

The object of this study is the financing mechanism for the development of local communities. The paper addressed the problem of improving this mechanism under conditions of limited resources through the use of digital technologies. The structure of the mechanism is represented as interconnected subjects, sources, methods, objectives, and technical infrastructure of financing. Local self-government bodies are the managing entity. Factors affecting the availability of financial resources, depending on the financing method, are the volume of resources, the orderliness of legislation and legal models, financial capabilities, and interests of financing entities. They also include legal restrictions on application, requirements of resource holders, their cost and duration of receipt. The crisis was recognized as a significant limiting factor. Identification of factors of accessibility and complexity makes it possible to identify weak points in the entire funding mechanism. The description of the theoretical concept of the financing mechanism due to its universality, the factors of the availability of financial resources and the shortcomings of the technical infrastructure, identified on this basis, made it possible to solve the investigated problem. As a result, directions for improving the financing mechanism for the development of local communities have been determined in terms of technical infrastructure. They consist in creating unified technical systems for managing financing processes and expanding training and support for financing entities. The use of artificial intelligence, big data, blockchain and tokenization technologies for decision-making, forecasting the needs of local communities and the development of crowdfunding is also proposed. Owing to this, it will be possible to achieve practical expectations for improving the effectiveness of the existing financing mechanism, which consists in reducing transaction costs, attracting additional financial resources, increasing public participation and transparency of financial processes

Keywords: financing mechanism for the development of local communities, technical infrastructure of financing, digital technologies

IMPROVING THE FINANCING MECHANISM FOR THE DEVELOPMENT OF LOCAL COMMUNITIES BASED ON THE USE OF DIGITAL TECHNOLOGIES

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1. Introduction

Local development is a process of changes in the socio-economic system that has developed in a certain territo-

ry. This process includes economic, social, ecological, political, and cultural aspects, and is closely related to the socially determined principles and values of the society living in this territory – the territorial community. Different places

are characterized by geographical diversity, the principles and values of the local population differ. This forms the unevenness of local development [1]. However, the general trends in this area are decentralization and orientation towards the Sustainable Development Goals (SDGs), adopted in 2015 at a special meeting of the UN General Assembly with the participation of representatives of 160 countries [2]. Sustainable development consists in meeting the needs of current generations, taking into account the need to meet the needs of future generations [3]. Sustainable development is considered local if it uses local resources in combination with national or global resources to achieve national development efforts [4, 5]. In addition, the concept of sustainable development provides for limitations imposed by the state of technology and social organization of society on environmental resources and the ability of the biosphere to absorb the consequences of human activity [3].

Owing to decentralization, more financial resources and powers are transferred to the level of local self-government, which allows more efficient use of funds for the development of the territorial community. Thus, there is an increase in the level of independence and responsibility of local communities in making decisions regarding their development and managing their own resources. However, local authorities often face limited access to financial resources for various reasons. For example, the COVID-19 pandemic and local armed conflicts have led to financial difficulties in many local communities, forcing authorities to review their budgets, diversify funding sources and seek effective ways to restore the economy and socio-economic development. In this context, the achievement of sustainable development goals in local communities is closely related to the consistent implementation of digital technologies in management, social and business processes. It was during the pandemic that the demand for financial applications increased due to the need to accelerate business activity due to restrictions on people's physical movements. Technologies of big data, biometrics and artificial intelligence began to be actively used in the financial domain.

The expansion of the use of digital technologies in methods of financing the development of local communities is of scientific interest for a number of reasons. First, digital technologies ensure the efficiency of economic systems by reducing information asymmetry and reducing transaction costs. The expansion of public access to financial and public services through their active digital transformation has led to changes in the ways of interaction between citizens, government and business and increased transparency in these relations. Secondly, digital technologies have contributed to the emergence of innovative financing methods such as fundraising and crowdfunding.

Therefore, the problem of financing the development of local communities requires a comprehensive approach. On the one hand, the development strategy should include measures to improve financial management, develop economic infrastructure, and promote entrepreneurship. On the other hand, the main goal of these measures is also to attract the necessary volume of financial resources and their effective use. It is digital technologies that can be the key tool that makes it possible to increase the efficiency of existing and apply additional innovative financing methods at the local level.

Thus, the study of the implementation of digital technologies in the methods of financing the development of local communities is relevant.

2. Literature review and problem statement

Under conditions of limitation or lack of budgetary resources, methods of financing the development of local communities based on citizen participation and public-private partnership become key. Thus, work [6] emphasizes that the global goals of sustainable development are related to the daily work of local authorities, therefore they are the level of government that can connect global goals with local communities. Therefore, it is local financial resources that are key in achieving the global goals of sustainable development. At the same time, work [6] analyzes the budgetary mechanism of financing sustainable development at the level of individual locations in South Africa. As a result, it was established that global development goals are not indicated in the budgets of African communities. Despite this, an analysis of the costs of infrastructure projects has indicated that one of the biggest obstacles facing local governments is the mismatch between increasing responsibilities and revenues. This leads to an inability to finance the growing demands for investment in infrastructure and public services. It can be assumed that this is the reason why only one of the methods of financing the development of local communities is considered in [6] – budgetary, and no attention is paid to the issue of the use of digital technologies at all.

In [7], the role of participatory budgets in financing local sustainable development in South Korea is investigated. As a result, the positive influence of public participation in the budget process on the financial results of the implementation of local development projects was established. An important result of work [7] is that public participation in the budget process at the local level contributes to more effective debt management by reducing the size of local debt and liabilities. A prerequisite for achieving these desired outcomes for the local community is maintaining financial sustainability by investing in community welfare programs. At the same time, local authorities should create an institutional environment that ensures citizens' participation in budget processes by establishing or regularly using various channels of participation. However, paper [7] does not contain an analysis of financing methods based on digital technologies, although the channels of public participation may indirectly predict the use of social networks.

Study [8] considers alternative instruments for financing local infrastructure in the USA, the relevance of which is justified by the lack of budgetary financial resources. Such alternative financing instruments in [8] include “green” bonds or social impact bonds, public-private partnerships, and privatization. As a result, the factors associated with the use of these tools were found to depend on the nature and type of the tool. Moreover, alternative financing instruments, such as fees from developers, are more associated with a decrease in political support for municipal bonds, and such “green” bonds are associated with budget imbalances. However, the effectiveness and stability of these tools is unclear, which does not allow determining their suitability for use in other countries. Also, work [8] does not define possible risks and obstacles that local self-government bodies may face in connection with the use of alternative financing tools.

Paper [9] examines the essence of the financial potential of territorial communities and its sources in Ukraine. In this work, it is stated that, according to the results of the analysis of the structure of financial resources of local self-government bodies, the financing mechanisms in work [9] found

that the main financing mechanism in Ukraine remains the budgetary mechanism, which has a limited resource due to the lack of land management documentation and registers of communal property. Public-private partnership is recognized as a promising mechanism, which is used despite the imperfection of the legislation and the limited number of project preparation specialists. Due to legal restrictions, the credit mechanism in the form of bond and bond-free loans in Ukraine has turned out to be an insignificant reserve for financing local development. The grant mechanism, on the other hand, was recognized in [9] as promising, but requires skills in developing project applications. However, in work [9] there is no substantiation of what the financing mechanism is and what role technology plays in it.

Work [10] instead focuses on the consideration of public-private partnership as an effective mechanism of interaction between the government and business structures. This work established that in Ukraine, the main areas of implementation of public-private partnership projects are the production of electricity and heat, water treatment, waste management, roads, health care, and leisure. In a broad sense, public-private partnership means a combination of public and private resources to meet public needs. However, the main attention in [10] is paid to the consideration of the legislative framework of public-private partnership, which does not give an idea of the technologies for its implementation and its place in the mechanism of financing the development of local communities. This is due to the fact that the successful experience of public-private partnership projects in Ukraine is limited.

It should be noted that all the methods of financing local development considered in works [6–10] are based on the use of digital technologies, since even the transfer of funds currently takes place via the Internet and remote banking programs. However, in [6–10], this aspect of the functioning of the financial mechanism is not considered in general.

The development of social networks, the sharing economy and digital platforms has contributed to the emergence of crowdfunding – an innovative financing method that has its own specifics for financing the development of local communities.

Thus, work [11] considers the phenomenon of public crowdfunding as a new technology that allows one to rethink what local self-government means from an individual and administrative point of view. The work determined that with the development of digital technologies, public crowdfunding has demonstrated the potential to increase traditional local government funding and service provision. An unconditional positive feature of community crowdfunding is the insignificant impact on the success of the project implementation of the size of the community and its income. However, paper [11] does not consider the availability of funds for local communities through crowdfunding. It is also not clear what tools ensure transparency, openness of the use of funds collected from crowdfunding at the level of local authorities. The issue of responsibility and reporting in the process of implementing crowdfunding projects in communities requires additional research. This is due to the fact that work [11] is of an exploratory nature, and its results require further research and justification.

In work [12], crowdfunding is defined as a peer-to-peer digital technology. In this work, the results of the analysis of the dynamics of public crowdfunding platforms initiated by state authorities revealed a high level of civic activity of

initiators of local development projects. This may be related to a positive partnership attitude towards the local government, which they consider to be reliable, aligned with their needs, transparent and necessary for innovation in the public space. The real success of crowdfunding campaigns depends on various online and offline ties that form social capital. In this aspect, public crowdfunding is perceived as a process of strengthening local ties and improving community cohesion. It was also established in [12] that public altruism is an important factor in predicting the behavior of donors to a crowdfunding project. On the other hand, digital divides in society give rise to a different level of involvement in crowdfunding, which significantly affects its effectiveness. At the same time, income and education do not have a significant impact on the behavior of involvement in projects.

Despite the important results of work [12], which reveal the factors of crowdfunding effectiveness, the technological basis of ensuring citizen participation has been neglected. It is also not clear how to ensure compliance with legal norms and regulations in the field of attracting and using funds through crowdfunding.

Study [13] emphasizes that public crowdfunding with the support of digital platforms allows citizens to participate financially in public projects and combine public and private funding sources. A study of 269 citizen crowdfunding campaigns in the Netherlands demonstrates that the success of joint projects depends on the target volume, the purpose of the project, the age structure of the population, the location of the community, and the level of urbanization of the area where the campaign is conducted. Therefore, work [13] paid attention to the social factors of the effectiveness of fundraising from crowdfunding. At the same time, the technological component of this process and the process of using funds remained neglected. Thus, the issues of control, reporting, and transparency in the use of the involved financial resources are not covered.

Work [14] also considers the assessment of the potential of civic crowdfunding, which is regarded as a creative form of participatory urban development and direct involvement of citizens in the development of the anthropogenic environment. The work examines the essence and features of civic crowdfunding as an alternative method of financing urban development, identifies its potential and risks as an urban development tool based on a comparative case study assessment. North-eastern regions of the USA (the New York metropolis) and north-western regions of the EU (Brussels, Amsterdam, Antwerp, and Rotterdam) were chosen as research cases. Comparative analysis was carried out on the basis of data obtained through semi-structured interviews. Local development is considered as a social practice.

The study revealed a strong influence of social and geographical distance on the motivation of donors in crowdfunding projects. In this aspect, crowdfunding should be understood as a form of communication that solves the problems of citizens through specific actions. In [14], it was recognized that crowdfunding is a promising way of involving citizens in decision-making processes regarding urban development. In addition, work [14] established if the main reason for crowdfunding campaigns is a lack of state funding, then the share of targeted funds increases, accordingly, there is a need for a more diversified use of this tool and additional research on it.

However, in work [14] insufficient attention is paid to the role of technologies in the development of this financing

method. Thus, there is no analysis of technical solutions that reduce the feeling of remoteness and increase the motivation of donors, in particular through personal contact or monitoring the progress of the project. If this is a completely digital method of financing, then it is appropriate to determine exactly how technologies contribute to improving communication between project organizers and their supporters. It is also not defined which digital technologies and how they can contribute to the development of specialized crowdfunding platforms for financing the development of local communities in order to use them more effectively. This may be due to the lack of data for such an analysis, which requires a separate study.

Work [15] considers the analysis of potential opportunities and obstacles of public crowdfunding and joint financing of local food initiatives. The study was conducted using the case study method of the crowdfunding activity of the operating group Madrid KmRegión in the Madrid region, Spain. Within this case, three public crowdfunding campaigns were conducted, the funds from which were supplemented by institutional funds for financing innovative projects in the field of short food supply chains. This type of funding is a form of public-private partnership and enables local authorities to engage interested citizens in supporting local food initiatives. In [15], it is emphasized that a significant limitation of supporting the development of local food systems is financial barriers associated with the contradiction in the goals of financial sector players and the goals of sustainable development. This contradiction can be overcome by applying a financing mechanism based on the social economy and the economy of joint participation. Work [15] describes the mechanism of joint financing, analyzes the behavior of donors depending on their motivation, as well as the experience of promoters. As a result, it was established that the main restraining factor in the spread of such a financing mechanism for local development is the lack of knowledge of local authorities regarding crowdfunding, as well as the lack of legal and administrative methods for conducting such campaigns.

However, paper [15] does not sufficiently reveal which digital platforms were used in crowdfunding campaigns, their capabilities for attracting citizens and coordinating financial flows. Also interesting is the issue of the integration of the crowdfunding platform with banks, electronic payment systems, etc. This may be due to the fact that in [15] the case study method was used, aimed at specific cases and problems faced by the operational group under study. Such an approach may lead to a more in-depth analysis of this particular context but limit the generalizability and extension of the results to other areas or contexts.

Therefore, the results of our review of scientific research reported in [6–15] indicate that they lack an idea of the essence of the financing mechanism and its structure in the context of the goal of the development of local communities. Also, the availability of financial resources within the financing mechanism, taking into account its technological component, remains insufficiently researched. For these reasons, it is very difficult to systematize directions for improving the functioning of the financing mechanism for the development of local communities. This allows us to assert that it is appropriate to conduct a study to analyze the mechanism of financing the development of local communities under conditions of limited budget resources based on the use of digital technologies.

3. The aim and objectives of the study

The purpose of our study is to improve the mechanism of financing the development of local communities related to the use of digital technologies. This will make it possible to increase the efficiency of financing mechanisms and attract additional resources in order to achieve the goals of local sustainable development.

To achieve the goal, the following tasks were set:

- to describe the structural and functional concept of the financing mechanism for the development of local communities, taking into account the technological infrastructure;
- to determine changes in the availability of financial resources depending on the financing method within the framework of the financing mechanism for the development of local communities;
- to determine the advantages and disadvantages of the technical infrastructure within the framework of the financing mechanism for the development of local communities as a socio-technical system;
- to determine directions for improving the financing mechanism for the development of local communities based on the use of digital technologies.

4. The study materials and methods

The object of our study is the financing mechanism for the development of local communities.

The main hypothesis of the study assumes that the use of digital technologies is the main implementation tool, owing to which the financing mechanism for the development of local communities could be improved.

Assumptions adopted in the work:

- the local development financing mechanism is a system;
- the financing method determines the availability of financial resources;
- the technical infrastructure of the financing mechanism is created based on the design principles of socio-technical systems.

Simplifications accepted in the work:

- development of local communities is considered as sustainable development;
- the mechanism is considered as a socio-technical system;
- the technical infrastructure of financing is analyzed only from the point of view of digital technologies, while the physical infrastructure of digital technologies was not considered.

The work was performed using general scientific methods. Thus, a systematic approach was applied to describe the structural and functional concept of the financing mechanism for the development of local communities, and to determine the functions of local self-government bodies in the context of sustainable development – comparison and analysis. The determination of changes in the availability of financial resources is based on the analysis and systematization of financing methods. The advantages and disadvantages of the technical infrastructure are determined using a sociotechnical approach. Directions for improvement of the financing mechanism are determined on the basis of generalization.

The sources of scientific information are specialized databases Scopus and ResearchGate. Sources of empirical data are open information from public websites of Ukrainian authorities.

The Microsoft Excel software (USA) was used to summarize data on the volume of funding.

5. Results of studying the influence of digital technologies on the financing mechanisms of local development

5.1. Structural and functional description of the financing mechanism for the development of local communities

The review of works [6–15] allows us to conclude that the financing mechanism for the development of local communities means a system of social relations regarding obtaining and using financial resources to achieve the goals of sustainable development within a separate administrative-territorial unit with self-governing status and powers on its territory, defined in legislation.

This allows us to describe the financing mechanism through its internal structure as an interconnected set of system-forming factors – system function and structure. The structure of the mechanism is shown in Fig. 1 and includes the following components: financing subjects, financing sources, financing methods, financing objects, financing technical infrastructure.

In Fig. 1, the subjects of financing are local self-government bodies, the population, the corporate sector, and financial intermediaries. Sources of financing are own and borrowed funds, which local self-government bodies receive at their disposal. Financing methods are techniques for attracting and distributing financial resources, which are based on certain rules.

The technical infrastructure of financing is a set of technical means that ensure the exchange of information and financial resources between financing entities.

An essential feature of the structure shown in Fig. 1 from the point of view of the system approach is the specification in the structure of the financing mechanism of the control subsystem. The management subsystem is a financing entity that performs management, i.e., planning, organizing, coordinating, stimulating, and controlling the acquisition and use of financial resources to perform functions related to the achievement of sustainable development goals. This subject is local self-government bodies because they have the authority to resolve issues of local importance, namely [4]:

- territorial planning;
- accountable and transparent decision-making;
- land use management;
- contract management;
- transparent and rational procurement;

- direct interaction with citizens and private structures;
- creation of a favorable regulatory and legal environment;
- creation of public infrastructure (education, health care, housing, green spaces, transport, culture);
- marketing activities and raising awareness of the proposed value of the space or place.

The powers of local self-government bodies in the management subsystem are, in their essence, managerial influences that shape the behavior of other subjects of the financing mechanism to achieve the goals of local community development.

In Fig. 1, interaction between local self-government bodies and the population (dotted arrow) refers to the definition of development goals in the context of the needs of local residents. A comparison of SDG, the needs of local residents and the powers of local self-government bodies makes it possible to shape the functions of local government bodies in the context of SDG (Table 1).

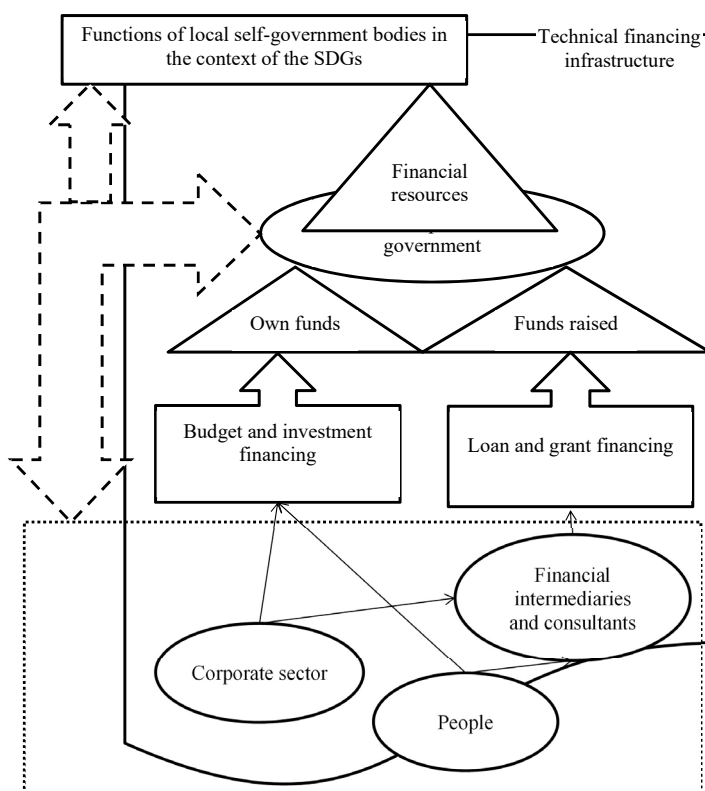


Fig. 1. Structure of the mechanism for financing the development of local communities

Table 1

Functions of local self-government bodies in the context of SDG*

Goals of sustainable development	Functions of local self-government bodies
1	2
1. Overcoming poverty	Identifying low-income people on the ground and working with them, promoting the creation of jobs, strengthening the sustainability of communities
2. Eradicating hunger, ensuring food security, and improving nutrition, promoting the development of sustainable agriculture	Management of natural resources (land, water, etc.), support of agriculture, development of transport infrastructure and local supply chains, provision of food needs of low-income and vulnerable households
3. Ensuring a healthy lifestyle and promoting the well-being of people of any age	Provision of clean water and sanitary services for the population, measures to reduce the level of pollution of natural resources, promotion of a healthy lifestyle, prevention of mortality from accidents
4. Providing quality education that is inclusive and accessible to all and promoting the creation of continuous learning opportunities	Direct responsibility for the field of education and access to it for all groups and strata of the population

Continuation of Table 1

1	2
5. Achieving gender equality and expanding the rights and opportunities of all women and girls	Creation and maintenance of public places of stay, protection of public order, assistance to women affected by violence, expansion of women's employment
6. Ensuring the availability and sustainable management of water resources and sanitation for all	Measures to protect the natural environment to improve water quality, development of water supply and sewage infrastructure
7. Ensuring equal access for everyone to affordable, reliable, sustainable, and modern sources of energy	Increasing the energy efficiency of buildings, developing sources of ecologically clean energy, implementing the concept of smart cities
8. Promoting continuous, inclusive, and sustainable economic growth, full and productive employment and decent work for everyone	Promoting the formalization of employment, preventing the use of child labor, promoting the protection of workers' rights, ensuring safe working conditions, developing tourism
9. Development of sustainable infrastructure, promotion of comprehensive and sustainable industrialization and encouragement of innovation	Development and maintenance of the infrastructure of settlements, promotion of the development of local industry, development, and elimination of deficiencies in access to information and communication technologies
10. Reducing inequality within and between countries	Management of resources needed to reduce inequality, development of civic engagement, provision of quality public services without discrimination, support of employment and increase of population incomes
11. Ensuring inclusiveness, safety, viability and sustainability of cities and settlements	Regulation of the land and housing markets in order to guarantee the right of residents to housing, prevention of urbanization through involved urban planning, ecologically safe handling of solid waste, promotion of the development of spirituality and culture, use of measures to protect against natural disasters
12. Ensuring the transition to sustainable models of consumption and production	Supporting the creation of local supply chains, promoting rational consumption and production of energy and water, limiting the volume of waste generation and carbon emissions
13. Taking urgent measures to combat climate change and its consequences	Antidote to dangers and natural disasters
14. Preservation and sustainable use of oceans, seas, and marine resources in the interests of sustainable development	Protection of lakes, rivers, and seas from discharge of pollutants
15. Protection and restoration of terrestrial ecosystems and promotion of their sustainable use, sustainable forest use, combating desertification, stopping land degradation, and reversing these processes, stopping the loss of biodiversity	Management of communal services taking into account the need to protect natural resources, finance sustainable forest use, preserve biodiversity
16. Promoting the building of peaceful and inclusive communities in the interests of sustainable development, ensuring access to justice for all and creating effective, accountable, and inclusive institutions at all levels	Taking measures to combat corruption, expand the population's access to information, develop civic engagement, and reduce violence
17. Improvement of the means of implementation of the Global Partnership for Sustainable Development and its activation	Development of interstate cooperation and partnership at the local level

Note: * – summarized by Authors according to [4, 16]

Ensuring the implementation of the functions specified in Table 1 is the purpose of the functioning of the financing mechanism for the development of local communities. That is why local authorities play the main role in its structure (Fig. 1).

5. 2. Analysis of methods for financing the development of local communities

In the structure of the financing mechanism for the development of local communities, shown in Fig. 1, the control subsystem by local self-government bodies exerts control influences (manages) the controlled subsystem. From the same figure, it follows that the managed subsystem of the financing mechanism for the development of local communities is financing methods. These include budgetary, investment, credit, and grant methods. Thus, in this work, the method of financing means the techniques for attracting and distributing funds for the purposes of local development. That is, the methods of financing contain the principles, rules, and procedures of financing.

The effectiveness of the financing mechanism depends on the availability of financial resources and the complexity of financing methods. Complexity is, in a sense, a subjective characteristic that depends on the qualifications of the people who make up the local government. The resulting parameter

that characterizes the financial mechanism is the time of obtaining the necessary financial resources. The effectiveness of the financing mechanism directly affects the dynamics of the development of the territorial community since the performance of the functions listed in Table 1, depends on the speed and timeliness of obtaining the necessary financial resources. Therefore, the analysis of financing methods from the point of view of their complexity is an important step in understanding the barriers to the development of local communities.

Table 2 summarizes the characteristics of methods of financing the development of local communities from the point of view of their complexity and possible availability of financial resources.

In Table 2, the availability of financial resources is determined within a specific method. Availability is a property that means that the initiator of a particular financing method (in this case, it is local authorities), who has the appropriate authority, can use the resource according to the rules defined within the method. At the same time, the resource waiting time can be determined by analyzing these rules.

The complexity of the financing method is determined by assessing the efforts that the initiator must spend to achieve the expected result. Efforts depend on parameters such as operational costs and time for financing procedures, risks,

skills of responsible personnel and their employment, level of automation or digitization of processes. Availability and complexity, thus, in this case characterize transaction costs.

Thus, from the point of view of local self-government bodies, the budget method of financing is the most orderly, because the management of funds received through this method is one of their main powers. Moreover, the procedure for raising funds through the budget method is well regulated, and taxes are mandatory payments stipulated by law that must be paid by individuals and legal entities. Other financing methods require more effort from self-government bodies. Thus, the investment mechanism involves finding a private partner and understanding the legal models of relationships. The credit mechanism requires awareness of the issues of credit legal relations, risk assessment and lending conditions, and the involvement of financial intermediaries. The grant mechanism provides for the search for donors who have the necessary funds and are ready to donate them for the development of the local community.

However, crises lead to a significant limitation of budgetary sources for financing public goods. Ukraine is an example of a country on whose territory a legal regime of martial law has been introduced since 2022 due to the military aggression

of the Russian Federation. Under such conditions, budgetary and investment methods of financing have limited possibilities. Table 3 gives the results of summarizing the volumes of financial resources involved through various financing methods in the regions of Ukraine during 2021–2023.

Thus, the revenues of local budgets in Ukraine, taking into account subsidies and subventions from the state budget during 2021–2023, decreased by USD 4.8 billion.

Investment methods at the local level in Ukraine are represented in the form of public-private partnership. According to the Ministry of Economy of Ukraine [23], as of January 1, 2023, 193 contracts have been concluded under the terms of public-private partnership, of which 18 are being implemented (9 – concession agreements, 5 – joint activity agreements, 4 – others). As for the other 175 agreements, 116 agreements are not being implemented, 46 have been terminated or expired, and 13 have been suspended due to armed aggression. In Table 3, the volume of funds raised through the investment mechanism is indicated without taking into account state funds, in addition, it includes projects of the national level, and not only of local importance. State support is also provided in the form of local guarantees, but their source is local budgets.

Table 2

Methods for financing local development

Funding method	Brief description of the funding method	Factors influencing the availability of financial resources	Complexity of the method
Budgetary (income from own sources – taxes and fees that local authorities are authorized to collect; interbudgetary fiscal transfers from the central government to local authorities)	<ol style="list-style-type: none"> Budget planning. Budget execution. Control 	<ol style="list-style-type: none"> Amounts of taxes and fees received. Volumes of interbudgetary transfers received. Planned expenses 	It is determined by the orderliness of budget legislation
Investment (corporatization; compensation of negative impact; public-private partnership)	<ol style="list-style-type: none"> Development of a local development project. Analysis of available legal models for project implementation and selection of the optimal model. Documenting the legal model. Implementation of the project 	<ol style="list-style-type: none"> Availability and comprehensibility of legal models for the use of the mechanism. Financial opportunities and interests of the private sector. Financial opportunities and interests of local authorities 	It is determined by the orderliness of legal models and the availability of personnel who have the necessary skills and knowledge to implement the mechanism
Credit (bank loan or credit)	<ol style="list-style-type: none"> Development of a local development project. Applying for a loan. Negotiations with a credit institution. Provision of credit resources. Implementation of the project. Implementation control 	<ol style="list-style-type: none"> There are legal restrictions on the use of the method. Requirements of the financial institution for the project. Cost of credit resources. Debt service capacity 	It is determined by the orderliness of the procedures of the financial institution and the availability of personnel who have the necessary skills and knowledge to implement the mechanism
Credit (municipal bonds)	<ol style="list-style-type: none"> Making a decision on the need to issue bonds. Preparation of documents necessary for the issue and placement of bonds. Issue and initial placement of bonds. Ensuring the circulation of bonds in the stock markets 	<ol style="list-style-type: none"> Financial and economic evaluation of the issuer's activities. There are legal restrictions on the use of the mechanism. Complexity and duration of the procedure for issuing and placing municipal bonds. The need for a qualified legal and financial advisor. Debt service capacity 	It is determined by the complexity and duration of the procedure for issuing and placing municipal bonds and the availability of personnel who have the necessary skills and knowledge to implement the mechanism
Grant (international technical assistance; grants from international donors; corporate social responsibility projects; crowdfunding)	<ol style="list-style-type: none"> Identification of local development needs (works, goods, services). Preparation of the grant application. Participation in the competitive selection. Obtaining financing or works, goods, services. Usage report 	<ol style="list-style-type: none"> Awareness of the terms of the grant or technical assistance. Availability of staff capable of preparing grant applications 	It is determined by the orderliness of the procedure for providing funds by the grantor and the availability of personnel who have the necessary skills and knowledge to implement the method

Note: * – summarized by Authors according to sources [17–19]

Table 3
Volumes of attracted local funds in Ukraine for 2021–2023, USD million*

Funding method	Year		
	2021	2022	2023
Budget (local revenues and budget transfers)	21,281.8	17,163.2	16,466.6
Investment (public-private partnership)	4738.2**		
Credit (municipal bonds)	29.3	–	–
Credit (internal and external loans)	807.3	89.9	30.8

Note: * – constructed by Authors according to data from [20–22]; ** – the need for funds to complete the implementation of investment projects, total (excluding public funds), declared in 2021

Grant methods of financing the development of local communities are represented in Ukraine in the form of international technical assistance and charitable assistance. According to estimates carried out in [24], during 2022–2023, Ukraine received EUR 132.7 billion of financial aid and EUR 16.7 billion of humanitarian aid based on bilateral relations with 42 countries of the world. As for financing programs specifically for local development, according to [25], as of December 31, 2023, 6 international projects are being implemented in Ukraine, 5 of which were started by 2022. The total volume of financing for these projects during the entire financing period is EUR 267.6 million. In addition, fundraising mechanisms are used to attract funds. For example, according to the United24 platform [26], the volume of funds collected from 05/05/2022 to 12/28/2023 by direction is:

- USD 17.5 million for the restoration of destroyed property and infrastructure;
- USD 51.0 million to provide health care needs;
- USD 1.7 million to meet the needs of humanitarian demining;
- USD 2.6 million to meet the needs of education and science.

As can be seen from the above data, the largest volume of funds at the local level in Ukraine is raised using the budget method. With the start of hostilities, its capabilities are reduced. Credit and investment financing mechanisms are sensitive to crisis phenomena, so their use is even more limited. At the same time, grant mechanisms help partially compensate for the lack of budget funds.

Therefore, the problem of lack of financial resources at the local level needs to be solved both from the point of view of their availability and the complexity of financing methods. In this context, the following tasks are key to be solved by local self-government bodies:

- search and analysis of information on possible holders of financial resources;
- quick and effective communication with holders of financial resources;
- reducing the complexity of financing methods, which in turn will reduce transaction costs.

The success of solving these tasks, in particular, depends on the technical infrastructure of financing the development of local communities.

5.3. Analysis of the technical infrastructure of financing the development of local communities

The technical infrastructure of financing is a technological base that reproduces the structure of interaction of financing entities. At the same time, if technical innovations are introduced, the nature of the relationship be-

tween financing entities also changes. Therefore, within the financing mechanism, technological components are closely intertwined with social ones, which allows us to consider financing mechanisms for the development of local communities as socio-technical systems [27]. At the same time, the technical infrastructure of financing covers end-to-end digital technologies (cloud technologies, big data, artificial intelligence, blockchain, wireless technologies), digital platforms, financial technologies (FinTech), hardware and other components.

This makes it possible to apply the principles of socio-technical systems to the improvement of the mechanism for financing the development of local communities [27].

Therefore, the mechanism of financing as a socio-technical system is formed on the basis of the parameters of the functioning of financing entities as a social subsystem and the technological infrastructure of financing as a technical subsystem. For the social subsystem, such parameters are informal institutions, customs, traditions, norms, culture, formal institutions, contractual and transactional regulation. These parameters define the relationships between stakeholders. Also, the functioning of the social subsystem is characterized by changes in its states, which can be described by certain indicators that depend on financing methods. It can be the volume of financial funds involved, the time it takes to complete the transaction, etc. For the technical subsystem, in turn, such parameters are individual features of the use of technical devices, technical standards, technology design paradigms, technical protocols and procedures, regulation in the field of development of technological artifacts, technical regulations, standards. The change in the state of the technological subsystem is manifested through such parameters as technical serviceability or malfunction, normal operation mode, emergency situation, etc.

Table 4 gives an analysis of the technical infrastructure of the financing mechanism for the development of local communities, depending on the methods.

The results of our analysis of the technical infrastructure of the financing mechanism for the development of local communities given in Table 4 indicate that its structure depends on the regulations (rules) for obtaining financial resources. Thus, the budget method has a formal regulation, which makes it possible to potentially create a unified technical subsystem. Investment and credit methods involve the joint participation in financing of both budgetary institutions and other institutions (banks, stock exchanges, private enterprises, etc.). Their functioning is accompanied by various technical means, since budget institutions use the technical subsystem of the budget method, and other credit and exchange institutions use their own technical subsystems. Interaction between them is mediated by means of communication (Internet, telephone, or mobile communication), the exchange of documents, depending on the specific rules adopted in one or another country, can be carried out by means of postal communication. Technical subsystems of grant mechanisms are based, as a rule, on publicly available information and communication technologies such as social networks or online platforms.

The results of our analysis of the technical infrastructure of financing as components of the socio-technical system provide an opportunity to determine directions for improving the mechanism of financing the development of local communities.

Table 4

Technical infrastructure of the mechanism for financing the development of local communities

Funding method	Technologies included in the financing infrastructure	Advantages	Disadvantages
Budgetary	Software applications, open data web portals and information and telecommunication systems. These components ensure the implementation of individual processes, such as tax administration, accounting of budgetary institutions, execution of treasury transactions, and provision of information to stakeholders	Reduction of transaction execution time, optimization of processes within the budget mechanism	Lack of a unified technological base
Investment credit	Separate information and telecommunication systems (digital trading platforms, payment systems) are not interconnected within the mechanism, because they ensure the functioning of different participants in the mechanism	Quick access to payment services and procurement procedures, information on the effectiveness of financial transactions	The lack of a unified system increases the time for formalizing relations and obtaining financial resources, reduces the transparency and clarity of the method. There is a risk of cyberattacks and phishing. The need for specialized knowledge for effective use
Grant	Social networks, online platforms used to search for information on grant competitions, crowdfunding platforms	Access to additional financial resources, relative speed of obtaining the necessary resources	Lack of regulation, risk of data leakage, dependence on the digital capabilities of the local community, transparency depends on the terms of the grant competition

5. 4. Directions for improving the financing mechanism for the development of local communities

The main areas of improvement of the financing mechanism for the development of local communities are related to the use of digital technologies. This is explained by the socio-technical nature of the transactions made within the framework of the financing mechanism under conditions of limited financial resources. Therefore, the mechanism of financing the development of local communities must be changed in this way.

First, to create a single technical system for the budgetary method of financing, which will combine its various components. Using a single platform for developing, planning, and executing budgets will unify processes and improve the accuracy and transparency of financial management.

Second, raise awareness and education through training and support for responsible government and private actors to use financial methods to achieve development goals.

Third, optimize interactions between funding entities based on artificial intelligence, big data, blockchain, and tokenization technologies. The goal of such optimization is to improve the decision-making process and the efficiency of resource use.

Fourth, implement a system of data analysis and artificial intelligence for forecasting the needs of local communities, effective distribution of financial resources, and evaluation of the effectiveness of projects.

Fourth, create and implement a unified electronic system for monitoring funds raised and spent using various financing methods, which will facilitate the generation of reports and provide the possibility of advanced data analysis.

Fifth, create and implement an electronic project management system that will facilitate coordination, communication, and efficient use of resources. For example, in 2023, the DREAM state electronic ecosystem was introduced in Ukraine [28]. This communication platform is positioned as a key digital tool for managing and controlling the process of reconstruction of real estate, construction, and infrastructure.

Taking into account the limitations of budgetary, investment and credit methods under the conditions of martial law in Ukraine, the improvement of grant methods of financing through the development of crowdfunding and fundraising acquires special importance. The technological component of these methods is completely digital because they accumu-

late funds through digital platforms. In addition, their use will make it possible to increase the level of civic participation at local levels.

In the context of the development of public crowdfunding and fundraising, the use of blockchain technology deserves special attention because it can ensure transparency, security, and efficiency of financial resource management. Blockchain can be applied to create a decentralized money pool that anyone can contribute to. At the same time, transparency, and trust in the use of financial resources can be ensured by a system of distribution of funds and publicity of transactions. Also, the issue of tokens (digital assets) can be used to represent the equity capital of local development projects, which makes it possible to attract investors from anywhere in the world and facilitate the transfer of ownership of part of the project. Smart contracts can be used to automate the distribution of funds and to develop a decentralized budget system, where decisions on the distribution of funds are made by vote of participants or upon achievement of a development goal.

It is important to note that the implementation of blockchain technologies requires careful study and consideration of legal, regulatory, and technical aspects. Also, the effectiveness of such solutions will be determined by the degree of acceptance and understanding of the technology in the local community.

Implementation of the proposed improvements to the financing mechanism for local development will contribute to the alignment of its social and technological components, which will ultimately increase its effectiveness.

6. Discussion of results of investigating the influence of digital technologies on the financing mechanisms of local development

Structural and functional description of the financing mechanism for the development of local communities, shown in Fig. 1, is mostly explained by the functions of local authorities in ensuring local sustainable development. Fig. 1 demonstrates that the financing mechanism involves the interaction of local authorities with local residents in determining the needs and goals of local development. This requires local authorities to have strategic vision and planning

skills, as well as technical and economic project evaluation skills. In turn, local residents must show a certain level of involvement in community life. Therefore, in order to ensure the financial capacity for local development, the communication skills of the community, as well as the management skills of local authorities, become the main ones.

In contrast to [6–15], in which the local development financing mechanism is considered from the standpoint of situational analysis, the structural and functional description shown in Fig.1 demonstrates its universal concept, formed on the basis of a systemic approach. Owing to the conceptualization of the local development financing mechanism, it becomes possible to identify its components and understand the interrelationships that underlie it. In a practical aspect, the conceptual model provides a tool for determining the purpose of the funding mechanism, funding subjects, funding flows and methods.

The results of our analysis of local development financing mechanisms that are given in Table 2 reflect their differences depending on the complexity of the mechanism and the availability of financial resources. The complexity of local development financing mechanisms is explained by a number of factors that interact and complicate the process of collecting, distributing, and using financial resources at the level of local self-government. Local financing systems are usually decentralized, meaning that local governments have their own sources of revenue and competence. Interregional differences in the levels of development of local communities determine the diversity of their financial needs. This leads to the use of a different set of financing mechanisms and uneven distribution of resources among local communities. Therefore, the organization of efficient and fair financing and distribution of resources under conditions of different needs requires taking into account these differences. On the other hand, the level of community participation and involvement of stakeholders in the funding decision-making process can complicate the allocation of resources due to the need to take into account diverse needs and opinions. In addition, the inconsistency of legislative norms and rules governing the financing of local development slows down the implementation of local development projects. Part of the financing of local development comes in the form of grants and subsidies from the central government, international organizations, or other donors. The administration and use of these resources is usually complicated due to differences in the rules for use and reporting for the funds spent. Under conditions of economic fluctuations and instability, there are structural shifts in the volume of funding because local governments are usually faced with lower revenues and greater social needs. Thus, the overall assessment of the availability of financial resources should take into account the context of the local community, the economic and social characteristics of the region, as well as the government's strategy for sustainable development.

For example, in Ukraine (Table 3), due to the military invasion of the Russian Federation in 2022, structural changes led to a reduction in financing through credit, investment, and budget mechanisms. At the same time, there is an increase in financing through the grant mechanism. The latter turned out to be more affordable. On the other hand, its complexity is higher than in other mechanisms, as it requires linking formal rules within the country with the rules of donor organizations. Also, its effectiveness depends on the information and communication skills of communities.

The results of our analysis of technical subsystems in the financing mechanisms of local development that are shown in Table 4 characterize their advantages and disadvantages for different mechanisms. The analysis of technical subsystems helps identify weak points and opportunities for improving the financing mechanism of local development through digital technologies. At the same time, the level of development of technological subsystems in local development financing mechanisms largely depends on the country, region, and specific local government. However, the general trend includes the growing use of digital technologies and innovations to improve the efficiency and transparency of financial management at the local level. The insufficient development of technical subsystems can be explained by such obstacles existing in communities as financial constraints, insufficient development of the technological base, lack of necessary skills by personnel.

The practical significance of our results is that the developed proposals for improving the mechanism of financing the development of local communities could be used by state authorities and local self-government bodies in their activities. It is expected that this will increase the efficiency of the existing financing mechanism by reducing transaction costs, as well as allow attracting additional financial resources. In addition, the proposed areas of improvement will contribute to increasing civic participation and increasing the transparency of financial processes. Theoretical results regarding the definition of the structure and description of the components of the local development financing mechanism could be used to rethink the processes of local development financing and in further scientific research into this topic.

The limitations of this study are that its results define the conceptual aspects of the digital transformation of funding mechanisms. That is, the work does not consider legal and regulatory restrictions on the use of blockchain in the field of financing, overcoming public prejudices regarding digitalization, its social and ethical aspects, and cyber security risks.

The constraints of the current research are the impossibility of applying its results in certain cases. If, for example, there are infrastructural, financial, technological, and qualification limitations in local communities, then the application of digital technologies needs to be solved.

The development of this study concerns the identification and assessment of the impact of individual factors of digital transformation on the effectiveness of local development financing mechanisms, including trust in the government, the level of digital literacy and the general acceptance of technologies by various sectors of society. Such studies should be conducted for different communities within individual countries.

7. Conclusions

1. The concept of the financing mechanism for the development of local communities is represented as a system of social relations regarding obtaining and using financial resources to achieve the goals of sustainable development within the territory of the local community. This made it possible to determine the structure of the financing mechanism in the form of interrelated components, which include financing entities, sources of financing, methods of financing, objects of financing, and technical infrastructure

of financing. Local self-government bodies are recognized as the management subsystem in the financing mechanism since they are the ones empowered to manage the receipt and use of financial resources and community development. The purpose of the functioning of the financing mechanism for the development of local communities, thus, is to ensure the implementation of the functions of local self-government bodies, which are defined from the point of view of the goals of sustainable development. A feature of the structural description of the funding mechanism proposed in this paper is its universality as a theoretical concept and the use of a systemic approach. This makes it possible to build a structure of processes for the digitalization of the financing mechanism for the development of local communities.

2. Funding methods are recognized as a managed subsystem of the funding mechanism. The peculiarity of financing methods is that they contain financing principles, rules, and procedures. This makes it possible to classify them depending on the source of financial resources (budgetary funds, investor funds, credit funds, or grant funds). The following factors affecting the availability of financial resources are singled out. The volumes of received taxes, fees and interbudgetary transfers, as well as the orderliness of budget legislation relate to the budget method of financing. Availability and clarity of legal models of investment in the development of local communities, financial opportunities and interests of the private sector and local self-government bodies affect the availability of investment financial resources. Legal restrictions on the use of the credit method, the requirements of the financial institution, the cost of credit resources and the ability of the community to service the debt, the duration of the issuance and placement of municipal bonds affect the applicability of the credit method of financing. The grant method is determined by the complexity of the procedure for granting funds by the grantor. An additional factor that limits existing methods of financing are crises that lead to structural shifts in the volume of financing when local governments are faced with less revenue and greater social needs. For example, in Ukraine, because of the military invasion of the Russian Federation in 2022, structural changes led to a reduction in financing through credit (by 97 %), investment (100 %), and budget (22 %) mechanisms. At the same time, there was an expansion of funding through the grant mechanism. The total volume of financial and humanitarian international aid for 2022–2023 is estimated at EUR 150 billion; with the help of fundraising, about USD 72.8 million were collected.

3. Consideration of the financing mechanism as a socio-technical system allows finding directions for its improvement through the use of technology. The parameters of the social subsystem are informal and formal institutions, customs, traditions, norms, culture, contractual and transactional regulation, which determine the relationships between stakeholders. Parameters of the technical subsystem are individual features of the use of technical devices, technical regulations and standards, technology design paradigms, technical protocols and procedures, regulation in the field of development of technological artifacts. The analysis of the technical financing infrastructure depending on the financing methods as a formalized set of parameters of the social subsystem of the financing mechanism made it possible to single out the advantages and disadvantages of this infrastructure. Thus, the technical means of the budget

method automate some of its processes, which reduces the time for transactions and optimizes budget processes. However, the lack of a unified technological base complicates control functions and increases the risk of management errors. Technologies that ensure the implementation of investment and credit methods of financing ensure the reduction of transaction costs for payment procedures and the provision of information necessary for the analysis of their effectiveness. But their drawback is the need for special knowledge to effectively use these methods, as well as the risk of cyber attacks and phishing. The technical basis of the grant method of financing is digital platforms, the advantage of which is relatively quick access to information about financial resources. The disadvantage is the dependence on the digital capabilities of communities and the lack of a single platform for managing funding.

4. Directions for improving the financing mechanism for the development of local communities relate to the further expansion of the use of digital technologies. Creation of a unified technical system for the budgetary method of financing. Expanding training and support of financing entities on the use of financing methods to achieve the goals of sustainable development. Optimizing the decision-making process, increasing the efficiency of using financial resources and forecasting the needs of local communities based on artificial intelligence, big data, blockchain and tokenization technologies. Development and implementation of an electronic system for monitoring the funds raised and spent using various methods of financing and managing micro-development projects. The use of blockchain technology and tokenization for the development of public crowdfunding and fundraising is also proposed.

The highlighted directions are different in that they indicate the potential of these innovations to increase the efficiency, transparency, and availability of funding for the development of local communities. However, it is important to consider challenges and risks such as cyber security, availability, and the need to constantly update and adapt to changes in the technological environment.

Conflicts of interest

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

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Data availability

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

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

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