90–120 min, of which 6 min.in weightlessness	450
NewShepard (BlueOrigin)	Suborbital. 6 tourists (no pilots required for control)	2021	90–106	10–11 min, of which in weightlessness – 3–4 min.	250
Bloon (Zero 2 Infinity)	Stratospheric. 4 tourists and 2 pilots	2025	36	270 min, of which in weightlessness – 0 min.	132.5
Neptune (SpacePerspective)	Stratospheric. 8 tourists and 1 pilot	2025	30	360 min, of which in weightlessness – 0 min.	125
Explorer (World View Enterprises)	Stratospheric. 8 tourists and 2 pilots	2024	30.5	360–480 minutes, of which in weightlessness – 0 min.	50
Crew Dragon(SpaceX)	Orbital. 7 tourists or crew members (no manual control required)	2020	330–430	3–6 hours – towards the ISS and 8 days – on ISS	55

Source: compiled by the author.

ties of SpaceX, Blue Origin, and Virgin Galactic, which are contributing significantly to the industry growth. In addition, the regulatory environment in North America (and especially in the U.S.) is also fuelling the growth of the industry. The U.S. government has shown a willingness to work with private companies by offering financial (grants and government contracts) and technical support. The high average disposable income and the presence of billionaires investing in space tourism are all contributing to the expansion of the industry in the USA (*Fig. 3*).

However, according to forecasts by a number of American consulting companies, significant investments in space tourism programmes by India and China will lead to the Asia-Pacific region becoming the fastest growing region in the world in the near future at a compound annual growth rate of 35.5%[4]. China's space tourism market is expected to reach USD 480 million by 2032, at a compound annual growth rate of 20% from 2023 to 2032. In Japan and Canada, space tourism growth during the same period will be 11.4% and 13.8% respectively, and in Europe it will be around 20%.[5]

[4] URL: https://market.us/report/space-tourism-market/ (accessed on14.02.2024).

[5] URL: https://www.precedenceresearch.com/space-tourism-market (accessed on 14.02.2024).

Table 3

Vehicles being developed for space tourism

Company (year of establishment, country)	Spacecraft	Type of space tourism	Number of seats	Note
SpaceX (2002, USA)	Starship / Starship Human Landing System	Lunar, interplanetary (flights to Mars)	100 travellers (no manual operation required)	Reusable super heavy rocket (starship). Assumes refuelling in Earth orbit. The first flight test took place in 2023. The estimated price of the flight is $ 1 million
Orion Span (2018, USA)	Orion	Orbital and lunar	6 tourists (in Earth orbit) and 4 tourists (in lunar orbit)	It has been in development since 2004. It was tested in lunar orbit without a crew in 2022
China Aerospace Science and Technology Corporation (1999, China)	Mengzhou	Lunar	6 tourists and 3 pilots	The first test flight took place in 2016
S.P. Korolev RSC Energia (1946, Russia)	Orel	Lunar	4 crew members	It has been under development since 2009. The first unmanned flight is planned for 2025. The first crewed flight is planned for 2029

Source: compiled by the author.

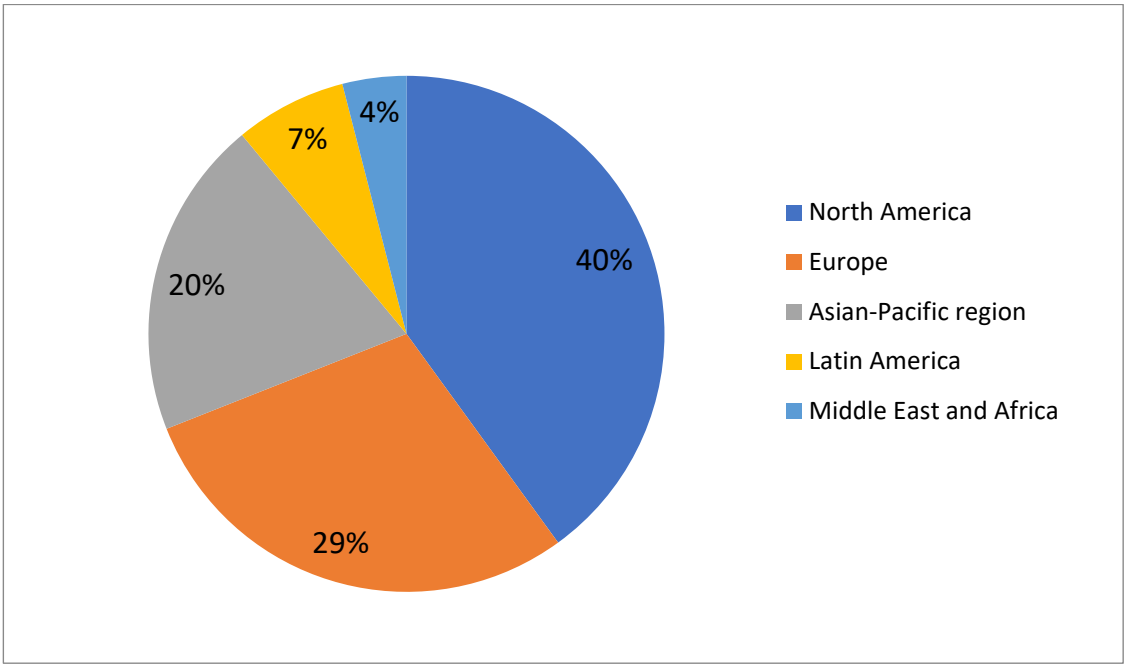

Fig. 3. **Shares of the global space tourism market by macro-regions in 2022**

Source: URL: https://www.precedenceresearch.com/space-tourism-market

Table 4

SWOT-analysis of the development of space tourism industry

S (strengths) – Technological advances in the development of reusable spacecraft and rockets; -development of artificial intelligence technology to assist in planning space travel, analysing satellite data and ensuring basic safety standards [11]; - high demand from individuals; - an influx of private capital aimed at finding more efficient ways to provide services; - government support for the development of the industry in a number of countries around the world; - successful experience of private companies in the field of orbital and suborbital tourism, which serves as a model for attracting new players to the industry.	W (weaknesses) – High cost and price of space travel; - significant safety risks; - lack of a well-developed legal framework protecting the rights of space tourists and companies operating in this field [9, p. 98]; - insufficiently developed infrastructure
O (opportunities) – Strengthening the links of space tourism with other industries to reduce the risks of flight and create a more comfortable travelling environment; – Utilising space tourism for educational purposes; - gradually reducing costs through new technologies and increasing demand for space travel; - expanding the types of space tourism through lunar tourism technologies and deep space travel; - development of artificial gravity technology on board spacecraft for orbital, lunar and interplanetary travel [12], which will significantly reduce the negative effects of space on the health of tourists	T (threats) – Depletion of rare metal reserves (lithium, gallium, indium, germanium, neodymium, platinum, etc.) required for the production of components used in spacecraft construction and other high-tech industries; - the likelihood of global instability, which affects the amount of investment in the industry by governments and private companies, forcing them to reallocate funds to other sectors of the economy, such as defence

Source: compiled by the author.

ANALYSING THE DEVELOPMENT OF THE GLOBAL SPACE TOURISM INDUSTRY

The space tourism industry is emerging due to many factors. As already mentioned, it strongly depends on the level of technology, which determines both the range of flights and their safety. The development of propulsion and new fuel elements determine the possibilities of energy production and refuelling of ships in space. Creation of an autonomous life support system will make it possible to extract water in space and build space hotels for tourists with the possibility of a long stay.

Since the industry is still in its infancy, it makes it difficult to make accurate forecasts of its development. Therefore, in order to assess its current state and potential opportunities, the author conducted a SWOT-analysis, which allows to take into account both internal (strengths and weaknesses) and external (opportunities and threats) formation factors associated with the development of other sectors of the economy and uncontrolled impact of the external environment (*Table 4*).

Thus, space tourism in the near future has a significant development potential. The threat identified by the author due to the depletion of rare metal reserves can be levelled, firstly, by recycling end-of-life parts and production waste in order to extract rare metals from them; secondly, by finding new ways of enrichment and extraction of such metals, including from hard-to-reach and deep deposits; thirdly, through the development of technologies that allow to obtain compounds with the same properties as rare metals.

The economic and political threats caused by global instability in international relations are the most difficult to mitigate, as they include a great number of different risks affecting the development of space tourism. According to the author, the dangers can be avoided by respecting interna-

tional law regarding the free flow of information and participation in international organisations with both economic and political objectives. Since space is a common resource and all countries have equal rights to it, this message should be the starting point for building trusting and mutually beneficial relations in the space sector.

DEVELOPMENT OF SPACE TOURISM IN RUSSIA

In 2001, it was thanks to Russia that the space tourism industry began to take shape. Between 2001 and 2009, the American company Space Adventures Ltd. and the Russian Aviation and Space Agency (the predecessor of Roscosmos) sent seven space tourists to the ISS, using several types of Soyuz spacecraft, and organising preflight training in Star City, where professional cosmonauts are trained.

However, the development of the new Crew Dragon spacecraft by SpaceX has squeezed Russia's position in the orbital space tourism market, and in 2022 an American spacecraft rather than the Russian Soyuz was used to deliver tourists to the ISS. Since flights to the ISS are very expensive and are currently available only to dollar millionaires, which are more numerous in the USA than in our country, it can be stated that Russia has lost the orbital space tourism market due to the refusal of Space Adventures Ltd. to use Soyuz spacecrafts.

As for suborbital space tourism, unfortunately, there are currently no companies in Russia engaged in the development of spacecraft to send tourists on such journeys. Although our government recognises the need to attract private business to the space industry, it is not ready to give it freedom in this area and reserves the right to control all areas of its activities. For example, CosmoCourses, a private space company established in 2014, planned to organise suborbital flights, but faced the fact that all developments had to be ordered from Roscosmos.[6] As a result, it was never able to start the practical implementation of its own project due to legal and bureaucratic difficulties and announced its liquidation in 2021.

What is now called space tourism in Russia, in the author's opinion, should properly be called "air tourism". It is represented by several companies, such as "Vezhitel", "Country of Space Tourism", "Agency of Space Tourism", "RocketTrip", which offer one and a half hour flights on IL-76 (small landing ship)aircraft on a parabolic trajectory at an altitude of 6–9 km above the Earth's surface (i.e., tourists do not leave the lower atmosphere — the troposphere). At the same time, they can feel the state of weightlessness for 25–30 seconds while passing the top of the parabola. The price of such a flight is now 420 thousand roubles per person in a group of 14 people.[7]

Another type of aviation tourism is a trip on a supersonic MiG-29 fighter jet with an ascent to a height of 18 km above the Earth's surface (the boundary between the troposphere and stratosphere) and an opportunity to see the curvature of the horizon. Cost — 80–100 thousand roubles per person for 20–30 min.[8]

In the author's opinion, a change in the situation of space tourism development in Russia would be helped by the entry into this sphere of big business capable of financing costly space projects at the initial stages of development until they get profitable. The US experience shows that it is large private companies headed by dollar billionaires that can make the investments necessary to create new spacecraft for tourists. Currently, Russian private business is concentrated in industries related to energy resource extraction. At the same time, space is not considered as a source of unlimited economic benefits, while the Earth's subsoil is exhaustible. In this case, our country could benefit from studying the US experience in the field of legislative regulation of space activities and support for private space companies.

[6] URL: https://ngs.ru/text/science/2018/11/07/65590081/ (accessed on 25.03.2024).

[7] URL: https://starcity-tours.ru/zerogravity/ (accessed on14.02.2024).

[8] URL: https://poletnaistrebitele.ru/poletvstratosferu (accessed on 14.02.2024).

CONCLUSIONS

1. Space tourism should be considered as a separate branch of the economy rather than a type of traditional tourism industry.

2. This industry has a number of peculiarities due to the development of new technologies, barriers to entry into the industry, the time of project development, the cost of services provided and the level of risk.

3. Increasing competition among private companies worldwide creates preconditions for reducing the cost of space travel for tourists.

4. The conducted SWOT-analysis has shown that space tourism as a branch of the world economy has a significant potential for development.

In conclusion it should be noted that space tourism is capable of completely transforming all spheres of human life. It is obvious that to support the industry it will be necessary to create new space infrastructure objects; to conduct research in biology, physics, astrophysics, chemistry, and other sciences; to develop up-to-date technologies. All this will require the emergence of new professions and modernisation of requirements for the existing ones. Thus, space tourism can have a significant multiplier effect on the entire global economic system.

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.

The article was received on 28.03.2024; revised on 15.04.2024 and accepted for publication on 30.04.2024. The author read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-17-28
UDC 332.1(045)
JEL O31, O39

Innovative Ecosystem of the Territory: Design, Assessment and Management Models

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ABSTRACT

The necessity of creation and implementing innovations, as well as the growth of ecosystems, are significant trends in modern economic development. Their combination and unification in the format of an innovation ecosystem opens up new opportunities and poses new research challenges. Therefore, the purpose of this article is to identify promising models for coordinating network interactions in the process of creating common innovative value, as well as developing tools for justifying the choice of the most appropriate formats for coordinating ecosystem interactions (an orchestration, in other words). The theoretical and methodological basis of the study includes: the concept of ecosystems, innovative value creation networks, role design and models of ecosystem interactions coordination, the concept, and models of assessing digital maturity. Based on the results of the analysis, promising models of ecosystem management were identified: hybrid orchestration, multi-orchestration and multi-tier orchestration. The characteristics of ecosystem roles are given, their influence on the success of creating overall innovative value is noted. An approach is proposed to determine possible ecosystem roles based on the ratio of maturity levels of participants and the ecosystem as a whole. A structured analysis of various approaches to assessing ecosystem maturity was carried out. The tools developed by the authors to justify the choice of ecosystem orchestration formats have scientific novelty: a framework for the formation of management and cooperation models in an innovation ecosystem and the structure of a flexible multi-component model for assessing the maturity of a territory's innovation ecosystem. The practical significance of the proposed tools is that they will allow making more informed decisions in the field of ecosystem orchestration by combining and systematizing key aspects of creating shared innovative value and modern management models.

Keywords: innovative ecosystem of the territory; overall innovative value; network coordination models; ecosystem roles; ecosystem maturity; ensemble of models

For citation: **Gileva T.A., Khussamov R.R. Innovative ecosystem of the territory: design, assessment and management models. *The World of the New Economy*. 2024;18(2):17-28. DOI: 10.26794/2220-6469-2024-18-2-17-28**

INTRODUCTION

Different types of ecosystems, aspects of their development and management models are now the focus of numerous researchers [1–4]. However, the proliferation of ecosystems raises more and more questions: for example, there is still no universally accepted classification of ecosystems [5]. In addition, the development of cooperation models corresponding to the principles of non-hierarchical coordination (orchestration), overcoming all sorts of barriers to effective interactions between relatively independent participants (actors) of an ecosystem, etc. are urgent tasks. [3–7].

• One of the relatively independent areas is innovation ecosystems research [4]. The distinctive feature of this type is that their focus is on the complex process of interaction between heterogeneous actors who cooperate to create and commercialise innovations of high integrated value for consumers [4, 6]. The importance and complexity of the organisation of interactions is determined by the following factors:

• the diversity of participants of the innovation process along the entire chain (network) of innovation value creation [8] and, accordingly, the large number and diversity (heterogeneity) of actors in the innovation ecosystem [6];

• determining role of interactions for the successful activity of all participants in the innovation process — if coordination within the ecosystem is insufficient, innovation will fail [4];

• relative independence of ecosystem actors, which requires the development of fundamentally new models of non-hierarchical cooperation [2–4; 7, 9];

• the "open innovation paradox", according to which the models of interaction in the innovation ecosystem should be open enough to stimulate the activity of partners, their complementarity and cooperation, but at the same time — closed enough to guarantee each organisation a fair, from its point of view, assignment of value [6].

The process of managing the creation and distribution of value in any ecosystem is called orchestration [5, 10, 11]. In one of the papers [11], four key tasks of an ecosystem orchestrator are formed: defining the value proposition, its realisation (including selection of participants and distribution of ecosystem roles), coordination of suppliers and partners in the process of value creation, and ecosystem development (bringing new ideas). Thus, ecosystem orchestration refers to a set of intentional and purposeful actions taken by an ecosystem organiser to encourage voluntary collaborative contributions that create value and coordinate effects among hierarchically independent actors [5]. Due to the specific nature of the innovation ecosystem, the task of ensuring the coordinated interaction of various participants of the innovation process is particularly relevant for it.

This paper identifies promising models for coordinating network interactions in the process of creating shared innovation value, and develops tools to justify the choice of the most appropriate orchestration formats.

INNOVATION ECOSYSTEM DESIGN

There are two approaches to analysing and forming an ecosystem: it is considered as an affiliation and as a structure [3]. The concept of an ecosystem as an affiliation has allowed us to go beyond industry boundaries, to ensure the growth of flexibility and adaptability of companies necessary for survival in an unstable environment due to the possibilities of faster and wider access to necessary resources and competences, as well as the expansion of network interactions [8, 9]. Many of the above opportunities have been provided before, for example, in the format of innovation clusters. However, there are features in the nature of interactions that give reason to consider these organisational forms as different [3, 12]. One of them — the possibility of obtaining network

effects — is largely implemented by organising the interaction of ecosystem participants through digital platforms [10, 13, 14]. Therefore, the concept of "ecosystem as belonging" considers it as a community of connected actors defined by their networks and belonging to platforms.

The concept of ecosystem as a structure proposed by R. Adner [3] is based on the fact that its formation is not simply based on the expansion of interaction opportunities, but on the creation of a common value, which is the meaning and foundation of all subsequent communications. According to this concept, an ecosystem is understood as a structure for agreeing on a multilateral set of partners that need to interact in order to materialise a core value proposition. From this position, the obligatory elements of an ecosystem are: activities (a set of actions necessary to realise the value proposition); actors (ecosystem participants carrying out various activities); roles associated with the process of transferring functions between participants, and links (material, financial, administrative, informational) that arise in the process of interaction in order to create shared value [3]. The necessity of singling out roles as a separate element is determined by the fact that one and the same participant can fulfil several of them; moreover, the role structure of an ecosystem is capable of changing even if the composition of actors remains unchanged.

There are also different approaches to the definition of innovation ecosystem [2, 15, 16]. In some works, the view of the innovation ecosystem is largely formed at the intersection of the concepts of regional innovation system and digital platform [15, 17].

Closely related to the concept of innovation ecosystem is another one — "entrepreneurial ecosystem", which is most often focused on the development of innovation potential within a certain local space [18]. In one of the works, it is called "a complex adaptive system that includes a set of proactive actors, cooperative links between them and environmental factors (including institutional, infrastructural, cultural and social) that provide more efficient use of labour, financial and intellectual resources within the region in order to effectively use the resources of the ecosystem in the process of producing goods and services and meeting public needs" [19, p. 1507].

The authors of another paper conduct a similar analysis of mainly foreign studies and draw conclusions:

- Despite the localised nature of entrepreneurship, national innovation systems research suggests that entrepreneurial ecosystems often operate at a national scale;
- Discussions of entrepreneurial ecosystems are largely focused on their key components, while much less attention is paid to the processes of interaction and the changing nature of relationships (i.e., the ecosystem is predominantly approached as an affiliation);
- The integrity and effectiveness of an entrepreneurial ecosystem is more likely to be the result of the strength and type of linkages rather than the number of participants [18].

Research in the field of entrepreneurial ecosystems provides interesting and important results from the point of view of activation of innovation processes of the territory. However, in essence, they are an organic component of the innovation ecosystem. This integral approach is reflected in the framework proposed by analysts at the MIT Sloan School of Management.[1] Traditionally, the design of the innovation ecosystem (as well as the regional innovation system) is defined by the models of triple or quadruple spirals [17]. However, within this approach five groups of stakeholders are represented: research institutions, entrepreneurs, corporations, investors, and government, which are connected by a strong social fabric of mutual interests, complementary needs and resources, as well as trust.

[1] URL: https://sloanreview.mit.edu/article/strategically-engaging-with-innovation-ecosystems/

In general, based on various studies, we can conclude that the innovation ecosystem is a multi-level network structure that ensures equal interaction between participants (actors) with different levels of integration: from individual enterprises and organisations, joint ventures, and alliances, to clusters, digital platforms, and ecosystems (entrepreneurial, partnership, industry, etc.). It is also of the digital type: its core is a digital platform, and since it can include several platforms, it is considered multi-core [17]. Most definitions of the innovation ecosystem emphasise diversity and hierarchical independence, but refer to the interconnectedness and complementarity of actors within the value proposition being created. Thus, there is a definition according to which an innovation ecosystem is an evolving set of actors, activities and artefacts (products and services, tangible and intangible resources, etc.), as well as institutions and relationships, including complementary and substitute relationships that are important for the innovative activity of an actor or group of actors [16]. The innovation ecosystem is also defined as a community of hierarchically independent but interconnected heterogeneous actors that collectively generate consistent results associated with a common value proposition oriented to a certain audience of users [5].

The relative independence of participants in the innovation ecosystem of the territory — on the one hand, and the key role of coordinated interactions in the creation of common value — on the other hand, as well as the dual nature of relationships based on both cooperation and competition at the same time [9], require the search for new models of non-hierarchical coordination [4, 7].

MODELS OF ECOSYSTEM ORCHESTRATION

To date, several promising research directions in this area can be identified. Firstly, it is the concept of hybrid orchestration in multi-stakeholder innovation networks [7]. As in any organisation, different management styles can be used in ecosystems: both dominant and consensus-based. The effective application of each depends on certain conditions. Dominant orchestration is most often carried out by an initial orcestrator company [6], which then acts as the central (leading, focal) organisation or hub of the ecosystem (these names are used in different works to denote the same role). At the first stages of the life cycle, it is such a company that is able to shape the overall value proposition and initiate the selection of the participants required for this purpose. However, the process of creating innovative value itself, due to non-hierarchical relations between the hub and ecosystem participants, may require more flexible management based on trust and co-operation (co-evolution). Hybrid orchestration implies the application of both management styles, with the choice of one or the other influenced by the number of actors, their diversity, the level of competences of the orchestrator and the nature of the tasks to be solved.

Secondly, it is multi-orchestration. There are three main management models: single, dual, and multiple orchestration ecosystems [11]. One of the prerequisites of this approach is the presence of phases in the innovation process that differ significantly in content and, therefore, require completely different competences. This applies to the processes of innovation creation and commercialisation — in some cases, researchers consider the innovation ecosystem as a set of two subsystems: innovation creation and business development [10]. Thus, not all companies have a high level of development in the full set of competences to coordinate the activities of the ecosystem at all stages of innovation value creation. Similarly, to distributed leadership, in high-performance teams the role of an orchestrator can be fulfilled by various participants of the ecosystem. This is

Table 1

Framework for the formation of management and cooperation models in the territory's innovation ecosystem

Ecosystem roles	Orchestrator	Strategic Partner	Complementor	Supplier	Satellite
Tasks of an orchestrator	Strategic		Tactical		
	Defining the value proposition	Bringing new ideas to the table	Implementing the value proposition	Coordination of suppliers and partners	
Type of orchestrator	One orchestrator	Two orchestrators	Multi-Orchestrator (multiple companies)		
Management models	Dominant orchestration	Orchestration by consensus	Hybrid orchestration	Application of digital platforms	
Aspects of management	Technological	Economic	Behavioural	Institutional	

Source: compiled by the authors.

determined by the presence and development of their respective competences, which are a component of the overall maturity level for each of the participants in the innovation process. That is, if one company (the initial orchestrator) does not have the necessary competences to both create and realise the value proposition, two or more firms can act as the ecosystem coordinator, taking on different tasks to orchestrate the ecosystem [11].

Thirdly, the concept of multi-tiered orchestration. It has been proved that in the presence of a large number of diverse (heterogeneous) participants, ecosystem orchestrators form well-managed groups (tiers) of complementors to which a common management approach is applicable [6]. Such an approach also combines formal and informal (or prescriptive and consensus-based [7]) management styles and tools, the choice of which depends on the domains of uncertainty relevant to each task. Where uncertainty is high, the research role of complementors is supported precisely through models based on trust and co-operation: e.g., joint ventures, co-investments, etc. A well-known and well-established co-operation model is outsourcing [20]. The role design of the ecosystem is also important: how close to the core or periphery is this or that participant (group of participants)?

The most common approach to defining ecosystem roles is to identify (in addition to orchestrator) strategic partner, supplier, complementor and satellite.[2] The choice of role in this case is determined by two criteria: the value of the resources and data received and the partner's ability to provide operational support and help scale the business.

Taking into account the peculiarities of the innovation ecosystem, requirements and promising trends in the field of ecosystem orchestration, we have built a framework for forming models of management and cooperation in the innovation ecosystem (*Table 1*).

This format systematises the key factors and opportunities in managing the interaction of heterogeneous actors in the innovation process to create shared value. It allows you to see and select the methods and models that will fit the most appropriate formats of interaction.

[2] URL: https://hbr.org/2022/03/how-to-choose-the-right-ecosystem-partners-for-your-business

Table 2

Ecosystem roles configurator

Ecosystem roles		Participant's level of digital maturity		
		low	medium	high
The level of ecosystem maturity	High	Recipient	Implementer or donor	Collaboration designer
	Medium	Recipient	Co-evolution zone	Task provider, strategist, or orchestrator
	Low	"Dead zone"	Achiever	Pilot or orchestrator

Source: compiled by the authors.

In the context of the innovation ecosystem of the territory, depending on the content of the tasks to be solved, within the groups of strategic partners, complementors, etc., different roles can also be distinguished: leadership roles (ecosystem leader and dominator); roles directly creating value (supplier, assembler and complementor); value creation support (expert and champion) and entrepreneurial ecosystem (entrepreneur, sponsor, and regulator) [21]. A more extended classification[3] includes 23 roles, also organised into several groups. It has been shown that the choice of ecosystem roles is influenced by the correlation between the maturity levels of the participating companies and the ecosystem as a whole [17]. The configurator of innovation ecosystem actor roles is presented in *Table 2*.

While a large number of models have been developed to assess the maturity of individual companies [22, 23], these issues are much less developed in relation to ecosystems.

INNOVATION ECOSYSTEM MATURITY: CONCEPT AND ASSESSMENT

Despite the existence of many digital maturity models, they assess not only and not so much technological aspects, but also the readiness of organisations and other structures (industries, ecosystems) to operate successfully in the digital environment [24]. Since the ecosystem as a management model was able to reach this level of development only with the help of digital technologies (including digital platforms), "we will consider the concepts of maturity" and "digital maturity" to be identical in relation to ecosystems.

The success factors of digital maturity are: increased customer focus; the emergence of the ability to create digital products or add-ons; improved operational efficiency, significantly reduced time to market, etc. The advantages of digital maturity models as management tools are that they provide a better understanding of the phenomenon of digital transformation; they play the role of a catalyst on the way to digital transformation; they substantiate digital transformation strategies; they prioritise areas of development (products, processes); they provide an opportunity to measure positions relative to competitors and development dynamics; they are focused on a continuous process of adaptation and improvement. At the same time, they cover on average 5–6 aspects (the most common: strategy and business model, organisational culture and personnel, operational processes, digital technologies) and 4–5 maturity levels [23, 24]. Ecosystem maturity models are constructed in

[3] URL: https://www.cerri.iao.fraunhofer.de/content/dam/iao/cerri/

Table 3

Approaches to assessing ecosystem maturity

Name and developer	Aspects	Characteristics
1. Innovation Ecosystem Maturity Model	Assessment areas	Monetisation, participants, management, knowledge, network
	Number of levels	5: Beginner, Builder, Experimenter, Connector, Expert
	Other features	Visual one-page presentation format
2. Ecosystem Maturity Model, Workspan	Assessment areas	Target setting, business model, number of partners, interaction formats, digital platform, scalability
	Number of levels	5: Pre-idea, Starting, Progressive, Mature, World-Class
	Other features	The list of assessment areas is not explicitly labelled, but a detailed characterisation of the state of the ecosystem at each level is provided
3. Digital business ecosystem maturity model [25]	Assessment areas	Transparency, governance, scalability, cybersecurity, knowledge base, standardisation (as a unification process based on consensus of actors)
	Number of levels	5: Initial, Managed, Defined, Quantitatively Managed, Optimized
	Other features	The model is based on a systematised literature review, expert interviews, and online surveys. It provides a detailed characterisation at all levels for each of the identified areas of assessment
4. Digital business ecosystem maturity model	Assessment areas	Products and services, process and organisation (knowledge management, collaboration, agility and flexibility), technology (infrastructure, use of ICT systems), customer focus (customer satisfaction, customer interaction), strategy and leadership (business model, digital culture).
	Number of levels	5: Infancy, Developing, Transforming, Optimized, Digital Maturity
	Other features	The model is based on expert interviews. It contains a characterisation of all levels for each of the identified areas of assessment
5. Pie Model	Assessment areas	1. Ecosystem value proposition. 2. Consumer segments. 3. Actors. 3.1. Resources. 3.2. Types of activities. 3.3. Contribution to value creation. 3.4. Receiving value. 3.5. Relationships, trust. 3.6. Risks
	Number of levels	No maturity levels have been established. Purpose of the model: a strategic tool for mapping, analysing, and designing innovation ecosystems
	Other features	The assessment is carried out at two interrelated levels: the ecosystem as a whole (Assessment Areas 1 and 2) and individual actors (Area 3 with further detailing)
6. Ecosystem Maturity Map	Assessment areas	The state of stakeholders at each stage of the ecosystem life cycle. The main groups of participants of the innovation process are identified as stakeholders: scientific and financial organisations, entrepreneurs and business support structures, corporations, and the government.
	Number of levels	5: Pre-idea & Culture, Ideation, Start-Up, Valley of Death, SME
	Other features	Visual one-page presentation format

Source: compiled by the authors.

Table 4

Structure of a model for assessing the maturity of a territory's innovation ecosystem

Evaluation block	Sub-models (areas of assessment)	Content (elements)
The core of ecosystem	1.1 Value Proposition	Target segments, products and services, customer centricity
	1.2. Governance	Ecosystem strategy and culture, ecosystem orchestration methods and models (hybrid multi- and tiered orchestration, etc.), scaling up
	1.3 Network structure	Composition and interaction of participants (actors) with different levels of integration: from individual enterprises and organisations, joint ventures, and alliances, to clusters, digital platforms and ecosystems (entrepreneurial, partnership, industry, etc.).
Actors (participants)	2.1 Creating innovations	Universities, research organisations and divisions of large corporations, scientific collaborations and consortia, etc.
	2.2 Implementing innovations	Industry and business
	2.3 Entrepreneurship	Categories of entrepreneurs: potential, owners of newly established (up to 3 years) and established (over 3 years) businesses. By format: individual entrepreneurs, SMEs, start-ups.
	2.4 Infrastructure	Platforms, technoparks, venture capital funds, business incubators and business accelerators, shared-use centres, testing facilities, etc.
	2.5 Government	Structures and programmes of state support for innovation activities
Interaction	3.1 Motivation and trust	Relationships and interaction formats in the process of creating and capturing value
	3.2 Continuity of the innovation process	Innovation value creation network, role design and role dynamics
	3.3 Formats and technologies	Digital platforms, cyber security
Risks	4.1 Systematic risks	Risks of changes in legislation, natural risks, etc.
	4.2 Non-systematic risks	Risks of unclaimed value proposition, technological risks, as well as risks of configuration (wrong combination of actors), interdependence, lack (loss) of trust, asymmetry (imbalance of power), coordination (loss of control), etc.

Source: compiled by the authors.

a similar way. *Table 3* summarises the research in this area.

Although at first glance the presented models appear to be different, they share the same basic characteristics. All of them have 5 maturity levels, which in 5 of the 6 models are assessed depending on the progress made in the selected areas of assessment (only the Ecosystem Maturity Map model considers the stages of the ecosystem life cycle as levels). The most common assessment areas are: value proposition (target, products and services, monetisation), actors, processes and formats (network, platform, infrastructure), their interaction and management (ecosystem orchestration). From the perspective of the innovation ecosystem, the area related to knowledge creation and dissemination is particularly emphasised.

When developing a model for assessing the maturity of the territory's innovation ecosystem, in addition to the analysis performed, we will use a constructive idea, the essence of which is the formation of a structured dynamic complex (ecosystem, ensemble) of models that assess various aspects of the ecosystem [26]. This approach allows us to:

- avoid the complexities of building and using a single, "comprehensive" model;
- provide an opportunity to customise the assessment tool for the specific situation by selecting the necessary modules from the general "menu" presented;
- provide the necessary depth of detail within each submodel without overcomplicating the model as a whole;
- to make the tool more dynamic and capable of development by modifying and/or supplementing individual submodels and even blocks.

The structure of the proposed model for assessing the digital maturity of the territory's innovation ecosystem is presented in *Table 4*.

The formed structure is the basis for building a multi-component model (ensemble of models) for assessing the maturity of the territory's innovation ecosystem. In order for the selected submodels to serve as a full-fledged tool for maturity assessment and subsequent justification of decisions on the design of role design for the implementation of a particular value proposition, and then contribute to the selection of the most appropriate models for the organisation of actor interaction, their specification for each block is required. The solution of this problem is considered by the authors as a promising direction for further research.

CONCLUSIONS

The article identifies promising directions of ecosystem orchestration development: hybrid, multi-, and tiered orchestration, which should be considered as complementary approaches. A framework for forming models of governance and co-operation in an innovation ecosystem is constructed, which visually integrates key aspects and methods of ecosystem management and establishes the need to take into account ecosystem roles when choosing the most appropriate model of actor interaction.

As in any ecosystem, these roles include orchestrator (usually the initiator of the innovation value creation and coordinator of the actors needed to implement it), strategic partner, supplier, complementor and companion (satellite). However, the roles in the innovation ecosystem are very diverse due to the existence of multiple processes required to develop and implement innovations. At the same time, one and the same participant can simultaneously fulfil several roles, and the role structure itself changes over time, which is related to both the parameters of the value proposition and the relationship between the maturity levels of an individual participant (actor) and the ecosystem as a whole.

While there are many models for assessing the digital maturity of companies, there are far fewer for ecosystems. Most of them do not take into account the specifics of innovation ecosys-

tems themselves. The authors have identified such consolidated areas of assessment as: value proposition (target, products and services, monetisation), actors, processes, and formats (network, platform, infrastructure), their interaction and management (ecosystem orchestration). The structure of the model for assessing the digital maturity of the territory's innovation ecosystem developed by the authors (*Table 4*) can be the basis for building a multi-component model (ensemble of models) for assessing the maturity of the territory's innovation ecosystem.

ACKNOWLEDGEMENTS

The study was financially supported by Russian Science Foundation under the scientific project No. 23-28-00395

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was received on 31.03.2024; revised on 17.04.2024 and accepted for publication on 11.05.2024.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-29-39
UDC 332.02(045)
JEL F02

Egypt is Thinking About the Future

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ABSTRACT

For decades, Egypt has been developing under the pressure of unfavorable factors that consistently complicate the work of its reproductive mechanisms, the functioning of the market and other institutions, and result in a series of economic turmoil, social tensions, and political upheavals. In certain periods, the country managed, under favorable circumstances, to mobilize its capabilities to temporarily offset and compensate for the negative influence of internal and external factors and even demonstrate signs of some macroeconomic stability. But the general trend, characteristic of and inherent in an economy developing in harsh conditions, did not give a chance to stay on a more or less constant course for a long time. At the beginning of the second decade of the new century, violent popular uprisings and demonstrations actually led the country to a serious crisis. Its echoes are still felt today, and they carry an element of extremely undesirable destabilization for the largest state in the region. Egypt has historically retained the status of a regional power, no longer the only one, but involved in almost all economic and political initiatives and processes developing in the Arab region, playing an important role in them, which, naturally, should be supported by the corresponding economic potential.

Keywords: Egypt; deficit; problems; budget; resources; market; economic potential; liberalization; diversification; modernization; reforms; development strategy; hydrocarbons

For citation: **Isaev V.A., Filonik A.O. Egypt is thinking about the future. *The World of the New Economy.* 2024;18(2):29-39. DOI: 10.26794/2220-6469-2024-18-2-29-39**

ARABIAN BACKGROUND

Since the end of the twentieth century, the Arab region as a whole has been able to achieve certain, sometimes significant, shifts in the transformation of its socio-economic structures. The modernisation of the material and technical base of production, in which considerable financial resources have been invested, together with the improvement of the infrastructural complex, major changes in social processes, the use of certain external factors in the interests of national development, etc., have created in a number of Arab countries very favourable preconditions for the reproduction of the social product.

Nevertheless, the significant developments in this area, which have led to a certain improvement in the overall macroeconomic performance of the Arab region as a whole, have not been able to fundamentally change the position of the Arab countries in the world economy and in the system of the international division of labour. The Arab countries, lacking a consolidated economic mechanism, both at the level of individual jurisdictions and, even more so, at the level of the entire region, continued to move in the rearguard of the economic processes taking place in the centres of the world economy and unwittingly reproduced Western models and solutions to a greater or lesser extent. But in doing so, they also produced most of the economic difficulties inherent in the states they imitated. As a result, the range of independent decision-making by the Arab countries was rather strictly regulated by the factors that were objectively outside their sphere of influence.

Thus, the economic growth of the Arab region is heavily influenced by the overall development strategy of Western countries, and this is an axiom. Western industrialism, as part of its vision of how to increase economic potential, relies on the mobilisation of national natural resources, which has been carried out since the 1970s. This vector was driven by the impact of a serious rise in fuel and raw material prices, which led to a transition to a policy of reducing the energy and material intensity of machines and mechanisms, the widespread introduction of synthetic construction materials, and a greater focus on alternative energy sources, the use of innovative digital technologies, and so on. The New path has also been accompanied by the strengthening of traditional and non-traditional trade barriers for a number of developing countries' exports, including those of Arab countries.

Moreover, the main outcome of the economic development of the Arab region in the early twenty-first century can be considered to be its increased differentiation and its departure from the static equilibrium in which it had remained for virtually the entire second half of the twentieth century. The explanation for this lies in the fact that, on the one hand, the socio-economic transformations characteristic of this period have virtually ceased to stimulate economic growth in the overwhelming majority of Arab States as they used to, and, on the other hand, the rise in energy prices, which had been the basis for many of the region's economic growth programmes and positive changes in the Arab world, began to lose this function due to the serious volatility of world prices for hydrocarbons and the transition to the "green energy" adopted by the majority of states classified as industrialized by international statistics. As a result of these and other processes, Arab energy was no longer able to fulfil its former role as the main factor that could guarantee consistently high incomes for some Arab countries and serve as a reliable source of financial assistance for others.

In this context, a number of Arab countries have turned to the development of long-term socio-economic development programmes that could gradually lead them to the formation of economic systems that, in their main parameters, would allow them to function normally even after the end of the "oil era". The pioneers in this field were the Emirate of Abu Dhabi, which adopted the Abu Dhabi Economic Vision 2030 socio-economic development programme as early as 2007, and Qatar and Bahrain, which approved their programmes in 2008, also until that date. They were

followed a few years later by Saudi Arabia (2016, Vision 2030), Egypt (2016, Vision 2030), Kuwait (2017, New Kuwait 2035), and then the United Arab Emirates (UAE) (2021, Development Roadmap up to 2071), Jordan (2022, Modernisation Plan 2033) and the Emirate of Dubai (2023, D 33).

Almost all of these programmes (with a few exceptions) were limited to the most general numerical indicators, as well as very vague provisions to only outline certain goals that each country hoped to achieve by a given date.

EGYPTIAN SPECIFICITY

Egypt has followed virtually the same principles in drawing up its programme — it plays a far from negligible role in the region, which, according to the local authorities, should be supported by appropriate economic capacity.

For several decades now, the country has been developing under the influence of a number of unfavourable factors. For example, in the fight against the COVID-19 pandemic, in which the country lost more than 25,000 people, more than $ 8 billion was spent to purchase 113 million doses of vaccine alone. This had a tangible impact on Egypt's budget, where such expenditure had not been foreseen.[1] In addition, local society has not yet calmed down after the Arab Spring and the dramatic events that followed in 2013, involving a fierce struggle for the country to develop in line with modern trends rather than self-isolating under pressure from the "Muslim Brotherhood".[2] The restructuring process that began after President As-Sisi came to power was also an additional test, which was negatively perceived by traditionalists and social and political organisations close to them.

The situation is also aggravated by the fact that the legacy left **to** the current Egyptian President is far from being a solid foundation for rapid economic growth. Many sectors of the national economy now require fundamental changes to bring it to a decent level. Although a certain backwardness of the country's productive forces is gradually being overcome, it is not at a pace that can ensure a qualitative breakthrough to achieve economic performance. The limited living space and the huge population (almost 111 million people, concentrated in only 4 per cent of the territory, i.e., the Nile Delta and Nile Valley[3]), by the standards of the Arab region, do not allow the State to fully meet even the minimum needs of the society. This makes it necessary for the authorities to structure socio-economic policies with the utmost care and caution, taking into account the different preferences of the various groups of inhabitants.

NEW TIMES

It is against this challenging backdrop that the 2016 renewal programme manifested as Sustainable Development Strategy: Egypt. Vision 2030 and developed under the leadership of President Al-Sisi to usher in a new period in the country's socio-economic development, In the opinion of the country's leadership, it was necessary to dispel the doubts accumulated in the egyptian society about the possibility of overcoming long-standing and new problems of socio-economic development. Otherwise, another social explosion could have occurred.

Thus, by putting forward his development programme during this very difficult period, President Al-Sisi has generally been able to mobilise public support for his initiatives and reaffirm his own readiness to address the most pressing challenges facing the country and to improve the methods and ways of governing the State apparatus. The President's initiatives have resonated with the population in a number of areas, raising hopes for a better future in various sectors of society. Against this background and within the framework of this programme, the government began to revise a number of previous ineffective and bureaucratic legislative and institutional acts, announcing the

[1] URL: https://covid19.who.int/region/emro/country/eg

[2] The organisation is recognised as a terrorist organisation in Russia.

[3] URL: https://ru.knoema.com/atlas/Египет/topics/Бедность

strengthening of the fight against corruption and stricter control of fiscal and monetary policy. Separately, the decision to introduce additional social protection measures for the poorest segments of the population was announced to mitigate the impact of the reforms initiated.

Looking directly at the content of the programme, many of its objectives are essentially reduced to eight key points. Their implementation could significantly improve the country's position in the world rankings by improving the quality of life of the population through the eradication of poverty by 2030, which would be the culmination of the entire development strategy and would ensure that social justice and social inclusion are actually achieved through civil initiatives.

To achieve this, it is necessary to ensure a sustainable economic growth trajectory for the country's national economy, which involves reducing the country's budget deficit and public debt, transitioning to a digital economy, encouraging innovation and supporting small and medium-sized businesses.

In addition, the task was set to increase investment in human capital, build scientific capacity and improve the level of educational services, while strengthening measures to preserve the environment, relying on alternative energy sources and new energy-saving production models.

There is a demand for strict adherence to the rule of law, rules and procedures necessary to ensure transparent decision-making and fight corruption.

Improving information security, strengthening the fight against terrorism and crime, and modernising the armed forces are also the objects of the state's close attention.

Enhancing Egypt's standing in the international arena and building mutually beneficial partnerships with various states and regional organisations has become an important component of foreign policy activity.[4]

It should be noted that some specific benchmarks highlighted in the programme immediately raised certain doubts among both Egyptian and foreign experts. In particular, the country was set a difficult task to increase per capita income from $ 3,400 in 2016 to $ 10,000 in 2030, to reduce the budget deficit from 11.5 to 2.28 per cent over the same period, to reduce public debt from 92.7 per cent of GDP to 75 per cent, and demote inflation from 11.8 to 3–5 per cent.[5]

Such ambitious plans were largely due to the development of natural gas deposits with estimated reserves of 2.2 trillion cubic metres, thanks to which Egypt not only became self-sufficient in this type of fuel in 2018, but also started exporting it. The country's expectations in this area were further strengthened in 2022, when a large natural gas field was discovered offshore on the north-eastern coast of the Mediterranean Sea, which experts estimate could contain up to 99 billion cubic metres of gas.[6] When developing gas fields, Egypt naturally relies on international companies, which have been operating in the country for quite some time under production sharing agreements, as well as on Egyptian General Petroleum Corporation (EGPC) and Egas, which are its partners in joint ventures. During the period under review, two liquid natural gas export terminals were built in the country, at Idku and Damietta. In addition, four export projects related to the transport of liquefied natural gas were at various stages of implementation. The most developed option is the project of the Spanish company Union Fenosa, which signed a contract with EGPC to purchase 4 billion cubic metres of gas per year for its subsequent liquefaction. For this purpose, Union Fenosa planned to build an LNG plant with a capacity of 8 billion cubic metres per year on islands in the Nile Delta. The bulk of the liquefied natural gas was to be delivered to Spain and used for power generation, with the remainder to be sold domestically and internationally. EGPC also signed an

[4] URL: http://www.cairo.gov.eg/en/GovernorsCVs/sds_egypt_vision_2030.pdf

[5] Ibidem.

[6] URL: https://neftegaz.ru/

agreement with BP and ENI to build a liquefied natural gas plant in the port of Damietta. Another similar project was developed by the Egyptian company in co-operation with British Gas and Italy's Edison, according to which, the plant is planned to be built near Alexandria.

HARD REALITIES

However, despite its rather impressive gas reserves and very significant political weight in the Arab region, Egypt remains, by all international criteria, among those developing countries that do not possess sufficiently significant natural resources to turn individual projects within the current modernisation discourse into effective levers for breakthrough economic growth. Its economic opportunities are affected by the effects of the accelerated liberalization of the economy in the last third of the last century, during which all IMF prescriptions were almost fully implemented. Thus, the state consumption decreased noticeably, but there remained a very acute budget deficit and a serious negative balance of foreign trade. At the same time, the country's external debt increased significantly, and society developed a certain negativism towards the authorities and their reforms, which increased social stratification, which did not contribute to the reduction of poverty and misery. It is from those very times that the internal environment of social tensions became habitual, especially under the influence of such factors as economic imbalances, financial instability, labour surplus and shortage of food at government-subsidised prices for the poorest segments of the population.

In different situations, these disruptions are supplemented by incoming events, which in some cases prove to be negative, especially for the poorest segments of the population, and which are expressed, for example, in higher prices for some everyday goods. Most often such goods come from local producers who modernise their lines and master new technologies, which requires additional investments and, consequently, higher prices for their products. But even successfully implemented projects proved unable to bring the country out of pre-crisis situations, which, as already noted, often arise spontaneously. In such cases, the state tends to emphasise its success in the construction of infrastructure projects of various kinds, which is very effective as a kind of visual propaganda, in order to maintain its own image. For the same purpose, especially during periods of remission, it uses examples of macroeconomic stabilization that have actually taken place, or focuses the attention of the population on indicators of poverty reduction. For example, this indicator, which was 29.2 per cent in 2019, has fallen to 27.9 per cent in 2022, and the Arab Republic of Egypt government has raised the official threshold to $ 562 per capita per year (compared to $ 169 a decade earlier[7]), spending some $ 3.7 billion over the past five years [1].

It should be noted that the state's efforts have resulted in each poor person receiving $ 1.97 per day in relief (not adjusted for inflation), rather than $ 1.5 as in 2012. In other words, the state's actions in this crucial area for Egypt have generally been reduced to a minimum that does not yet meet the targets set by Vision 2030.

One can say that the current economic reality is a distorted version of the socio-economic development of the country, already suffering from limited reserves of various kinds and population growth rates. What is happening is only exacerbating chronic problems that will continue to have long-term consequences in the form of poverty, social and economic inequality, and high unemployment. At the same time, serious social consequences exacerbate the imbalance between labour supply and demand that has long existed in Egypt, leading to protests and unrest, such as during the Arab Spring [2]. Since the population growth trend may continue in the country for at least another 15–20 years, this should be taken into account in the medium- and long-term development plans of the Arab Republic of Egypt,

[7] URL: www.statista.com

since the 2011–2013 protests highlighted one of the most acute social problems presented by mass unemployment among local youth. This makes job creation a priority for the Egyptian government, which in the long term can hardly provide employment through the public sector alone. Hence, according to the government, the crucial task of creating the conditions for the private sector to develop as a provider of new jobs, but this requires measures to seriously reform local labour laws to create new incentives for private recruitment while maintaining adequate protection for workers.

TACTICAL LINE

Indeed, the range of socio-economic problems in Egypt is really wide. Therefore, the state is currently focusing on finding optimal solutions in the conditions of limited resources, deficit of domestic savings, reduced inflow of foreign capital investments in order to respond as quickly as possible to the slightest changes in the conjuncture, although the reaction to them may be restrained. In particular, the difficulties with non-tariff barriers, export restrictions and, in some cases, direct import bans have not been overcome, which creates additional obstacles to the growth of foreign trade, which has always been one of the main sources of foreign exchange earnings. In addition, tourism revenues and remittances from Egyptians working abroad have declined, although this may vary depending on circumstances.

Having attached great importance to the growth of the private sector in the economy in the last ten years under the influence of external factors (primarily the IMF), Egypt has been pursuing a fairly consistent policy of denationalisation since 2013. Thus, it is gradually losing state control over its productive assets and the ability to influence the situation in a number of sectors of the national economy, including those that are important for employment and can create imbalances in the local labour markets. Especially since these processes have been and are taking place against the backdrop of rapid population growth, increasing even with declining birth rates simply due to previously accumulated human resources and increasing life expectancy.

Despite the ongoing negative factors, it should be noted that a number of measures taken under the programme have generally helped Egypt to maintain (and in some cases improve) the positive attitude of the population towards the leadership's desire to increase economic growth, at least in some areas.

For example, in 2020, the country ranked 116th out of 189 on the Human Development Index, surpassing all Arab states for the first time in history.[8]

This is due to the fact that since the early 2000s Egypt started paying special attention to the development of information technologies, attracting such leading companies in this field as IBM, Microsoft, Intel, etc., and taking advantage of their interest in expanding their activities in the markets of the Middle East and North Africa. In particular, a special technology park based on Smart Village was created in the Cairo suburb of Giza, where foreign IT companies that opened offices were provided with tax and other incentives. In 2015, more than 130 companies from different countries were already working here, having trained more than 13,000 Egyptians in their specialisation [3].

In addition, the Egyptian Ministry of Information and Communications Technology and its related agency have launched an incentive programme for small and medium-sized enterprises to encourage them to actively use information and communications technology programmes and disseminate their competencies. The Agency invites Western firms to advise and financially support Egyptian entities and, for its part, provides them with tax incentives and finances staff training and development programmes.

Of course, this does not mean that Egypt has succeeded in completely overhauling its education system as the country still needs such reform,

[8] URL: https://hdr.undp.org/data-center/human-development-index#/indicies/HDI

which requires serious investment. In addition, this issue is in no small part a matter of changing cultural standards and many traditions, which is a long and complex process.

In terms of ease of doing business, Egypt ranked 114th out of 190 in 2019, behind only Arab countries such as Morocco, Saudi Arabia, Oman, and Jordan.[9] The country's GDP increased by 23.7 per cent between 2020 and 2023, with annual growth rates of between 3.6 and 5.9 per cent over the same period. In addition, public debt was stabilized, but still remained at a very high level of 89.6% of GDP in 2020 and 2023.[10]

A number of vital indicators have also remained largely unchanged: inflation (11%) and unemployment (6.9%) remain high, and the Egyptian pound has depreciated by 50% against the US dollar over 2022–2023, pushing almost 60% of the population below the poverty line [4], while the per capita income of the poorest part of the population is also extremely low.

Under these conditions, the Arab Republic of Egypt government received a $ 3bn loan from the IMF,[11] but on rather tough conditions for the country which means curbing inflation and privatising state companies owned by the Egyptian army, most of which are systemically important for the country's national economy. It should be said that the army, on which the government largely relies, owns not only a number of the most important construction, steel and agro-industrial companies, but also chains of large supermarkets and hotels in the most popular tourist areas of Egypt, and military contractors usually receive the most favourable orders [5]. In addition, active and retired officers sit on the boards of directors of major Egyptian public and private companies [6]. If we take into account that the status of the army in the Egyptian society is historically very high, and during the coup d'état of 2013 it was the army that removed the Muslim Brotherhood protégé M. Morsi from power and brought in the current President As-Sisi, it becomes clear that it will not give up its positions in the national economy of the country so easily.

IN FRONT OF CHALLENGES

These and other circumstances oblige the current Egyptian leadership to be extremely cautious in its efforts to avoid serious miscalculations in the country's modernization. The authorities have so far been able to demonstrate competence and determination to achieve a marked improvement by 2030. However, it is difficult to foresee what the results will be, given the many different socio-economic challenges, the resolution of which requires not only significant financial outlays but also considerable material resources. Meanwhile, the planned economic recovery needs constant nourishment, but in the current context Egypt is far from being able to mobilise sufficient resources to concentrate them simultaneously and with equal efficiency across the country's reform area with large deficit niches.

These dangers, particularly evident with the beginning of As-Sisi's second term and the reforms put forward by the IMF, have not disappeared, with recurrent budget deficits and shortages of resources for projects.

This is characteristic not only of Egypt, but also of other Arab countries whose economic policies are clearly dominated by the state and state enterprise, with predominantly administrative methods of regulating the economy in general and the public sector in particular, with all the consequences that entails. For example, the mobilisation of budgetary revenues is carried out mainly through compulsory taxation. The same applies to the inflationary method of budget financing, as well as, to a certain extent, to state credit.

As a result, a stalemate began to develop in the country's national economy, as the monopoly of the state and the army in the economy is almost impossible to abolish completely, although the current state of affairs requires urgent and radical

[9] URL: https://archive/doingbusiness.org/en/rankings

[10] URL: en.wikipedia.org

[11] URL: htpps://www.xinhuanet.com/English/2019–01/10/c_137734351.htm

reforms. Thus, in 2022, foreign debt service rose to $ 42 billion, total public debt reached $ 157 billion, and local banks imposed severe restrictions on withdrawals from foreign currency accounts and markedly increased credit card service fees [4].

These and other difficulties began to increase due to the physical and moral deterioration of the main production assets of a number of leading state enterprises, the outflow of qualified specialists abroad (primarily to the Arab monarchies of the Persian Gulf). Negative dynamics intensified after a sharp increase in competition for state-owned enterprises from Western and Chinese producers of goods, which flooded the domestic market due to a noticeable reduction in import duties, the growing debt of many state-owned companies.

The extremely difficult situation in the country, according to some analysts, is also connected with certain miscalculations of the Egyptian leadership, which initiated a number of costly but prestigious megaprojects: the construction of a new administrative capital in the desert with the involvement of Chinese capital; the expansion of the Suez Canal; large purchases of weapons; the construction and modernization of several thousand mosques. The government justified the expenditures on these projects by saying that the new capital would relieve Cairo's 20 million inhabitants and promote the development of sparsely populated areas of the country (citing the positive experience of Morocco, Brazil, Turkey and Kazakhstan), extensive work on the Suez Canal would double its capacity, the procurement of new modern weapons is necessary to improve Egypt's defence capabilities in a highly volatile foreign policy environment in the Middle East and North Africa, while the construction and renovation of mosques should support the "high religious morale of the population" [7].

ONGOING ADJUSTMENT

The Egyptian leadership continued to adjust the socio-economic course within the framework of the programme, in particular by taking measures to channel public capital into material production in order to alleviate or correct the structural imbalances of the previous decades. There were also attempts to restructure the state management of the economy, which involved a partial return to elements of planned development, adjustments to the investment code, the empowerment of the administrative boards of state-owned enterprises in the use of foreign exchange earnings and product pricing, and so on.

In addition, the entry of a number of foreign banks into the Egyptian market has increased competition in the financial and banking sector and created conditions for risk management operations to reach a new level. The Central Bank of Egypt has not only become more independent and manoeuvrable, but has also gained the right to establish credit agencies that collect information on borrowers and their performance in order to inform clients about loan recipients and optimise disbursement decisions.

Structural reforms and the liberalization of currency and investment regulations undertaken by the Government as part of Vision 2030 have stimulated foreign investors' interest in the Egyptian market and increased the inflow of foreign direct investment into the country.

The foreign economic sector has undergone a major transformation with the liberalization of the customs and tariff system. Thus, Egypt began to more actively use its competitive advantage of geographical proximity to Europe, Asia and Africa to expand export sales to their markets. A number of new, important for Egypt trade and economic agreements, including free trade agreements, were concluded with many European, Asian and African states.

As a result, since the beginning of the adoption of the Vision 2030 programme by the Egyptian leadership, the country has gradually begun to abandon the previously practiced directive methods of economic management in favour of liberalization, which, along with the introduction of a number of privatization initiatives, has contributed to a certain reduction in the role of the public sector in the country's economic practice.

However, the current socio-economic situation in Egypt remains very tense, as shifts in the national economy and changes in the dynamics of its main components are not pronounced enough to sustainably support modernisation processes, transformational trends, and social narratives. As the results show, the Egyptian economic model of development does not fully cope with the tense contemporary realities that often dash the country's national economy.

PERSISTENT DIFFICULTIES

Today, the leadership of the Arab Republic of Egypt faces the need to implement complex reforms in order to boost the country's economic growth in the medium to long term. At the same time, the Arab Republic of Egypt needs a short-term plan to stabilise its national economy, which has been severely affected by the Arab Spring unrest and the ensuing external economic crises, which have disoriented not only government agencies and institutions, but also the private sector and local and foreign investors.

Stabilizing the economic and financial situation is an extremely difficult task, which the country's leadership is unlikely to be able to solve on its own, without massive financial support from regional partners (primarily the Gulf oil monarchies) and without loans from international financial institutions.

In this regard, it should be emphasised that of all the countries affected by the Arab Spring, Egypt has the greatest potential for investor confidence and attracting financial assistance. However, the realization of these opportunities largely depends on the preservation of internal political stability in the country, as well as the successful implementation of the Vision 2030 programme by the government. In addition, the investment climate in the country requires further improvement, when the "rules of the game" should be clearly established at the legislative level and the impossibility of changing them arbitrarily should be fixed.

"Vision 2030" so far helps to locally and temporarily mitigate the previously accumulated problems, but at the same time it creates new ones against the background of objectively emerging contradictions of intra-economic and intersectoral plan. As a result, their overcoming occurs, in fact, in an emergency mode, which in some cases becomes constant and is conditioned, on the one hand, by the need to consolidate all available reserves to improve the sustainability of the national economy and its quality, and, on the other hand, by the desire of the ruling circles to accelerate the transfer of the reproduction base to a new technological basis.

It can be assumed that Egypt, with the very ambitious goals set out in the programme, wanted to strengthen its socio-economic foundations (which have so far kept it from finally sliding into the global periphery), while hoping to move to a higher level of development at some point. "Vision 2030" basically means that the Arab Republic of Egypt's leadership has realised that the country does not yet have sufficient resources to move to a more representative position in the global economic system. The authorities are still looking for ways and opportunities to meet this global challenge in the dramatically changing economic and political environment of the world around them, with the hope of success.

Entering the trajectory of qualitative socio-economic growth requires the ability of the leadership to quickly address multidimensional challenges. In doing so, however, there is a risk that a "super idea" may not be sufficiently adapted to the current circumstances or the international and/or inter-Arab situation and become a destabilizng factor that negatively affects the pace of implementation of the programme's strategy.

Meanwhile, Egypt, in terms of its economy, is gradually becoming a rather large subject not only of regional, but also, in some cases, of global economic activity, in which, in addition to hydrocarbon production, it operates in the markets of phosphates, iron and aluminium ores, rare-earth metals, and, in the future, uranium, the discovery of large deposits of which was reported back in

January 2013, intending to start mining this fossil in 2024.[12]

The country intends to make extensive use of available natural resources to diversify its economy and consolidate its position on all available platforms, including foreign ones. This is crucial for Egypt to stabilize its macroeconomic performance, diversify the sources of funding for the major national projects outlined in the programme, and gain access to the latest technologies [8]. Obviously, the implementation of such plans requires the support of all segments of the population, which, in the current, highly volatile external and internal environment, should know what measures the leadership intends to take to achieve the set goals.

Thus, the government is facing a task of great importance and complexity — to form a social and national consensus on the strategic long-term goals of the country's development. At the same time, the choice of ways and methods of further promotion of the modernisation process, which will allow the country to qualitatively reduce the rather high level of internal political, socio-economic, and religious contradictions, is of particular importance. In this regard, it should be emphasised that the increase in economic growth rates should be accompanied by an active policy of mitigating social contrasts and supporting small and medium-sized segments of the population [9]. Otherwise, the emerged political, economic, social, and other difficulties may lead to a serious destabilisation of the internal political situation, and then it will have to be mitigated by focusing on additional and costly measures to seriously reduce poverty and deprivation, curb inflationary processes and solve other acute social problems, and, most likely, to make significant adjustments to a number of indicators outlined in the Vision 2030.

While noting this fact, it is still necessary to point out that Egypt has made significant progress over the past 20 years in diversifying and strengthening inter-sectoral linkages and establishing a fairly integrated national market space and its most important components. This is evidenced by the emergence of a number of new economic sectors and economic entities, including the private sector, which has noticeably stimulated local production of consumer and industrial goods. The development of Egypt's export industries, business, trade and tourism ties with the outside world, despite the intensely predicted challenges and threats, contributes to the country's greater involvement in the global market, which is in line with the Vision 2030 programme strategy that was adopted for the future.

[12] URL: neftedaz/ru/news/nuclear/782716-egipet-nachnet-dobychu-urana-v-2024-g/

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was received on 20.03.2024; revised on 15.04.2024 and accepted for publication on 10.05.2024. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-40-47
UDC 339.9(045)
JEL F01

Corporate Responsibility in the Field of Sustainable Development on the Example of India

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ABSTRACT

The relevance of national approaches to the study of corporate responsibility in the field of sustainable development is based not only on the expansion of methodological tools for assessment, but also on the need to provide it with a global perspective. Of particular interest is the study of corporate responsibility in developing countries that lag behind in terms of adoption but have distinct national characteristics. India, as the first country to oblige its companies to allocate funds for corporate social responsibility (CSR), demonstrates its intentions to form a national concept of sustainable development. The BRICS partnership between Russia and India provides opportunities for deeper co-operation in the field of sustainable development in general and corporate responsibility in particular. The paper chooses reports related to sustainable development and corporate social responsibility expenditures, as well as public initiatives of Indian companies as objects of research. An indicator characterising the national corporate approach to sustainable development is proposed.

Keywords: non-financial reporting; sustainable development; corporate responsibility; sustainable development report; information disclosure; India

***For citation*: Goroshnikova T.A. Corporate responsibility in the field of sustainable development on the example of India. *The world of new economy*. 2024;18(2):40-47. DOI: 10.26794/2220-6469-2024-18-2-40-47**

INTRODUCTION

Corporate responsibility in the field of sustainable development is an integral part of corporate governance of business entities and is undoubtedly of interest for scientific research [1, 2]. The obligations of these entities include dynamic activities in the environmental and social spheres, as well as ensuring transparency in management procedures. Social events for employees and clients, projects to reduce environmental impact, financial support for volunteer programmes, etc. are examples of corporate responsibility initiatives. Ethical issues are undoubtedly important, but the long-term strategy is based not just on maintaining the brand image and reputation, but on creating value for stakeholders: employees, customers, investors, government agencies, public and international organisations. Mechanisms that influence corporate responsibility include legal and voluntary measures, partnerships, as well as non-financial reporting that justifies the fulfilment of intentions in practice and makes it possible to assess the contribution to achieving sustainable development.

DEVELOPMENT OF CORPORATE RESPONSIBILITY

The evolution of global corporate responsibility can be traced through the publication of company reports since the 1960s. At first, these were short extracts from US and European enterprises with comments on its significance for society. In the 1990s, not only social but also environmental issues began to be widely covered. The geographical expansion of report publications was uneven, depending on public awareness of the concept of sustainable development. In the developed countries of the European Union, the emergence and evolution of the concept of reporting on sustainable development is based on the understanding of the need to transition to it under the influence of political and socio-economic factors [3].

Simultaneously with the growing number of companies publishing sustainability reports, a system of standards and recommendations was developed to provide information in a clear and comparable form. Since 2000, the most widely used methodology is that of the independent international organisation GRI (Global Reporting Initiative).

The importance of publishing sustainability-related documents has also grown due to their increasing integration with financial reports and the development of responsible investment. Stock exchanges have supported this initiative and have gradually started to develop guidelines on disclosure and management of social and environmental risks. In particular, the European Union has environmental and social disclosure rules primarily for investors. Since June 30, 2024, in accordance with the European Sustainability Reporting Standards, sustainability reporting has become mandatory for 50,000 companies in the EU.[1] But despite the standards adopted in July 2023 to simplify reporting, it was decided in February 2024 to postpone sustainability reporting for selected sectors and third country companies for two years.[2] In other countries, actual disclosure will remain a requirement of stock exchanges, many of which are developing regulatory frameworks or separate listing requirements for this purpose. For example, since 2012, India's stock exchange listing agreement has required that business responsibility related to environmental, social and corporate governance issues for the top 100 companies must be disclosed in annual market capitalisation reports. This requirement is now voluntary for all entities listed on the stock exchange.

We're not expecting any order of mandatory reporting on sustainable development in States outside the European Union yet, but defining the conditions and prerequisites for its introduction in developing countries is becoming an urgent task.

[1] URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022L2464

[2] URL: https://www.consilium.europa.eu/en/press/press-releases/2024/02/07/council-and-parliament-agree-to-delay-sustainability-reporting-for-certain-sectors-and-third-country-companies-by-two-years/

CORPORATE REPORTING OF DEVELOPING COUNTRIES

Studies of sustainability reporting in developing countries reveal limited information on environmental and social performance, as well as inconsistent and inconclusive information on company organisational composition and ownership structure. The theories of stakeholder, legitimacy and voluntary disclosure have been attempted to inform the theoretical underpinnings of sustainability reporting publications [4–9].

Not only researchers but also international organisations are paying attention to corporate responsibility for sustainable development. The differences between developing and developed countries are reflected in the United Nations Global Compact for 2020.[3] Reports from developed countries mainly covered issues related to sustainable production and emissions in the supply chain, while developing countries were concerned with education and human rights topics.

The pace of development of corporate responsibility and sustainability reporting in developing countries varies. *Table 1* shows the dynamics of report publications in the sample countries up to 2020. We note the strong leadership of China, while South Africa demonstrates a stable high indicator of the number of reports.

South Africa actively supports the publication of sustainability reports, which was relatively widespread in the country prior to the introduction of the Johannesburg Stock Exchange (JSE) requirements; improving the regulatory framework and encouraging voluntary initiatives by companies.[4] Malaysia, on the other hand, had a very low level of reporting prior to the introduction of regulations by the Stock Exchange (Bursa Malaysia). Both countries have mandated sustainability disclosure prior to 2011 and have adopted listing rules/requirements. The Johannesburg Stock Exchange (JSE) has authorised the depth of disclosure of sustainability activities based on recommendations issued by the Royal Committee on Corporate Governance.[5] Bursa Malaysia made the publication of sustainability information a listing requirement following a speech by the Malaysian Prime Minister, but specific guidelines came much later.

The Johannesburg Stock Exchange was one of the first emerging markets to require its companies to either publish an integrated report containing financial and non-financial statements or explain why they had not done so. The introduction of this tool has helped meet the information needs of an extremely wide range of stakeholders, not just investors.[6]

A significant component characterising a country's commitment to sustainable development is compliance with international greenhouse gas accounting standards (GHG Protocol).[7] Whilst recognising the problems associated with the disclosure of emissions data within the Scope 3 area, the Exchange retains the requirement to provide reasons why they are not accounted for.

INDIA

In the Indian context, mandatory corporate social responsibility has gradually emerged as a component of sustainable development. The theoretical underpinnings for a national corporate approach have been expanding, such as the underlying CSR principles of giving back to society on the profits generated.

The evolution of sustainability reporting in India began with the launch of the BRR (Business Responsibility Report) in 2009. Starting from 2012,

[3] URL: https://globalcompact.ru/

[4] URL: https://www.jse.co.za/our-business/sustainability/jses-sustainability-and-climate-disclosure-guidance

[5] URL: https://cdn.ymaws.com/www.iodsa.co.za/resource/resmgr/king_iii/king_report_on_governance_fo.pdf

[6] URL: https://www.jse.co.za/sites/default/files/media/documents//JSE%20Sustainability%20Disclosure%20Guidance%20June%202022.pdf

[7] In accordance with international standards for greenhouse gas accounting, a division of emissions into three scopes has been introduced: 1 (Scope 1) — direct company emissions during production; 2 (Scope 2) — company emissions during energy consumption; 3 (Scope 3) — emissions including all indirect greenhouse gas emissions, divided into two types of flows in the supply and distribution chain.

Table 1

Number of corporate responsibility reports (non-financial) by country

Country / Year	2016	2017	2018	2019	2020
India	146	147	144	161	166
China	111	508	616	694	774
Thailand	92	100	120	115	127
Indonesia	86	97	96	111	113
Malaysia	67	89	112	132	135
SOUTH AFRICA	317	317	297	302	304
Saudi Arabia	10	12	19	17	23
Oman	10	7	6	6	6

Source: compiled by the author according to URL: https://www.corporateregister.com/map/

the 100 largest companies, as mandated by the Securities and Exchange Board of India (SEBI), published sustainability reports, and in 2015 the requirement was extended to a further 400 organisations. In 2019, the "National Voluntary Guidelines" were revised and reissued as "National Guidelines for Responsible Business Conduct". In May 2021, the "Responsible Business Report" became the "Responsible Business and Sustainability Report" and the list of companies expanded to 1,000 companies. Performance indicators in the new document are divided into two groups: core indicators, the disclosure of which is mandatory, and voluntary indicators, which provide companies with an opportunity to demonstrate a desire to "achieve a higher level of excellence in their pursuit of social, environmental and ethical responsibility". Note that disclosure of information related to a company's production processes and commodity supply chains under Scope 3 is included in the list of leadership indicators, making it voluntary. This distinguishes the Indian document from, for example, the European Union's Corporate Sustainability Reporting Directive (CSRD). Scope 3 is the most significant category in developing countries, accounting for one-third of global carbon emissions, which is associated with the consumption of high-carbon intensity fossil fuels, as well as poverty, corruption and hunger. Therefore, the fact that reporting on this category has been moved to voluntary disclosure emphasises the reluctance of Indian companies to do so due to the insignificance of the data to stakeholders and/or the lack of regulations governing the process of collecting emissions from supply chains.

Nevertheless, Indian companies that already publish sustainability reports disclose a significant number of indicators, which proves that they are serious about showing corporate responsibility [10–13]. In 2016, the quality of disclosure was almost 80%. The 2019 reports of 493 companies[8] show that 80 per cent of them followed the GRI (Global Reporting Initiatives) system's non-financial disclosure standards for the three dimensions of sustainability — social, environmental, and economic.[9] Differences were identified in the disclosure of such information by sector of production, confirming the unpreparedness of Indian companies to report in a common format.

[8] URL: https://www.globalreporting.org/media/i4udupws/sa-trends-2019-publication.pdf

[9] URL: https://www.globalreporting.org/media/ioqnxtmx/sebi_brsb_gri_linkage_doc.pdf

Table 2

Corporate Social Responsibility expenditure of companies in India by state in 2021–2022 as compared to similar TOP-600 Indian companies, crores of rupees

States and territories	Ratio of expenditures by states to expenditures of TOP-600 Indian companies
Andhra Pradesh	640.70/433.92
Arunachal Pradesh	119.39/117.11
Assam	398.70/375.80
Bihar	165.66/131.94
Chhattisgarh	292.83/246.41
Delhi	1158.0/673.07
Gujarat	1554.16/820.16
Haryana	654.88/342.07
Himachal Pradesh	138.84/ 114.17
Uttarakhand	192.41/124.76
Karnataka	1761.39/1061.13
Kerala	234.01/ 139.14
Madhya Pradesh	420.04/278.31
Maharashtra	5229.31/ 3657.34
Pinjab	177.48/ 74.56
Rajasthan	700.44/ 453.52
Tamil Nadu	1371.91/ 809.77
Telingana	670.06/ 337.27
Uttar Pradesh	1321.36/ 968.10
West Bengal	541.46/262.96
Odisha	652.01/565.81

Source: compiled by the author according to: URL: Indiastat.com

Table 3

Distribution of companies by state

State	The number of companies
Jharkhand	1
Goa	2
Chhattisgarh	2
Himachal Pradesh	3
Odisha (Orissa)	6
Kerala	12
Rajasthan	14
Madhya Pradesh	14
Punjab	16
Andhra Pradesh	48
Uttar Pradesh	66
Gujarat	86
Haryana	91
West Bengal	92
Karnataka	97
Tamil Nadu	115
Delhi	125
Maharashtra	501

Source: compiled by the author.

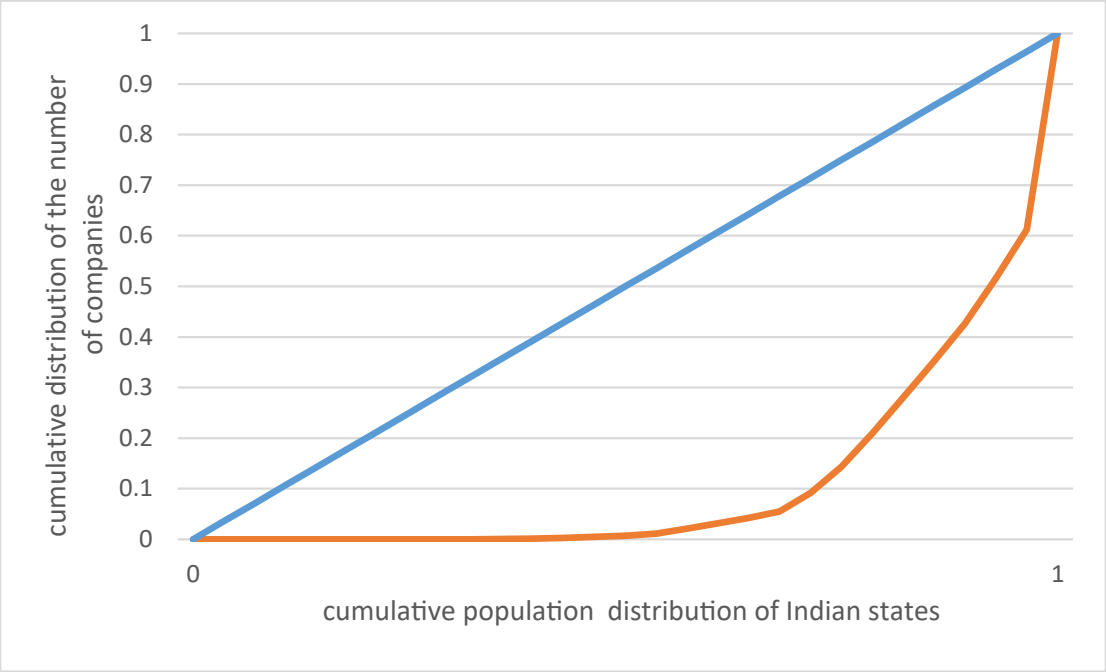

Fig. **Estimating the uneven distribution of companies listed in the CSRHub database across states in India**

Source: compiled by the author according to URL: https://www.csrhub.com/

Note: Information on companies from the states of Sikkim, Mizoram, Arunachal Pradesh, Nagaland, Manipur, Meghalaya, Tripura, Uttarakhand, Assam, Bihar, Jammu, and Kashmir was not available in the CSRHub database as of the date of the request.

Of course, the quality of reporting is significantly influenced by a number of internal company characteristics: age, industry, size, and environmental sensitivity. Only 1/5 out of 586 organisations in India assessed sustainability performance over time and/or in relation to other companies in published reports in 2021.[10] At the same time, 12 new companies made such information public for the first time. In general, the level and quality of sustainability reporting remained virtually unchanged until the introduction of the Regulation on Business Responsibility and Sustainability.

A general trend can also be noted[11] — disclosure of information in the context of the Sustainable Development Goals (SDGs). India's level of transparency is comparable to China's and slightly lower than that of Organisation for Economic Co-operation and Development (OECD) countries. The most common are SDG 13 (Climate Action), SDG 5 (Gender Equality), SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth), SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production). The SDG India Index 2020–2021, published by the National Institution for Transforming India[12] and developed in collaboration with the United Nations, shows that SDG 6, SDG 12, SDG 11 are almost achieved; SDG 8 and SDG 13 are partially achieved; and SDG 5 has not been achieved by any state.

The listed targets are consistent with the major sustainable development challenges India faces, but there is room for improvement in reporting practices. Disclosure on SDG 13 is two-sided: on the one hand, the goal is among the most popular, but on the other hand, only a small number of companies consider climate change to be a significant issue.[13] A possible explanation is that

[10] URL: https://reportyak.com/sustainability-reporting-standards-in-india-2022/

[11] URL: https://www.cdsb.net/sites/default/files/sustainability_india_report_web.pdf

[12] URL: http://niti.gov.in/

[13] The reporting exchange, Sustainability reporting landscape in India, https://www.cdsb.net/sites/default/files/sustainability_india_report_web.pdf

this is not a major issue in India. The peculiarity is that the country is transitioning to a low-carbon economy from an agrarian economy rather than an industrial one. India's per capita energy consumption is quite low, and unlike developed countries, it has not yet developed a sufficient greenhouse gas inventory. The power sector accounts for almost 40 per cent of emissions as it uses coal, which emits carbon dioxide during processing.

The analysis of corporate social responsibility expenditures by state in India (*Table 2*) shows that the top three states are Maharashtra (the financial and economic centre of India with many large registered companies), Karnataka and Gujarat, followed by Tamil Nadu and Delhi.

In general, there are significantly more companies active in the area of corporate social reporting than those who show themselves to be in the area of corporate sustainability responsibility. However, according to IndiaStat.com, the number of the former is decreasing: while there were 21,525 in 2017–2018, and 25,985 in 2018–2019, then by 2021–2022 there were 18,623 left. The explanation for this is a shift in focus towards corporate sustainability and reformatting reporting.

In addition, we have also investigated distribution of companies willing to show themselves in sustainability aspects across the states of India addressing the CSRHub database, as of April 2023 (see *Figure*). Each of the 1,291 companies was identified as belonging to a parent company in one of the states (*Table 3*).[14] The degree of deviation of the curve indicates the uneven distribution of sustainability initiatives in India.

It should be noted that 12 states are not represented by any company, i.e., they have not demonstrated initiatives in the field of sustainable development in particular and corporate responsibility in general.

The majority of companies are registered in the state of Maharashtra with its administrative centre in Mumbai. This is followed by Delhi, the second largest administrative centre, by a wide margin. It is expected that this process will spread to other states as companies realise the need for disclosure, either voluntarily or as a result of regulatory pressure.

CONCLUSION

The formation and implementation of a national concept of transition to sustainable development in India is important for the Russian Federation, as the country is seen as our strategic partner. The tools and mechanisms to manage the transition process should be evaluated in terms of their effectiveness and the possibility of risks.

However, the country's commitments to carbon neutrality, which require companies to disclose information, are unevenly implemented across states, forcing management to use tools to incentivise the publication of sustainability reports. Compliance with greenhouse gas accounting requirements, particularly Scope 3 disclosure, remains voluntary. The very fact of disclosing information on greenhouse gas emissions (Scope 3) can serve as one of the indicators characterising the national corporate approach to sustainable development.

[14] The method of assessing the unevenness of the distribution of the studied attribute in statistical analysis was proposed by economist Max Lorenz. The Lorenz curve clearly shows how much the actual distribution differs from the uniform distribution (a straight line at an angle of 45°).

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.

CThe article was received on 12.12.2023; revised on 17.01.2024 and accepted for publication on 15.02.2024. The author read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-48-58
UDC 336.7(045)
JEL C55, G17

Comparative Analysis of the Stability of the Russian and US Stock Markets in the Context of Geopolitical Transformations

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ABSTRACT

Subject. The global economic crisis of 2008, geopolitical crises between 2014 and 2023 and the socio-economic consequences of the COVID-19 pandemic have a significant negative impact on the stock markets. The result of this influence is a significant increase in stock market volatility and instability. **The purpose** of the article is to develop a methodology for assessing the sustainability of the stock market and, on its basis, carrying out a comparative analysis of the sustainability of the stock markets of the Russian Federation and the USA. **Methodology.** Systematic and comparative analysis is used, as well as statistical methods and methods of the theory of cenoses. **Scientific novelty:** a dimensionless indicator of the stability of the economic system of stock market companies has been developed. **Results.** A methodology is proposed for assessing the sustainability of stock market issuing companies based on its model — economic cenosis. Within the framework of this methodology, a cenological analysis of structural changes and stability of the economic system under consideration is carried out. The developed methodology was tested based on the capitalization data of 100 companies listed on the Moscow Exchange and the S&P 500 index. A comparative analysis of the stability of the stock markets of the Russian Federation and the United States showed a sufficient degree of stability of the Russian stock market in relation to one of the most developed stock markets in the world — the US stock market. **Conclusions.** The proposed methodology makes it possible to assess the sustainability of the stock market as a unified economic system of issuing companies based on their key parameter — capitalization. Maximizing the sustainability indicator makes it possible to determine the potential investment valuation of the selected company shares, provided that the economic system of the stock market, in the process of its evolution, strives for its most stable state. **Practical significance.** The results and conclusions of the article may be in demand not only by regulatory organizations and stock market participants, but also by potential ordinary investors.
Keywords: stock market; issuing company; capitalization of companies; economic sustainability; economic cenosis; indicator of sustainability

For citation: **Dorokhov E.V. Comparative analysis of the stability of the Russian and us stock markets in the context of geopolitical transformations. *The World of New Economy*. 2024;18(2):48-58. DOI: 10.26794/2220-6469-2024-18-2-48-58**

INTRODUCTION

In recent times, in the context of crisis phenomena in the world economy and global geopolitical transformations, one of the main features of stock markets/ stock exchanges (SE) development is a significant increase in their volatility and instability. Such significant changes in stock assets and indices may further adversely affect the economies of countries. In this regard, governmental organisations regulating stock market processes need to react quickly in order to mitigate and, if possible, eliminate these phenomena. Therefore, the task of assessing the sustainability of the Russian stock market and comparing it with one of the most developed ones — the US stock market — is relevant. The results of this assessment allow regulators to take appropriate corrective or prohibitive actions to stabilise the stock market, and provide participants with knowledge about its dynamics and development, on the basis of which they form tactics and strategies for exchange trading.

The topical issue presented in this article is actively researched by the scientific community, whose interests lie in the field of analysing the state, development, and sustainability of stock markets under the influence of external factors.

Various features of the influence of external factors on the stock market of Russia are considered in the works of Russian scientists. The article by E. A. Kudryavtseva shows that the volume of GDP and the cost of oil have a significant impact on the Russian stock market [1]. The study by A. V. Berdyshev and F. N. Ilmukov is devoted to the features of the Russian stock market development in 2021, before the introduction of financial and economic restrictions on the Russian Federation by Western countries [2]. The need for state regulation in the stock market under unfavourable geopolitical conditions is formulated in the work of L. I. Tenkovskaya [3]. The study conducted by M. R. Narzulloev and A. S. Duisembayeva proves that the stock market reacts to the cost of oil to a greater extent [4]. And I. I. Belyaev, S. N. Silvestrov and T. S. Gaibov in their article demonstrate that, despite the impact of the COVID-19 pandemic on the global and Russian economy, the domestic banking sector has uneven growth rates of total assets and stable growth of equity capital. At the same time, the stability of the Russian banking sector at the end of 2020 is observed [5].

Many scientific works pay attention to various aspects of stock market sustainability. Thus, V. A. Gorelik and T. V. Zolotova assess the collective risk and sustainability of the stock market based on the concept of entropy and correlation coefficients of random values of companies' returns [6]. Time effects on the stock market of the Russian Federation are studied by S. V. Vatrushkin [7]. The articles of foreign scientists state that some industry clusters of Warsaw stock market indices during the COVID-19 pandemic had different stability indices [8]; the stock market stability based on diffusion entropy and the Dow Jones Industrial Index is analysed [9]; the stock market stability index is formulated within the framework of the asymptotic steady-state autoregressive model (ASAR). [10]. At the same time, in one paper the authors prove that most of the world stock markets in the process of adapting to various aspects of globalisation have faced new problems related to their stability and efficiency, and in order to mitigate these negative effects of globalisation they propose to adopt a number of regulations, measures and practices [11].

There is a study where Discrete Ricci curvature procedures are considered within a hybrid model of time series analysis to describe the nonlinear architecture of financial networks, which is used to estimate future risks, volatility, and stability of the Shanghai Stock Exchange of China. It is shown that this estimation procedure can be used for the whole stock market of China [12].

Several articles present stock market models as a nonlinear non-stationary system with strong

volatility, close coupling, and asymmetry [13–18]. Within these models, various tools, and interdisciplinary approaches such as trigger points, stock price and cash flow feedback and complexity theory are proposed to estimate the stock market with a high degree of correlation and to monitor and adjust it.

"One study shows that sentimental" traders who buy stocks in rising markets and sell stocks in falling markets jeopardise the stability of stock markets [19]. And others consider a number of models of stock market dynamics based on the behaviour of heterogeneous interacting agents (chartists and fundamentalists). It is established that the stock price will tend to its fundamental value as long as the influence of chartists (traders using technical analysis) and fundamentalists (traders focusing on company fundamentals) on the stock market does not exceed certain limits [20, 21]. Based on the evolutionary model of the stock market, scientists demonstrate that the stock market is evolutionarily stable if and only if stocks are valued by expected relative dividends [22].

The given review of the current state of the problem under study shows that the mentioned scientific works cover various aspects related to the analysis of the state, development, and local stability of stock markets under the influence of external factors. At the same time, the assessment of stock market sustainability as a unified economic system of issuing companies is not fully studied, so this problem is of particular scientific interest.

METHODOLOGY FOR ASSESSING THE SUSTAINABILITY OF THE STOCK MARKET

Many companies — stock market issuers are considered as an economic system that develops in a competitive environment for access to financial resources under the influence of internal and external factors. In the process of evolution of this system there is a natural selection and development of the most effective organisations. The sustainability of companies — issuers of the stock market is studied on the basis of economic cenosis [23], which is a model of the economic system.

The structural changes and stability of the economic system under consideration are analysed using rank parametric distributions of economic cenoses. The key economic indicator of a given economic system is usually chosen as a parameter, so for companies — stock market issuers such parameter can be their capitalisation. The rank parametric distribution is formed by ranking the issuing companies according to the decrease in their capitalisation. The belonging of the economic system to the cenological type is determined by the value of Kendall's coefficient of concordance (W) [23], which gives an estimate of the correlation of rank parametric distributions of issuing companies in time dynamics:

$$W = \left(12\sum_{i=1}^{N}\left(\sum_{j=1}^{T} r_{ij} - \mathrm{S}\right)^2\right) / \left(T^2\left(N^3 - N\right)\right), \quad (1)$$

$$S = \left(\sum_{i=1}^{N}\sum_{j=1}^{T} r_{ij}\right) / N, \quad (2)$$

where N — is the number of issuing companies of the stock market; T — is the number of time periods under consideration, for which rank distributions are constructed; r_{ij} — is the i-th rank of the j-th time period; S — is the average sum of ranks of issuing companies for each time period.

If $W > 0.5$, the given economic system belongs to the cenological type. To calculate the Kendall's coefficient of concordance, the rank parametric distributions of the capitalisation parameter of the issuing companies for each time period (quarter, half-year and year) are generated.

As practice shows, in the process of evolution in the environment competing for access to financial resources under the influence of internal and external factors, the rank parametric distributions of economic cenoses tend to their most stable state. This state is described by the hyperbolic H-distribution with a rank

coefficient in the interval β ∈ [0.5; 1.5] [24]:

$$P(r) = P_1 / r^{\beta}, \quad (3)$$

where $P(r)$ — is the economic indicator of the company with rank r; P_1 — is the economic indicator of the company with rank 1; β — is the rank coefficient.

Consequently, the closer the capitalisation values of the rank parametric distribution are to its approximating function (3) with the rank coefficient β ∈ [0.5; 1.5], the higher is the stability of this economic cenosis of stock market issuers. The parameter of the approximating function β is determined by the following formulae:

$$\min \sum_{r=1}^{N} \left| C(r) - \frac{C_1}{r^{\beta}} \right|, \quad (4)$$

$$\min \sum_{r=1}^{N} [C(r) - C_1 / r^{\beta}]^2, \quad (5)$$

where C(r) — is the observed capitalisation of the issuing company of the stock market with rank r; C 1 — is the capitalisation of the company with rank 1.

Formula (4) is based on the method of least moduli, formula (5) — is based on the method of least squares.

Figure 1 shows the rank parametric distribution of the first 100 companies of S&P 500 by capitalisation parameter, as of 04.10.2023,[1] and the approximating function constructed to it with the ranking coefficient β = 0.7534, calculated by formula (4). Additionally, *Fig. 1* shows hyperbolic *H*- distributions (3) with rank coefficients β = 0.5 and β = 1.5, limiting the stability region.

Visual analysis of the graphs in *Fig/ 1* shows that the observed capitalisation of S&P 500 companies, as of 04.10.2023, is mostly in the stability region (except for companies with ranks 2 and 3). Moreover, the entire constructed approximating curve to the empirical capitalisation data of these companies is also located in the stability region. The capitalisation data of the top five ranked companies of the S&P 500, as of 04.10.2023, and their corresponding *H*-distribution values with rank coefficients β = 0.5 and β = 1.5, presented in *Table 1*, confirm that the capitalisation of companies with ranks 2 and 3 is outside the sustainability area.

To assess the proximity of capitalisation values of the rank parametric distribution of issuing companies to its approximating function of the hyperbolic *H*-distribution, we introduce a dimensionless indicator of the stability of the economic cenosis of the stock market:

$$\Pi_{mnm} = \left| \sum_{r=1}^{N} C(r) \right| / \sum_{r=1}^{N} \left| C(r) - C_1 / r^{\beta_{\min}} \right|, \quad (6)$$

$$\Pi_{mnk} = \left(\sum_{r=1}^{N} C(r) \right)^2 / \sum_{r=1}^{N} \left[C(r) - C_1 / r^{\beta_{\min}} \right]^2, \quad (7)$$

where $C_1 / r^{\beta_{\min}}$ — is the approximating hyperbola to the empirical rank parametric distribution $C(r)$; β_{min} — solution to the extreme problems (4) or (5).

Calculation of the stability index according to formula (6) is carried out using the method of least moduli, and the calculation according to formula (7) corresponds to the method of least squares. It follows from formulas (6) and (7) that a greater stability index characterises greater stability of the stock market.

Finding the maximum values of stability indicators (6), (7) when changing the values of capitalisation of some selected companies makes it possible to obtain those values of their capitalisation at which the economic structure under consideration has maximum stability with the capitalisation of other issuing companies remaining unchanged. For this purpose, we select companies whose capitalisation differs sufficiently from the corresponding values of the approximating curve, for example, with rank 2 and 3 (*Fig. 1*).

The developed methodology for assessing the sustainability of the stock market includes:

[1] URL: https://ru.tradingview.com/symbols/SPX/components/ (accessed on 04.12.2023).

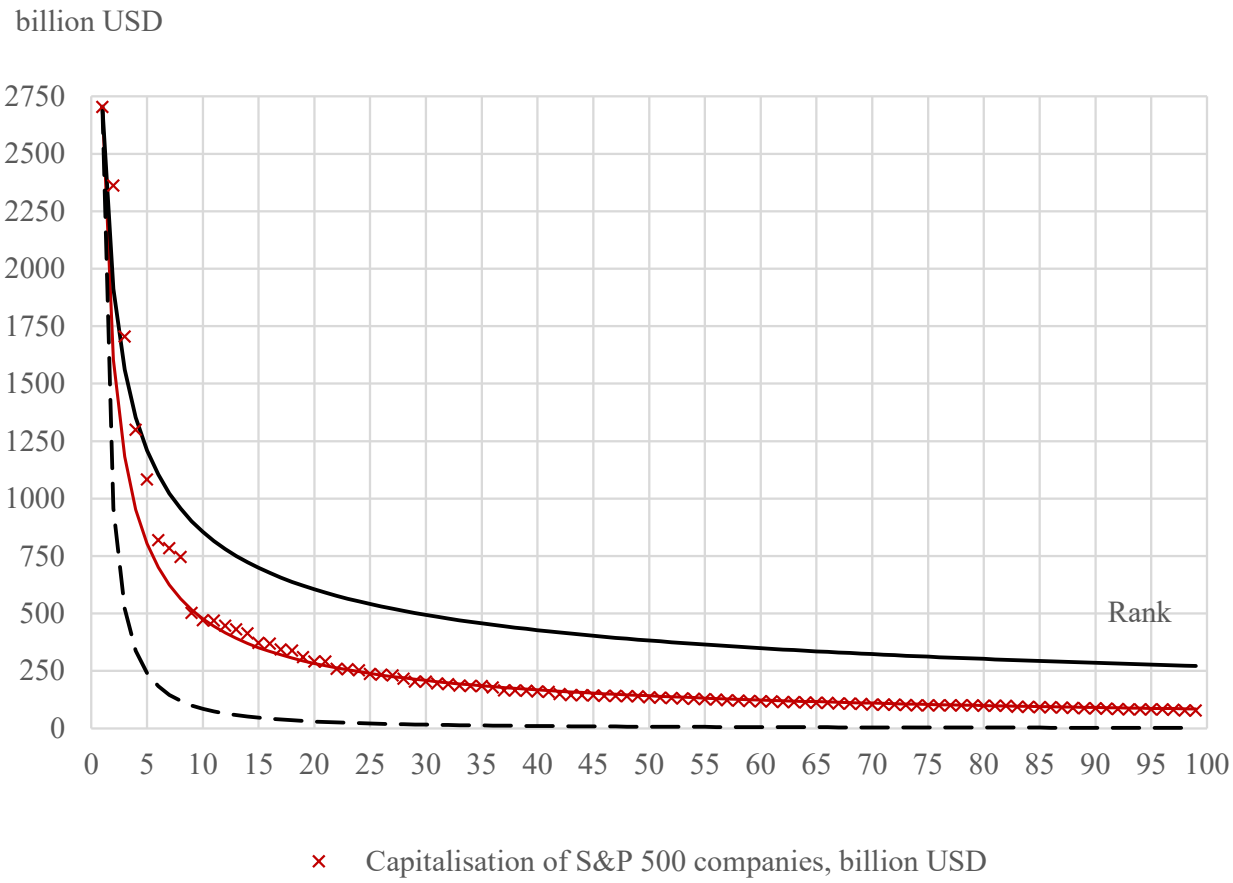

Fig. 1. **The area of stability for rank parametric distributions of S&P 500 companies**

Source: compiled by the author.

Table 1

Capitalization of the top 5 S&P 500 companies and *H*-distribution values with β = 0.5 и β = 1.5

Rank	1	2	3	4	5
S&P 500 companies' capitalisation data (as of 04.10.2023), USD bln.	2705.00	2362.00	1706.00	1300.00	1084.00
H-distribution with β = 0.5	2705.00	1912.72	1561.73	1352.50	1209.71
H-distribution with β = 1.5	2705.00	956.36	520.58	338.13	241.94

Source: compiled by the author.

• selection of a time interval for cenological analysis and selection of a set of companies — issuers of the stock market;

• construction of rank parametric distribution of issuing companies by the selected parameter (capitalisation) for each reporting time period (quarter, half-year, year) of the selected time interval;

• determining whether the selected economic system of stock market issuers belongs to the cenological type according to the value of the Kendall coefficient ($W > 0.5$), formulas (1), (2);

• construction of approximating function of hyperbolic *H*-distribution according to formulas (4), (5) and determination of stability assessment of the given stock market by the selected parameter for each reporting time period (quarter, half-year, year) according to formulas (4)-(7).

COMPARISON OF SUSTAINABILITY OF ISSUING COMPANIES ON THE EXAMPLE OF MOSCOW STOCK EXCHANGE AND S&P 500 INDEX COMPANIES

To study the sustainability of the economic system of Moscow Exchange issuing companies in the period from 2022 to 2023, rank parametric distributions of the first 100 companies by the size of their capitalisation are formed. Based on the obtained data on the dynamics of capitalisation ranks of the issuing companies for 2022 and 2023[2] the Kendall's coefficient of concordance is determined using formulas (1) and (2), which takes the value: $W = 0{,}9872 > 0{,}5$. Similarly, the coefficient of concordance is determined for the economic system of the first 100 companies from the S&P 500 index, which for the data on the value of their capitalisation for 2022 and 2023[3] takes

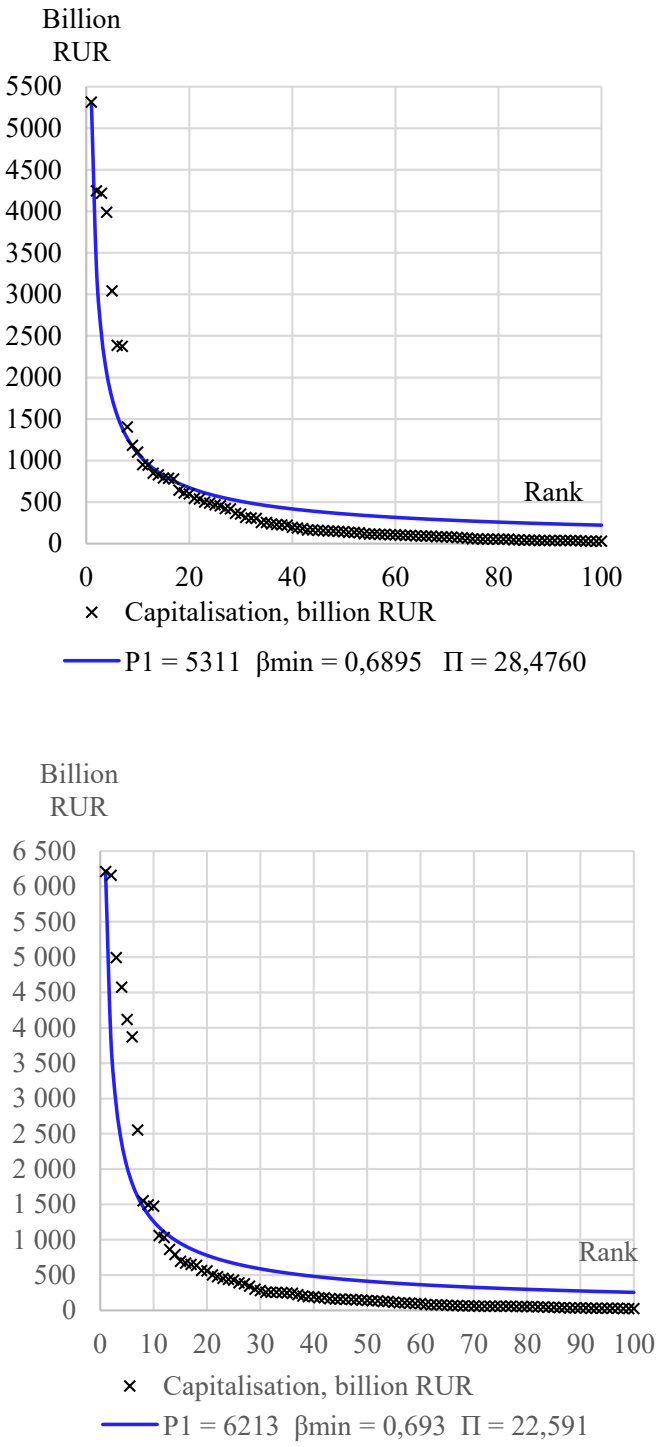

Fig. 2. **Rank parametric distribution of the first 100 companies by capitalization of the Moscow Stock Exchange and the hyperbolic H-distribution curves approximating them**

Source: compiled by the author.

[2] URL: https://smart-lab.ru/q/shares_fundamental4/order_by_title/asc/?field=market_cap (accessed on 04.12.2023).

[3] S&P 500 Index. List of SP: SPX stocks. TradingView Inc., 2023. URL: https://ru.tradingview.com/symbols/SPX/components/

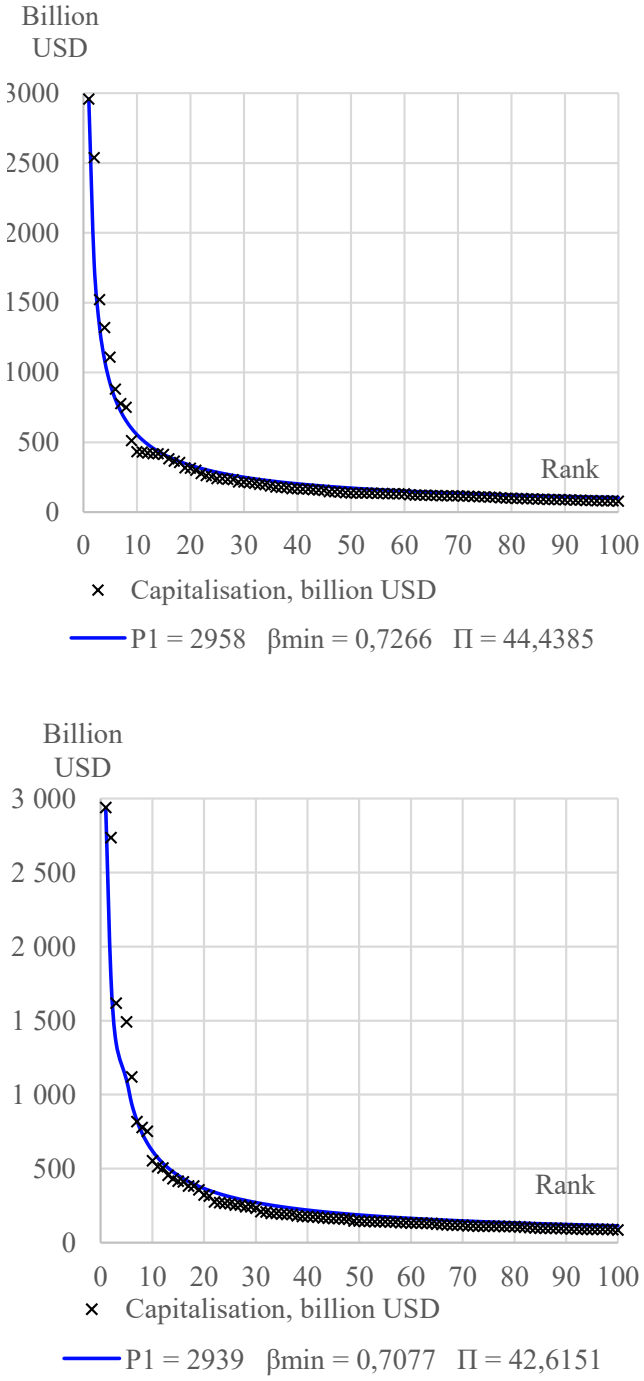

Fig 3. **Rank parametric distributions of the first 100 companies by capitalization of the S&P 500 and the hyperbolic H-distribution curves approximating them**

Note: P1 — capitalisation of the company with rank 1; βmin — rank coefficient, which gives the minimum value to the problem (5); Π — stability indicator calculated by formula (7).
Source: compiled by the author.

the value $W = 0,9998 > 0,5$. Consequently, the economic systems of the Moscow Exchange and S&P 500 Index issuers under consideration can be classified as economic cenosis.

To compare the sustainability of the Moscow Exchange issuing companies and the S&P 500 Index from 2022 to 2023, data on the value of their capitalisation as of 01.07.2023 and 04.12.2023 are considered. *Figure 2* shows the rank parametric distributions of the first 100 Moscow Exchange companies by capitalisation and the approximating curves of the hyperbolic *H*-distribution. The first graph is based on capitalisation data as of 01.07.2023, and the second — as of 04.12.2023.

Figure 3 shows the rank parametric distributions of the first 100 S&P 500 companies by capitalisation and the approximating curves of the hyperbolic *H*-distribution. The first graph is based on capitalisation data as of 01.07.2023, and the second — as of 04.12.2023.

Determination of β_{min} in problem (5) is carried out using a nonlinear optimisation method based on Nelder-Mead simplex search in the Matlab software environment.[4] Based on empirical data on rank parametric distributions and their corresponding generated approximating hyperbolic functions (3), the stock market stability indicators (Π) are calculated by formula (7).

Table 2 presents calculated data of rank coefficients of approximating curves of hyperbolic *H*-distribution, as well as indicators of stock market stability of Moscow Exchange companies and S&P 500 index companies as of 01.07.2023 and 04.12.2023.

The analysis of *Fig. 2, 3* and the calculated data presented in *Table 2* shows that the capitalisation values of the first 100 companies of the Moscow

(accessed on 04.12.2023). Largest 1000 US Companies in 2023. Top Companies from the United States as of Jul. 01, 2023. URL: https://disfold.com/united-states/companies/ (accessed on 04.12.2023).

[4] Find minimum of unconstrained multivariable function using derivative-free method. The MathWorks, Inc. URL: https://www.mathworks.com/help/matlab/ref/fminsearch.html (accessed on 04.12.2023).

Table 2

Rank coefficients of approximating curves of the hyperbolic H-distribution and indicators of stability of stock markets

Parameters	01.07.2023	04.12.2023
Moscow Stock Exchange		
βmin	0.6895	0.6930
Π	28.4760	22.5911
S&P 500		
βmin	0.7266	0.7077
Π	44.4385	42.6151

Source: compiled by the author.

Exchange and the S&P 500 index are close enough to their most stable state (rank coefficients of approximating curves in the interval $\beta \in [0.5; 1.5]$). Therefore, the above economic systems of the issuing companies are sufficiently stable in the cenological sense.

However, a visual comparison of the graphs in *Fig.2 and 3* shows that the approximating curves in *Figure 3* are closer to the rank parametric distributions of capitalisation of S&P 500 index companies than the approximating curves in *Fig. 2* are to the rank parametric distributions of capitalisation of Moscow Exchange companies. The results of calculations of stability indicators of these stock markets, presented in *Table 2*, confirm this fact. Judging by *Table 2*, the stability index of the Moscow Exchange companies is much lower than the stability index of the S&P 500 index companies. Moreover, over the period from 01.07.2023 to 04.12.2023, the sustainability index of the Moscow Exchange decreased by 20.67%, while that of the S&P 500 index — only by 4.10%.

Thus, we can conclude that the economic system of the S&P 500 index companies representing the US stock market is more sustainable than that of the Moscow Exchange companies representing the Russian stock market. The different rate of decline of the sustainability indicator may depend on both its initial value and negative factors affecting the economic system of the stock market.

Taking into account the results of the study of sustainability of stock markets in Russia and the United States, it is advisable to identify the following areas of possible activities of domestic stock market regulators to improve the sustainability of the economic system of issuing companies:

• creating conditions for attracting long-term financial resources to the Russian stock market, especially from Russian residents and non-residents from friendly countries;

• limiting the inflow and outflow from the Russian stock market of financial resources of non-residents from unfriendly countries;

• creation of attractive conditions for domestic backbone financial institutions to operate on the Russian stock market in the first place;

• creation of favourable conditions for attracting financial resources of private Russian investors.

The closer the economic system of the Russian stock market is to its most stable state, the better its structure reflects the real state of the Russian economy. The optimal structure of the Russian stock market is characterised by the fact that the share of capitalisation of its various sectors roughly corresponds to the shares of these sectors in the country's economy.

CONCLUSIONS

The developed methodology provides an opportunity to carry out a pricing analysis of structural changes in companies — issuers of the stock market as a single economic system and calculate the assessment of its stability by the key parameter — capitalisation. The given dimensionless stability index determines the proximity of rank parametric distributions of companies to the most stable (optimal) cenological structure of the stock market economic system described by the hyperbolic *H*-distribution with a rank coefficient in the interval $\beta \in [0.5; 1.5]$. Finding the maximum of the stability index of variational problems (7) and (8) allows to determine the potential movement of the exchange rate value (investment valuation) of the selected shares of the issuing companies under the condition of aspiration of the considered economic system of the stock market in the process of its evolution to the most stable position.

Numerous Russian and foreign specialised Internet resources engaged in the analysis of stock market processes provide on their websites current information on the main parameters of companies — issuers of various stock markets, including the capitalisation indicator. On the basis of this information it is possible to calculate the current value of the stability indicator for the stock market under consideration. This information may be useful not only for stock market participants, owners and acquirers of companies, but also for potential ordinary investors.

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.

The article was received on 31.01.2024; revised on 17.02.2024 and accepted for publication on 29.02.2024.
The author read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-59-68
UDC 336.7(045)
JEL F33

Digital Financial Assets as a Tool for International Payments

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ABSTRACT

The relevance of the research topic is due to the need to develop alternative methods of international settlements for Russia in the context of increasing sanctions pressure. Over the past few years, countries have been actively implementing new tools that have emerged due to digitalization and have been called "digital financial assets", the potential of which can be realized, including in the field of international settlements, ensuring a reduction in sanctions pressure on the Russian economy. **The purpose** of this article is to identify the possibilities of using digital financial assets as a tool for international settlements. **Methods.** The study was carried out using up-to-date data and sources, as well as an analysis of the principles, methodological approaches and practices of using digital financial assets in international settlements. **The scientific novelty** of the work is that it presents the mechanism of Russia's use of digital financial assets for international settlements and highlights its key risks. **The results of the study.** The article examines the essence of digital financial assets, reveals the features and mechanisms of their application in international settlements, presents the approaches of various countries to regulate them, and examines the possibilities and risks of their introduction in Russia. **Practical significance.** The results and conclusions of the article can be useful both for the scientific community and for participants in foreign economic activity and other organizations working with digital financial assets, as well as for the Bank of Russia.

Keywords: digital financial assets; international settlements; digitalization; blockchain; token; digital financial asset issuance operator

***For citation*: Ryabukhin S.N., Minchenkov M.A., Kokorev I.A., Meletidi K.L., Lyukshin A.M. Digital financial assets as a tool for international payments. *The World of the New Economy*. 2024;18(2):59-68. DOI: 10.26794/2220-6469-2024-18-2-59-68**

INTRODUCTION

In the last decade, both in the world and in Russia, one of the most notable development trends has been digitalisation — the gradual digitisation of data and work processes. It has also affected the financial sector, where new instruments — digital financial assets (DFAs) — are being developed [1, p. 7].

It is estimated that by 2030, trading in digital financial assets linked to securities alone will be between $ 4 trillion and $ 5 trillion.[1] The Russian market of digital financial assets will increase from the current RUB 70 billion to RUB 5–10 trillion by 2027–2028[2]

Digital assets are designed not only to increase the efficiency of the financial market and the economic system as a whole [2, p. 84]: the participants of transactions with them — investors and issuers — receive a less risky and costly, but faster way of conducting transactions. In addition, investors can split into shares those assets, the acquisition of which is too costly and risky. Market participants also have access to less liquid but more profitable financial instruments: for example, surrogates whose securities are not authorised for trading on the stock exchange, cultural and artistic objects, and other financial instruments.

The development of the digital financial assets market is expected to save on transaction costs, overheads, and administrative expenses [3]. In addition, companies will be able to quickly tokenise assets, attract financing for them, and gain access to a new liquidity market. Distributed registry technology in the use of digital financial assets allows to reduce the number of intermediaries, which should reduce costs[3] [4, p. 202]. Banks, on the other hand, are interested in digital financial assets to expand their investment product lines [5, p. 124].

Over the past few years, many sanctions have been imposed on the Russian Federation by unfriendly states, which has complicated the mechanisms of foreign trade settlements. Therefore, the use of digital financial assets in our country is one of the promising directions that will help speed up foreign trade operations and reduce the impact of sanctions. This topic is not sufficiently studied in the world, and most countries do not have such experience. For Russia, however, the emergence of new mechanisms is now more relevant and in demand than ever before.

CHARACTERISATION OF THE STATE OF THE RUSSIAN DIGITAL FINANCIAL ASSETS MARKET

Digital financial assets are digital rights that exist and are traded in an information system by means of a blockchain-based distributed ledger technology. The advantage of this technology is the possibility to automate the process of execution of transactions with digital financial assets through the use of smart contracts,[4] which are actually a programme that allows to automatically track and ensure the execution of all obligations under the transaction [6, p. 62].

Digital financial assets are characterised by the following features: the absence of a centre or subject of issuance, as well as intermediaries; simplicity of the mechanism of issuance and registration of a digital wallet; reduction of transaction costs; the ability to make payments and transactions around the clock; openness for third-party developers to study them [7, p. 144; 8, p. 143].

There are quite a large number of different digital financial assets that can be used for international settlements: crypto assets (cryptocurrencies, tokens, cryptographic securities), digital fiat assets (smart contracts and electronic money), other digital financial assets (assets for P2P lending) [9, p. 974].

Many countries are still in the process of forming their legislation on the regulation of digital financial assets. In Russia, Federal Law No. 259-FL dated 31.07.2020 'On Digital Financial Assets,

[1] URL: https://www.mckinsey.com/industries/financial-services/our-insights/tokenization-a-digital-asset-deja-vu

[2] URL: https://www.vedomosti.ru/investments/articles/2024/03/26/1027931-mosbirzha-ozhidaet-vzrivnogo-rosta-rinka-tsfa

[3] URL: https://www.vedomosti.ru/business/articles/2022/06/08/925659-zachem-biznesu-tsifrovie-finansovie-aktivi

[4] URL: https://www.cbr.ru/find_infrastructure/digital_oper/

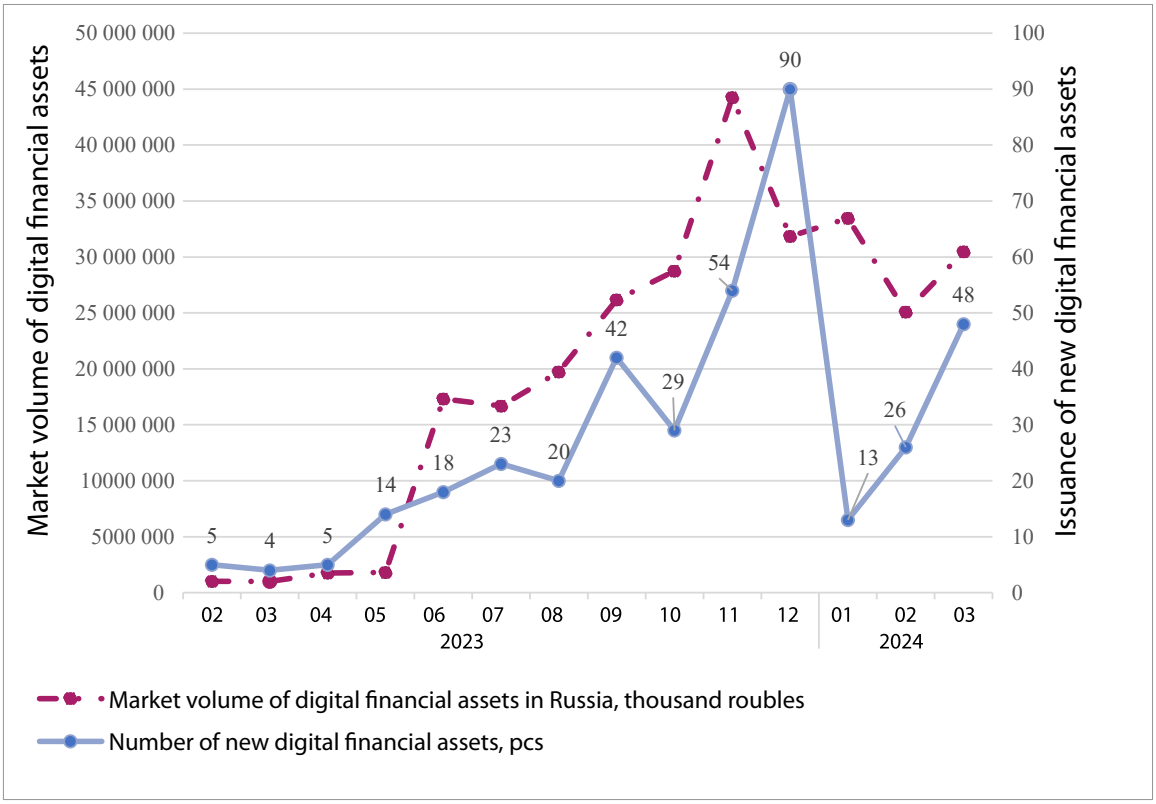

Fig. 1. **Market volume of digital financial assets, RUB thousand and issuance of new digital financial assets, pcs**

Source: compiled by the authors based on URL: https://cbonds.ru/dfa/?ysclid=luhfbh35pv703308035.

Digital Currency and Amendments to Certain Legislative Acts of the Russian Federation'[5] (hereinafter — FL on digital financial assets) was adopted as early as in 2020. According to this regulatory legal act, in our country digital financial assets are understood as 'digital rights, including monetary claims, the possibility of exercising rights on equity securities, the right to participate in the capital of a non-public joint stock company, the right to demand the transfer of equity securities, which are stipulated by the decision to issue digital financial assets in the manner prescribed by this Federal Law, the issue, accounting and circulation of which are possible only by making (changing) entries in the information system on the basis of the distributed register, as well as in other information systems'.[6] It is also possible to issue hybrid digital rights, which combine the properties of digital financial assets and utilitarian digital rights (for example, as provided for in Article 8 of Federal Law No. 259-FL dated 02.08.2019 'On Attracting Investments with the Use of Investment Platforms and on Amendments to Certain Legislative Acts of the Russian Federation').[7]

Russian legislation defines the operator of the information system where digital financial assets are issued (there are 11 such operators in Russia by 2024), whose task is to ensure the functioning of information systems where digital financial assets are issued and recorded; and the operator of digital financial assets exchange (there are 2 such operators in Russia).

By the end of 2023, 10 platforms for issuing digital financial assets were identified in the register of the Central Bank of the Russian Federation: Sberbank, Alfa Bank, Eurofinance Mosnarbank, National Settlement Depository, Spb Exchange,

[5] URL: https://www.consultant.ru/document/cons_doc_LAW_358753/

[6] URL: https://www.consultant.ru/document/cons_doc_LAW_358753/

[7] URL: https://www.consultant.ru/document/cons_doc_LAW_330652/

Atomise, Lighthouse, Distributed Ledger Systems (Masterchain), Tokens (Tokeon) and Blockchain Hub (part of the MTS ecosystem). At the same time, there is only one operator for exchanging and creating a secondary market for digital financial assets — the Moscow Stock Exchange.

The Russian market of digital financial assets is in the stage of active development (*Fig. 1*).

Once the use of digital financial assets in international settlements is authorised, interest in the Russian market will increase — the volume and number of new digital financial assets will increase.

FOREIGN EXPERIENCE IN THE REGULATION OF DIGITAL FINANCIAL ASSETS

In foreign sources there is a more general term — 'digital assets', which means literally everything that exists in digital format, including cryptocurrencies, NFTs, asset-backed tokens, tokenised real estate and so on. When considering the application of digital financial assets in international settlements, special attention should be paid to the problems related to their legal regulation and circulation (*Fig. 2*).

It should be noted that in some jurisdictions the legal regulatory regime implies prohibitions of the most risky (in the opinion of regulators) types of digital assets for all entities.

Thus, there is a situation in the world where the same digital assets in different jurisdictions may have different legal nature and legal regulatory regimes, which creates risks of invalidation of transactions with them in international settlements. In addition, differences in the requirements of states related to the issuance and circulation of digital financial assets may impose additional obligations on individual participants in the relevant legal relations.

A key step to remove legal uncertainty and minimise legal risks in this area will be the development of international standards and norms for the regulation of digital assets as a means of international settlement. At the moment, individual international organisations[8] are developing framework regulations. Point solutions include the conclusion of international treaties and agreements by countries involved in settlements.

[8] URL: https://documents.un.org/doc/undoc/gen/v20/025/50/pdf/v2002550.pdf?token=g1pkDP35WSrWTRgKP8&fe=true; URL: https://www.unidroit.org/work-in-progress/digital-assets-and-private-law/

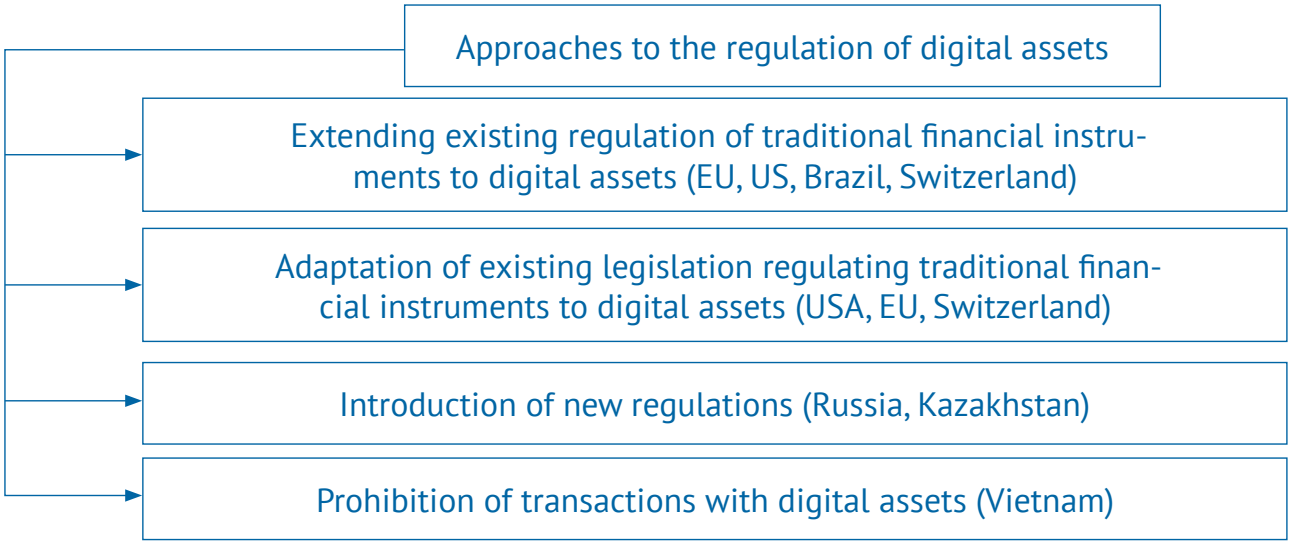

Fig. 2. **Approaches to the regulation of digital assets by different countries**

Source: compiled by the authors based on URL: https://www.nasdaq.com/solutions/marketplace-technology/about-digital-assets

Russian practice of using digital financial assets and international settlements: opportunities, peculiarities, and risks

To understand the level of Russia's preparation for international settlements using digital financial assets, it is necessary to consider the issues of their legal regulation and collision regulation of cross-border transfers.

Digital assets in Russia are singled out as a separate object of regulation with a special legal status (direct regulation model). The Civil Code enshrines the concept of digital rights (Article 141.1 of the Civil Code of the Russian Federation) and stipulates the need for special regulation of rights recognised as digital rights. The Federal Law on Digital Financial Assets in Russia defines certain types of digital rights, specifies their content, and sets out the requirements for their issuance, accounting, and circulation. Thanks to the use of information technologies (e.g., a unique code for digital financial assets), holders have direct access to their digital rights without the involvement of intermediaries. The law includes operators of information systems and digital financial assets exchanges among the main participants in the infrastructure of the digital rights market. The law also effectively regulates the use of smart contracts: 'The terms of a transaction may provide for the fulfilment by its parties of obligations arising therefrom upon the occurrence of certain circumstances without a separately expressed additional volition of its parties aimed at the fulfilment of the obligation. This may be done by means of information technologies specified in the terms of the transaction'.[9]

The Federal Law on Digital Financial Assets contains norms aimed at regulating the participation of foreign persons in legal relations with digital financial assets in Russia, determining the application of Russian law to such legal relations. It also provides for the possibility of performing transactions with digital financial assets issued in foreign information systems through a Russian digital financial assets exchange operator. However, the detailed procedure of such turnover is not regulated by the legislation: there are no rules for admission of foreign digital financial assets to circulation in the Russian market [10, p. 27], the mechanism of interaction between Russian operators of digital financial assets exchange and foreign operators of digital financial assets exchange is not defined.

The issues of information security, qualification of foreign digital rights as digital financial assets (by analogy with the qualification of foreign financial instruments as securities of foreign issuers (Article 51.1 of Federal Law No. 39-FL dated 22.04.1996 'On the Securities Market'[10]); are currently being worked out; requirements to the financial standing and business reputation of the issuer of foreign digital financial assets and their quality (liquidity, availability of collateral), to the disclosure of information on digital financial assets by the responsible person and to ensuring their fulfilment by the issuer are being established.

It should be noted that when addressing issues of conflict of laws regulation of cross-border transfers of digital assets, the application of classical approaches to determining the legal regime is complicated by their unique characteristics (existence in the form of computer code, cross-border nature). The following rules may be considered as conflict of laws options for determining the applicable law for financial transactions in a decentralised technological environment for participants: the application of the law of the place of the account in which the digital financial assets are held or the location of the intermediary holding the account; choice of law by the operator or users of the distributed registry, subject, for example, to the approval of the chosen law by the financial supervisory authority and public disclosure of the information on the chosen law by the financial registry operator or users of the distributed registry.

[9] URL: https://www.consultant.ru/document/cons_doc_LAW_5142/1cd43e51fbd4129343b325971a466ec5cd32a425/

[10] URL: https://www.consultant.ru/document/cons_doc_LAW_10148/

Special attention should be paid to the issue related to the legislative prohibition to accept digital financial assets as a means of payment for transferred goods, 'works, rendered services, as well as in any other way that allows assuming payment by a digital financial asset for goods (works, services)' (part 10 of Article 4 of the Federal Law on Digital Financial Assets).

The first steps to mitigate this restriction have been taken. At the beginning of March 2024, the Federation Council of the Federal Assembly of the Russian Federation approved amendments to the Federal Law on Digital Financial Assets, allowing the use of digital financial assets in international settlements: 'Digital financial assets may be used as counterpart under foreign trade agreements (contracts) concluded between residents and non-residents, which provide for the transfer of goods, performance of work, rendering of services, transfer of information and results of intellectual activity, as well as the use of digital financial assets in international settlements including exclusive rights thereto'.[11]

The creation and recording of digital rights exclusively within Russian systems may be critical for non-residents. The willingness of foreign counterparties to participate in transactions with digital financial assets on Russian platforms will facilitate the introduction of innovations and the development of the digital economy in Russia. A key role for the digital financial assets market in Russia can be played by the availability of market makers and market pricing for digital financial instruments, which increases their liquidity and attractiveness for investors.

The maximum effect of digital assets can be achieved due to their technological advantages, flexible regulatory regime, and the possibility of circulation in the organised market in addition to the already established mechanism. Creating a legal framework for the traditional financial market infrastructure will expand the potential of the digital rights market, including increasing the scale of their circulation, and will contribute to increasing their liquidity and, consequently, their investment attractiveness.

On 11 March 2023, President of the Russian Federation V.V. Putin signed the long-awaited law on the use of digital financial assets in international settlements.[12] It is assumed that now a counterparty from another state will have to register on platforms in Russia, which may cause some difficulties and affect the liquidity of digital financial assets. In addition, the settlement procedure has not yet been fully worked out, and therefore additional costs may arise, for example, related to the involvement of consultants.

In international settlements using digital financial assets, the Russian and foreign parties to the transaction must be registered on the operator's platform. Then, when paying for any goods under a contract, the Russian party needs to transfer digital financial assets from its wallet to the wallet of its foreign partners. Thus, it will be a transfer within one platform, and it will be realised virtually instantly.

Such a transfer does not require a bank account — digital financial assets can be stored in your wallets and freely disposed of. The absence of any intermediaries is also a plus. The foreign recipient can use the digital financial assets for their intended purpose or in subsequent transactions, as well as realise them on the platform. Only digital financial assets issued within the legal framework of the Russian Federation are valid in this scheme.

However, counterparties from other countries that accept as payment Russian digital financial assets that are accounted for exclusively in the Russian jurisdiction run the risk of remaining inside our financial system. This may also affect the liquidity of digital financial assets and limit their widespread use in international settlements.

The market of digital financial assets in Russia today has a rather small liquidity, but the tech-

[11] URL: https://www.consultant.ru/law/hotdocs/84020.html

[12] URL: http://publication.pravo.gov.ru/document/0001202403110010?index=1

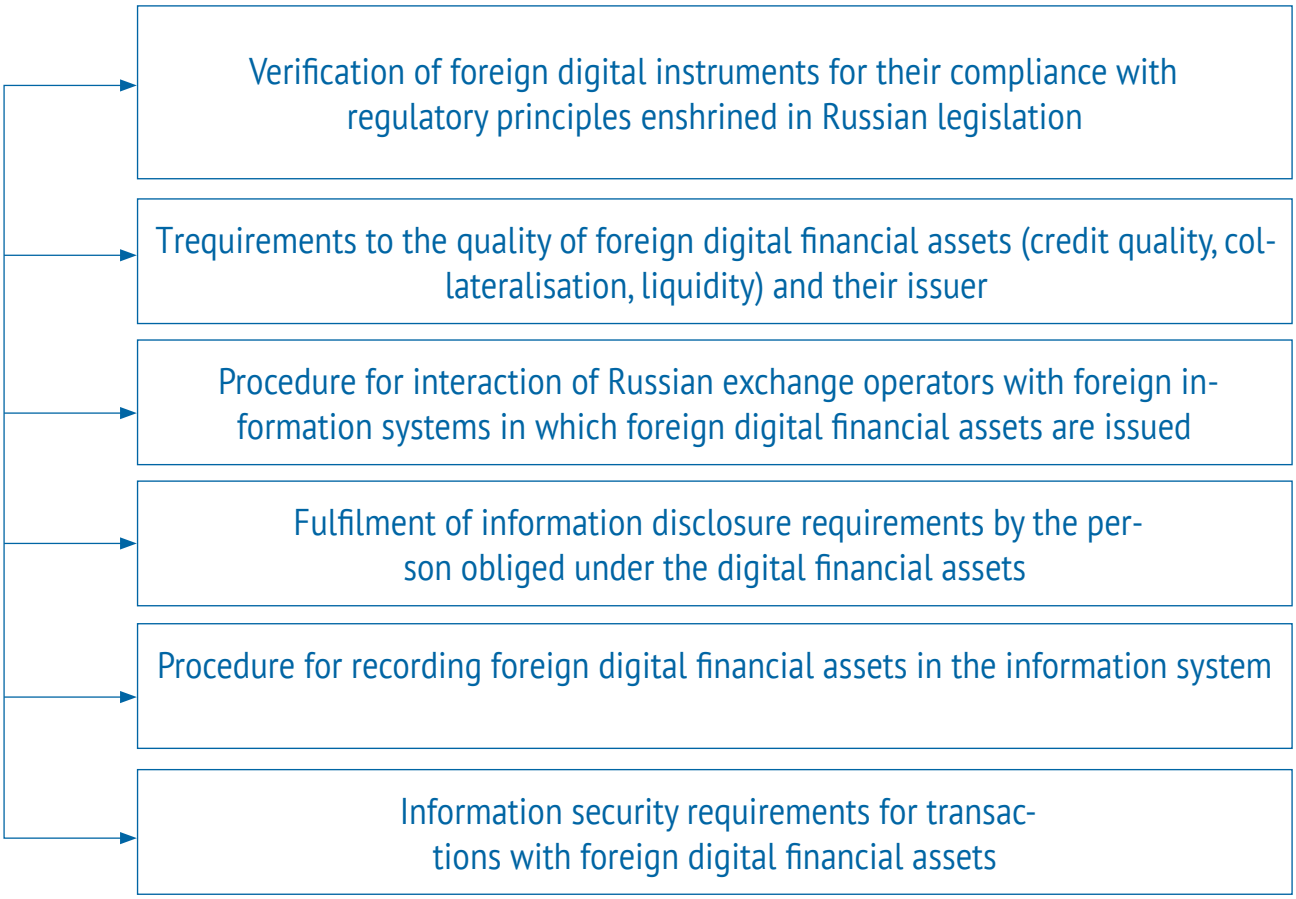

Fig. 3. **Issues for joint study in the field of interaction between the Russian and international digital financial assets markets**

Source: compiled by the authors.

nological possibilities of its circulation in other countries are limited.

Undoubtedly, international settlements using digital financial assets make it possible to bypass the banking system and make them 'invisible' to unfriendly countries, but the above-mentioned legal risks and those related to liquidity should not be discounted. In addition to these, there are industry, country, systemic, market, inflation, credit, regulatory, operational and — one of the most important — information security and IT-related risks in general.

Today, there is a clear need to create a favourable environment for the use of digital assets in international settlements, overcoming obstacles — both technological and those related to differences in national legal regimes and the lack of international standards and norms for their regulation. The above-mentioned problems require a comprehensive approach and active participation of states in creating a flexible and adaptive mechanism for international settlements using digital financial assets.

At the same time, the detailed procedure for introducing foreign digital financial assets into circulation on the Russian market is also not regulated. In order to develop this segment, it is necessary to establish a mechanism of interaction between Russian operators of digital financial assets exchange and foreign ones and admission of foreign digital financial assets to circulation in the Russian market.

Figure 3 shows the issues that the Bank of Russia plans to work out together with the participants of the digital financial assets market.

The implementation of this initiative will allow Russian investors to carry out transactions with foreign digital assets that meet established quality criteria (availability of the issuer, collateral, etc.).

The issue of recognition, liquidity and turnover of digital financial assets is of key importance, because these three parameters are the key to success in building a system of international settlements. Winning confidence in new financial instruments (in particular, digital financial assets) on the part of international counterparties requires government agencies to develop a set of measures to create an appropriate system of cross-border payments.

International agreements should recognise digital financial assets as assets that can be used in international settlements. Principles for their cross-border circulation should also be established for digital financial infrastructures involved in settlements.

CONCLUSIONS

In order for the Russian market of digital financial assets to serve foreign trade operations, it needs to reach a fundamentally new level of development and liquidity; it is necessary to expand the functionality of digital financial assets for foreign trade and qualitatively work out the issues of interaction between Russian operators for issuing digital financial assets with foreign counterparties.

The current Russian market for digital financial assets has good development potential, but the current opportunities for their use for international settlements are limited, which directly affects the market's liquidity.

In many countries, digital financial assets are still poorly regulated, or even banned. For their successful application in international settlements, it is necessary that they be legally authorised not only in Russia, but also in the counterparty's country.

The market for digital financial assets offers new opportunities for both countries and participants, but we should not forget about the risks and potential problems that users may face.

Today, the mass use of digital financial assets in international settlements is complicated by problems related to their regulation and increased volatility. At the same time, their use in international settlements with friendly countries is objectively necessary for Russia and will help to reduce sanctions risks.

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K.L. Meletidi — analyzing the risks of using digital financial assets for international settlements, analyzing foreign experience of using digital financial assets for foreign trade settlements.
A.M. Lyukshin — analyzing the Russian market of digital financial assets, its regulation, opportunities for the Russian Federation to use digital financial assets for international settlements.

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was received on 10.04.2024; revised on 30.04.2024 and accepted for publication on 14.05.2024. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-69-83
UDC 341.655(045)
JEL F51

Sanctions Against the Russian Rocket and Space Industry: Strategic Risks and Countermeasures

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ABSTRACT

The relevance of the research is determined by current situation of the long-term targeted sanctions impact on the technological sectors of the Russian economy and strategic importance of ensuring sustainable development of the national space industry. **The purpose** of the research is to review the external sanctions measures and to examine the possible extent of their influence on the development of the industry, to identify strategic risks and to propose priority goals and tools to achieve them within the framework of managing the task of maintaining the competitiveness of the Russian space sector. **Methods:** the study was carried out on the basis of actual foreign legal framework analysis with the application of abstract-logical methods. **Scientific novelty:** the author proposed comprehensive measures to support the sustainable development of the rocket and space industry under conditions of significant external restrictions. **Research results:** the article systematizes the main current sanctions measures against the domestic space industry and puts forward mechanisms to counteract their negative impact. **Practical significance:** the outcomes can be useful both for the scientific community and for decision-makers, who participate in the processes of strategic planning for the development of the national rocket and space industry.

Keywords: sanctions; rocket and space industry; risks; strategic management; technological sovereignty; sustainable development

For citation: **Makarova D.Yu. Sanctions against the Russian rocket and space industry: strategic risks and countermeasures.** ***The World of New Economy.*** **2024;18(2):69-83. DOI: 10.26794/2220-6469-2024-18-2-69-83**

INTRODUCTION

Starting from 2014, the Russian economy has been subjected to large-scale sanctions pressure from the Western countries led by the US. In the modern world, economic sanctions have become one of the main tools of hybrid wars aimed at undermining the power of the state without direct armed intervention [1, 2]. New economic restrictions against Russia, despite their wide coverage, have a pronounced targeting nature: they are largely aimed at undermining the military power and technological development of the country. At the same time, when implementing the plan to cut off access to advanced technologies in strategic industries, the rocket and space sector is one of the key targets. In February 2022, U.S. President Joe Biden stated bluntly: "We estimate that we will cut off more than half of Russia's high-tech imports, and it will strike a blow to their ability to continue to modernize their military. It will degrade their aerospace industry, including their space program".[1]

Science-intensive high-tech rocket and space industry (RSI) is able to act as a locomotive of innovative development, it promotes the country's involvement in international scientific and technological cooperation, ensures the sovereignty of the information and telecommunication infrastructure environment, plays a fundamentally important role in ensuring national security, creates the prestige of the state in the international arena [3]. In addition, since the end of the Cold War, the products of RSI and related space services have become a serious source of commercial revenue. According to some expert estimates, the global space sector exceeded $ 600 billion in 2023, with a forecast to reach $ 1.8 trillion by 2035.[2]

For Russia, the rocket and space sector is one of the priority areas of development.[3] Historically, the country has been at the forefront of space exploration, and the domestic RSI retains a high potential at the international level. A developed space sector ensures Russia's parity among the leading space powers and geopolitical status, creates conditions for a higher standard of living for the population by providing services based on complex space systems, generates economic profit and serves as the engine of scientific and technological progress. All this makes it necessary to implement competent strategic management of the industry in order to ensure its sustainable development in the context of organised sanctions restrictions imposed by Western countries and their allies.

SANCTIONS AGAINST THE RUSSIAN ROCKET AND SPACE INDUSTRY

The sanctions measures that affect the Russian RSI can be summarised and classified as follows:

1. Restrictions on the supply of military and dual-use goods and technologies.

2. Targeted sectoral sanctions imposed through the export control system aimed at restricting the supply of know-how, components, finished goods and services in the rocket and space sector.

3. Targeted sanctions in the form of inclusion of individuals and organisations of RSI in sanctions blocking lists.

4. Sanctions against other high-tech industries that are related to RSI [towards electronic industry, creation of sensor equipment, software, etc.].

5. Secondary sanctions.

A separate factor of sanctions influence can be called the refusal to participate in joint scientific and technical projects in the field of space exploration and research. For example, in spring 2022, the German Aerospace Center announced the termination of bilateral cooperation with Russian space institutions (including the shutdown of the eROSITA telescope on board the Spektr-RG orbital astrophysical observatory, which was carrying out research in tandem with the Russian ART-XC telescope). In July 2022, it was announced that the European Space Agency (ESA) would withdraw from the joint Russian-European multi-year Mars exploration mission. The planned co-operation

[1] URL: https://spacenews.com/biden-sanctions-will-degrade-russian-space-program/

[2] URL: https://www3.weforum.org/docs/WEF_Space_2024.pdf

[3] URL: http://government.ru/news/48570/

between State Space Corporation "Roscosmos" and NASA on Venus exploration was also cancelled [4].

The leading role in the process of initiating and implementing anti-Russian sanctions belongs to the US, which began to pursue a policy of restrictions against the Russian rocket and space sector even before the military crisis in Ukraine.

UNITED STATES SANCTIONS

US sanctions are comprehensive and are imposed mainly by the U.S. Department of State, the Bureau of Industry and Security (BIS) of the U.S. Department of Commerce and the Office of Foreign Assets Control (OFAC) of the U.S. Department of the Treasury (see *Figure* below).

In the summer of 2013, the US began blocking the supplies of electronic components in the "military" and "space" categories (radiation-resistant components) for the production of rocket and space technology (RST) in Russia [5]. These products fall under the supervision of the International Traffic in Arms Regulations (ITAR), a national regime for controlling the circulation of military and defence technology, administered by the US Department of State.

In 2018, the U.S. Department of Defence established a ban on contracting for its needs with certain foreign commercial satellite service providers if there is a national security risk in doing so.[4] As of 2019, Russia is included in the list of such suppliers along with China, North Korea, Iran, Sudan and Syria.[5] As of 1 January 2023, the prohibition on the purchase of such services also applies if spacecraft or launch vehicles (LV) developed or manufactured in these countries (or by an enterprise with full or partial participation of these states) are used for their implementation. In essence, this measure means the refusal of US military units from 2023 onwards to purchase satellite services provided by satellites launched by Russian LV outside the US, as well as those created with Russian participation.

In March 2021, the U.S. State Department's decision to include Russia on the list of countries subject to the ITAR restrictions of subsection 126.1, "Prohibited Exports, Imports, and Sales to or from Certain Countries", took effect.[6] In fact, this means that the country falls under an embargo on military trade with the US and, in the specific case of Russia, a general "policy of denial" of licences and other permits to export military and dual-use products and services to the country, including RST and related items and equipment listed in the U.S. Munitions List (USML).[7]

The US sanctions imposed immediately after Russia's announcement of a special military operation in Ukraine are multidimensional and wide-ranging.

Firstly, starting from April 2022 many Russian RSI enterprises — among which part of State Space Corporation "Roscosmos" framework JSC "Russian Space Systems", JSC "Academician M.F. Reshetnev Information Satellite Systems", JSC "Lavochkin Assosiation", JSC "Center for Operation of Space Ground Based Infrastructure" ("TSENKI"), JSC "TerraTech", JSC "Makeyev State Rocket Center", JSC "Scientific and Production Corporation "Precision Instrument Engineering Systems", JSC "Salavat Chemical Plant", JSC "Federal Research and Production Centre "Titan-Barrikady", JSC "Arsenal Design Bureau named after M.V. Frunze" — are included in the sanctions list of the Specially Designated Nationals and Blocked Persons List (SDN List) of the US Treasury Department's OFAC.[8] It also contains many other scientific and manufacturing organisations directly or indirectly related

[4] URL: https://www.govinfo.gov/content/pkg/USCODE-2022-title10/pdf/USCODE-2022-title10-subtitleA-partIV-chap135-sec2279.pdf

[5] URL: https://www.federalregister.gov/documents/2019/05/31/2019–11306/defense-federal-acquisition-regulation-supplement-foreign-commercial-satellite-services-and-certain

[6] URL: https://www.federalregister.gov/documents/2021/03/18/2021–05530/international-traffic-in-arms-regulations-addition-of-russia

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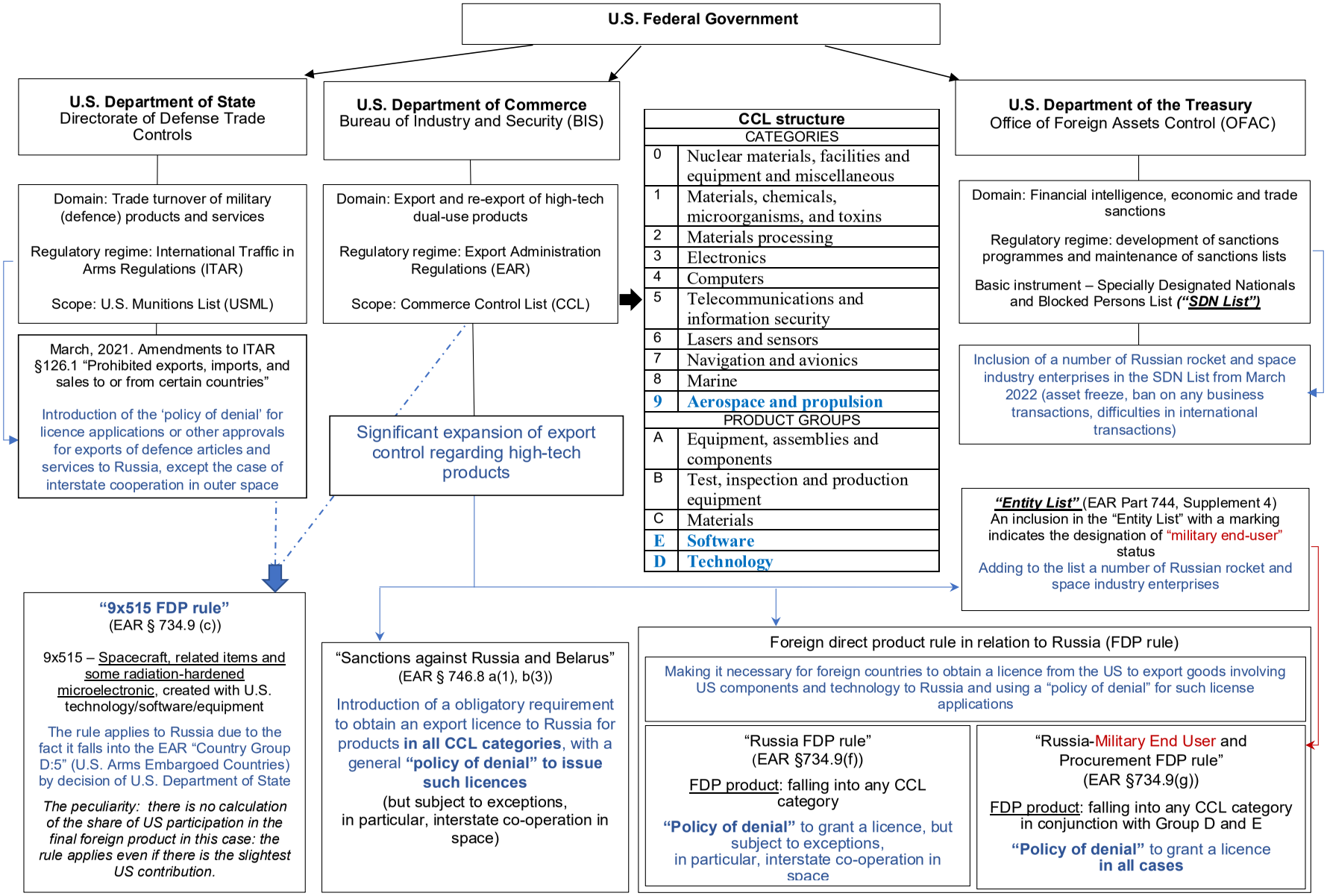

Fig. **Schematic representation of US sanction restrictions on the Russian rocket and space sector**

Source: compiled by the author based on a study of the U.S. regulatory framework.

to the development of RST, including electronics. Economic transactions with these organisations are prohibited for US residents and on US territory. In addition, it potentially implies difficulties in international transactions participation, as the U.S. financial system identifies SDN List participants through automated screening.

Secondly, BIS of the U.S. Department of Commerce has included some aerospace companies and of related industries in the list of foreign entities that are subject to special licensing requirements of the Export Administration Regulations (EAR) — so-called "U.S. Entity List".[9] The list mentions more than 10 Russian entities subject to an a priori "policy of denial" when issuing an export licence, but a licence may be approved if it relates to the US government's support for the use of the International Space Station.

Third, BIS published a number of amendments to the EAR that tighten export controls on Russia in general:

• licensing requirements for exports and re-exports for dealing with Russia for all items on the Commerce Control List (CCL) were introduced, where no licence was previously required. CCL is a list of high-tech goods with dual-use potential, in which category 9 "Aerospace and Propulsion" includes space products (spacecraft, LV, payloads, onboard systems, various components, ground-based space equipment, rocket propulsion systems, software etc.). With a few exceptions (including intergovernmental cooperation in space), the licence, which has become mandatory, is issued using a "policy of denial".[10] According to BIS, the measure is being taken to "significantly limit Russia's ability to obtain items it is not able to produce itself"[11];

• two new Foreign Direct Product Rules (FDP) — Russia FDP rule / Russia-Military End User and Procurement FDP rule — were introduced, requiring foreign suppliers that use U.S. technology, software or equipment in the creation of their finished goods to obtain a licence from the US for their planned shipments to Russia.[12] These rules apply to products pertaining to any item in CCL list.[13] Applications for these licences should be processed by the US using the "policy of denial". In the case of the "Russia-Military End User FDP rule" (i.e., where it is known that the purchaser/intermediary in transfer to the last recipient/end user of the above products is a person with a designated "military end user" status), the "policy of denial" for licences does not provide for an exemption.[14] Belonging to mentioned consumer status under this rule is determined by a special mark on the Entity List, where many Russian defence and aerospace organisations are listed from 2022. FDPs against Russia create significant restrictions on imports of space products from other countries, as it is common to find certain components, parts or technologies of U.S. origin in their manufacture.

The U.S. general foreign export control regulations have a section "9x515 FDP rule" that relates specifically to the space sector.[15] "9x515" is the so-called Export Control Classification Numbers (ECCNs) of EAR that were formerly covered under ITAR (USML, Category XV "Spacecraft and Related Articles"). In the ECCN "9x515" "x" denotes any of the product groups A, B, C, D or E of the CCL list (*Table 1*).

Under the "9x515 FDP rule", a foreign space industry end-item is subject to U.S. export control if it was created using U.S. software or technology

[9] URL: https://www.bis.gov/ear/title-15/subtitle-b/chapter-vii/subchapter-c/part-744/supplement-no-4-part-744-entity-list

[10] URL: https://www.bis.gov/ear/title-15/subtitle-b/chapter-vii/subchapter-c/part-746/ss-7468-sanctions-against-russia-and

[11] URL: https://www.federalregister.gov/documents/2022/03/03/2022–04300/implementation-of-sanctions-against-russia-under-the-export-administration-regulations-ear

[12] URL: https://www.bis.gov/ear/title-15/subtitle-b/chapter-vii/subchapter-c/part-734/ss-7349-foreign-direct-product-fdp-rules

[13] In the case of the "Russia-Military End User FDP rule" all CCL items in conjunction with product groups D (software) and E (technology) are considered

[14] URL: https://www.bis.gov/ear/title-15/subtitle-b/chapter-vii/subchapter-c/part-746/ss-7468-sanctions-against-russia-and

[15] URL: https://www.bis.gov/ear/title-15/subtitle-b/chapter-vii/subchapter-c/part-734/ss-7349-foreign-direct-product-fdp-rules

Table 1

ECCNs of "9x515 FDP rule"

ECCN	Description of the meaning
9A515	Spacecraft and related commodities
9B515	Test, inspection, and production equipment "specially designed" for spacecraft and related commodities
9C515	None (-)
9D515	Software "specially designed" for the development, production, operation, installation, maintenance, repair, overhaul, or refurbishing of spacecraft and related commodities
9E515	Technology required for the development, production, operation, installation, repair, overhaul, or refurbishing of spacecraft and related commodities

Source: compiled by the author based on the analysis of category 9 "Aerospace and Propulsion" of the CCL.

designated in ECCN 9D 515 or 9E 515 and is covered by any ECCN 9x515, coupled with the condition that its export destination be certain groups of countries. Russia is affected by the "9x515 FDP rule" due to its inclusion, as of 2021, in the EAR section "Country Group D:5" (countries, which are subject to US arms embargo).[16] Since ITAR is superior to the EAR regime, ECCN 9x515 positions are also more controlled than other ECCNs in the CCL. Accordingly, a foreign enterprise applying for a U.S. licence to export such space products to Russia will receive a refusal with the utmost degree of probability. It is important that, unlike other FDP rules, which prevalently become active when identified share of U.S. participation in a foreign product in excess of 10 or 25% (so-called "de minimis level" accounting), the "9x515 FDP rule" does not involve such calculations — it applies always, even when the U.S. contribution to the creation of products matching with these ECCNs is negligible.[17]

EUROPEAN UNION SANCTIONS (EU)

The most significant restrictions for the Russian RSI are contained in "Council Regulation (EU) 2022/328 of 25 February 2022 amending Regulation (EU) No 833/2014 concerning restrictive measures in view of Russia's actions destabilising the situation in Ukraine".[18]

Firstly, the EU has imposed targeted restrictions — a ban on the sale, supply, transfer, or export to Russia of goods and technologies suitable for use in the RSI (namely spacecraft and their components), whether or not they originate from the EU. The provision of insurance, reinsurance, maintenance, financing, and material assistance services in relation to space technologies and products is also prohibited. Later, a ban was added on the transit through Russian territory of these technologies exported from the EU to third countries.

Secondly, the EU has imposed a ban on the export to Russia of all dual-use products and technologies and those which "might contribute to Russia's military and technological enhancement, or the development of the defence and security sector". The provision of all kinds of support services and financing in relation to them is prohibited. The list of dual-use items is defined in Annex I of "Regulation (EU) 2021/821 of the European Parliament and of the Council", where category 9 "Aerospace and Propulsion" includes

[16] URL: https://www.bis.gov/ear/title-15/subtitle-b/chapter-vii/subchapter-c/part-740/supplement-no-1-part-740-country-groups

[17] URL: https://www.bis.gov/ear/title-15/subtitle-b/chapter-vii/subchapter-c/part-734/ss-7344-de-minimis-us-content

[18] URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R 0328 (there is currently an updated version of the document).

many diverse items from the space technology sector.[19] An exception is possible in certain cases, in particular if the purpose is intergovernmental cooperation on space programmes, but even in this situation a licence may not be granted or may be subsequently suspended/cancelled at the discretion of the competent authorities.

It is legally prohibited to knowingly or intentionally engage in activities that have the purpose or effect of circumventing the above prohibitions.

The EU also maintains its own list of end-users of military products, which includes among others JSC "Space Rocket Centre "Progress", JSC "Central Research Institute of Machine Building" ("TsNIIMash"), JSC "Russian Space Systems", JSC "Lavochkin Assosiation", JSC "Yaroslav Radio Factory", JSC "Afanasyev Technomac". List provides for a strict targeted ban on transactions in dual-use goods and technologies with the above organisations.[20]

SANCTIONS IMPOSED BY OTHER COUNTRIES

Japan, Canada, the United Kingdom (the UK), Taiwan, Singapore and South Korea joined the anti-Russian sanctions.

The UK and Canada added JSC "TsNIIMash", JSC "Space Rocket Centre "Progress", JSC "Makeyev State Rocket Center" and some other organisations of the Russian RSI to their national sanctions lists.[21] Both countries have banned insurance and reinsurance services for space products and technologies which owned, controlled or operated by Russia.[22]

Any person under the national jurisdiction of Canada is prohibited from exporting/supplying to Russia items noted in the "Special Economic Measures (Russia) Regulations" under the "arms production" list, which includes satellites, sub-orbital and space LV (exception — items for use in connection with International Space Station activities).[23]

In addition to the established ban on imports and exports of military goods, dual-use goods and critical technologies, in March 2022, the UK imposed a targeted ban on exports and transfers to Russia of RST (as well as technology and software for their design, development or use) and on the provision of technical assistance, brokerage and financial services in support of space technologies.[24]

In March 2022, *Japan* imposed sanctions against JSC "Space Rocket Centre "Progress", JSC "Russian Space Systems" and JSC "TsNIIMash", as well as against many enterprises of the Russian radio-electronic industry and restricted the supply of high-tech products related to the production of semiconductors and microchips. In April 2023, the country imposed a targeted ban on the export of spacecraft, their parts, and components to Russia.[25]

Taiwan has imposed export controls on many items of high-tech goods (including aerospace) similar to those of the US and the EU.[26] Supplies of equipment for the production of semiconductor components, microchips and microprocessors are prohibited to Russia. Taiwan Semiconductor Manufacturing Company (TSMC), the world's largest semiconductor manufacturer, announced its intention to fully comply with export control rules in relation to Russia.[27]

Singapore in March 2022 imposed a ban on the transfer to Russia of all items from the "Military

[19] URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R 0821&qid=1697278574468

[20] URL: https://eur-lex.europa.eu/eli/reg/2024/745

[21] URL: https://www.gov.uk/government/publications/the-uk-sanctions-list; https://www.international.gc.ca/world-monde/international_relations-relations_internationales/sanctions/consolidated-consolide.aspx?lang=eng

[22] URL: https://www.legislation.gov.uk/uksi/2019/855/regulation/29A; https://gazette.gc.ca/rp-pr/p2/2022/2022–04–27/html/sor-dors74-eng.html

[23] URL: https://laws.justice.gc.ca/eng/regulations/SOR-2014–58/FullText.html

[24] URL: https://www.gov.uk/government/publications/russia-sanctions-guidance/russia-sanctions-guidance

[25] URL: https://www.meti.go.jp/press/2022/03/20230331001/20230331001.html

[26] URL: https://www.moea.gov.tw/Mns/english/news/News.aspx?kind=6&menu_id=176&news_id=104215

[27] URL: https://sputnikglobe.com/20220227/taiwanese-semiconductor-producer-reportedly-suspends-supplies-to-russia-due-to-sanctions-1093426167.html

Goods List" and all items in the "electronics" category from the "Dual-Use Goods List" as presented in the national legal document "Strategic Goods (Control) Order 2021".[28]

South Korea is actively cooperating with the US under the FDP rule to block Russia's access to global high-tech products such as electronics, semiconductors, and RST. Under the 2022 amendments to the national export control regulation "Public Notice on Trade of Strategic Items", such items must receive special authorisation from the Korean Ministry of Trade, Industry and Energy to be shipped to Russia — each case will be reviewed separately, and export authorisation will be granted on an exceptional basis.[29]

CAN THE SANCTIONS BE EFFECTIVE?

In the short term, the main consequences of the sanctions impact on the domestic rocket and space sector are as follows:

- reduction or termination of scientific and technical co-operation with "traditional" competent space actors (US, European countries, ESA);
- loss of export revenues (in particular, termination of sales of RD-180/RD-181 engines to the US and termination of co-operation with OneWeb to organise a series of launches to deploy a satellite constellation of the same name);
- displacement (loss of position) from the international market of commercial launch services (in particular, the breakdown of relations with ESA and Russia's cessation of launches from the Guiana Space Centre);
- delay in the implementation of domestic satellite constellation deployment programmes due to the stoppage of supplies of Western electronic components (before the sanctions began, many civilian communications satellites were manufactured on the principle "Russian platform — imported payload"[30]);
- exposure of the heavy dependence on foreign Earth remote sensing (ERS) data: operators Maxar (US), Capella Space (US), Airbus D&S (France), SIIS (South Korea), Deimos Imaging (Spain) and a number of others have stopped supplying data, and Russia has entered into an agreement on the supply of ERS information with Chinese companies;
- termination by some foreign partners of maintenance of their software used by the Russian space infrastructure;
- reduction of supplies and maintenance of ground equipment in the sphere of satellite communication services implementation;
- reduction in the share of foreign satellite service operators, increase in revenue of domestic suppliers in this segment.

Since Russia is not widely represented in commercial segments of the global space industry, the main impact of the imposed sanctions is more of a technological nature. The most vulnerable area of the Russian RSI is radiation-resistant microelectronics that remain functional in outer space. Despite the fact the import substitution programme has been underway in the industry since 2014, the dependence of the national RSI on imported supplies of electronics for spacecraft production remains significant [6].

It is worth noting that the so-called extraterritorial secondary sanctions pose a certain threat to the economic dynamics of Russia's space sector. In this case, it implies the imposition of strict measures by the West against companies from other countries not under their jurisdiction which do not adhere to the sanctions policy against Russia. For example, in February 2023, Chinese companies HEAD Aerospace and Spacety were placed on the Entity List for co-operating with Russia in the supply of commercial ERS data contrary to US policy and were labelled as "Russian military end-users" with all the resulting restrictions on international

[28] URL: https://www.mfa.gov.sg/Newsroom/Press-Statements-Transcripts-and-Photos/2022/03/20220305-sanctions

[29] URL: https://www.kimchang.com/en/insights/detail.kc?sch_section=4&idx=24881

[30] URL: https://www.rscc.ru/news/1234/

transactions. Companies from Armenia, Belarus, Uzbekistan, and Canada, among which there are many manufacturers and suppliers of electronic components, have also received similar status for co-operation with Russia. Extraterritorial secondary sanctions can also be imposed in the situation of import of products of the Russian RSI by third countries. For example, JSC Rosoboronexport has the right to conduct foreign trade activities in relation to military products, under which some types of competitive RST products fall. However, the organisation is enrolled in the US SDN List and Entity List, which discourages some foreign customers, as they risk being included in these blocking lists if the US proves or even suspects such cooperation. The reluctance of foreign third-country companies to lose contact with the US and EU markets and to allow increase their commercial risks due to the threat of being subject to secondary sanctions may strengthen the economic isolation of the Russian RSI in the future.

In general, the consequences of the impact of the "sanctions siege" in the long term are difficult to predict. The presumption of its effectiveness is based on the concept that these measures can have a significant negative impact on the global competitiveness of the target state's industries. US authorities state: "Some of the most powerful impacts of our actions will come over time as we squeeze Russia's access to finance and technology for strategic sectors of its economy and degrade its industrial capacity for years to come".[31] Various works devoted to this issue confirm that restrictive measures in the form of technological sanctions have an effect on the technological development of the country [7–12]. In particular, the rupture of established chains of production of high-tech products with foreign participants, withdrawal from joint projects of scientific and technological cooperation, decline in investment attractiveness, capital outflow have a negative impact on the ability of the sub-sanctioned economy to generate innovations. Moreover, according to studies, the accumulation and strengthening of negative consequences of technological sanctions is observed in the next 5 years after their introduction [7]. Under such conditions, the internal anti-crisis policy pursued by the target state comes to the forefront.

In this context, China's long experience of being under sanctions since 1989, aimed at slowing down the country's development and maximising US economic benefits, is noteworthy. Nevertheless, China has made a tremendous leap forward in economic, technological, and military-political terms: having realised the difficulty of importing technological products from Western countries, the country focused on its independent research and development, including the field of space technologies [13]. According to official government data, China's R&D expenditures in the "spacecraft manufacturing" segment soared from $ 22.6 million in 2000 (10 patents) to $ 386.6 million in 2016 (632 patents).[32] At present, China's achievements in space sphere are more than significant — the country has become a full-fledged space power comparable to the US. China's success in overcoming the consequences of technological sanctions was ensured due to the implementation of a systematic economic, scientific, and technological policy [14].

Thus, the sanctions imposed by Western countries can have a short- and medium-term negative impact on the Russian rocket and space sector, but in the long term the outcome of the situation will largely depend on the state's strategic course of managing its development in the new emerging conditions.

COUNTERACTING STRATEGIC RISKS

The scale, segmental "point" targeting approach together with the long-term and escalating feature of foreign sanctions imposed on the Russian economy from the beginning of 2022 are a

[31] URL: https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/02/24/remarks-by-president-biden-on-russias-unprovoked-and-unjustified-attack-on-ukraine/

[32] URL: https://chinapower.csis.org/china-space-launch/#:~:text=In%20pursuit%20of%20this%20goal%2C, to%20632%20applications%20in%202016

Table 2

Main types of strategic risks for the Russian rocket and space sector in the context of sanctions and countermeasures

Type of risk	Counter measures
Risk of industry stagnation due to the general crisis and possible structural deformation of the economy	• Competent state policy • (understanding of the strategic importance of the RSI, provision of necessary support measures)
Risk of delay in the industry's development due to isolation from supplies of high-tech space products	• Search for alternative suppliers (in particular, strengthening co-operation with China); • parallel import; • import substitution policy: localisation of production, concentration on development of own solutions, technologies, and competences
Risk of loss of export revenues due to termination of actual and potential commercial space projects	• Search for new partners in the international space market; • introduction into the RSI practice of turning the created useful item/service into a product and bringing it to the end consumer; • development of the domestic market (in particular, by facilitating the integration of services based on spacecraft systems into the everyday life of the population), creation of conditions close to market self-reproduction in the RSI; • developing competences in promising commercial space activities (e.g., providing enhanced space situational awareness services); • performing marketing analyses of the global market and conducting campaigns to promote national competences abroad; • improving mechanisms for increasing and maintaining the competitiveness of the RSI, its products, and services
Risk of organising cooperation with new space partners	• Comprehensive assessment of a potential partner: the level of development of its space technologies, political will and financial readiness to invest resources in the development of space programmes, consideration of the history of political and economic relations with Russia; • taking into account the extent of the partner's political ties with Western countries and economic exposure to secondary sanctions; • assessing and controlling own role and position in the planned co-operation project
The risk of a complex technological lag of the rocket and space industry due to external restrictive measures and a certain degree of isolation.	• The general course of state policy towards the fourth industrial revolution, development and implementation of technologies of the sixth technological mode, striving to put in practise the concept of digital transformation in the RSI; • implementation of government measures to support innovation and stimulate innovative development in the RSI; • development of related industries (in particular, radio-electronics) and cross-cutting technologies, introduction of technological road maps and development of effective mechanisms to control their implementation; • organising scientific and technical interstate space projects with new partners; • utilising the potential of private business in the development of the domestic RSI; • prioritising long-term strategic goals over short- and medium-term benefits (e.g., creating in-house developments and technologies as opposed to profitable technological purchases from new suppliers); • searching for ways to reform the institutional structure of the RSI (in particular, developing mechanisms and encouraging the development of public-private partnerships); • managing the risk of integration into international value chains of space products and services creation; • monitoring global technological trends, strategies for the development of space industries and emerging product, technological or organisational innovations; • search for mechanisms to attract extra-budgetary sources of investment in R&D, innovation and support for RSI-projects with a long time horizon for the development, testing and commissioning of new domestic knowledge-intensive products

Table 2 (continued)

Type of risk	Counter measures
Risk of non-achievement/ inadequacy of the embedded strategy	• Revision of the current planned strategy for the long-term development of the national space sector, taking into account current geopolitical and economic conditions and the need for the RSI to comply with modern technological trends and patterns in order to maintain its competitiveness and ensure national security, sovereignty and status in the international arena; • Introduction of medium-term threshold "reconciliation points" on the way to the long-term goal to monitor both the efficiency of the implementation of planned tasks and the changing conditions of the external and internal environment in order to flexibly make the necessary adjustments and overall assessment of the relevance of the initially set development trajectory

Source: compiled by the author.

source of strategic risks for the Russian RSI [15]. Such risks in relation to the rocket and space sector in the current conditions are presented in *Table 2*.

As part of the anti-crisis course of counteracting strategic risks, at the first stages the focus of the RSI development should be the policy of import substitution and achievement of technological sovereignty [16]. This is consistent with the national document "Concept of Technological Development for the period until 2030" approved in May 2023, which has the primary goal of ensuring national control over the reproduction of critical and cross-cutting technologies, including microelectronics and advanced space systems and services.[33] First of all, the Russian RSI needs to overcome its critical dependence on imported microelectronics, as well as to solve the problem of insufficient provision of domestic needs in applied space services: satellite communications and ERS services. A strategic priority in the near future should be the qualitative and quantitative growth of the domestic satellite constellation aimed at meeting the country's socio-economic needs and improving the quality of life of the population — this is a national security issue.

Government support plays a key role in regulating the situation in the RSI under sanctions restrictions. In addition to direct budget financing, one of the current measures of assistance is a programme approved by the government to identify priority areas for technological sovereignty projects (includes the development of spacecraft and new rocket systems) and for structural adaptation of the Russian economy (includes space transport services).[34] The above-mentioned projects will be able to receive a reduced rate of loan approval from the banking sector and more active support from development institutions.

A strategy of complete self-sufficiency in the RSI will contribute to its sustainability, but it is important to avoid a model of complete autarky, which could lead to self-isolation in the long term and carry the risk of technological conservation. In order to avoid this situation, Russia needs to establish co-operation in space exploration with new partners, in the light of breakdown of its long-standing scientific and technological co-operation with the West. In March 2022, the Russian government approved a list of countries and territories unfriendly to Russia.[35] Organising scientific and technological alliances in the rocket and space sector with the above-mentioned states is associated with a high strategic risk, at least because it implies potential instability of ties. The most promising option is the implementation of such projects with the BRICS countries, which would also be an element of strategic partnership. Under current conditions, the importance of the long-

[33] URL: http://government.ru/docs/all/147621/

[34] URL: http://government.ru/docs/48272/

[35] URL: http://government.ru/docs/44745/

standing Russian-Belarusian cooperation in the space sector under the programmes of the Union State of Russia and Belarus is also increasing.

As the RSI reaches the required level of self-sufficiency, it is advisable to develop a plan-strategy for further development of the space sector, taking into account current conditions and global trends, and using the standpoint of a systemic approach as well: coherence, integrity, acceptability and continuity [17, 18].

In general, the concept of development of the domestic RSI needs to be similar to the business model in order to meet global realities. The government should create conditions for effective (networking) interaction between participants of cooperation in the space sector, including representatives of the private sector, as this is an important factor in the formation of a more innovative and dynamically developing industry environment. Attention should be paid to updating the legal framework in order to ensure comfortable regulatory conditions for the development of private companies and more elaborated legislative coverage of commercial activities in the space sector.

The functioning model of the national space sector should provide for active export development. In this respect, Russia's space competences have obvious potential: domestic space products include, among others, LV for launching satellites into various types of Earth orbits, proven manned spacecraft, universal upper stages, various types of satellite platforms, and advanced rocket engines. However, it is necessary to develop attractive diversified commercial offers and raise awareness of them among potential foreign partners (in particular, countries with emerging space sector). For example, African States are very interested in the creation of turn-key ERS complexes with launch of orbital segments by reliable LV and training of personnel, which would allow them to solve various local economic tasks.[36] Under current conditions, it is worth considering the possibility of shifting the geography of space commercial activities to the markets of the SCO (The Shanghai Cooperation Organization) and ASEAN (Association of South East Asian Nations) countries, African and Latin American countries, the Middle East, and South-West Asia [19]. At the same time, it is necessary to implement an anticipatory policy of offers, as these regions are attractive potential markets for other participants of space activities. The search for new commercial partners and entrance into foreign markets is necessary to realise in order to maintain funding of the domestic space sector, strengthen geopolitical strategic ties, and provision incentives for continuous modernisation of space technologies and services to meet market needs in an increasingly competitive environment.

When entering new markets, Russian RSI enterprises will have to reckon with the growing number of foreign private space companies that reduce the cost of products and services through mobility and innovation. The problem of competitiveness of the Russian rocket and space sector is a subject of study for many researchers and requires a comprehensive system approach, since the Russian RSI is characterised by a significant degree of inertia, primarily non-market nature of functioning under the conditions of predominant government ordering [20]. However, the global space industry is approaching the "Space 4.0" paradigm, which is closely intertwined with the fourth industrial revolution and digital transformation. This implies the transition to fundamentally new technologies in the design, production, and testing of RST, as well as in the organisation of interaction between participants in this activity (use of augmented and virtual reality, digital twins, robots, additive manufacturing, quantum technologies, the Internet of Things, the concept of blockchain, cloud computing, artificial intelligence, etc.). [21]. The introduction of such technologies into the industry and their convergence carry the potential for disruptive innovations that can significantly improve the quality and shorten the timeframe

[36] URL: https://www.roscosmos.ru/39545/; https://globalaffairs.ru/articles/kosmicheskie-razvilki/

for RST development, reduce operating costs, which simplifies its production and makes this process and the final product itself more marketable. Digital transformation may become the new leading strategic direction of reforming the Russian RSI, which, if properly elaborated, will make it possible to resolve to a large extent its long-term systemic organisational, structural and conceptual problems, and lead it out of the situation of growing technological backwardness, highlighted by the sanctions impact. The implementation of this task requires a comprehensive multi-level policy of the state to enhance innovation development and create favourable conditions for the formation of competitive advantages of high-tech industries.

An important element in the development and subsequent implementation of the RSI development strategy could be the introduction of a mandatory procedure for identifying, accounting for, and assessing the impact of potential economic and political risks of medium and high threat level, as well as a mechanism for their management.

The proposed measures will serve to maintain long-term sustainability of the Russian RSI in the conditions of external constraints, as well as to form a vector of its development aimed at ensuring technological and economic global competitiveness.

CONCLUSIONS

The large-scale sanctions imposed by Western countries are a source of strategic risks for the domestic RSI and the space sector as a whole and can have a negative impact on its sustainable development.

Maintaining strategic autonomy in space for Russia will largely depend on its ability to create domestic electronic components for the RSI or to import them steadily from alternative sources. However, reliance on parallel imports and Chinese components should not be excessive in order to avoid maintaining and increasing the technological dependence of the Russian RSI. Also, a factor in ensuring national security is the build-up of its own orbital constellation of satellites.

In order to prevent undermining the global competitiveness of the domestic RSI in the context of long-term sanctions, it is necessary to strategically manage the development of the space sector by introducing mechanisms of comprehensive support, permanent forecasting and risk assessment, as well as to increase incentives for its innovative development.

Strategic management implies the possibility of transforming the industry's sanctions restrictions into an impetus for the growth of its technological sovereignty, and can lead to a shift in the focus of co-operation from competent but unreliable Western countries to new friendly partners with significant interest and potential market demand for space technologies and services.

If a well-developed, flexible but consistent anti-crisis policy is implemented, the national space industry can emerge from the current detrimental situation renewed, self-sufficient and more sustainable, capable of solving complex tasks of a new level.

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ACKNOWLEDGEMENTS

The paper was prepared on the research results carried out at the expense of budgetary funds within the framework of the government research assignment to the Financial University.

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.

The article was received on 30.04.2024; revised on 19.05.2024; and accepted for publication on 10.06.2024. The author read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-84-98
UDC 338.012(045)
JEL L52

Formation of a Model of Sustainable Development of the Pipe Industry

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ABSTRACT

Relevance: the article analyzes an alternative view of the model of sustainable development of the pipe industry. A comparative description of the classical and author's models is given. The following **methods** were used in the work: analysis of reliable sources, up-to-date data, as well as calculations of an integrated model of sustainable development using the example of the Chelyabinsk Pipe Rolling Plant. The **scientific novelty** of the research consists in the fact that the author's model of sustainable development of the pipe industry is proposed, justified, and substantiated on the basis of the interaction of the main areas of sustainability (on the example of the Russian Federation and the European Union). **The results and conclusions** of the article can be useful for the scientific community and pipe industry enterprises in the development of strategic economic development programs.

Keywords: pipe industry; pipe products; sustainable development; economic growth; integrated model

For citation: **Kutieva A.N., Glotko A.V. Formation of a model of sustainable development of the pipe industry. *The World of New Economy*. 2024;18(2):84-98. DOI: 10.26794/2220-6469-2024-18-2-84-98**

INTRODUCTION

Foundations of the classical model and an alternative model of development sustainability The main decisions concerning the concept of sustainable development were adopted in 1992 at the Second International Conference of the United Nations in Rio de Janeiro. This concept implies equally economic growth, social development, as well as satisfaction of people's needs and implementation of environmental programmes to preserve the environment and resources [1].

Presidential Decree No. 236 of 04.02.1994 "On the State Strategy of the Russian Federation for Environmental Protection and Sustainable Development" approved the Basic Provisions of the State Strategy of the Russian Federation for Environmental Protection and Sustainable Development.[1]

The essence of this principle for each country and individual regions is to build an economy that meets the needs and legitimate desires of people, but at the same time does not exceed the ecological limits of the planet.

"In order to create a sustainable economy, to increase its adaptive capacity to changing conditions, certain factors are important. The concept of sustainable development is based on three main principles [2]:

— Ensuring a balance between the economy and ecology, i.e., achieving a degree of development where people in production or other economic activities will stop destroying the environment;

- ensuring a balance between the economic and social spheres taken in the human dimension, which means maximising the use of resources in the interests of the population;

- solving the tasks related to development, not only in the interests of the present, but also of future generations" [3].

Thus, the concept is a harmonious combination of social, economic, and environmental spheres, the intersection of which gives sustainable development [4] (*Figure 1*).

We propose to modify this model by including a fourth sphere — world order (or world stability), which leads to either stable development or chaos, affecting the country's economy,

[1] URL: http://www.kremlin.ru/acts/bank/5422

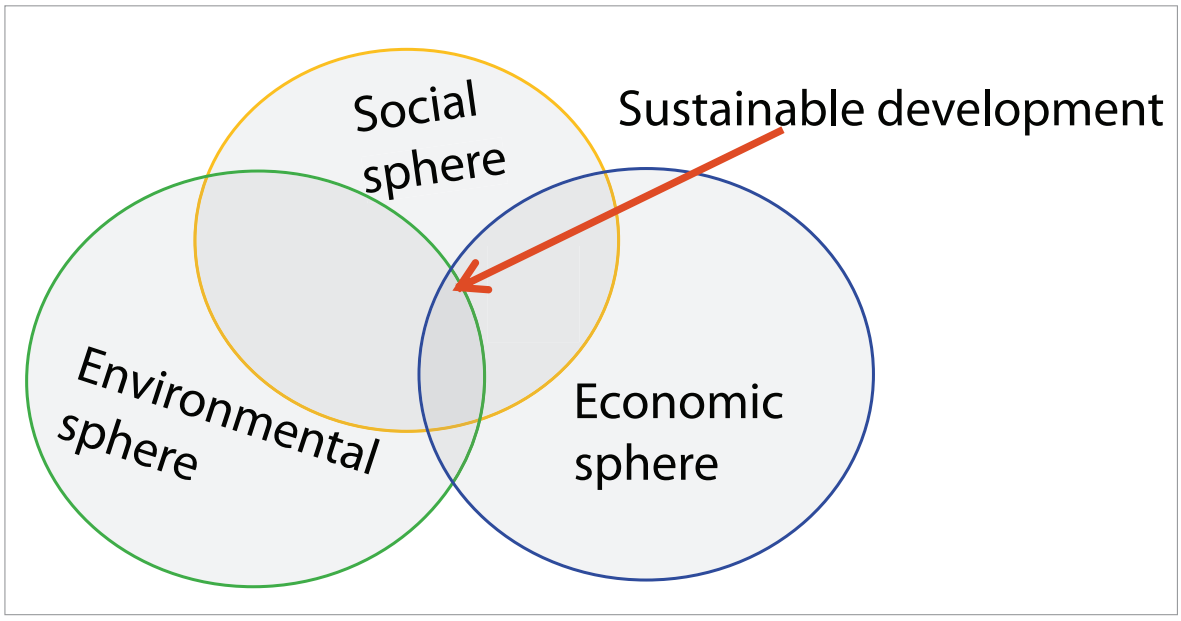

Fig. 1. **Model of the concept of sustainable development**

Source: compiled by the authors.

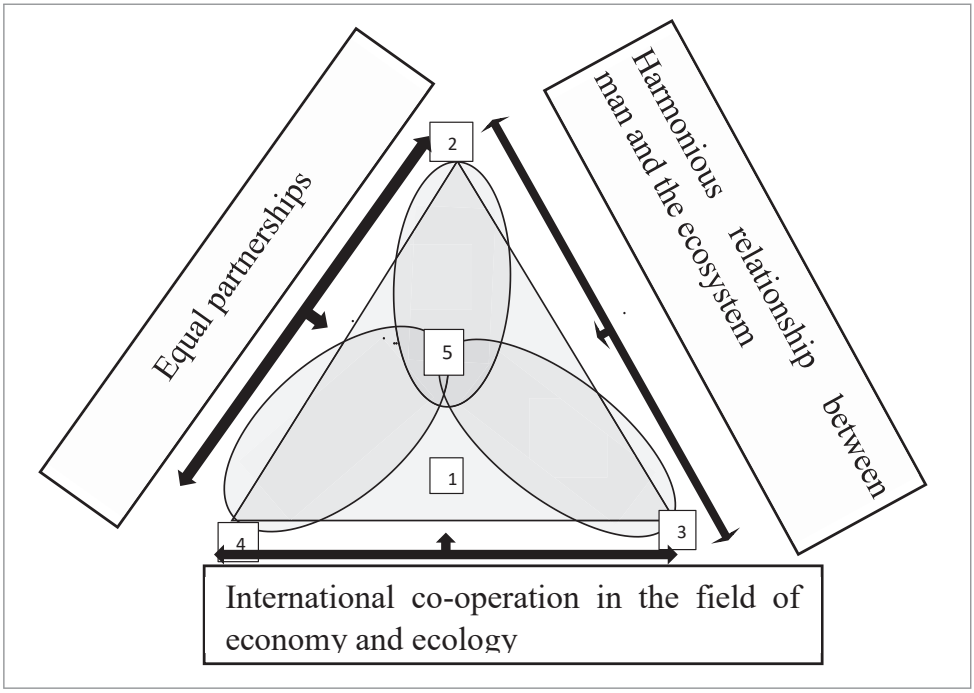

Fig. 2. **Author's new model of sustainable development**

Source: compiled by the authors.

Note: 1. Economic sphere. 2. Social sphere. 3. Environmental sphere. 4. World order; stability. 5. Sustainable development.

social development of society and the environment.

Figure 2 shows the author's model of sustainable development.

So, this model provides an opportunity to take a broader look at the underlying principles of sustainable development. The classical model included economic, social and environmental spheres. At the same time, the economic sphere was equated with the others and was considered as the optimal activity of creating raw materials, labour, financial, mental resources in order to optimize and effectively use them in technological processes for environmental safety and preservation of the ecosystem.

In the author's model, the economic sphere acts as a foundation — only with a stable and dynamic economy, the formation of social and environmental directions is possible. Equal angles of the triangle also indicate equal development of the economy in terms of economic (tax, banking) indicators of industry (metallurgy, machine-building, light industry, food industry, etc.).

The social sphere implies the creation of conditions for human life, health, work and leisure (pensions, benefits, housing programmes, support for large families, etc.).

Deterioration of the environmental situation is fraught with serious consequences for the country's economy as a whole. In a balanced development of all spheres, the environmental sphere is the most vulnerable, so it is important to preserve and increase natural resources.

Thus, the concept of sustainable development is closely linked to balanced economic growth and can help solve problems concerning the preservation of ecosystems and resources exploited to meet human needs.

As for the world order added by the authors to the sustainable development model, this is done because today all countries are linked by trade and financial relationships, and an imbalance in one affects the others, globally transforming the world's foundations.

Let us consider the interaction of the three spheres presented in *Fig. 2*:

1. World Order — Economic Sphere — Social Sphere. This combination implies equal partnership relations between countries in sociocultural, political, economic, energy and financial aspects with observance of all norms, laws and requirements stipulated in international documents, decrees, resolutions, treaties, etc., without violating or infringing upon the legal rights of the parties and moral and ethical feelings of a person.

2. Social sphere — economic sphere — ecological sphere. This combination was presented in the classical model of sustainable development. It is applicable both to a single country and to the whole world, and is designed to ensure the harmonious coexistence of the ecosystem and human beings, as well as the economic development of the region. As already mentioned: the richer the resources, the more dynamic the economy and the higher the well-being of the population.

3. Ecological sphere — economic sphere — world order. It is understood as global cooperation in the field of ecology (joint programmes and projects on environmental protection, environmental safety, environmental doctrines). For this purpose, various funds are created, membership fees are paid, i.e., each country contributes its share of financial payments. The economic sphere plays an important role here.

All these combinations can be implemented both together and separately. A change in one sphere affects the others.

Let us show how the sustainable development of the Russian Federation and the EU may look like (*Fig. 3, 4*).

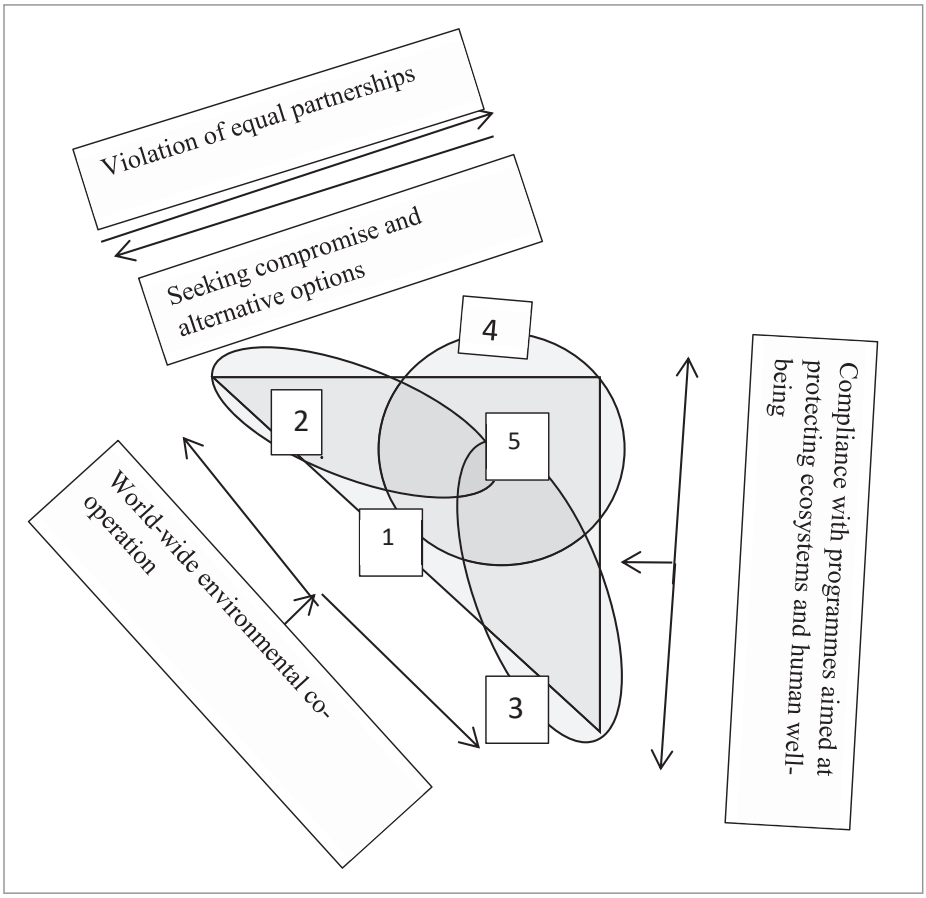

Fig. 3. **Author's model of sustainable development of the Russian Federation**

Source: compiled by the authors.

Note: 1. Economic sphere. 2. Social sphere. 3. Environmental sphere. 4. World order; stability. 5. Sustainable development.

Judging from *Fig. 3*, it can be noted that the imbalance is observed in relation to the world order, where external processes affect all spheres. The view of the model has changed, and the sharp corners indicate the acuteness of the problems of world stability and ecology (preservation or suspension of projects until the situation improves).

Overall sustainable development requires stability in the economic sphere as a foundation on which the social sphere holds. Let us consider this on a particular example. For example, the GDP of the Russian Federation for 2022 was $ 2,240 billion with an annual growth rate of 4.9% (as of August 2023). The public debt for 2022 is 17.2%. At the same time, a number of draft bills were passed to support industry and private entrepreneurs, where the industrial production index for 2023 was planned at 5.4%. At the same time, many programmes were envisaged to support the poor, large families, and young families, as well as employment and the development of private enterprise. As a result, according to state statistics, the unemployment rate in 2023 was only 3 per cent, but it would take considerable time to settle the world order sphere, as inflation at that time was 6 per cent.[2]

As for the environmental sphere, financing under the state programme "Environmental Protection" reached RUR 115.6 billion in 2021, RUR 125.9 billion in 2022, RUR 147.651 billion in 2023, and is expected (according to the plan) to reach RUR 112.364 billion in 2024. Within the framework of the national project "Ecology", in 2022 the financing volumes amounted to

[2] URL: https://take-profit.org/statistics/countries/russia /; https://www.gks.ru

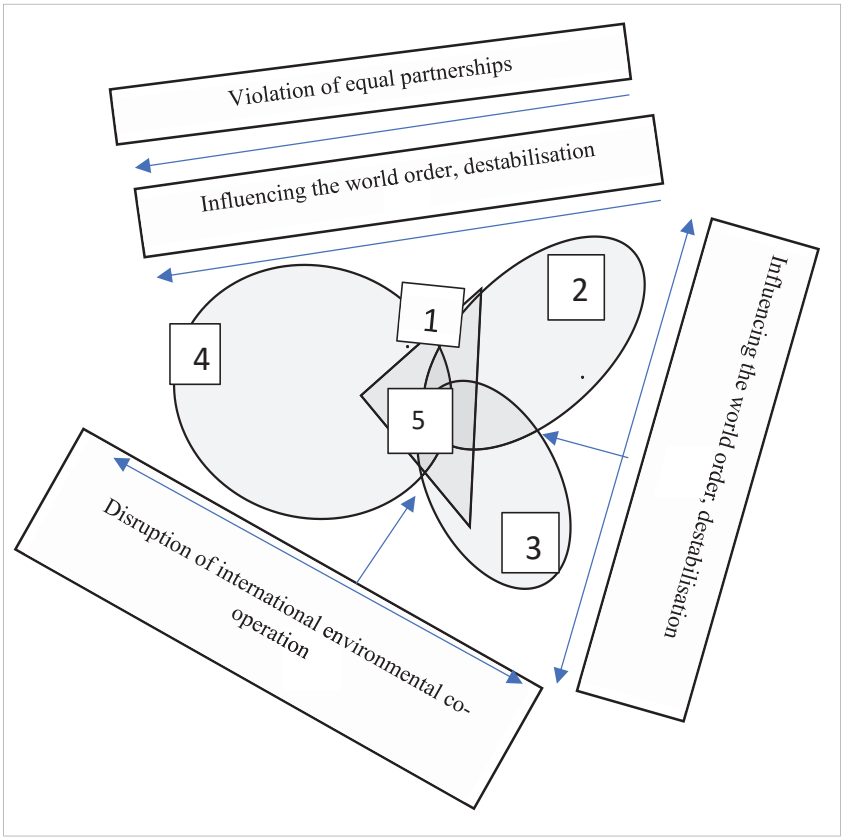

Fig. 4. **The author's model of sustainable development of the EU**

Source: compiled by the authors.

Note: 1. Economic sphere. 2. Social sphere. 3. Environmental sphere. 4. World order; stability. 5. Sustainable development.

RUR 115,561.3 million, in 2023 — RUR 125,225.3 million, and in 2024 the amount of RUR 99,544.7 million is planned (as planned).[3]

It is important to note that the combination "world order — economic sphere — social sphere" has been transformed: polarity has manifested itself, with one side — the EU — trying to disrupt equal partnership (by sanctions, restrictions of various kinds), which prevents equal relations in economic, political, financial, socio-cultural, sports and other aspects (*Fig. 4*).

This model of sustainable development of European countries is not balanced (sharp corners, "protrusion" of certain areas).

For example, in the social sphere there is a violation of the legal rights of the population: to work and receive a decent wage, to live in normal conditions, etc.

The environmental sphere has been left without financial support, and projects in it have been suspended.

But the most noticeable imbalance is observed in the foundation, i.e., in the economic sphere. Thus, the level of GDP in 2022 is down, compared to 2021: $ 16,641 billion and $ 17,177 billion respectively, and the annual growth rate in 2023 was only 0.4%. And the further this imbalance persists, the thinner is the foundation: in 2022, the public debt-to-GDP ratio was 85%, and the inflation rate rose by 5.9–6.5% in 2023. With a weak economic sphere, financial flows are actively channelled to maintain the world order, but instead of stabilisation, an imbalance on a global scale is created. In this case, the sphere of the world order resembles a huge balloon that can swallow all the others, destroying the economy. In 2023, the unemployment rate in the European Union was 5.9 per cent, with 14 per cent among young people; the industrial production rate was 2.4 per cent. In addition, there has been a strong reduction in funding for the Environmental Innovation Fund (from € 10 billion to € 1.5 billion), etc.[4]

[3] URL: https://take-profit.org/statistics/countries/russia /

[4] URL: https://take-profit.org/statistics/countries/european-union/

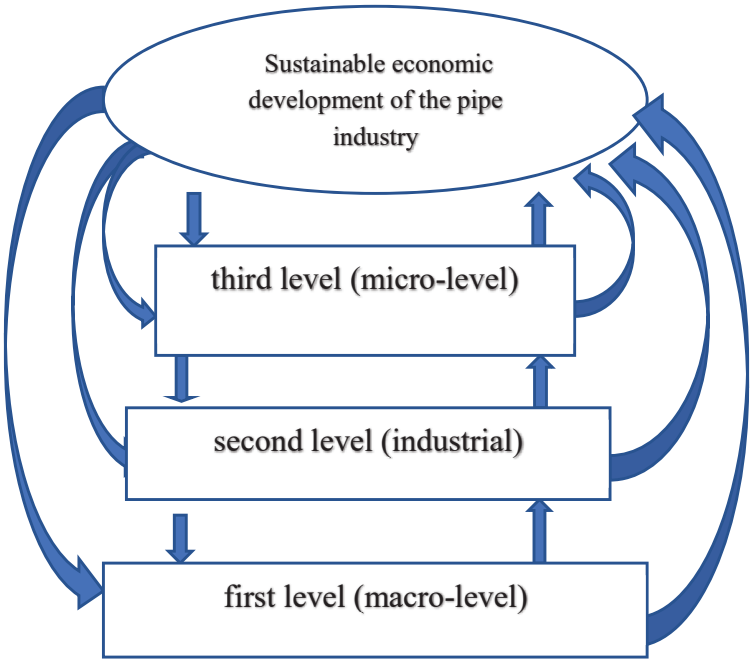

Fig. 5. **Levels of sustainability of the pipe industry development**

Source: compiled by the authors.

The combination "world order — economic sphere — social sphere" is transformed not towards mutual exchange and partnership relations, but towards destabilisation. This happens due to the violation of all international rights in the field of free trade, choice of partner, market prices, etc. and can lead to the collapse of the entire system of world order and the destruction of the economy of individual countries.

So, let us summarise the three models of sustainable development:

- Author's model — an ideal and harmonious combination of all spheres (economic, social, environmental and world order), which provides reliable and stable development of the country and the world as a whole.
- Author's model (RF) — there is an imbalance in relation to the world order. The whole model has changed, but despite this, there is stability in the field of sustainable development, as the foundation is the economic sphere.
- Author's model (EU) — sharply differs from the ideal model, with the appearance of sharp corners and the "bloated" sphere of the world order indicating that the economic sphere is weakening, destroying the economy, while the social sphere is also suffering, and the environmental sphere in general is in a deplorable condition.

First level of sustainability (macro level)		
Economy of the country; state sustainability	International sustainability of the competitive environment of the pipe industry	Sustainability of global pipe industry prices
1. Legislative and regulatory framework (laws, regulations, decrees, etc.). 2. Tax system (tax regulatory frameworks, exemptions, holidays, etc.). 3. Customs regulation (customs tariffs, duties, customs fees, licences, etc.). 4. Trade policy, state regulation of pricing policy. 5. Antitrust policy of restraining unreasonable price growth. 6. Implementation of import substitution programmes. 7. State megaprojects: - programmes for the development of gas supply and gasification of 67 entities (2021-2025); - oil and gas projects in the Arctic; oil and gas production, increase in pipe orders; - construction and housing and utilities; 8. Strategy for the development of the construction industry and housing and communal services of the Russian Federation until 2035	1. Stability of price competition in the global market. 2. Fair non-price competition (quality of goods, novelty of goods and services, etc.). 3. Absence of unfair competition, i.e. collusion of a group of producers to displace competitors. 4. Protection of own commodity producers (restrictions, US "steel tariff", quotas on imports of steel pipes in the EU, customs tariffs, anti-dumping duties of the Russian Federation, etc.)	1. Support programme for the economies of leading countries. Growth rate of the economy. 2. Containment of increase in prices of raw materials (iron ore and metals) and shortage of sheet metal output of Western steel companies. 3. Impact (up or down) on prices, reduction or increase in oil and gas production and reduction or increase in demand for tubular products. 4. Stability of quotations on metal exchanges

Fig. 6. **The first level of sustainability (macro level)**

Source: compiled by the authors.

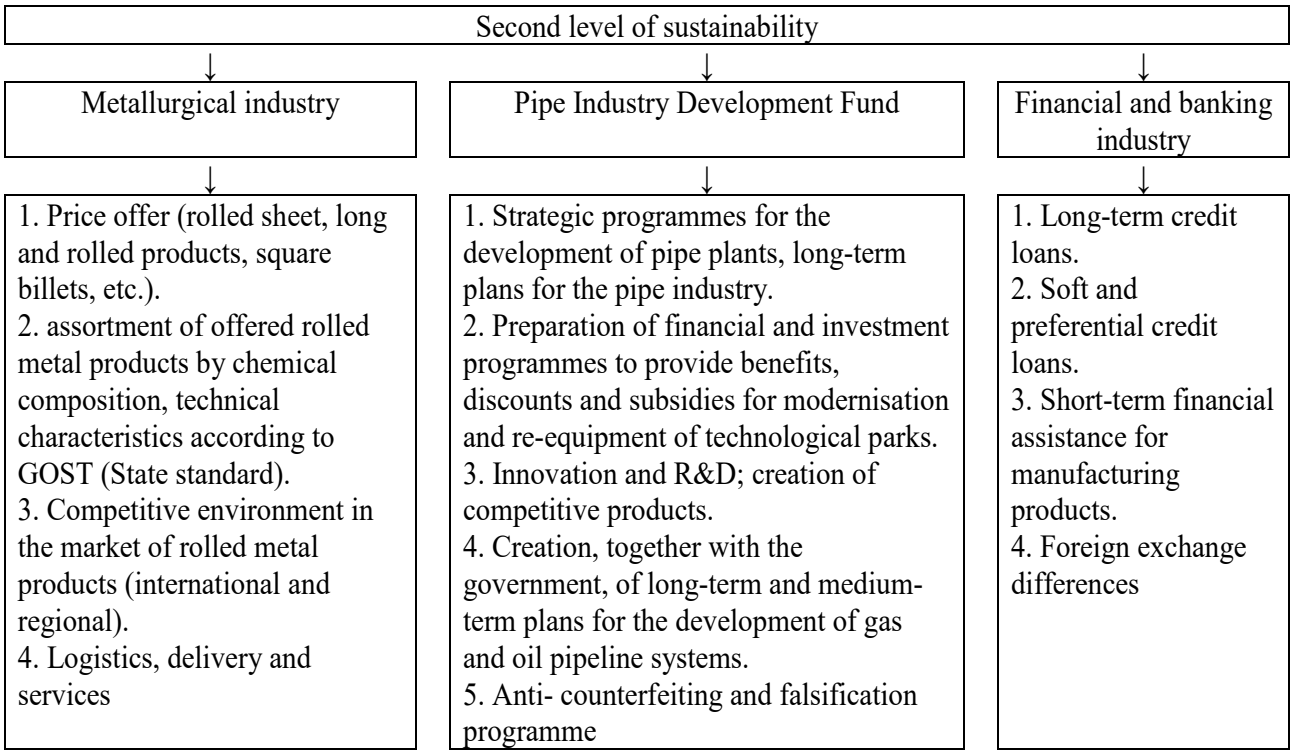

Fig. 7. **The second level of sustainability (industry)**

Source: compiled by the authors.

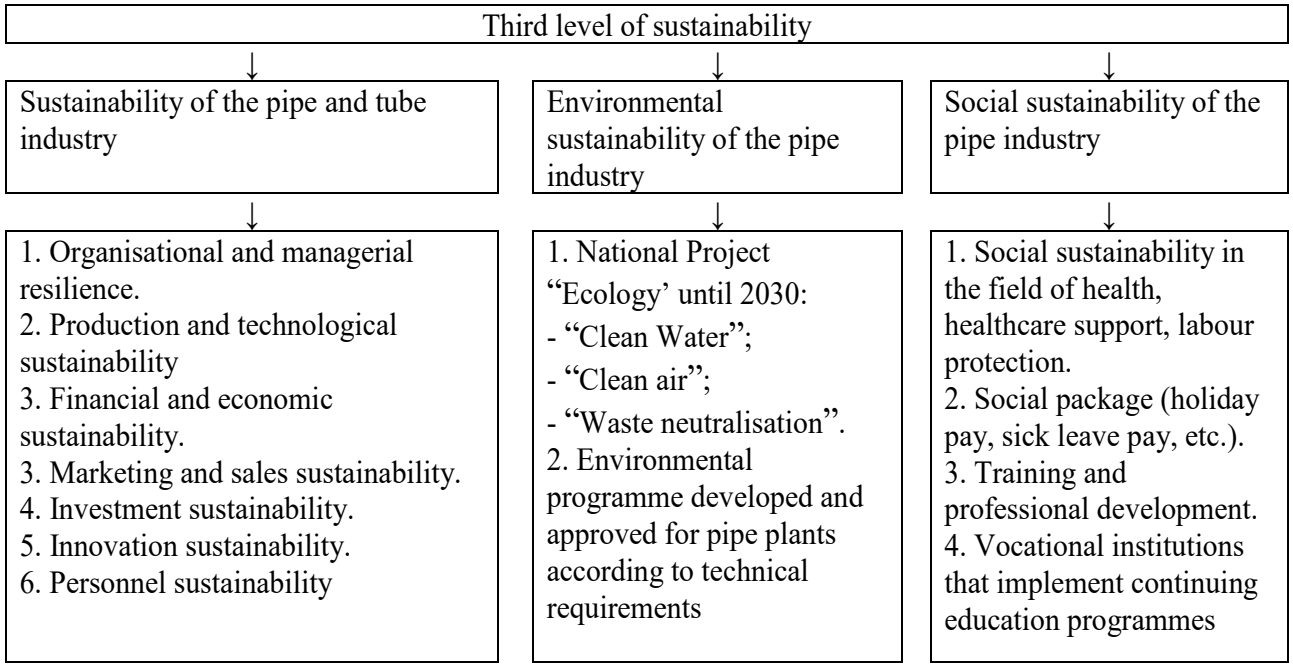

Fig. 8. **The third level of sustainability (microlevel)**

Source: compiled by the authors.

Thus, we can formulate the following definition: **Sustainable development** is the achievement of balance in the economic sphere by establishing harmonious relations in the social and environmental spheres, as well as in the world order to maximise benefits.

SUSTAINABLE DEVELOPMENT OF THE RUSSIAN PIPE INDUSTRY

Sustainable development of the pipe industry can be classified by levels: first (macro-level), second (industry), third (micro-level) [5–8] (*Fig. 5*).

Stability at all levels has a positive effect on the sustainable development of the economy as a whole (*Fig. 6–8*).

Judging from *Figures 6–8*, the ability of the enterprise to respond to changes in various factors contributes to the sustainability of its development and increase in profitability.

The activity of the enterprise is carried out in the conditions of constant struggle for the sales market, assortment renewal, etc. Therefore, it is important for the enterprise to react promptly to all changes, creating new strategic programmes, conducting constant analysis, and monitoring of the whole system.

Thus, sustainable development of the Russian pipe industry implies the interconnection of various processes that directly affect economic growth. Over time, it becomes more and more difficult to maintain sustainable development, which affects the efficiency of the company's operations.

DEFINITION OF AN INTEGRAL MODEL OF SUSTAINABILITY

On the example of Chelyabinsk Tube Rolling Plant, we will consider integral models of sustainability in the main spheres: economic, social, environmental and world order [9].

Economic sustainability

The tables show the calculated indicators of the specific weight of the integral level of financial, production and sales sustainability (*Tables 1–3*).

According to *Table 1*, the total value of the level of financial stability is 7.833. The weight coefficient of financial stability was determined experimentally — 63.83%.

As a result, the total value of the level of production stability is 6.7. Its weight coefficient is 74.62%, which indicates successful utilisation of production opportunities.

The total value of the level of sales stability is 5.89, the weight coefficient is 84.88%, i.e., strategic programmes to improve the sales policy of the enterprise have been developed correctly.

Sustainability of the world order

Next, we need to determine the indicators of the specific weight of the integral level of sustainability of foreign economic activity, financial independence and debt obligations (*Table 4*).

The total value of the level of foreign economic stability is 3.229, and the weight coefficient is 64.5%. That is, the foreign economic activity of the enterprise is stable, although in 2020-2021 there was a sharp decline in exports, especially to the EU and the U.S., but the new sales policy was able to reorient to the states of Asia, Africa and the CIS.

An important indicator of the stability of the world order is the level of financial independence (credit loans, subsidies, etc.) (*Table 5*).

The total value of the level of financial independence stability is 0.333, the weighting coefficient is 6.66%. This indicator is very low, i.e., dependence on external sources of financing is high. But starting from 2023 there is a decrease in dependence on external liabilities.

It is also important to determine the sustainability of debt burdens — debt liabilities excluding interest, taxes, and amortisation payments (*Table 6*).

The aggregate value of the level of debt sustainability is 1.68, the weighting coefficient is 33.6%, i.e., the enterprise covers its debt obligations.

Thus, the cumulative level of world order sustainability is: 3.229 + 0.333 + 1.68 = 5.242, and the weighting coefficient is 95.3%. This indicates stability and smooth development in the field

Table 1

The share of the integral level of financial stability

Sustainability		Absolute indicators of sustainability, Coefficients	Indicator for 2021	Norms	Score value of the level, Vi	Specific weight of the integral level of sustainability, Yi
Economic sustainability	Financial sustainability	Manoeuvrability ratio	1.766	⩾ 0.5	5	0.35
		Financial stability ratio	0.472	⩾ 0.6–0.5	4	0.118
		Working capital ratio	–0.463	⩾ 0.6	0	0
		Capitalisation ratio	14.735	⩾ 1	2	7.365
Total value of financial stability level, Syi						7.833

Source: compiled by the authors on URL: www.chtpz.tmk-group.ru

Table 2

The specific weight of the integral level of production stability

Sustainability		Absolute indicators of sustainability, Coefficients	Indicator for 2021	Norms	Score value of level, Vi	Specific weight of integral sustainability level, Yi
Economic sustainability	Manufacturing sustainability	Profitability ratio	28.5	1–5% — low rate; 5–10% — medium rate; 20–30% — high rate	5	5.70
		Efficiency ratio /return on assets ratio	4.038	⩾ 1	4	1
Total value of the level of production stability, Syi						6,7

Source: compiled by the authors on URL: www.chtpz.tmk-group.ru

Table 3

The share of the integral level of marketing sustainability

Sustainability		Absolute indicators of sustainability, Coefficients	Indicator for 2021	Norms	Score value of level, Vi	Specific weight of integral sustainability level, Yi
Economic sustainability	sales sustainability	Inventory turnover ratio	5.881	–	5	1.176
		Output volume ratio	0.51	⩾ 1	4	0.12
		Market share by region,%	181.57–100%	100	5	–
		RUSSIAN FEDERATION	158.7 – 87	–	4	4.59
Total value of the level of sales stability, Syi						5.89

Source: compiled by the authors on URL: www.chtpz.tmk-group.ru

Table 4

The share of the integral level of foreign economic stability

Sustainability		Absolute indicators of sustainability, Coefficients	Indicator for 2021	Norms	Score value of level, Vi	Specific weight of integral sustainability level, Yi
Sustainability of the world order	sustainability of foreign economic activity	Export production ratio	0.125	–	3	0.041
		Currency earnings ratio	9.566	–	3	3.188
Total value of the level of external economic sustainability, Syi						3.229

Source: compiled by the authors.

Table 5

The proportion of the integral level of financial independence

Sustainability		Absolute indicators of sustainability, Coefficients	Indicator for 2021	Norms	Score value of level, Vi	Specific weight of integral sustainability level, Yi
Sustainability of the world order	sustainability of financial independence	Financial dependency ratio	0.936	⩾0,6–0.7	3	0.312
		Autonomy ratio	0.063	⩾0.5	3	0.021
Total value of the level of financial independence sustainability, *Syi*						0.333

Source: compiled by the authors.

Table 6

The specific weight of the integral level of stability of debt loads

Sustainability		Absolute indicators of sustainability, Coefficients	Indicator for 2021	Norms	Score value of level, Vi	Specific weight of integral sustainability level, Yi
Sustainability of the world order	sustainability of debt burdens	Debt burden ratio	5.05	⩽ 3.0	3	1.68
Total value of debt sustainability level, Syi						1,68

Source: compiled by the authors.

Table 7

The specific weight of the integral level of social stability

Sustainability		Absolute indicators of sustainability, coefficients	Indicator for 2021	Score value of level, Vi	Specific weight of integral sustainability level, Yi
Social sustainability	Sustainability of material support	Cost per employee ratio	13.139	4	3.28
	Sustainability of staffing	Personnel stability coefficient	0.65	4	0.162
		Employee break-even ratio	3.746	5	0.749
Total value of the level of social sustainability, Syi					4.191

Source: compiled by the authors.

Table 8

The specific weight of the integral level of environmental sustainability

Sustainability		Absolute indicators of sustainability, coefficients	Indicator for 2021	Score value of level, Vi	Specific weight of integral sustainability level, Yi
Environmental sustainability	Sustainability of environmental activities	Cost coefficient for facilities and equipment	–	5	3.971

Source: compiled by the authors.

of foreign economic activity, the possibility of finding new potential foreign partners and the ability of the enterprise to reduce external debt and other obligations at the expense of profit. The total value in general for economic stability is not presented.

Social sustainability

Let us consider the indicators of social sustainability. The total value of the level of social sustainability is 4.191, its weight coefficient is 83.8%. This is an indicator of enterprise stability, which implies the presence of the production elite,

Table 9

The levels of the integral model of the stability of the Chelyabinsk Pipe Rolling Plant

Sustainability		Indicator
Economic	Financial	7.83
	Production	6.7
	Sales	5.89
World Order		5.24
Social		4.19
Environmental		3.97

Source: compiled by the authors.

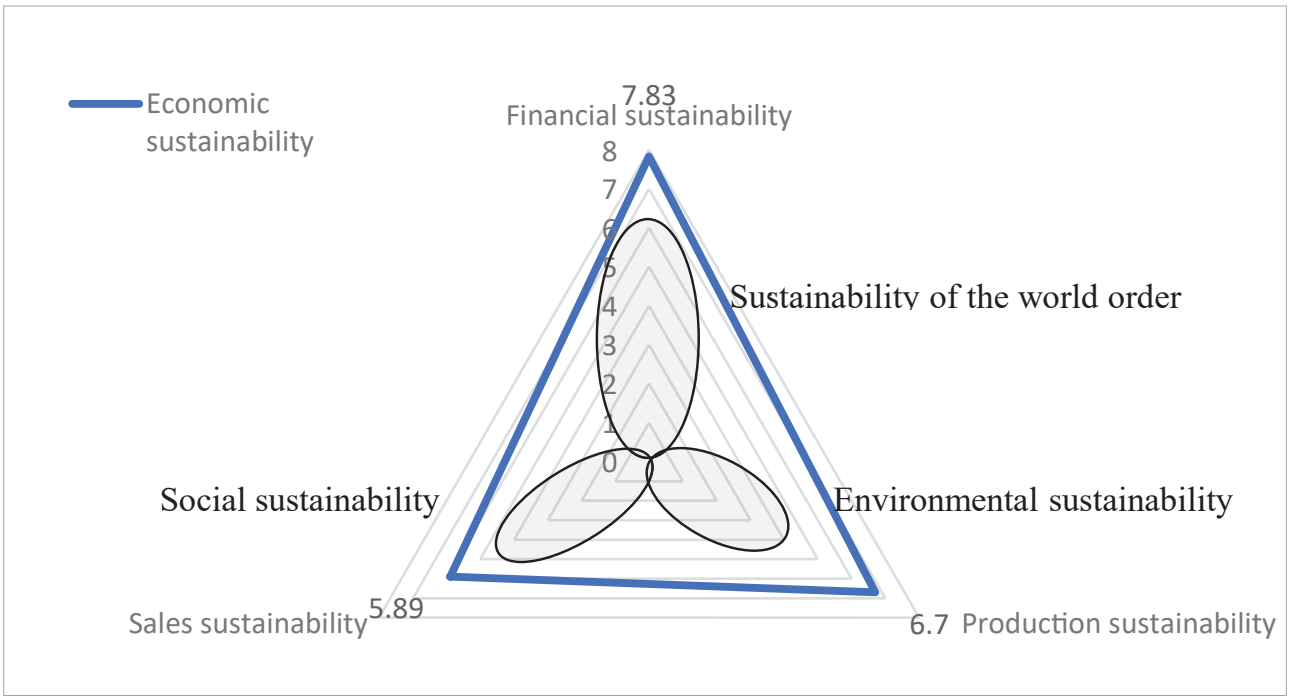

Fig. 9. **Chelyabinsk Pipe Rolling Plant sustainability model for 2021**

Source: compiled by the authors.

favourable working conditions, as well as wage growth, reduction of staff turnover, compliance with social programmes, training, and professional development of employees (*Table 7*).

Environmental sustainability

The total value of the environmental sustainability level is 3.971, and the weighting coefficient is 79.42%. This is a high indicator, i.e., the company invests in environmental programmes, actively introduces new equipment and technologies to protect the ecosystem of its region (*Table 8*).

Integral model of Chelyabinsk Pipe Rolling Plant sustainability

Based on the author's calculations, an integral model of Chelyabinsk Pipe Rolling Plant was compiled by levels of sustainability of the world order, as well as by economic, social, and environmental sustainability. (*Table 9*).

The obtained indicators by sustainability levels will be distributed in a petal (author's) diagram, which will show how the Chelyabinsk Pipe Rolling Plant sustainability model will look like (*Fig. 9*).

This model is symmetrical, its form is close to the ideal one. The foundation of the enterprise development is economic sustainability, while social, environmental and world order sustainability are in direct dependence on it, as investment is necessary for successful operation of the enterprise, implementation of social and environmental programmes.

CONCLUSIONS

Thus, sustainable development of the pipe industry is a complex process, where both external and internal factors must be taken into account. All of them affect the financial and economic performance of the enterprise, social programmes to improve working conditions, recreation, and health, as well as environmental projects to conserve natural resources and protect the ecosystem (water, air and land) depend on them.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was received on 20.02.2024; revised on 15.03.2024 and accepted for publication on 05.04.2024.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-99-112
UDC 336.63;004(045)
JEL Q54, O32, P49, Q54, Q55, R11

Crisis Management in Socio-Economic Systems in the Context of Digitalization Using the Example of a "Smart City"

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ABSTRACT

The purpose of this study is to analyze the processes of transformation of crisis management in socio-economic systems in the context of digitalization and to develop, using the example of a "Smart City", an approach to the formation of a crisis management system using modern digital technologies and embedding in this system a controlling module responsible for information and analytical support of decision-making processes. **The research methodology** uses a systematic, complex and logical analysis of the ongoing processes of digitalization, as well as a theoretical and methodological apparatus for developing a crisis management system in socio-economic systems in the context of digitalization using the example of a "Smart City". **The results of the study include the following**: an approach to the transformation of crisis management in socio-economic systems in the context of digitalization has been developed using the example of a "Smart City"; the main requirements and provisions for the formation of a crisis management system in the conditions of digitalization have been formulated; based on the analysis, comprehensive proposals for the formation of a crisis management system using the example of a "Smart City" have been formulated with a built-in controlling module.

Keywords: crisis management transformation; crisis situation; digitalization; socio-economic system; Smart City; controlling

For citation: **Sarian V.K., Umanskiy R.Yu. Crisis management in socio-economic systems in the context of digitalization using the example of a "Smart City". *The World of the New Economy*. 2024;18(2):99-112. DOI: 10.26794/2220-6469-2024-18-2-99-112**

INTRODUCTION

The unprecedented speed of development of digital technologies and platform solutions has led to the transformation of the structure of traditional economy and social life, modifying the existing methods of managing the sustainability of socio-economic systems. The need for digitalisation of all spheres of life of society and economic entities, along with the formation of new approaches to the design and implementation of the strategy of security and development of socio-economic systems due to the emerged geopolitical factors, require a rapid transition to domestic information technologies [1].

The significant growth of various crisis situations that are harmful to the life and health of people, the environment, enterprises and affect the security of the state as a whole predetermines the need to ensure sustainable development of existing socio-economic systems at the state level. The introduction of promising digital trends and technologies should contribute to the creation of fundamentally new products and services.

In the authors' opinion, the key task of managing the sustainable development of socio-economic systems should be the safety of all objects included in them. And in the conditions of increasing number of crisis (including emergency) situations and taking into account the scale of their consequences, it is necessary to activate all existing opportunities for their monitoring and prevention, as well as for protection against the emergence of risks [1]. In addition, there is a need to promptly inform the population, enterprises, and public institutions about actions in crisis situations. The analysis of the events of 2023 in Turkey and Syria, when the strongest earthquake occurred, demonstrates the obvious relevance of the implementation of this task, because without it the indicators of sustainable development of any socio-economic system — from a small enterprise to an entire state — may change.

The digitalisation of business processes is intended to ensure the development and implementation of a crisis management system (hereinafter — CMS) on a fundamentally new basis. Its tasks should include the development of predicative analytics of crisis occurrence, the creation and implementation of mass personalised user information services, as well as the introduction of special management modes in socio-economic systems in the event of crises. The crisis management system will make it possible to form an effective organisational and management mechanism for the timely identification of crisis situations and risk management, and will ensure the availability of the necessary resources for this purpose. Such a system includes a set of proactive measures to assess and mitigate risks, the development of contingency plans and the introduction of early warning systems. It also includes mechanisms for rapid response, crisis communication, resource allocation and coordination among all stakeholders.

The authors suggest using the example of a "smart city" as a new paradigm of digital development of the urban environment to consider the implementation of a crisis management system for effective problem solving in the event of any crisis situations (natural, man-made, political, social, etc.). Such a system will ensure life safety and sustainability of all objects of the "smart city" in any place and at any time.

THEORETICAL FOUNDATIONS OF CRISIS MANAGEMENT IN SOCIO-ECONOMIC SYSTEMS UNDER CONDITIONS OF DIGITALISATION

Digitalisation should be considered in the narrow (as the conversion of information from analogue to digital form in order to increase its volume and speed, as well as to reproduce the signal with absolute accuracy) and broad (as the application of digital technologies in various spheres, which results in a complete digital transformation of all processes occurring in socio-economic sys-

tems) sense of the word [2]. And if a few years ago information technologies were used mainly for specific applied tasks, today they are capable of solving problems that require the application of complex algorithms as well [3]. Digitalisation is aimed at improving the quality of life of the population, and economic development acts as the main sphere for the introduction of digital tools [4].

This process covers all aspects of state and social life [5]. It is important to remember that socio-economic systems differ from other systems, first of all, because their integral part is the activity of people [6], who should be provided with maximum security and comfortable existence.

In recent years, there have been many studies that analyse both positive and negative consequences of digitalisation [7]. One of the works states that it currently acts as an anti-crisis tool, which began to lead to its widespread implementation [8]. It is logical to assume that all elements of the socio-economic system will use digital tools and take into account the results of digital transformation. For example, organisations are developing new business models, revising value creation processes, as smartphones, which are an integral part of people's daily life and activities, are becoming more and more widespread.

Today, digital platform solutions are not only tools for business. Forming ecosystems [9], they attract a huge number of users, providing them with a wide range of tools and services, and coordinate the interaction of participants through special rules, regulations, and standards.

At the state level, electronic data and information technologies are used to improve the efficiency and transparency of the work of government agencies at all levels of government to ensure more responsive management. According to Professor S. G. Kirdina-Chandler, digitalisation changes the system of interaction between citizens and the state, allowing them to interact through the provision of a set of services in real time [2]. Therefore, it is a fundamental element of competent management and development not only of the state as a whole, but also of each individual element of the socio-economic system [10].

The tasks to develop and improve the system of prevention and actions of management structures in the emergency mode, to enhance the quality and efficiency of its functioning on the basis of integrated automation of management processes were formulated in the late 80s — early 90s of the last century and are associated with the emergence of fundamentally new for that time complexes of software and hardware [11]. However, the processes of digitalisation have formed prerequisites for the design and implementation of a fundamentally new crisis management system, in which all key elements will be integrated into the digital environment with the ability to form and receive the required information in a personalised, real-time manner.

Any crisis situation in a socio-economic system disrupts its functioning [12], therefore, the crisis management system to be developed should have the following properties:

1. Readiness for any crisis situations. This implies the need to implement a set of measures to assess the probabilities of potential crises and possible consequences, to develop various scenarios of response and practical actions in crisis situations.

2. Availability of effective digital coordination and feedback with all participants of the socio-economic system.

3. Flexibility and adaptability, implying that all plans and actions formed with the help of algorithms for making and implementing management decisions in crisis management system can be adjusted in real time, depending on changes in the nature of the crisis and emerging challenges. A high level of flexibility and adaptability is achieved by implementing digital tools.

4. Availability of an expert system which, in case of a crisis situation, is capable, based on

existing digital technologies, to ensure instant processing of incoming information, make a decision and communicate information and the algorithm of subsequent actions to all objects.

5. Presence of a controlling system to provide an organisational and methodological basis for supporting all elements in the crisis management cycle through the regulation of management functions [13].

6. The possibility of personalised communication within the crisis management system, which is provided by a high level of penetration of subscriber devices; this allows for the optimal formation of the user's behaviour programme in the event of a crisis situation, taking into account his location, health status and other personal factors.

7. The ability to allocate and manage resources optimally in order to cope effectively with crises, minimise their impact on the socio-economic system and facilitate its rapid recovery.

8. The ability to utilise Internet of Things, artificial intelligence and machine learning technologies to improve the quality of predictive and reactive mechanisms. This makes it possible to collect high-quality information on the state of infrastructure, provide monitoring and forecasting of crisis situations, and prepare analytical data for further in-depth analysis of the situation.

METHODOLOGY OF DEVELOPMENT OF CRISIS MANAGEMENT SYSTEM IN SOCIO-ECONOMIC SYSTEMS

The development and implementation of crisis management systems in the context of digitalisation has been the subject of active research by a number of Russian scholars. Most of them agree that the role of crisis management system becomes especially relevant at the present stage, because, on the one hand, there is an increase in emergency situations and growing geopolitical instability, and on the other hand, the ever-increasing capabilities of information technologies have formed an objective need and technological base for the creation of standardised digital models for managing people, enterprises, regions, industries, and the state as a whole.

A number of authors note that in the case of crisis situations it is not enough to use conventional tools due to the limited time for decision-making [14]; there is also a lack of competences to solve problems under stress and various medical and psychological factors [15]. Thus, the introduction of special management regimes is required [16, 17], the development of which in crisis situations should be carried out in advance, with the definition of rights and responsibilities of all participants of socio-economic systems [18–20]. And it is precisely with public funding, since it is difficult to attract the required huge resources to such projects due to the unobviousness of the potential financial effects of investments [21].

That is, digitalisation has created prerequisites and necessitated the development of a scientific basis for the practical implementation of an information platform for the management of various complex socio-economic systems. At the same time, the obtained practical experience should be extended to the elimination of all crisis situations, which will lead to the creation of a platform capable of ensuring the implementation of the entire set of legal, administrative, economic and information regulation measures that are activated in case of emergencies of natural and/or man-made nature [22]. In fact, we are talking about a public service of crisis management.

The basis for the implementation of such a platform should be the proposed concept of the system of individualised subscriber behaviour management, which was developed by Russian scientists [23–25] (*Fig. 1*).

The presented block diagram is created within the framework of the system of individualised subscriber behaviour management and subscriber information (mainly for real-time control) for monitoring and preventing the de-

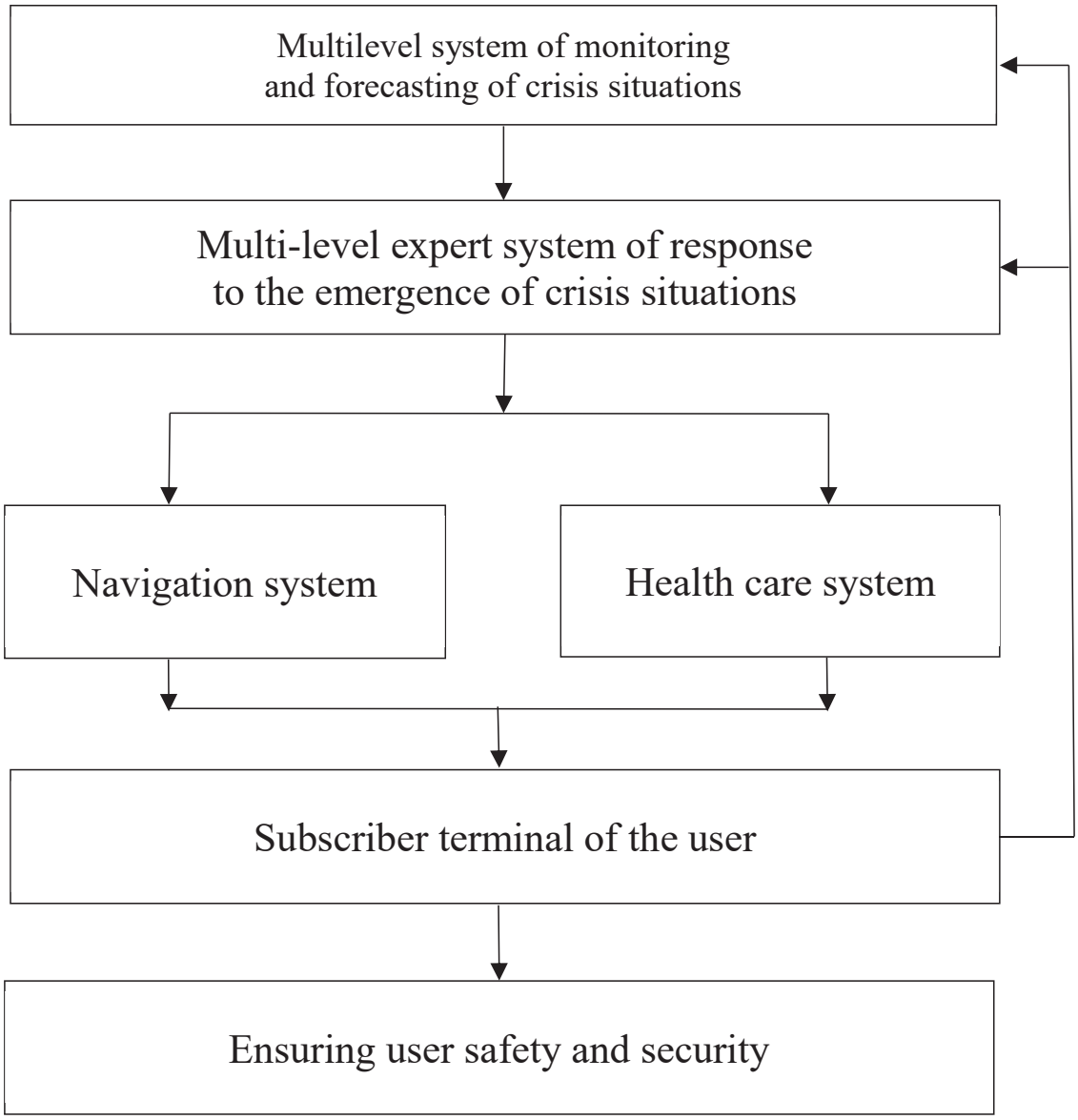

Fig 1. **Block diagram of the organization of an individualized management system of subscriber behavior in a crisis situation**

Source: compiled by the authors.

velopment of dangerous situations. In addition, it can be used in times of crises to monitor the status of resources that need to be activated when special administrative and legal regimes are introduced.

To form a crisis management system, it is necessary to:

1. To use general principles of construction similar to the system of individualised management of subscriber's behaviour.

2. To create and justify systems of approaches, principles, methods, and techniques for short-term, medium-term, and long-term forecasts of the onset of crisis situations.

3. To define a list of indicators and signals derived from the data of continuous monitoring of economic, social, and legal life of the society. This should take place in correlation with the indicators of digital socio-economic and legal models of predicted crisis situations, created by

interdisciplinary teams. Thus, it will be possible to manage the socio-economic system (state, region, city, industry, enterprise, people) within the timeframes defined by this model.

4. To combine interdisciplinary models of multilevel expert systems with the system of individualised subscriber behaviour management. Such integration on the basis of a single digital platform will allow the newly formed crisis management system to implement a mass information personalised service in case of crisis situations and to track not only the state of the natural and man-made environment, but also other parameters within the framework of special control modes.

EXPLORING THE PROSPECTS FOR DEVELOPING A CRISIS MANAGEMENT SYSTEM USING THE EXAMPLE OF A "SMART CITY"

The main technological, socio-economic, and environmental changes that have occurred in recent years have caused the revision of approaches to the management of the city as one of the most complex socio-economic systems. Today, the most important project of urban environment development, which covers all areas of its functioning and improvement, is the concept of "smart city". Within its framework, based on the achievements of advanced info-communication technologies and digital transformation, the efficiency of all processes of functioning of urban services and infrastructure is increased. At the same time, the diverse needs of present and future generations are fully met [28, 29].

Another advantage of the "smart city" is an integrated approach to the formation of an accessible, comfortable, and safe urban environment based on the digitalisation of urban resource management and the system of analysis of urban space transformation with feedback from the residents of the territorial unit [29]. This will improve the living standards of the population and the quality of urban services, economic development, and competitiveness of the city, as well as create a safe environment for citizens and the functioning of businesses.

Thus, the "smart city" concept is a systematic approach to the use of information technology based on data analytics to provide services that promote sustainable economic development and high standards of living [30] (*Fig. 2*).

"Smart economy" implies the development and introduction of innovative products and new, more efficient methods in the production process, as well as the implementation of innovative approaches in the field of marketing, strategies for promoting digital economy services and the introduction of new methods for managing the structural divisions of companies.

"Smart governance" is aimed at the development of services of state, regional and municipal services, implementation of proactive city security model, "smart healthcare", healthy lifestyle, "smart systems" of housing and communal services and digitalisation of social protection.

"Smart Finance" focuses on the development of the city's investment portal and the implementation of open budget principles.

"Smart Infrastructure" involves the development of unmanned and electric motor transport, creation of smart car parks, high-speed trains, introduction of digital payment for services, and development of areas for pedestrians and cyclists.

"Smart environment" includes development of energy saving projects for office and industrial buildings, use of renewable energy sources and waste recycling, minimisation of harmful emissions into water and atmosphere, planning of friendly urban space incorporated into the natural landscape.

"Smart residents" will be covered by adaptive education, based on the use of specialised software, and allowing to change the complexity and content of courses depending on the degree of preparation and development of students' skills directly in the learning process. This in-

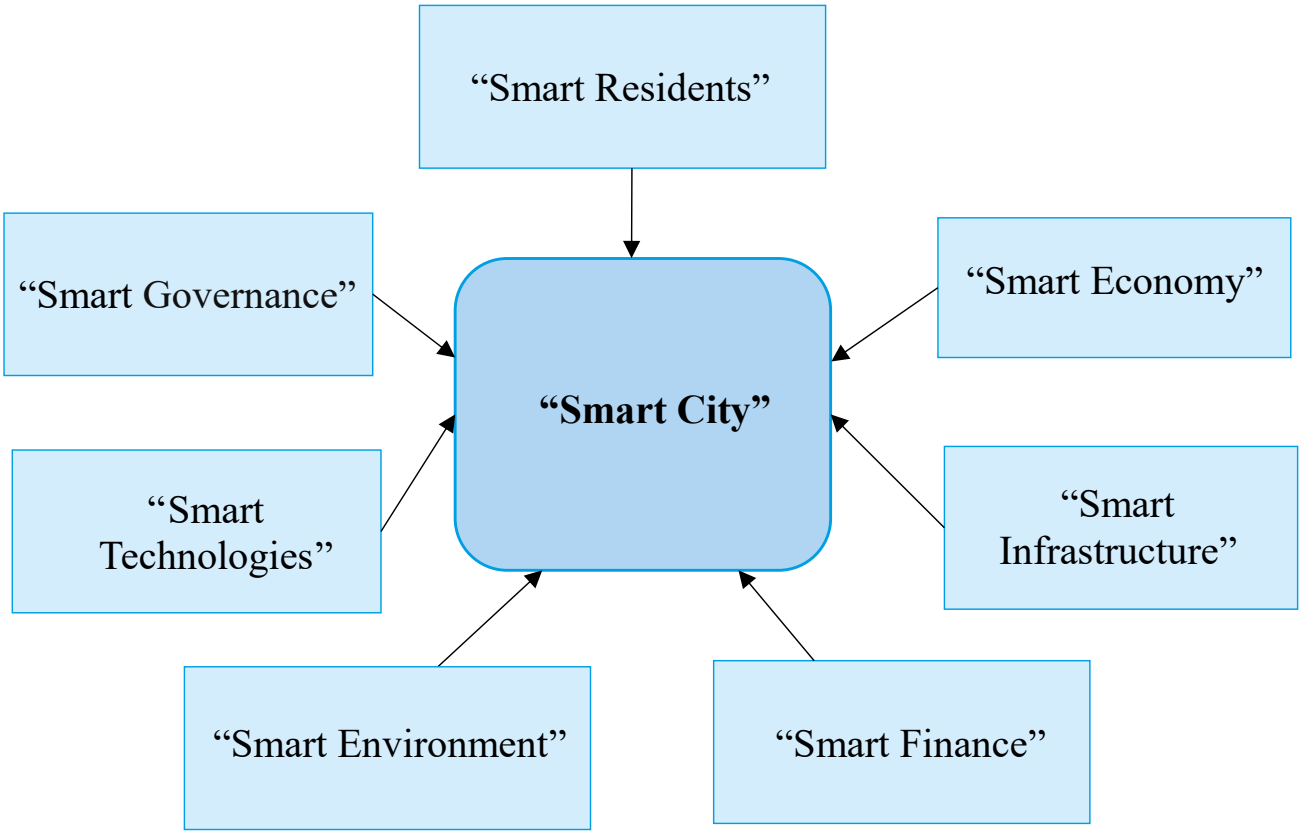

Fig 2. **The main “Smart City” projects**

Source: compiled by the authors based on data from the Report on the results of the research work “Indicators of smart cities NIITS 2017”. URL: https://www.tadviser.ru/images/8/8b/SmartCities_%D 0%9D% D 0% 98%D 0%98%D 0%A2%D 0%A1_2017.pdf

cludes the use of neurotechnologies and virtual and augmented reality technologies; training in skills for future professions; and cooperation between municipalities, scientific and public organisations.

“Smart technologies” are aimed at developing the entire range of technologies and maintaining digital infrastructure objects in a workable condition, as well as ensuring cyber security.

In our opinion, it is within the framework of a “smart city” that it is possible to start introducing a crisis management system, which should become a necessary addition to its concept and solve many problems.

It is expected to introduce a set of digital solutions in a number of areas, such as “smart city transport”, public safety systems, “smart housing and utilities”, communications, tourism, services, etc., but there are a number of problems.

Firstly, the lack of a unified development system and a competent management approach to the project implementation. The very concept of “smart city” in regulatory documents is very vague, there is no clear idea of what should be done, there is no algorithm of implementation and a set of services. As a result, different regions and cities perceive the project in their own way, which leads to ambiguity of the final results and assessment of the quality of its implementation. The requirements for the development of digital infrastructure are also perceived differently. To solve this problem, it is necessary to develop a unified methodology for the construction and development of a smart

city, including standardisation of requirements for digital infrastructure.

Secondly, a clear system of state management of the project at the federal, regional, and municipal levels must be formed. It is important to note that to date, the management outline does not include such necessary components as the development of a green economy, prevention of crisis situations, as well as (taking into account the development of the geopolitical situation in the world) digital solutions in the field of cyber security, anti-terrorist protection, prevention of offences, etc.

According to the authors, ensuring the sustainability of the smart city, i.e., its ability to cope with crisis situations, should be based on the construction of control contours including [31]:

Strategic, where management tools and technologies should be developed and used to coordinate the efforts of various elements of the digital economy and society as a whole to achieve the formed strategic goals of sustainable development. The crisis management system in the structure of this contour should guarantee the fulfilment of the set goals due to the built system of predicative signals and a set of anti-crisis measures.

The strategic contour is the main one in the "smart city" system, in accordance with it all other contours will be formed and applied. At the same time, the adoption of strategic goals should be based on the methodological principles of green economy and achieving sustainability of digital economy objects.

Ideological, where tools and technologies are used to form a new way of thinking about smart city management, life safety and green economy. The crisis management system is considered here as an integral part, without which it is impossible to achieve sustainability of digital economy objects and form a full-fledged solidarity information system.

Organisational, which implies the formation of an optimal structure and principles of functioning of all elements — objects of the digital economy. This contour ensures the effective organisation of employees' activities and information flows within the smart city, distribution of authority and responsibility for making managerial decisions to achieve the set strategic goals. The crisis management system in this contour is responsible for digital models and regulations of behaviour, modes of functioning of objects of the digital economy depending on the crisis situation that has arisen.

Operational, necessary for the coordination of smart city life, when in practice it is necessary to make managerial decisions and allocate resources based on the received information in real time. In fact, this contour is responsible for the implementation of all developed principles, mechanisms and regulations aimed at achieving strategic goals.

The above hierarchy of management levels makes it possible to form a unified process based on the goals and development strategy of the smart city, which ensures its more efficient functioning. However, at the onset of any crisis situation, all levels should switch to the ***anti-crisis one***. It automatically switches the management into a special mode, which ensures functioning in a crisis situation from the moment of its occurrence and detection to the end and elimination of all the resulting consequences.

Figure 3 presents the author's interpretation of crisis management system implementation in a smart city.

Such a platform should become an automated system capable of linking the Internet of Things, big data processing systems and cloud technologies in order to automate one or more functions of management of all socio-economic activities. It will help to form an objective picture of emerging situations (including crisis situations) in various spheres of urban life.

Development of controlling in the system of crisis management in a smart city

Taking into account the proposed crisis management system and the highlighted

management contours, for the optimal development of the "smart city" it is necessary to implement a comprehensive system of decision-making support in the conditions of prevention and occurrence of crisis situations. It is about comprehensive information and analytical support of decision-making processes in crisis management through the development of a system of key indicators and benchmarks [32].

Figure 4 presents the author's interpretation of controlling in the crisis management system of the "smart city". Its main task is to prevent possible crisis situations, as well as to manage them in case of their occurrence. Information support of controlling should include analysis, monitoring, modelling and risk assessment of crisis situations, as well as planning and coordination of actions, organisation of communications and information support. In addition, controlling is responsible for planning and evaluating the performance of the crisis management system and adjusting it to achieve optimal characteristics.

Priority directions of controlling development for the implementation of crisis management system can be summarised as follows:

Designing a digital platform for managing crisis situations in a smart city with the ability to use tools and algorithms for semi-automatic and automatic response to their occurrence.

Introduction of technologies of the Internet of Things, artificial intelligence and machine learning, which will raise the level of crisis management to a new level and provide processing of huge amounts of information to support managerial decision-making [32]. With their help, it is possible to form models for predicting crisis situations and personalised recommendations to subscribers in case of their occurrence.

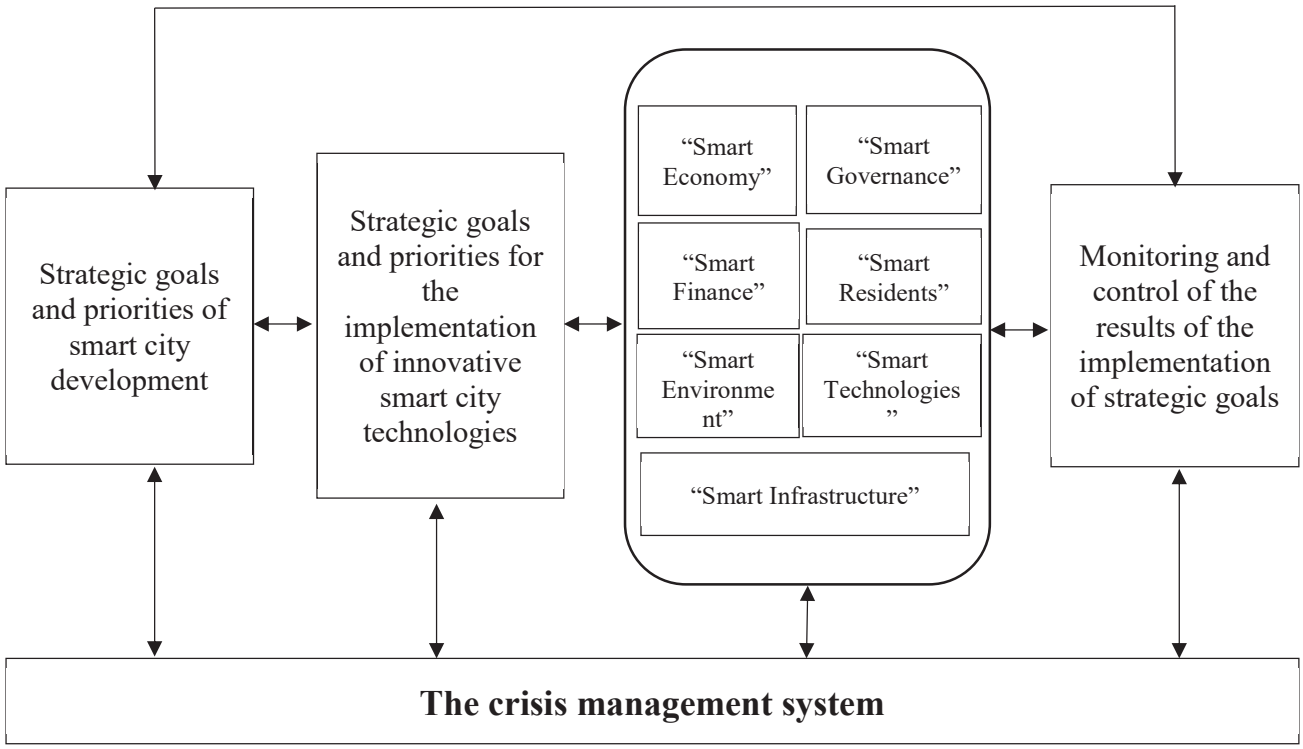

Fig 3. **The role and place of the crisis management system in a "Smart City"**

Source: compiled by the authors.

Formation of a system of key indicators and parameters in the crisis management system for making timely and effective management decisions.

Development of regulatory documents defining the procedure for interaction between all departments and users of the Smart City, as well as training of employees responsible for managing crisis situations.

It is important to note that, despite the existence of a well-developed scientific and technological basis for the concept of forming a crisis management system, for its full-fledged implementation it is necessary to assess the

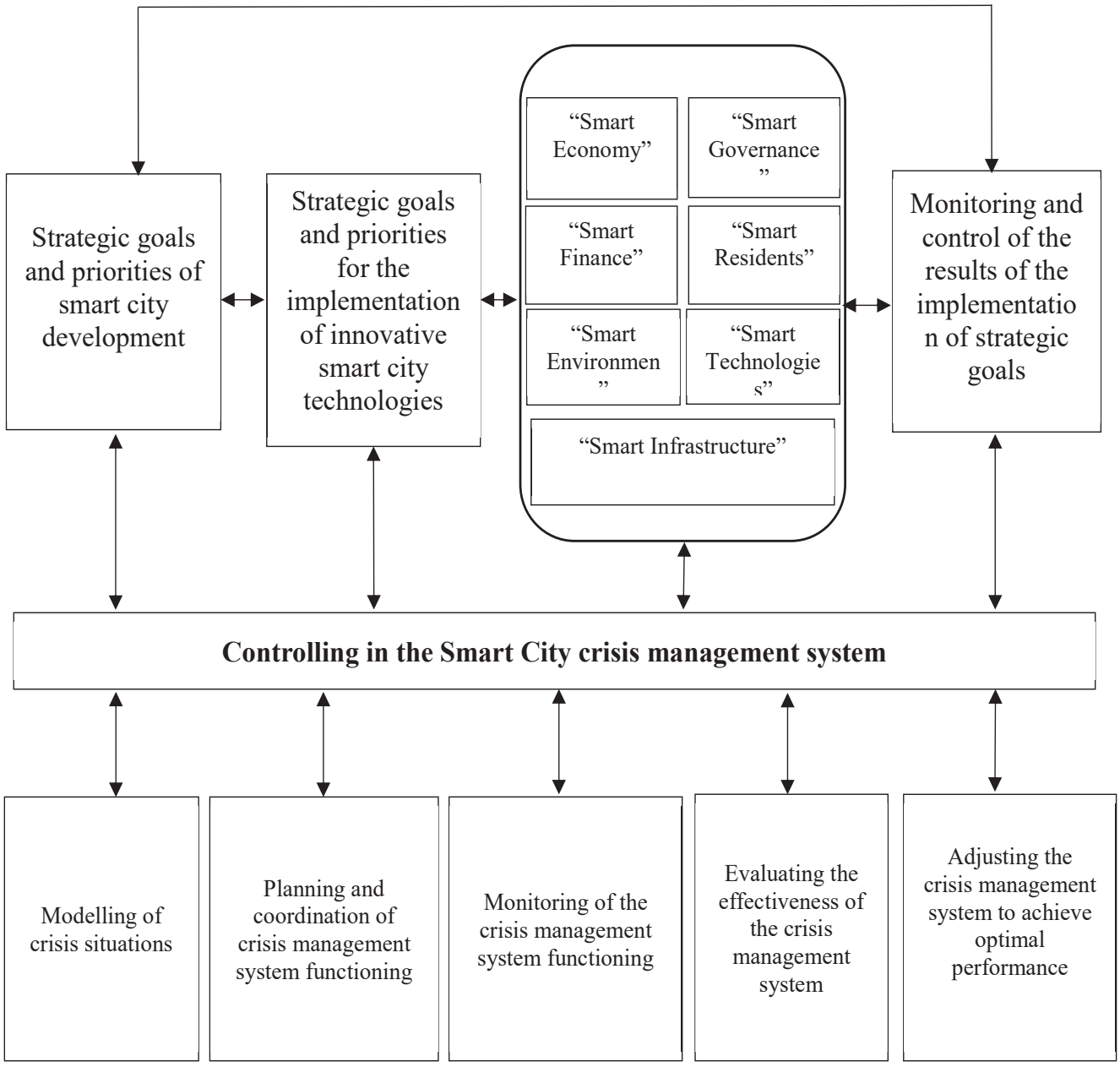

Fig 4. **Controlling in the "Smart City" crisis management system**

Source: compiled by the authors.

readiness of all participants (government and industry organisations, telecom operators, etc.) to build such an information platform and the level of technical support for users. In addition, a significant factor in the success of implementation should be human and financial resources for the implementation of this project at the federal, regional and local levels.

CONCLUSIONS

Thus, under the conditions of digitalisation of socio-economic systems and the growth of crisis situations, there is a growing need to develop and implement large-scale management solutions for the construction and effective functioning of crisis management systems in socio-economic systems at any level.

The development and implementation of crisis management system will be an important step in the development of Russia's info-communication system and an integral part of the emerging state management information system using Russian information technologies and infrastructure of telecom operators.

The creation of crisis management system in the conditions of "smart city" on the basis of the developed system of individualised subscriber behaviour management will allow to ensure a high level of sustainable development of complex socio-economic systems in the conditions of growing crisis situations. It is especially important to emphasise that such a crisis management system can be implemented taking into account existing domestic developments. This should be reflected in the implementation of projects under the national programmes "Digital Economy of the Russian Federation" and "Data Economy", as well as the Federal Law "On Protection of Population and Territories from Natural and Technogenic Emergencies" and the Programme of Fundamental Scientific Research in the Russian Federation for the long-term period of 2021–2030.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was received on 22.04.2024; revised on 30.04.2024 and accepted for publication on 15.05.2024.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-113-125
UDC 330.3(045)
JEL O11, O4

The Impact of Globalization on the Dynamics of the Domestic Market of National Economies

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ABSTRACT

In the context of the turbulence of the global economy, the relevance of research aimed at determining the ability to ensure the sustainable development of national economies within the current model of global economic development is increasing. The purpose of this study is to obtain data characterizing the development potential of national economies. The article analyzes the impact of globalization on the dynamics of development of the leading national economies in the ranking of countries in terms of GDP at PPP with a population of more than 50 million people. At the same time, the following characteristics were studied: labor productivity, the level of debt burden, the level of consumption of industrial products and services in the domestic market, the standard of living of the population, the ratio of income of the population and the level of per capita consumption. It is shown that in the analyzed countries the total per capita consumption is greater than per capita GDP. It was revealed that the differentiation of the debt burden in various segments of the economy is due to the difference in the dynamics of labor productivity. It is shown that within the framework of the current models of national economies, the conditions for the generation of structural problems and the decline in the level of consumption and the quality of life of the population have been formed.

Keywords: structure of the economy; manufacturing industry; industry; real economy; service sector; export; import; balance of international trade

For citation: **Bogachev Yu.S., Bekulova S.R. The impact of globalization on the dynamics of the domestic market of national economies. *The World of the New Economy.* 2024;18(2):113-125. DOI: 10.26794/2220-6469-2024-18-2-113-125**

INTRODUCTION

The authors' previous work [1] published the results of research into the nature of crisis processes of leading countries, and analysed the dynamics of development, structure, and various models of national economies. This article studies the impact of globalisation on the economic efficiency of production and the dynamics of consumption of goods and services by the population in the domestic market, which determine the sustainability of the development of national economies.

Economic literature and statistical data indicate that the national economies of both developed and developing countries are currently experiencing crisis processes [2–4]. This is manifested in the growth of inflation rates, debt burden of the population and households, increasing unemployment.[1] In addition, the coronavirus pandemic and increased geopolitical tensions have contributed to the regionalisation of the world economy, which causes the need to adjust the development models of national economies [1; 5–8]. These factors contribute to the growth of social tensions primarily in developed countries [9–14]. In these conditions, the problem of creating a recovery plan for national economies is relevant.

Previously, the authors wrote that the process of integration of national economies into the global economy has led to dependence on imports of manufacturing goods to meet domestic needs [1]. At the same time, the hypertrophied development of the service and financial sectors is unable to compensate for the losses arising from the deficit of domestic industrial production [1; 15–19]. In this regard, it is important to decide whether it is possible to ensure sustainable development of national economies under the current model of globalisation or whether its regionalisation is necessary.

RESEARCH METHODOLOGY

Within the framework of the study, the authors analysed:

- the dynamics of the value of product realisation in the domestic market segment "goods of the manufacturing industry";
- dynamics of the price of goods in the domestic market;
- debt burden of households, non-financial corporations and the government;
- potential of the national economy to provide the existing level of per capita consumption.

The use of GDP data in Purchasing Power Parity format in constant prices allowed to take into account the specifics of pricing in different countries and exclude the impact of inflation on statistical data.

The purpose of this study is to identify the impact of economic factors on the adequacy of the current model of global and national economies. The dynamics of national economies in 2020–2023 was significantly influenced by the impact of non-economic factors — pandemic and increasing geopolitical tensions. For this reason, as well as in order to distinguish between state regulation and restrictions on economic activity in the specified period, the authors have chosen the time period 2008–2019.

IMPACT OF PRODUCTION AND IMPORT OF PRODUCTS ON THE DEVELOPMENT OF THE DOMESTIC MARKET OF NATIONAL ECONOMIES

The dynamics of the volume of sales of goods in the domestic market depends on changes in the cost of products. To calculate the volume of goods realisation (P) in the market, the authors introduced the following variables:

- the cost of domestic products P_o, which is calculated by the formula:

$$P_o = V^*(1-E), \quad (1)$$

where V — is the output of the national manufacturing industry; E — share of export products in the output of the national manufacturing industry (V);

- the value of imported products P_I, is calculated by the formula:

$$P_I = a^*V, \quad (2)$$

[1] URL: https://www.imf.org/external/datamapper/PCPIPCH@WEO/OEMDC/ADVEC/WEOWORLD; https://www.imf.org/en/Publications/WEO/Issues/2022/10/11/world-economic-outlook-october-2022

where a — is the coefficient of proportionality between the value of purchases of imported products and those produced in the national economy.

The values of E and a for 2008 and 2019 are presented in *Tables 4, 5* of [1], the value of V is taken from the UNIDO database.[2]

Thus, the value of products sold on the market (P) is determined by the following formula:

$$P = P_o + P_I = V * (1 - E) + a * V = \\ = V * (1 - E + a). \quad (3)$$

When analysing the dynamics of the ratio of the cost of national and imported products on the market for the period 2008–2019, the following equation is true:

$$\frac{P_o}{P_o + P_I} = \frac{1 - E}{1 - E + a}. \quad (4)$$

In formulas (1)–(4), the introduced parameters a, E — are abstract numbers representing, respectively, fractions of a unit, the values of which lie in the interval from 0 to 1. For the convenience of text perception these values in tables and text are presented in percentage form.

The results of calculations according to formulas (1)–(4) are shown in *Table 1*.

According to the data of *Table 1*, the analysed countries are divided into three groups. The first group includes those whose domestic sales volume in 2019 was higher than the corresponding value in 2008: China, the USA, India, Indonesia, Mexico, South Korea. In the second — 6 countries where the value of product sales decreased over the analysed period: Germany, Russia, Brazil, France, UK, Italy. In the third — Japan and Turkey, where the cost of product realisation practically does not change over the period 2008–2019.

It is noteworthy that the increase in the realised value of products occurs in countries where manufacturing output is growing. It should be noted that only in China, Indonesia, and South Korea the share of domestic industry products in the domestic market is increasing. In the USA, India, Mexico the increase in the cost of sales is associated with imported products. Thus, the main factor determining the dynamics of the "manufacturing goods" segment in the 11 countries is the change in the cost of imported products. Consequently, the process of integration of the national economy into the global economy was booming there. This is expressed to the maximum extent in the USA, India, Japan, Germany, Great Britain, Italy, France, and Mexico, where the share of imported products in the domestic market increased by more than 6 per cent. In Indonesia, on the other hand, the share of domestic industry products in the domestic market increased by 12%, which led to an increase in the full value of sales by 182% over the period 2008–2019 (*Table 1*).

In the segment "service and facilities" the dynamics of product sales depends on national production (*Table 2*).

According to the dynamics of the value of product realisation in 2008–2019, countries can be conditionally divided into two groups. In the first one (France, Germany, Italy, Japan) it is decreasing. In the second (USA, UK, and South Korea) it is increasing. In Mexico — it practically does not change. It should be noted that in all countries, except for Italy, the dynamics of the cost of production depends on imports. However, everywhere, with the exception of South Korea, the trade balance of service and maintenance products increases to a large extent at the expense of exports.

Thus, the integration of the national economy into the global economy leads to a greater dependence of the dynamics of the domestic market on the general market. It should be noted that the segment "service and maintenance" is formed by 90% on the basis of the sale of national products.

To find out the reasons for the dynamics of internal market development, let us consider the influence of the following factors:

1. Dynamics of supply of products generated by national manufacturing industry (*Tables 1, 2*).

As shown above, the dynamics of sales value of manufacturing products on the domestic market

[2] UNIDO Database. URL: https://stat.unido.org/database/MVA%202021,%20Manufacturing (accessed on 04.04.2022).

Table 1

Dynamics of the cost of sales of products in the domestic market segment "manufactured goods" in 2008–2019

Country	MG production volume ratio for 2008–2019	Domestic sales volume ratio for 2008–2019		Share of MG goods in exports (E), %		Share of imported products (a) in shares of national production, %		Share of sales of products of the national industry in the full volume of the value of sales in the domestic market, %	
		total sales volume	sales of imported products	2008	2019	2008	2019	2008	2019
China	2.26	2.33	1.87	22.6	17.5	13.3	11.1	85.3	88.1
USA	1.07	1.12	1.37	20.5	24.3	29.9	38.4	72.7	66.4
India	1.64	1.68	1.99	22.8	26.0	26.2	31.8	74.7	69.9
Japan	0.95	0.99	1.17	23.9	23.6	15.0	18.5	83.5	80.4
Germany	0.89	0.81	1.21	54.2	66.4	37.0	50.5	55.3	40.2
Russia	0.85	0.82	0.93	23.4	30.3	29.3	32.0	72.3	68.6
Indonesia	1.85	1.82	1.40	43.9	32.2	56.0	42.3	50.0	61.7
Brazil	0.84	0.86	1.21	15.6	18.6	15.0	21.6	84.9	78.9
France	0.88	0.90	1.01	44.8	49.2	47.1	54.3	54.0	48.4
United Kingdom	0.81	0.86	1.13	42.9	57.6	58.2	80.9	49.5	34.2
Italy	0.80	0.69	1.00	36.1	46.6	29.6	36.9	68.3	59.0
Mexico	1.38	1.14	1.48	73.2	88.7	88.8	95.2	23.2	10.4
Turkey	1.00	0.98	1.12	34.3	41.3	41.0	46.1	61.6	56.1
South Korea	1.40	1.52	1.48	41.7	42.4	28.4	26.8	67.2	68.4

Source: compiled by the author on URL: https://databank.worldbank.org/ ; URL: https://stat.unido.org/database/MVA%202021,%20Manufacturing
Note: Statistical data on Iran are published irregularly, not in all analyzed areas and are not presented in all used databases, and therefore, during the study, it was not always possible to collect data for tables on Iran, and the authors were forced to exclude Iran from a number of tables.

Table 2

Dynamics of the cost of sales of products in the segment of the domestic market "service and facilities" in 2008–2019

Country	Segment volume growth rate for 2008–2019	Domestic sales volume ratio for 2008–2019		Share of export products in the full value of national production of services and facilities (E), %		Share of imported products (a) in shares of national production, %		Share of sales of products of the national service sector in the full volume of the value of sales in the domestic market, %	
		Total sales volume of products	Sales of imported products	2008	2019	2008	2019	2008	2019
France	0.77	0.77	1.47	5.48	10.88	5.3	10.1	94.7	89.8
Germany	0.83	0.83	1.27	5.38	10.02	6.6	10.1	93.4	89.9
Italy	0.69	0.68	0.86	3.85	5.63	4.9	6.1	95.2	93.9
Japan	0.79	0.78	1.13	2.24	4.25	2.8	4.1	97.2	95.9
South Korea	1.55	1.56	1.23	11.56	7.40	12.4	9.8	87.7	90.4
Mexico	0.99	0.99	1.27	2.65	4.38	3.9	5.0	96.1	95.0
UK	1.20	1.17	1.69	8.32	11.39	6.4	9.0	93.5	90.7
USA	1.38	1.38	1.34	2.94	3.19	2.3	2.2	97.7	97.8

Source: compiled by authors on URL: https://databank.worldbank.org/ ; https://stats.oecd.org/
Note: only 8 countries are presented in the table, since publicly available statistical data on the service do not allow calculating the analyzed indicators for all the countries studied.

depended on national production only in China and Indonesia.

In the segment of "service and maintenance" products, the dynamics of product sales value depends on national production only in South Korea and (to some extent) in the USA, where it is practically the same for domestic and imported products.

2. Product price dynamics (inflation, deflation).

3. Dynamics of the population demand.

The cost of selling products on the market is defined as:

$$P(t) = \left(C_0 + \Delta C(t)\right) * \left(S_0 + \Delta S(t)\right), \quad (5)$$

where: S_0 and C_0 — respectively, the physical volume of products produced and the price of these products in the base year; $\Delta C(t)$ and $\Delta S(t)$ — respectively, the increments of price and physical volume of production for the period 2008–2019.

The coefficient of growth[3] of the value of sales $P(t)$ in PPP and fixed-price statistics can be defined as:

$$k_s = 1 + \frac{\Delta S(t)}{S_0}, \quad (6)$$

And the coefficient of growth $P(t)$ in the statistics with only the price change:

$$k_C = \frac{\Delta C(t)}{C_0}. \quad (7)$$

Then:

$$k = \frac{P(t)}{C_0 * S_0} =$$

$$= 1 + \frac{\Delta S(t)}{S_0} + \frac{\Delta C(t)}{C_0} + \frac{\Delta S(t)}{S_0} * \frac{\Delta C(t)}{C_0} =$$

$$= k_s + \frac{\Delta C(t)}{C_0} * k_s \quad (8)$$

and, consequently, the product price growth coefficient is determined by the ratio:

$$\frac{\Delta C(t)}{C_0} = \frac{k - k_s}{k_s}. \quad (9)$$

The results of calculations according to formula (9) are presented in *Table 3*.

Analysis of the data in *Table 3* shows that in all countries there is an increase in the physical volume of sold products, but the mechanisms of price change differ significantly.

In the USA and South Korea there are inflationary processes of increasing the price of products (Price). For ten years it increased by 17.0 and 20.4 per cent respectively. It should be noted that the growth of physical volume of production is 19.8 and 36.7 per cent (*Table 3*). At that, in the rest of the countries there are high rates of price (Price) decrease in comparison with the increase in the physical volume of production. This is due to the decrease in the value of the national currency against the dollar.

The data of *Table 3* allow us to determine the dynamics of realised product price in the domestic market.

To confirm the possibility of calculating the price dynamics by formula (9), the authors have made a calculation based on direct data on inflation in the domestic markets of national economies and the dynamics of the dollar exchange rate.

The price of products sold in the domestic market, expressed in dollars, is determined as follows:

$$C(t) = C_0 + \Delta C(t) =$$

$$= \left(NC_0 + \Delta NC(t)\right) * \left(W_0 + \Delta W(t)\right), \quad (10)$$

$$\frac{C}{C_0} = 1 + \frac{\Delta C(t)}{C_0} =$$

$$= \left(1 + \frac{\Delta NC(t)}{C_0}\right) * \left(1 + \frac{\Delta W(t)}{W_0}\right) = X * Y, \quad (11)$$

$$\frac{\Delta C(t)}{C_0} = X * Y - 1, \quad (12)$$

where C_0 — is the price of products in the base year; ΔC_0 — product price increment for

[3] The growth coefficient is a measure of the intensity of change in the level of a series, expressed in fractions of a unit; a similar measure, expressed in per cent, is the growth rate. They both differ only in the units of measurement.

Table 3

Dynamics of GDP growth for 2008–2019

Country	GDP growth rate in current US dollars (k)	PPP GDP growth rate at constant prices (international dollars, 2017), k_s	Domestic price growth coefficient, $(k - k_s) / k_s$
China	3.024	2.162	0.399
USA	1.401	1.198	0.170
India	2.253	1.974	0.141
Japan	0.986	1.065	–0.074
Germany	1.066	1.134	–0.060
Russia	0.998	1.102	–0.094
Indonesia	2.043	1.688	0.210
Brazil	1.130	1.134	–0.003
France	0.956	1.098	–0.129
United Kingdom	0.987	1.151	–0.143
Italy	0.872	0.968	–0.099
Mexico	1.101	1.234	–0.107
Turkey	1.010	1.661	–0.392
South Korea	1.647	1.367	0.204

Source: compiled by the authors according to: URL: https://databank.worldbank.org/

Table 4

Dynamics of the price of products in US dollars in the domestic market according to the dynamics of the exchange rate of the national currency and pricing in the national currency for the period 2008–2019

Country	Domestic product price growth coefficient, calculated according to formula (9)	Product price growth coefficient in national currency, X	Growth coefficient of the relative value of the national currency against the dollar, Y	The coefficient of product price growth in dollars, $Z = X*Y$	Growth coefficient of relative product price in dollars, calculation according to formulas (10)–(12)
USA	0.170	1.193	1.000	1.193	0.193
Germany	– 0.060	1.177	0.803	0.945	– 0.055
France	– 0.129	1.106	0.803	0.888	– 0.112
United Kingdom	– 0.143	1.220	0.721	0.880	– 0.120
Italy	– 0.099	1.144	0.803	0.919	– 0.081
South Korea	0.204	1.237	1.000	1.237	0.237

Source: compiled by the authors on: URL: https://databank.worldbank.org/; https://stats.oecd.org/

Table 5

The level of debt of households, non-financial corporations, and the government in relation to GDP, %

Country	2008				2019			
	households	non-financial corporations	government	Aggregate indebtedness	households	non-financial corporations	government	Aggregate indebtedness
China	17.9	87.3	27	132.2	54.1	153.6	50.6	258.3
USA	97.9	126	73.7	297.6	77.9	133	106.9	317.8
India	101	43.4	72.7	217.1	120.5	45.4	43.9	209.8
Japan	62.3	148	183.4	393.7	61.6	146	237.4	445.5
Germany	60.2	103.2	65.6	229	54.6	100	61.6	216.2
Russia	11.6	36.1	7.4	55.1	18.2	178.7	14.6	211.5
Indonesia	11.5	15.5	30.2	57.2	17	23.2	30.1	70.3
Brazil	19.5	35.7	61.5	116.7	28.3	42.3	87.6	158.2
France	72.4	145.2	68.8	286.4	72.3	181.7	98.4	352.4
United Kingdom	102.4	145.3	49.7	297.4	94.1	129.8	86.7	310.6
Italy	52.5	119.6	56.5	228.6	53.6	112.6	135.5	301.7
Turkey	12.3	35.4	38.1	85.8	14.7	69.2	30.2	114.1
South Korea	74.4	152.6	26.9	253.9	94.6	151.1	37.9	283.6

Source: compiled by the authors on URL: https://data.imf.org/regular.aspx?key=62805740

the period 2008–2019; NC_0, $\Delta NC(t)$ — respectively, the price of products sold in the domestic market, expressed in national currency, in the base year (2008) and its increment for the period 2008–2019; W_0, $\Delta W(t)$ — respectively the national currency exchange rate in the base year (2008) and its increment for the period 2008–2019; X — domestic price growth coefficient in national currency for the period 2008–2019; Y — dynamics of the national currency exchange rate against the dollar for the period 2008–2019.

The results of calculations according to formulas (9)-(12) are presented in *Table 4*.

Indeed, the analysis of the data in *Table 4* shows the coincidence of the results of calculations according to formulas (9)–(12). Only by comparing the dynamics of GDP in the specified statistical format can information about the impact of the global financial system on the dynamics of prices of products sold in the domestic market be obtained. This confirms the interpretation of the reason for the divergence of GDP dynamics in nominal terms and with PPP with fixation of prices in the base year.

The data of *Table 4* show a noticeable inflation in the national economies. The fall of the national currency exchange rate and inflation in the domestic market negatively affect the profitability of production and the incomes of those employed in it. The costs of purchasing components are growing to a greater extent than the proceeds from the sale of products, which is manifested in the increase in the cost of imported products and the volume of negative trade balance.

DEBT BURDEN OF ECONOMIC ENTITIES AND THE LEVEL OF CONSUMPTION OF GOODS AND SERVICES

The noticeable impact of changes in the price of products on the full cost of their realisation leads to a number of negative consequences. First of all, it leads to a decrease in profitability and an increase in the debt burden of industries. *Table 5* presents the distribution of domestic debt between non-financial corporations, households and the government.

The total debt burden of households, non-financial corporations and the government exceeds the GDP of the analysed countries with the exception of Indonesia, Russia and Turkey in 2008. In 2019, the situation when the total debt burden is less than the country's GDP was only in Indonesia. However, the presented countries show a different mechanism of debt burden distribution among the above-mentioned entities.

Analysis of the data in *Table 5* shows that in 2019 in 9 countries (including China and Russia) the level of debt of non-financial corporations was more than 100% of GDP, while in 2008 there were 7 such countries. At the same time, the level of non-financial corporations' debt to GDP increased 5 times in Russia and almost 2 times in China. The high debt burden of non-financial corporations indicates inefficient, from the economic point of view, organisation of the production process.

In the case of households in 2019, debt greater than 50% of GDP is observed in 9 countries, while in 8 of them the debt of non-financial corporations is greater than 100%. Approximately the same distribution of debt of these economic entities was in 2008. Consequently, to maintain the solvency of households and corporations it is necessary to attract borrowed funds, including from external sources. National economies are generally unprofitable, as evidenced by the level of debt of non-financial corporations.

Thus, we can conclude that the structure of the economy and the model of interaction with the global market do not form conditions for positive dynamics of development of economic entities and increase in the level of profitability and are not able to support household incomes at the level necessary to meet their needs.

The data in *Table 6* show that households are heavily indebted. For households in most countries, with the exception of Italy in 2008 and 2019 and Germany in 2019, the debt-to-income ratio exceeds 100 per cent.

Table 6

Household debt to the level of their income, %

Country	2008		2019	
	Debt to incomes	Income level to GDP	Debt to incomes	Income level to GDP
USA	128.46	76.21	108.65	71.70
Japan	107.56	57.92	107.27	57.43
Germany	101.83	59.12	95.31	57.29
France	102.8	70.43	120.68	59.91
UK	162.25	63.11	141.15	66.67
Italy	80.77	65.00	86.76	61.78
South Korea	147.53	50.43	184.20	51.36

Source: compiled by the authors on: URL: https://www.imf.org/external/datamapper/datasets/GDD; URL: https://databank.worldbank.org/

Table 7

The ratio of total public and external debt to GDP in 2019

Country	Total public debt to GDP ratio, %	Total external debt to GDP ratio, %
USA	108.5	95.5
United Kingdom	85.2	298.4
France	97.6	228.9
Germany	59.2	144.7
Japan	235.4	82.9
Italy	134.6	124.8
China	57.2	14.5
Mexico	36.1	36.6
Turkey	32.7	54.7
Russia	13.8	29.0
South Korea	47.9	28.5
Brazil	86.9	30.6
India	74.1	19.9
Indonesia	30.6	36.1

Source: compiled by the authors on: URL: https://www.imf.org/external/datamapper/datasets/GDD; https://www.ceicdata.com/en/indicator/external-debt — of-nominal-gdp

The ratio of income level to GDP is determined by the formula:

$$\ln = m * 100\%, \quad (13)$$

where

$$\left.\begin{aligned} u &= \frac{Db}{GDP}, \\ m &= \frac{Db}{In}, \end{aligned}\right\} \quad (14)$$

where *Db* — debts; *In* — household incomes.

Data from IMF statistics and the results of calculation according to formula (14) are presented in *Table 6*.

Analysis of the data in *Table 6* shows that in the USA, Germany, France and Italy in 2019, compared to 2008, there was a decline in the ratio of household income to GDP.

Another factor negatively affecting GDP dynamics is the high level of external debt.

The data of *Table 7* show the different policies of countries in determining the sources of credit. There is a significant indebtedness in the domestic (compared to the external) market of Japan. A similar picture is characteristic of Brazil, France, and the UK.

Seven countries have an aggregate external debt exceeding 50% of GDP, at which, according to the IMF methodology, the degree of risk for sustainable economic development is high [20]. It should be noted that in six of them this indicator exceeds 90%. Thus, to maintain the development of the national economy, countries have to use loans from external sources.

CONCLUSIONS

The authors have established multidirectional dynamics of the volume of product sales in the domestic market as a whole and in individual sectors (manufacturing and services). In all countries, the value of sales of products of these segments depends on imports. According to the ratio of the dynamics of the cost of imported and domestic products in the domestic market, countries are divided into two groups. In the first group the total cost of realisation of the volume of products on the domestic market is growing, while in the second group it is falling.

In 2008–2019, the degree of integration of national economies increased, which led to greater dependence of domestic markets on the processes taking place in the global economy. In all countries there is an increase in the physical volume of product sales. At the same time, its value is decreasing due to the devaluation of the national currency against the dollar.

It should be noted that the debt burden of households, corporations and governments is growing. In 2019, in all analysed countries, except for Indonesia, the total debt burden exceeded GDP.

The above-mentioned trends are caused by structural problems due to high indebtedness of enterprises in the real sector of the economy and the non-financial services sector, on the one hand, and hypertrophied stimulation of financial sector development, on the other hand.

Thus, the research has shown that within the framework of the current models of national economies of the countries with a population of more than 50 million people, leading in the ranking by the level of GDP in PPP, in the period 2008–2019, the conditions for the generation of structural problems have been formed, manifested in the growth of the debt burden in various segments of the economy, an increase in the negative current account balance and, ultimately, a decline in the level of consumption and quality of life of the population. The obtained results indicate the need to form a fundamentally new model of national economies.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was received on 22.09.2023; revised on 30.11.2023 and accepted for publication on 15.01.2024. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2220-6469-2024-18-2-126-142
UDC 336.01(045)
JEL G40, G41, G53

Due to the Assignment of Financial Ethics and Financial Literacy, the Interest of Accounting Students in Using Financial Technology Products is Increasing

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ABSTRACT

The presented work examines the impact of financial ethics and financial literacy on the interest shown by accounting students studying in the city of Lubuklingau* in using financial technology products. The article uses quantitative research methods. The survey, with pre-defined criteria specifically targeted at accounting students who use fintech products, had 661 respondents. The study results demonstrate that financial literacy and financial ethics have a significant impact on students' interest in using financial technologies.

Keywords: financial ethics; financial literacy; financial technology; accounting students

For citation: **Rimbano D., Eprianti Yu., Rusydi G., Sari T.A., Dora M. Due to the assignment of financial ethics and financial literacy, the interest of accounting students in using financial technology products is increasing. *The World of New Economy*. 2024;18(2):126-142. DOI: 10.26794/2220-6469-2024-18-2-126-142**

*The city of Lubuklinggau is located in South Sumatra, Indonesia. According to official estimates, its population as of mid-2023 is 241.9 thousand people

INTRODUCTION

Information technology is developing rapidly and has a very rapid influence on users. The Internet has become a form of technological development necessary for all. Access to technology provides services that are easier so that every individual or company uses technology as a tool for achieving a goal. The sophistication of this technological development offers new and creative innovations that make community activities more effective and efficient. Various industrial sectors in Indonesia offer innovations that can transform the business models of each industry into more efficient ones. With the development of this information technology, technology emerged that led to financial innovation with the touch of modern technology in the field of services called fintech [1]. This research on the impact of ethics and financial literacy on the inclination of accounting students in Lubuklinggau to utilize financial technology products has practical implications for the accounting industry and the education sector, providing insights into the factors that influence the adoption of fintech in accounting practices.

Fintech is a digital financial business that provides financial services using modern software and technology. Fintech operates in various areas, such as payments, transfers, or share sales. Fintech provides the facility for transactions in finance, becoming more practical and efficient and aimed at maximizing the use of technology in accelerating financial services [2]. The most dominant fintech business in Indonesia today is the type of payment. Payment systems are electronic services that replace cartel money and girl money as means of payment, e.g., e-money, go-pay, OVO, and bitcoin cards. In contrast, Payment gateways are online payments whose functions describe and validate information on a transaction according to the policies established by the providers. In today's online age, payment gateways are very popular and become famous, especially among e-commerce perpetrators, because they facilitate digital-based financial

transactions supported by the Internet network. The presence of fintech in Indonesia can benefit the public as a user of the financial services facility and maximize financial services. Customers or users can access financial services through smartphone or laptop technology, so there is no need to come directly to the bank to make transactions. Students have become a generation with a high curiosity to keep up with the latest technology trends. Technological advances have brought many changes in student lifestyles. The use of technology is becoming increasingly popular among the younger generations of students without exception.

Students are part of a society that is very close to the issues of access to the world of the Internet, technology, and information, not only the science that requires students to always look for the latest information but also the question of the various basic needs as human beings in the digital age [3]. Fintech has become a hot topic of discussion among students to conduct financial transactions between people and technology. Along with today's technological advances, two things influence students to use fintech: financial literacy and knowledge of financial ethics. Financial literacy becomes a skill that every individual should master to improve their standard of life and to understand the planning and allocation of financial resources appropriately and efficiently [4].

Ethics in the financial field would generally be more accessible to apply if it had been taught since childhood so that it had become a habit for individuals. The personal perspective of the financial sector will indirectly affect financial management because people will tend to act on their habits, and these habits will build a personal definition of financial ethics. It is well known that many students have no or difficulty applying ethics in managing finance, and the key factors influencing how people act and think are in the financial sector. Therefore, education is needed to understand the ethics of the financial sector and increase knowledge and awareness of ethics in the management of our financial sector. According to data from World Bank 2022, the number of Indonesians who have had accounts in formal financial institutions is only about 36%. The remaining 64% of the Indonesian population does not have accounts or access to formal or often referred to as unbanked institutions [5]. That means more than half of the Indonesian population has not received financial services like banks. It's an opportunity for a business that moves in the financial sphere to take advantage of technology. For example, Investree is a fintech startup operating in peer-to-peer lending that meets people with borrower needs and people willing to borrow money.

Currently, fintech operators in Indonesia still dominate the business of payments (43%), loans (17%), and the rest in the form of aggregators, crowdfunding, etc [6]. Fintech has the potential to benefit a wide range of stakeholders, ranging from businesses to the community that uses its services, as well as economic growth. In Indonesia, many startups use Fintech services and are better known than other financial industries that have strict rules that are too strict. Meanwhile, Fintech uses technologies, software, and data that are more effective and efficient. Based on the research results, Lubuklinggau City people are still interested in using fintech; proven interest variables use of fintech significantly influence financial inclusion. The perception of ease of use of fintech has no significant influence on financial inclusion in the Lubuklinggau city community. People are still unfamiliar with fintech, so they think using it is difficult. Besides, the efficiency of the use of fintech also has no significant influence on the financial inclusion of the people of Lubuklinggau City. Based on the level of risk, using fintech has a considerable impact on the economic inclusion of the Lubuklinggau community because the public believes that using fintech is detrimental and has a great deal of risk if used.

Looking at the above issues, it can be concluded that a level of financial literacy and knowledge of financial ethics is essential to improving understanding of finance and financial technology. The existence of fintech in Indonesia can benefit people by facilitating and maximizing financial services. However, in Lubuklinggau City, people are still unfamiliar with fintech, so they think it is difficult. Students are a generation of people with a high

level of curiosity and are very close to the issue of internet access. Two things influence students to use fintech: financial literacy and knowledge of financial ethics. A study by Saleh concluded that student financial literacy influences the use of fintech. Students who will use fintech products should also consider the knowledge aspect of financial ethics where it is known; many students have not or have difficulty applying ethics in managing finance [1].

In the study conducted, it was concluded that student financial literacy influences the use of fintech. Also, the research obtained results that showed a positive and significant influence between the level of financial literature and the interest in using fintech products [8]. While it is known that many students do not have or have difficulty applying ethics in managing finance, the main factors affecting how people act and think are in the financial sector. So, research is required to determine the influence of literacy level on the interest in financial technology products and to know the impact of financial ethics. Based on the problem formulation above, the problem formula for this study is: Does the level of financial literacy in students influence interest in using financial technology products? Does knowledge of financial ethics influence interest in using financial technology products? Does the level of financial literacy and financial ethics influence interest in using financial technology products?

LITERATURE REVIEW

Unified Theory of Acceptance and Use of Technology

Venkatesh has created a model of the Unified Theory of Acceptance and Use of Technology. The theory is based on previous models of acceptance and adoption of technology, such as the Theory of Reason Action, Theory of Planned Behaviour, Task-Fit Technology, and the Technology of Acceptance Model, and Their Combined Model of Personal Computer Utilization, Social Cognitive Theory, Innovation Diffusion Theory or Diffusion of Innovation, and Motivational Model that predict performance expectations and expectations of enterprises as the most influential factors for the intensity or interests of behavior. This Unified Theory of Acceptance and Use of Technology model identifies critical factors in the acceptance of information technology measured by the desire to use the technology and the level of actual use. The Unified Theory of Acceptance and Use of Technology aims to explain a person's interest in using a technology information system and subsequent user behavior [9]. Venkatesh originally compiled the Unified Theory of Acceptance and Use of Technology model, which consists of four variables as determining factors in the use of information technology; the first performance expectancy is the extent to which an individual believes that using this system will help in achieving results in the performance of work. Second is the expectation of an effort. To what extent is the level of convenience associated with using a system? The relationship between the four predictors and the purpose of the use of information technology is influenced by the four variables of the moderator: gender, age, experience, and obligation or voluntary use of information technology being studied [10,11]. This study uses the Unified Theory of Acceptance and Use of Technology model to identify the factors that drive a person to use a system. Unified Theory of Acceptance and Use of Technology is a suitable model to identify characteristics of interest in using fintech products in accounting students in Lubuklinggau.

Financial Literacy

Financial literacy is a set of knowledge and skills that enables individuals to make effective decisions with all their financial resources [12]. Financial literacy is the ability to make informed judgments and effective decisions regarding the use and management of money. The financial attitude and behavior aspect suggests that financial literacy is not only about knowing, being skilled in using, and trusting financial institutions, products, and services but also about changing one's financial attitudes and behavior to live a more prosperous life. The underlying reason for the need for financial attitude and behavior aspects in financial literacy is that financial literature programs that rely solely on knowledge-only approaches cannot

change a person's behavior when they do not have appropriate attitudes and motivations [13,14] Financial literacy is the essential knowledge people need to survive in modern society. This basic knowledge involves knowing and understanding the complex principles of spending, saving, and investing [15]. Everyone should own and carry out ideals to achieve financial independence, knowledge, and implementation of sound personal financial practices. The extent to which the knowledge and implementation of a person or society in managing his finances is often known as financial literacy. Financial literacy covers many aspects that need to be measured [16]. Financial literacy is an individual's ability to make decisions regarding financial arrangements. Divides financial literacy into four aspects: basic financial knowledge covering expenditure, income, assets, debt, equity, and risk. This basic knowledge usually relates to making decisions in making investments or financing, which can affect a person's behavior in managing the money he owns [17]. Saving and borrowing is a banking product better known as savings and credit. Savings are the amount of money that is saved for future needs. A person who has a higher income than his expenditure will tend to save the remainder of the money for future requirements. Insurance is a form of financial protection provided through life, property, education, and health insurance. An investment is a form of fund or asset-planting activity to earn a profit in the future. The forms of investment can be tangible assets (property and gold), financial assets (shares, deposits, bonds, and other financial assets), and so on.

Financial Ethics

Although finance raises many ethical issues, the academic study of financial ethics has surprisingly received little attention from scholars in finance and business ethics [18]. Finance can be widely defined as the generation, allocation, exchange, and management of monetary resources [19]. The main topic area in finance is defined as follows: Personal finance, in which individuals store, invest, and borrow money in order to carry out their personal lives [20]. Corporate finance is where the business or use is most productive. Public finance is where the government increases income through taxes and loans and spends it to provide services to the government's citizens. Robert W. Kolb, in his financial and ethical implications, considered financial theory, at least by its followers, ethically neutral or without normative imports. However, the theory's central assumptions, such as the assumption of rational or selfish behavior and the views driven by the theoretical adoption, lead to conclusions about how people (morally) should behave and how companies should be regulated and operated [21]. Personal perspectives about the financial sector would indirectly affect financial management because people would act based on their habits, and habits would build a personal definition of ethics [22]. To control it, students must have good financial management skills. It all starts with trying to keep our finances healthy. Make sure the money that comes out does not exceed the money it comes in. However, this study found that most students could not plan and estimate the cost because it followed their desire and thus resulted in unexpected costs [23]. Ethics is derived from the Greek ethos, which means character. Another name for ethics is morality, which comes from the Latin mores, which means habit. Morality focuses on human behavior that refers to "right" and "wrong." So, ethics is about stating how one behaves toward another [24]. According to Wati and Sudibyo, ethics is the values of behavior or rules of conduct that are accepted and used by an individual or a particular group [25]. Student financial management ethics must be applied to avoid wasting all income. Therefore, it is clear that students should have good ethical knowledge in managing finances. Not only for the benefit of the present but also as a livelihood in the future. For that, the moment as a student needs to be used well to experiment and explore financial management.

Financial Technology

Financial Technology combines financial services with technology, transforming the business model from conventional to moderate. Initially, payments must meet face-to-face and carry some cash, but

Table 1

Operational Definitions of Variables

No.	Variables	Variables Definition	Indicators
1	Financial literacy level (X1)	The level of financial literacy is the understanding that an individual can analyze and apply financial knowledge in everyday life, make financial decisions, and be aware of the risks associated with those decisions	General knowledge of personal finance, Loans, Savings, Investment
2	Knowledge of financial ethics (X2)	Knowledge of financial management ethics in student finances	Student perspectives on finance, Financial management ethics
3	Interest in using financial technology products (Y)	Individual interest in fintech products or business models in the financial services industry. Fintech is a revolution that has merged financial services with information technology and improved the quality of financial services	There is a feeling of pleasure, The presence of attention, There is interest, Willpower

Source: Adoption of research conducted by Cagle & Baucus (2006); Persons (2009); Chiu (2016); Potrich et al. (2015); Caplinska & Ohotina (2019); Dorfleitner et al. (2019).

Table 2

Population and Study sample

University	Program	Number of Students	Persentase	Sample
Universitas Bina Insan	Accounting	1.356	25%	339
Universitas Musi Rawas	Accounting	1.286	25%	322
Jumlah Mahasiswa		2.642 Population		661 Sample

Source: URL: https://pddikti.kemdikbud.go.id/

now, it can be done with remote transactions by making payments that can be made in seconds [26]. Financial Technology is an innovation in financial services that does not need paper money. Financial technology transforms currencies into digital to be more efficient. Fintech refers to the use of technology to provide financial solutions. Fintech comprises companies that use technology to make the financial system and the dissemination of financial services more efficient [27]. According to the Bank of Indonesia Regulations, fintech is a technology within a financial system that produces new products, technology services, and business models and can affect monetary stability, the stability of the financial system, or the efficiency, smoothness, security, and reliability of the payment system. The objective of Financial Technology is to regulate the implementation of financial technology to drive innovation in the financial field by applying the

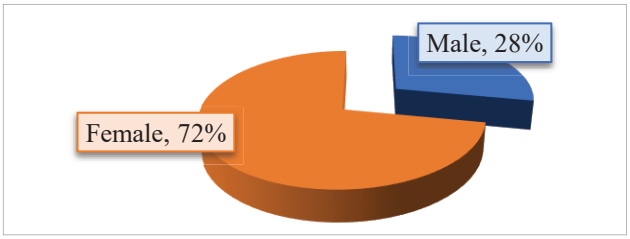

Fig. 1. **Gender of active accounting study program students**

Source: Processing research data sourced from primary data collected during field research, 2023.

principles of consumer protection as well as risk and prudence management to maintain monetary stability, the stability of the financial system, and the efficient, smooth, and secure and reliable payment systems [28–30]. In this study, this research variable is related to previously relevant variables. Referring to previous research, it was concluded that the level of financial literacy and knowledge of

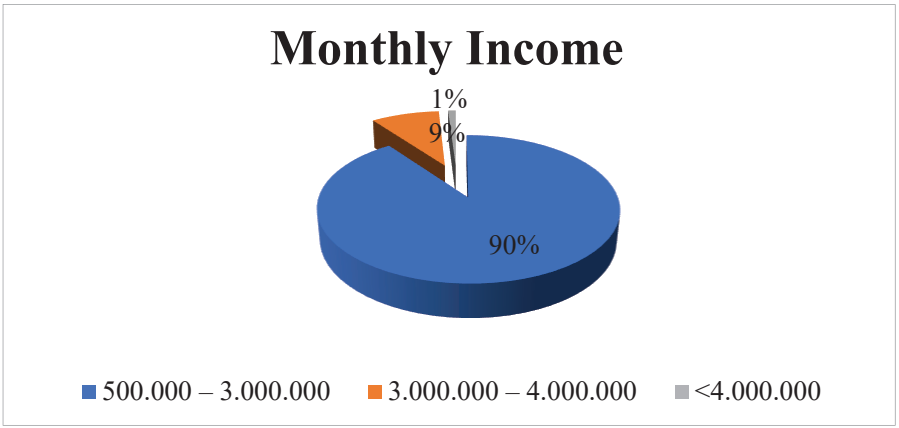

Fig. 2. **Respondents based on monthly income**

Source: Processing research data sourced from primary data collected during field research, 2023.

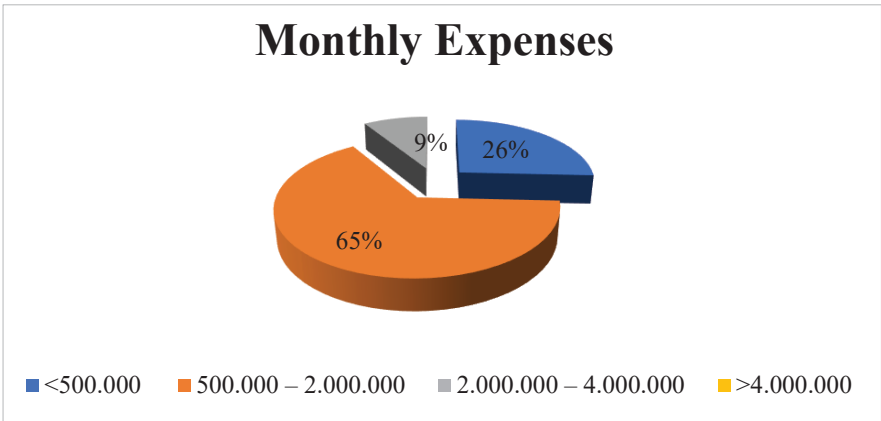

Fig. 3. **Respondents based on monthly expenses**

Source: Processing research data sourced from primary data collected during field research, 2023.

financial ethics in students. There is a positive and significant influence between financial literacy and understanding of financial ethics on interest in using fintech products. The higher the student's ability to manage finance as a capital improves the quality of life, the greater the interest of students in following current economic developments in the era of technology, and the emergence of interest in using fintech products will increase.

Hypothesis

Students' financial literacy factors significantly influence their interest in using financial technology products (H1).

Factors of knowledge about financial ethics in students significantly influence interest in using financial technology products (H2).

Factors Students' financial literacy and knowledge of financial ethics significantly influence their interest in using financial technology products (H3).

METHODS

Quantitative research methods are one type of research whose specifications are systematic, planned, and structured from the beginning to the end of the research design. This descriptive approach is used to find the existence of autonomous variables, either one or more, without making comparisons with other variables [31, 32] (*Table 1*).

Population is a generalized area consisting of objects/subjects with specific characteristics and qualities applied by the author to be studied and

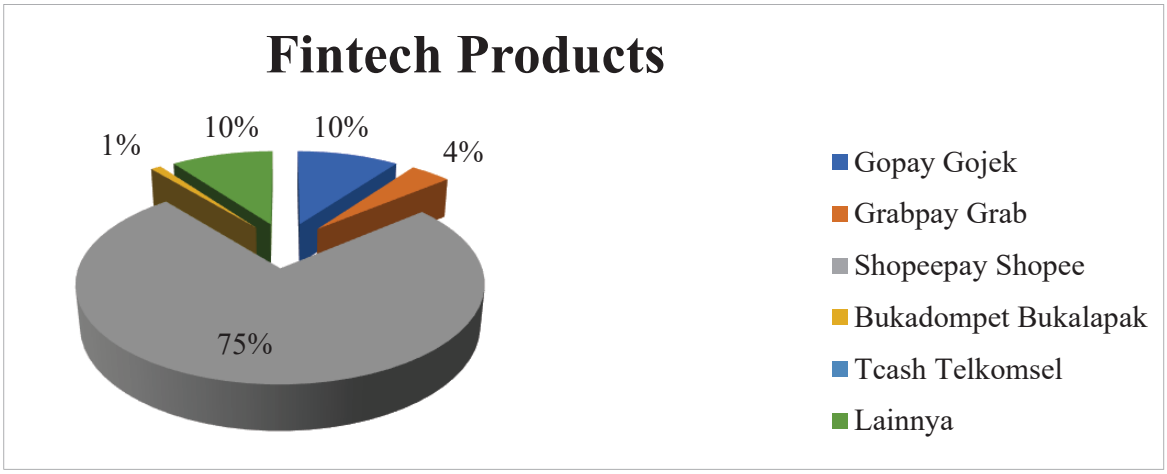

Fig. 4. **Respondents based on fintech products used**

Source: Processing research data sourced from primary data collected during field research, 2023.

then drawn conclusions. Population is not only people but also other natural objects and objects. So, population is not just the number of the object/subject studied but includes all characteristics or properties of the subject or object under study [39]. If someone wants to examine all the elements in the research area. The study or research is called a population study or census study. The population in this study is all accounting study program students of Universitas Bina Insan and Universitas Musi Rawas in Indonesia (*Table 2*).

The sample is part of the characteristics and quantities that the population possesses [40]. Suppose the population is large and the author cannot study everything in the population, for example, because of the limitations of funds, energy, and time. In that case, the author can use a sample from that population. Based on what he learned from the sample, the conclusion will apply to the population. For that, the sample taken from the population must be precisely representative. So, the sample range can be 25 percent of the research population [41]. However, the sample selection criteria are (1) Students active in accounting studies at Universitas Bina Insan and Universitas Musi Rawas. (2) Students who already use fintech products. Multiple linear regression is an equation model that explains the relationship of a bound variable with two or more free variables [42]. A double linear regression test tests the strength of the relationship between a free variable and a bound variable. So, in this study, the regression is as follows:

$$Y = a + b_1X_1 + b_2X_2 + e.$$

Information:

Y = Dependent Variable, namely Financial Technology;

a = Constant;

b = Regression Coefficient;

X_1 = Financial Literacy;

X_2 = Financial Ethics.

The t-test is performed to see to what extent an independent variable individually influences or explains the dependent variable. The hypothesis in this t-test is H0 = no significant impact and H1 = significant impact. As for the basis of decision-making in the t-test, H0 is accepted, and H1 is rejected if the t-count value < of the T-table or if the significant value > 0,05. H0, and H1, when the t-count value > from the t-table or a considerable value < 0,05.

RESULT

Percentage Chart of Number of Respondents by Gender

From *Fig. 1* above, it can be seen that the majority of active students in accounting at Universitas Bina Insan and Universitas Musi Rawas who have completed the questionnaire were female primarily respondents, 476, with a percentage of 72%,

Table 3

Validity Test Results

Variable	Statement Item	R Count	R Table	Judgment
Financial Literacy (X1)	FL.1	0.2497	0.195	Valid
	FL.2	0.3885	0.195	Valid
	FL.3	0.4905	0.195	Valid
	FL.4	0.3923	0.195	Valid
	FL.5	0.6301	0.195	Valid
	FL.6	0.5073	0.195	Valid
	FL.7	0.4447	0.195	Valid
	FL.8	0.4623	0.195	Valid
	FL.9	0.3583	0.195	Valid
	FL.10	0.5165	0.195	Valid
	FL.11	0.5129	0.195	Valid
	FL.12	0.5020	0.195	Valid
	FL.13	0.2209	0.195	Valid
	FL.14	0.5589	0.195	Valid
	FL.15	0.4712	0.195	Valid
	FL.16	0.4094	0.195	Valid
Financial Ethics (X2)	FE.1	0.6618	0.195	Valid
	FE.2	0.6507	0.195	Valid
	FE.3	0.7487	0.195	Valid
	FE.4	0.6814	0.195	Valid
	FE.5	0.4954	0.195	Valid
	FE.6	0.5250	0.195	Valid
	FE.7	0.6641	0.195	Valid
	FE.8	0.5733	0.195	Valid
	FE.9	0.6206	0.195	Valid
	FE.10	0.6889	0.195	Valid
Financial Technology (Y)	FT.1	0.5049	0.195	Valid
	FT.2	0.5846	0.195	Valid
	FT.3	0.6996	0.195	Valid
	FT.4	0.6742	0.195	Valid
	FT.5	0.7314	0.195	Valid
	FT.6	0.7058	0.195	Valid
	FT.7	0.7048	0.195	Valid
	FT.8	0.7835	0.195	Valid
	FT.9	0.7523	0.195	Valid
	FT.10	0.6311	0.195	Valid
	FT.11	0.7183	0.195	Valid

Source: Processing research data sourced from primary data collected during field research, 2023.

Table 4

Coeficiencies R and R Square First Hypothesis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.542a	0.294	0.287	3.254

Source: Processing research data sourced from primary data collected during field research, 2023.

Table 5

Simple Regression and First Hypothesis t-Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant) Financial Literacy	15.039 0.452	4.753 0.071	0.542	3.164 6.388	0.002 0.000

Source: Processing research data sourced from primary data collected during field research, 2023.

Table 6

Coeficiencies R and R Square Second Hypothesis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.575a	0.331	0.324	3.168

Source: Processing research data sourced from primary data collected during field research, 2023.

Table 7

Simple Regression and Second Hypothesis t-Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant) Financial Ethics	21.582 0.573	3.424 0.082	0.575	6.302 6.965	0.000 0.000

Source: Processing research data sourced from primary data collected during field research, 2023.

and some of the other male, 185 respondents, with 28 percent of a total of 661 respondents.

Percentage Chart of Number of Respondents Based on Monthly Income

Figure 2 above shows that of the 661 respondents who were accounting students, 595 had an average income between 500,000 and 3.000,000, with a percentage of 90%. In contrast, some respondents' income between 3,000,000 and 4,000,000 amounted to 59 respondents, with a rate of 9%, and only seven respondents whose income is more than 4,000,000 had a percentage of 1%.

Percentage Chart of Number of Respondents Based on Monthly Expenses

Based on *Fig. 3* above, it can be seen that 430 of the 661 respondents had the most expenditure

between 500,000–2.000,000 with a percentage of 65%, then in second-order were 172 people had less than <500,000 with 26%, and the remaining 59 people had the most minor expenditures between 2,000,000–4.000.000 with 9%.

Percentage Chart of Number of Respondents Based on Financial Products Technology Used

From the picture above (*Fig. 4*), it can be concluded that respondents who use financial technology products such as Shopeepay from Shopee are 496 people with 75 percent, Gopay from Gojek is 66 people with 10 percent, Grabpay from Grab is 26 people with 4 percent, and Bukadompet from Bukal is seven people with 1 percent. The use of other financial products of technology is 66 persons with 10 percent.

Validity Results

A validity test recognizes the validity of details in a list of statements used to define a variable.

Based on *Table 3* above shows that the whole question element is valid, which can be seen from r-hitung > r-table (0,195) on each statement element. Thus, it is concluded that 661 statements in this study are valid and will be used in the research.

Research Hypothesis Test

Hypotheses are interpreted as answers to the formula of research problems. Hypothesis testing in research aims to test the truth of research between free variables versus bound variables. The authors in this study use simple regression analysis to test the first and second hypotheses, while the third hypothesis uses double regression.

Test the First Hypothesis

This first hypothesis uses a simple regression analysis test with the help of statistical applications and states that financial literacy and interest in using fintech products have a positive and significant influence (*Table 4*).

Based on these results, the value of the coefficient of determination expressed by R'Square is 0.294, or 29.4%. This means that financial literacy (X_1) can influence 29.4% of changes in interest in using fintech products (Y), and other factors influence the remaining 70.6%.

Judging from the table, the coefficient value is 0.452, and the constant number is 15.039. Then, the regression line equation can be structured as follows: $Y = 15{,}039 + 0{,}452X + e$. The equation above shows that the value of the X_1 coefficient is 0.452, which means that if the level of financial literacy (X_1) increases by 1 point, it will be followed by an increase in interest points in *using fintech* products (Y) by 0.452. The t-test is performed to see the extent to which the influence of one

Table 8

Coeficiencies R and R Square Third Hypothesis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,606a	0.367	0.354	3.097

Source: Processing research data sourced from primary data collected during field research, 2023.

Table 9

Test f Third Hypothesis

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression Residual Total	539.806 930.304 1470.110	2 658 660	269.903 9.591	28.142	0.000b

Source: Processing research data sourced from primary data collected during field research, 2023.

independent variable individually influences or explains the dependent variable. This t-test hypothesizes that H0 = has no significant effect and H1 = has a considerable impact. The basis for deciding the test is: H0 is accepted, and H1 is rejected if the t-count value is < from the t-table or if the significant value is >0.05. H0 is rejected, and H1 is accepted if the t-count value is > from the t-table or if the critical value is <0.05. Based on *Table 5*, the financial literacy variable has a regression coefficient value of 0.000 positive, a t-count value of 6.388>t-table 1.984, and a significant value of 0.000 > 0.05, which means that financial literacy (X_1) has a positive and considerable influence on the interest in using fintech products (Y).

Test the Second Hypothesis

This second hypothesis uses a simple regression analysis test with the help of statistical applications and states that knowledge about financial ethics positively influences interest in using *fintech products*. A summary of the results of the second hypothesis test can be seen as follows (*Table 6*).

Based on the results above, the value of the coefficient of determination expressed by R'Square is 0.331, or 33.1%. This shows that knowledge of financial ethics (X_2) can influence 33.1% of changes in interest in using fintech products (Y), and other factors influence the remaining 66.9%.

Judging from *Table 7*, the value of the correlation coefficient is 0.573, and the constant number is 21.582. Then, the regression line equation can be structured as follows: $Y = 21{,}582 + 0{,}573x + e$. The equation shows that the value of the correlation coefficient X_2 is 0.573, which means that if knowledge of financial ethics (X_2) increases by 1 point, it will also be followed by an increase in interest points in using fintech products (Y) by 0.573. The t-test is performed to see the extent to which the influence of one independent variable individually influences or explains the dependent variable. This t-test hypothesizes that H0 = has no significant effect and H1 = has a significant effect. The basis for deciding the test is: H0 is accepted, and H1 is rejected if the t-count value is < from the t-table or if the significant value is >0.05. H0 is rejected, and H1 is accepted if the t-count value is > from the t-table or if the significant value is <0.05. Based on *Table 7*, it can be seen that the variable knowledge of financial ethics has a regression coefficient value of 0.000 positive value and has a t-count value of 6.965>t-table 1.984 and a significant value of 0.001 < 0.05, which means that knowledge of financial ethics has a positive and considerable influence on the interest in using fintech products (Y).

Test the Third Hypothesis

This third hypothesis uses multiple regression analysis tests with the help of statistical applications and states that there is a positive and significant influence of the level of financial literacy with knowledge of financial ethics together on interest in using fintech products. The summary of the results of the third hypothesis test can be seen in the *Table 8*.

The *Table 8* shows that the value of the coefficient of determination R 2 expressed in R'Square is 0.367. This means that the level of financial literacy (X_1) and knowledge of knowledge ethics (X_2) together can influence 36.7% of changes in interest in the use of fintech products (Y), and other factors influence the remaining 63.3%.

The f-test is performed to see whether all independent variables in the model have a shared influence on the related or dependent variable. The decision in the F test is: If F-calculate > F-table and the significance value < 0.05, then the independent variables simultaneously (together) significantly affect the dependent variable. If the F-count < the F-table and the significance value > 0.05, the independent variables simultaneously (together) have no significant effect on the dependent variable. Based on the results of the Simultaneous test (F), *Table 9* above shows that the significant value of the resulting calculated F is 0.000. The value is below the significant value of 0.05. This proves that the third hypothesis is proven so that it can be concluded that the variables of financial literacy (X_1) and knowledge of financial ethics (X_2) simultaneously (together) have a significant effect on the variable of interest in using fintech products (Y).

DISCUSSION

The Effect of Financial Literacy Level on Interest in Using Fintech Products

This research shows that the level of financial literacy can have a positive and significant effect on accounting students' interest in using fintech products in Lubuklinggau. Financial literacy factors cause interest in using fintech products among students because the higher their understanding and knowledge in managing finances will cause a sense of interest in developing the technological economy in the form of fintech. Following the UTAUT theoretical model used in this study, financial literacy can encourage students to use fintech products because it is to improve the quality of life in making individual financial decisions and individual behavior in managing finances better to be able to determine and utilize institutions, products, and financial services that suit the needs and abilities of students to achieve welfare. Based on the questionnaire that respondents have filled out, it can be said that respondents are interested in using fintech products because the higher the understanding of financial literacy in students, the greater the interest in using fintech products.

This research gets the same results as those of [43]. There is a positive and significant influence between the level of financial literacy on the interest in using fintech products because the better the ability of students to manage finances as capital to improve the quality of life, the greater the sense of student interest in following current economic developments in the technological era and the emergence of interest in using Fintech products. The results of this study are also supported by research conducted by [44] that there is a relationship between financial literacy and interest in using fintech products, which states that financial literacy has a positive and significant effect on interest in using fintech products. This is because the higher the financial literacy, the higher the use of fintech products in students. Knowledge of financial literacy includes general knowledge, skills, and beliefs that influence attitudes and behaviors to improve the quality of decision-making and financial management to achieve prosperity. The more mentally skilled a person is in financial knowledge or good financial literacy, the higher their interest in economic development in technology such as fintech. Research shows that financial literacy positively and significantly affects interest in using fintech products. This illustrates that the better the ability of students to manage finances as capital to improve their quality of life and students are also able to choose financial products and services that suit their needs and abilities, the greater the sense of student interest in following current economic developments in the technological era and the emergence of interest in using fintech products.

The Influence of Knowledge of Financial Ethics on Interest in the Use of Fintech Products

This research shows that knowledge of financial ethics positively and significantly affects accounting students in Lubuklinggau using fintech products. The factor that causes interest in using fintech products among students is the better application of ethical knowledge in finance and good habits in managing finances will arouse their curiosity towards fintech products. Following the UTAUT theoretical model used in this study, knowledge of ethics in finance can also encourage students to use fintech products because good student behavior and habits in managing, managing and planning their finances applied in daily life will cause their desire and interest to use and utilize technology in financial services such as fintech products. Based on the questionnaire that respondents have filled out, it can be said that respondents are interested in using fintech products because the better the application of financial ethics knowledge in daily life in students, the greater the interest that arises in using fintech products. So, it is increasingly evident that knowledge of financial ethics positively affects the use of fintech products by accounting students in Lubuklinggau.

Student perspectives on finance will indirectly affect financial management [45, 46] which states that people act based on their habits, and their habits will construct a personal definition of ethics. To control it, students must do good financial management,

starting with making our financial condition healthy. Ethics in student financial management must be applied to avoid wasting all income. Therefore, it is clear that students must have good ethical knowledge in managing finances. Not only for the benefit of the present but also as a provision for life in the future. This research shows that there is a positive and significant influence between knowledge of financial ethics and interest in using fintech products. A better understanding of financial ethics applied in everyday life in planning and managing finances by managing income and expenditure needs will cause a high sense of curiosity and interest in developing financial services technology in using these fintech products. This aligns with research conducted by [47] which states that fintech, a finance-based system, can uphold good financial ethics.

The Effect of Financial Literacy Level and Knowledge of Financial Ethics Together on Interest in Using Fintech Products

The results of this study show that the level of financial literacy has a positive and significant effect on accounting students' interest in using fintech products in Lubuklinggau. As explained in UTAUT theory, financial literacy can encourage students to use fintech products to improve the quality of making individual financial decisions and individual behavior in managing finances better to be able to determine and utilize financial institutions, products, and services that are by the needs and abilities of consumers to achieve welfare. This is also based on the research results for knowledge about financial ethics, which has a positive and significant effect on interest in using fintech products. Knowledge of ethics in finance can also encourage students to use fintech products because good student behavior and habits in managing and planning their finances in everyday life will cause their desire and interest to use and utilize technology in financial services such as fintech products.

The level of financial literacy and knowledge of financial ethics has a positive and significant influence together on the interest in using fintech products because of a good understanding of finance and the application of knowledge about financial ethics in everyday life, then students' curiosity or interest in using fintech products It will be even more significant because it has been supported from factors from within the individual about financial understanding and encouraged by the application of knowledge about financial ethics in financial management. Knowledge and application in managing finances are essential; this is done to prevent waste. Accounting students equipped with both primary and overall expertise in managing finances will form a sense of student interest in following current economic developments in the technological era, and the emergence of interest in using fintech products will increase.

CONCLUSION

There is a positive and significant influence between the level of financial literacy on the interest in using fintech products with a correlation coefficient R of 0.598; the coefficient of determination R 2 is expressed in R'Square by 0.294; Y= 15.039 + +0.452x + e; and t-count of 6.388 > t-table of 1.984 at a significance level of 5 percent. The higher the financial literacy and the ability of students to manage finances as capital to improve their quality of life, the higher the students' interest in following current economic developments in the technological era, and the emergence of interest in using fintech products will increase.

There is a positive and significant influence between knowledge of financial ethics on interest in using fintech products with a correlation coefficient R of 0.575; the coefficient of determination R 2 is expressed in R'Square by 0.331; Y = 21.582 + 0.573x + e; and t-count of 6.965 > t-table of 1.984 at a significance level of 5 percent. The better the understanding of financial ethics applied in everyday life in planning and managing finances by managing income and expenditure needs, the better the use of fintech products for students.

Based on the results of the simultaneous test (test F), the level of financial literacy and knowledge of financial ethics has a positive and significant influence on the use of fintech products with a significance value of 0.000 < 0.05 with a contribution value from

the results of the coefficient of determination test of 36.7%. In comparison, other factors influence the remaining 63.3%. Understanding of sound finance and the application of knowledge about financial ethics in everyday life, the curiosity or interest of students in using fintech products will be even more significant because it has been supported by factors from within individuals about financial understanding and is encouraged by the application of knowledge about financial ethics in financial management.

SUGGESTION

Financial literacy needs to be improved not only among students but also in the community. The community also needs to educate about financial literacy so that people understand more about using financial technology products that have recently been widely used by smartphone users worldwide.

Students must know good financial ethics in managing finances. Not only for the benefit of the present but also as a provision for life in the future. For this reason, as a student, I need to use it well to experiment and expolarize in financial management, with so much interest in developing financial services-based technology in fintech products.

This fintech product business competition is a new challenge for the banking world in providing financial services, so cooperation between the banking world and fintech companies is needed so as to expand banking access and improve productivity by reaching all segments and elements of society.

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D. Rimbano — evolution of financial ethics and financial literacy conceptual tools used in financial technology.
Yu. Eprianti — evolution of conceptual tools for specific financial resources for accounting students.
G. Rusydi — the role of stakeholders in developing financial technology, formulation of research goals.
T.A. Sari — concept development and general management of article writing.
M. Dora — the role of stakeholders in the development of financial technology.

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was received on 15.03.2024; revised on 10.04.2024 and accepted for publication on 29.04.2024.
The authors read and approved the final version of the manuscript.