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Digital transformation of financial management: innovative technologies and outsourcing in the development of territorial communities

Abstract

The purpose of the study is to assess the impact of the level of digital maturity and the application of outsourcing practices on the effectiveness of financial management in territorial communities of the Lviv region.

Methodically, the study is based on typological analysis, comparative statistics, Student's t-criteria, and Mann-Whitney U-criteria.

As part of the analysis, typologised communities were identified: 21% had a comprehensive digital architecture, 48% – a fragmented one, and 31% – a basic level of digital presence. In digitally mature communities, the average time for approving financial decisions was 1.9 days (vs. 6.5 days), documentation processing – 2.4 days (vs. 7.1), and the share of errors in financial documents – 3.2% (vs. 11.4%). Integrated accounting platforms provided forecast accuracy of 5.7%, while basic accounting platforms provided forecast accuracy of 13.1%. In communities with digital control, the frequency of exceeding budget limits did not exceed 4.1%, and the share of erroneous transactions – 2.8%. Outsourcing was applied in 38% of communities and was accompanied by a 27% reduction in costs, errors – up to 3.1%, delays in reporting – up to 1.1 days. In 24% of communities, analytical functions were transferred to external performers. Based on the results, a conceptual model for integrating digital technologies and outsourcing with a network of shared service centres is proposed.

Practical importance lies in the possibility of applying the results to form digital development strategies, optimise costs, and improve the efficiency of municipal administration in the context of decentralisation.

The obtained conclusions can be used by heads of territorial communities, specialists of local self-government bodies, regional divisions of the Ministry of Digital Development, and specialised consulting structures in the development of digital transformation programs, selection of outsourcing support models, implementation of electronic budgeting platforms, and in the development of intermunicipal initiatives to create joint service centres.

KEYWORDS: Budget planning – Public finance – Decentralisation – Analytical modelling – Standardisation of reporting – Financial technologies

1. Introduction

The growing complexity of financial management in the context of decentralisation has led to the need to expand the institutional capabilities of territorial communities through the introduction of digital tools. The intensification of information flows, the growing need for accurate budget planning and operational control, and the requirements for transparency of management decisions have actualised the transition to digital public financial management. The fragmented use of digital platforms, the lack of uniform accounting standards, low integration of information systems, and limited human and technical resources remained widespread, which hindered the implementation of the strategic goals of communities. The study focused on the need to develop a comprehensive management model that combines digital services with outsourcing mechanisms to ensure the sustainability, efficiency, and adaptability of budget processes. Outsourcing of financial and technical functions was considered as a tool for improving functional capacity without increasing the internal burden on management structures.

Publications devoted to digital transformation mainly analysed general economic or sectoral changes, which led to the presence of aspects that were not covered, related to the functioning of digital solutions in the field of financial management at the level of territorial communities. Thus, in the study by Badiaiev[1] and Kolodii et al.[2], the impact of digital transformation on the financial management of enterprises is analysed in the context of crisis changes, with a focus on crisis response tools. However, the specifics of digitalisation in the public sector, in particular, in the activities of local self-government bodies, were not considered, and the role of outsourcing mechanisms in the budget process was ignored.

1 O. BADIAIEV, Digital transformation of financial management in an enterprise during a crisis. *Modeling the Development of the Economic Systems*, 2, 2024, 253-258. https://doi.org/10.31891/mdes/2024-12-33

2 I. KOLODII, R. SKUPSKYI, L. DOMBROVSKA, A. KOLODIY, and V. HALANETS, Mechanism of anti-crisis management in agricultural enterprises: Characteristics and features of the implementation. *Review of Economics and Finance*, 21(1), 2023, 2460-2466. https://doi.org/10.55365/1923.x2023.21.261

The analysis of the scientific literature shows the dominance of approaches in which digital transformation is considered mainly in connection with the development of the private sector, marketing strategies, or macroeconomic shifts. Therewith, the specifics of the functioning of digital solutions in the public sector of local self-government often remain out of the scope of the studies. For example, Krymska et al.[3] paid closer attention to digital communication channels and consumer behaviour analytics, disregarding the use of digital services in public financial management systems. In the paper of Tyshchenko[4], digital technologies were positioned as a driver of macroeconomic development, but their impact on the institutional structure of the budget process in communities was not explored.

In the field of strategic planning for the development of territorial communities, the emphasis was placed on resource potential and general approaches to the development of long-term programmes, which is highlighted by Pastuh[5]. Thereby, the issues of digital administration, automation of financial-budgetary procedures and integration of outsourcing mechanisms into the local government system were overlooked. Tools for digital support of strategic control and evaluation of the effectiveness of management decisions were also not considered.

However, a number of modern international studies show a growing interest in the topic of digital transformation in connection with the development of outsourcing mechanisms to support management processes. In this context, Guo et al.[6] reviewed the relationship between internal practices of research and development (R&D practices), external technological support, and parameters of sustainable digital transformation, concentrating on the corporate level. In the stu-

3 A.O. KRYMSKA, U.O. BALYK, and I.O. KLIMOVA, Digital transformation in the field of marketing: New approaches and opportunities. *Academic Visions*, 26, 2023. http://dx.doi.org/10.5281/zenodo.10374255

4 D. TYSHCHENKO, Digital transformation as economic development driver. *Digital Economy and Economic Security*, 4(4), 2023, 38-45. https://doi.org/10.32782/dees.4-7

5 K. PASTUH, Strategic development planning of territorial communities. *Scientific Herald: Public Administration*, 1(7), 2021, 195-215. https://doi.org/10.32689/2618-0065-2021-1(7)-195-215

6 C. GUO, Y. ZHAO, Z. MIAO, W. LI, and H. CHEN, Indigenous R&D, outsourcing technology, and sustainable digital transformation. *Journal of the Knowledge Economy*, 15(4), 2024, 20745-20777. https://doi.org/10.1007/s13132-024-01983-0

dy by Messaou and Barakate[7], digital modernisation of the budget is viewed through the prism of the introduction of an electronic visa procedure for local budgets, which is an important example of technical transformation, but does not cover the organisational and functional level of interaction between communities and service contractors. In both cases, there is no systematic understanding of the role of digital platforms in the context of institutional management and strategic control in local self-government bodies.

Some papers have covered the phenomenon of digital transformation through the prism of institutional changes, but the financial aspects of management at the level of territorial communities have mostly remained out of focus. For instance, Kim et al.[8] present a case study of digitalisation of the banking sector in South Korea and other countries, without an analysis of the implementation of digital solutions in public administration at the local level. Komninos et al.[9] demonstrate the functioning of urban digital platforms within various industry ecosystems, while the mechanisms of budget administration and the institutional logic of attracting external service structures were not the subject of analysis.

A study by Qureshi[10] focuses on the aspects of digital inclusion and self-government development in border and socially vulnerable regions, disregarding the automated financial planning, monitoring, and analytics tools as factors for strengthening the institutional capacity of communities. A study by Tan[11] displays the political economy of digital transformation processes in China, parti-

7 I. MESSAOU, and H. BARAKATE, The contributions of digital transformation to local finance management: The example of the electronic visa procedure for territorial collectivities budgets. In: Y. Farhaoui (Ed.), *Artificial Intelligence, Big Data, IOT and Block Chain in Healthcare: From Concepts to Applications*. Cham: Springer, 2024, 354-370. https://doi.org/10.1007/978-3-031-65014-7_32

8 E. KIM, M. KIM, and Y. KYUNG, A case study of digital transformation: Focusing on the financial sector in South Korea and overseas. *Asia Pacific Journal of Information Systems*, 32(3), 2022, 537-563. https://doi.org/10.14329/apjis.2022.32.3.537

9 N. KOMNINOS, C. KAKDERI, A. COLLADO, I. PAPADAKI, and A. PANORI, Digital transformation of city ecosystems: Platforms shaping engagement and externalities across vertical markets. In: L. Mora, M. Deakin, X. Zhang, M. Batty, M. de Jong, P. Santi, F.P. Appio (Eds.), *Sustainable Smart City Transitions: Theoretical Foundations, Sociotechnical Assemblage and Governance Mechanisms*. London: Routledge, 2022, 91-112. https://doi.org/10.4324/9781003205722

10 S. QURESHI, Digital transformation at the margins: A battle for the soul of self-sovereignty. *Information Technology for Development*, 28(2), 2022, 215-229. https://doi.org/10.1080/02681102.2022.2062291

cularly in the context of choosing strategic partners, while local management transformations related to fiscal policy and digital administration are not investigated. The presence of such restrictions indicates the lack of a holistic scientific vision for the use of digital solutions in the field of municipal financial management and their combination with outsourcing mechanisms, which justifies the need for a systematic examination of these aspects.

The study aimed to clarify how the level of digital maturity of management processes and the introduction of outsourcing mechanisms affect the effectiveness of financial management in territorial communities of the Lviv region in the context of institutional transformations related to the implementation of the decentralisation reform. The following tasks were set to achieve this goal: conduct a typologisation of communities by the level of digital maturity; assess the effectiveness of using digital platforms in budget planning and control; analyse the practice of using outsourcing models in the field of financial and accounting support and management of technical processes; develop an integrated model of digital outsourcing interaction as a tool for strategic development of communities.

2. Methodology

The study was analytical and applied in nature and took place during 2019-2024. The spatial boundaries were territorial communities of Ukraine, with a focus on the communities of the Lviv region as a region with active processes of digitalisation and organisational renewal within the framework of the decentralisation reform. The study was based on open sources, including the Ministry of Finance of Ukraine[12], the State Statistics Service of Ukraine[13], and the National Agency of Ukraine on Civil Service[14]. Data from the Open Budget system[15]

11 J. TAN, Buying smart: Unpacking the political economy in the partner selection of China's digital transformation. *Chinese Political Science Review*, 2024. https://doi.org/10.1007/s41111-024-00262-2

12 Ministry of Finance of Ukraine. Budgetary policy, 2025. https://mof.gov.ua/uk/budget-policy

13 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

14 National Agency of Ukraine on Civil Service. Public finance, 2025. https://nads.gov.ua/publichni-finansi

15 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/

and statistics from the Prozorro platform[16] were also used.

For in-depth analysis, communities of the Lviv region representing different levels of digital maturity were selected: Lviv, Drohobych, Chervonohrad, Stryi, Sokal, Zolochiv, Yavoriv, Sambir, Kamianka-Buzka, Peremyshliany, Horodok, Mykolaiv, Zhovkva, and Radekhiv. The selection was based on the criteria of diversity of digital practices, availability of reporting information, participation in digitalisation projects, and territorial and socio-economic distribution. The inclusion of communities with different administrative capacities allowed us to identify patterns that are characteristic of both urbanised and rural municipalities.

Within the framework of the study, methods of content analysis of the current regulatory support for digital transformation of Public Administration were used, in particular, the Law of Ukraine No. 2807-IX "On the National Information Program"[17] and the Law of Ukraine No. 2456-VI "On Budget Code of Ukraine"[18]. The relevant government resolutions on the organisation of electronic interaction of state electronic information resources and the implementation of public finance reform were also considered, including transparency in the management of public funds and the introduction of digital budget monitoring tools[19,20].

In the structure of the study, a block of retrospective analysis was identified, the purpose of which was to trace the stages of digital transformation of territorial communities of the Lviv region in 2019-2024. This approach allowed recording the dynamics of the transition between the levels of digital maturity, assessing the relationship between the intensity of information technology (IT) costs and the nature of implemented digital solutions, and identifying consistent

16 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

17 Law of Ukraine No. 2807-IX "On the National Informatization Program". 2022. https://zakon.rada.gov.ua/laws/show/2807-20#Text

18 Law of Ukraine No. 2456-VI "On Budget Code of Ukraine". 2010. https://zakon.rada.gov.ua/laws/show/2456-17

19 Resolution of the Cabinet of Ministers of Ukraine No. 357 "On Some Issues of Organizing Electronic Interaction of State Electronic Information Resources". 2018. https://www.kmu.gov.ua/npas/deyaki-pitannya-organizaciyi-elektronnoyi-vzayemodiyi-derzhavnih-elektronnih-informacijnih-resursiv

20 Cabinet of Ministers of Ukraine. Reform of public finance management, 2025. https://www.kmu.gov.ua/reformi/efektivne-vryaduvannya/reforma-derzhavnih-finansiv

changes in administrative and managerial approaches. The inclusion of the retrospective component ensured the integration of time parameters into the overall analytical design of the study, identifying causal relationships in the processes of digitalisation of municipal administration.

Analytical data processing included a comparative analysis of the level of community digitalisation, the dynamics of digital service costs, the use of outsourcing, and related effects on the budget process. Statistical methods included the use of the Student's t-test at a significance level of $p \leq 0.05$ to check hypotheses about differences between community groups. In case of violation of the assumption of normality of the distribution, the Mann-Whitney U-test and the Fisher criterion were used. The effectiveness of digital accounting platforms, automated document management systems, Big Data analytics modules, and digital financial monitoring solutions was evaluated separately. Personnel costs, error rate, documentation processing time, response to changes in budget parameters, and the level of integration of external services into the internal digital contours of communities were evaluated.

Considerable attention was paid to the examination of the implementation of outsourcing models, in particular, in the areas of accounting support, IT infrastructure administration (information technology infrastructure), analytical consulting, and waste management. There was a reduction in costs and an increase in operational efficiency when transferring functions to external performers. The analysis also considered examples of outsourcing integration into the financial accounting system of community enterprises through digital platforms with environmental and logistics monitoring.

The interpretation of the results obtained was based on a multidimensional comparison of the structural characteristics of the digital infrastructure, indicators of budget performance, and practices for using external resources. Typologisation of communities by the level of digital maturity allowed identifying progressive management models that demonstrated the highest indicators of efficiency, adaptability, and strategic balance between resources and functions. Based on empirical conclusions, the author's model of digital outsourcing integration was developed as a tool for improving the effectiveness of financial activities of local self-government bodies.

3. Typology of levels of digital maturity of financial management systems on the example of analysis of 14 territorial communities of the Lviv region

Systemic changes in the field of public finance that occur in the context of decentralisation are accompanied by an increase in the institutional burden on local self-government bodies. Increasing the scope of budget planning, control, and analysis functions requires a transition from fragmented use of digital tools to integrated solutions that can ensure the functional integrity of management processes. The growing complexity of financial transactions in communities, the expansion of data volumes, and the need to improve the accuracy of budget decisions have led to the urgency of developing structured models that allow assessing the level of digital maturity of management systems at the municipal level.

The intensity of digital transformation in territorial communities reveals major variability, which is explained by differences in technical support, human resources, local finance volumes, and organisational approaches to managerial decision-making[21]. As a result, asymmetric models are formed in which the digital infrastructure can either cover all key stages of the budget cycle or be reduced to an elementary level of automation of individual procedures. This unevenness creates potential gaps in the speed of response to changes, the reliability of reporting data, and resilience to human-related risks. The presence of these imbalances justifies the need to develop a typology of digital models that would reflect the real state of the financial and management infrastructure at the local level.

To this end, a structural grouping of territorial communities of the Lviv region was conducted, accounting for the three key criteria: the number of functional modules that ensure the performance of budget functions; the level of integration of digital components into a single information system; and the degree of application of artificial intelligence tools in analysis and forecasting processes. This approach allowed establishing both the availability of digital solutions and assessing their depth, functional completeness, and potential for automated management. Typical characteristics of each of the identified groups, proportion in the sample structure, and specific examples of communities are given in Table 1.

21 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

Table 1. Typology of communities by level of digital maturity and their characteristics

Community type	Characteristics of the digital infrastructure	Examples of tools used	Number of functional modules	Availability of AI analytics	Share of the total sample	Examples of communities
Integrated digital integration	Unified information system, full automation of accounting, planning, and control	*FinTech*-modules, artificial intelligence (AI)-scenarios, *Big Data*, electronic audit	6 or more (accounting, planning, monitoring, analysis, forecasting, audit)	Yes (using scenario models, automated forecasting)	21%	Lviv city, Zymnovodivska rural, Horodok city, Stryi city
Fragmentary digitalisation	Using separate digital solutions without cross-system integration	Accounting systems, document management, open budgets	2-5 (accounting, document management, open budget, etc.)	Limited (only in individual modules or during the testing phase)	48%	Boryslav city, Sambir city, Drohobych city, Truskavets city
Basic level of digital presence	Minimal use of digital technologies, no automation	Basic spreadsheets, manual accounting, offline reporting	1 or missing (manual accounting, spreadsheets)	None	31%	Slavske settlement, Dobrosyn-Maheriv rural, Borynia settlement, Pomoriany settlement

[Source: compiled by the authors based on [22,23,24,25,26]]

Table 1 demonstrates a clear differentiation of territorial communities of the Lviv region in terms of digital maturity, which is manifested in the depth of

22 Ministry of Finance of Ukraine. Budgetary policy, 2025. https://mof.gov.ua/uk/budget-policy

23 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

24National Agency of Ukraine on Civil Service. Public finance, 2025. https://nads.gov.ua/publichni-finansi

25 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/

26 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

application of digital tools, the structure of information infrastructure, and the degree of automation of financial processes. Communities with integrated digital integration (21% of the sample) are characterised by the presence of a single information system with six or more functional modules, the use of FinTech solutions, artificial intelligence and Big Data analytics, which ensures a high level of accuracy, control, and efficiency of management decisions. In communities with fragmented digitalisation (48%), there is a partial introduction of digital tools without proper integration between modules, which limits the potential for effective financial control. The least effective is the category of communities with a basic level of digital presence (31%), where digitalisation is reduced to the use of elementary tables and manual accounting without automation or the use of intelligent systems, which indicates a critical need for technological strengthening of these municipalities.

The results of the analysis showed the variability of digital maturity depending on the availability of financial resources, organisational structure, and level of human resources (Figure 1). In communities with a developed digital infrastructure, modules for electronic reporting, revenue forecasting, cost analysis, and tools for budget modelling were used. However, in communities with partial digitalisation, separate modules were used without a single integration logic, which limited the effectiveness of financial analysis.

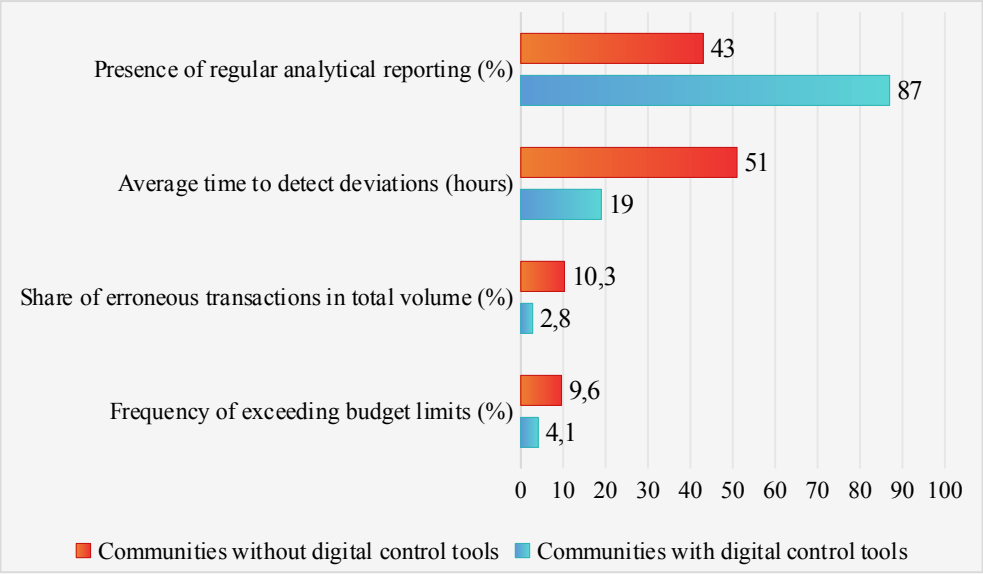

Figure 1. Comparative performance indicators of budget procedures in communities with different levels of digitalisation in 2024

[Source: compiled by the authors based on [27,28,29,30,31]]

Figure 1 illustrates the pronounced relationship between the level of digitalisation of management processes in territorial communities and the effectiveness of implementing budget procedures. Communities with a basic level of digital presence show the worst performance in all parameters: the highest share of errors in financial documents (11.4%), the longest average time for approving a financial decision (6.5 days), and the longest processing time for budget documents (7.1 days). In the context of fragmented digitalisation, these indicators are improving, although they remain average (6.8%, 4.7 days, and 5.3 days, respectively). The best results are achieved by communities with integrated digital integration: the error rate is only 3.2%, approval of a financial solution takes 1.9 days, and documentation processing – 2.4 days. This indicates a direct correlation between the depth of digitalisation and improved accuracy, speed, and overall efficiency of financial and administrative procedures.

The identified patterns confirm that the introduction of integrated digital solutions is a critical factor in improving both the efficiency and accuracy of budget management. Special attention should be paid to the role of tools built based on artificial intelligence. These tools include, in particular, predictive analytics modules for estimating budget revenue, cost classification, and prioritisation algorithms, systems for detecting anomalies in transactional data and platforms for scenario modelling of budget parameters with adaptive settings in real time. Their use ensures the adaptability of financial planning, increases the accuracy of forecasting, and reduces the influence of the human factor. AI models allow for scenario modelling in view of changes in environmental parameters in real time, which substantially increases the validity of management

27 Ministry of Finance of Ukraine. Budgetary policy, 2025. https://mof.gov.ua/uk/budget-policy

28 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

29National Agency of Ukraine on Civil Service. Public finance, 2025. https://nads.gov.ua/publichni-finansi

30 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/

31 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

decisions, providing a combination of strategic flexibility with procedural transparency and compliance with ethical standards of digital governance.[32,33]

Accounting for these factors, a retrospective analysis of digital dynamics in the communities of the Lviv region was conducted during 2019-2024. The subject of the study was both changes in the distribution of communities by levels of digital maturity and average spending on IT services, which allows for identifying financial determinants of digital transformation. The results of the dynamics of digitalisation of municipal administration and accompanying budget investments are summarised in Table 2.

Table 2. Dynamics of community digitalisation and IT spending in 2019-2024

Year	Share of communities with integrated digital integration (%)	Share of communities with fragmented digitalisation (%)	Share of communities with a basic level of digitalisation (%)	Average cost of IT services per community (thousand UAH)
2019	7	39	54	110
2020	10	41	49	145
2021	14	44	42	190
2022	18	46	36	240
2023	21	48	31	285
2024	25	49	26	330

Note: the cost figures include the total annual costs of software procurement, server infrastructure maintenance, licenses, technical support, and digital audit, listed on average per community.

[Source: compiled by the authors based on [34,35,36,37,38]]

32 W.A. ADDY, A.O. AJAYI-NIFISE, B.G. BELLO, S.T. TULA, O. ODEYEMI, and T. FALAIYE, Transforming financial planning with AI-driven analysis: A review and application insights. *World Journal of Advanced Engineering Technology and Sciences*, 11(1), 2024, 240-257. https://doi.org/10.30574/wjaets.2024.11.1.0053

33 B.R. REXHEPI, L. MUSTAFA, M.K. SADIKU, B.I. BERISHA, S.U. AHMETI, and O.R. REXHEPI, The impact of the COVID-19 pandemic on the dynamics of development of construction companies and the primary housing market: Assessment of the damage caused, current state, forecasts. *Architecture Image Studies*, 5(2), 2024, 70–79. https://doi.org/10.48619/ais.v5i2.988

34 Ministry of Finance of Ukraine. Budgetary policy, 2025. https://mof.gov.ua/uk/budget-policy

35 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

36 National Agency of Ukraine on Civil Service. Public finance, 2025. https://nads.gov.ua/publichni-finansi

37 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/

38 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

Table 2 reflects the gradual changes in the structure of digital maturity of territorial communities in the Lviv region during 2019-2024, accompanied by a steady increase in average IT spending. The share of communities with integrated digital solutions increased from 7% in 2019 to 25% in 2024, indicating a trend towards the spread of full-featured digital solutions in budget process management. Thereby, the share of communities with fragmented digitalisation grew more slowly – from 39% to 49%, which indicated the spread of only partial automation without full integration of systems. The most noticeable decline was in the category of communities with a basic level of digital presence – from 54% to 26%, which indicated the rejection of elementary forms of digitalisation in favour of more complex models. The increase in average spending on IT services from 110 to 330 thousand UAH per community confirmed a direct relationship between the level of digital transformation and the financial capabilities of local authorities, which requires strategic consideration when planning state support for digital initiatives.

4. Effectiveness of using digital tools in budget planning and control

The spread of digital tools in the budget management system of territorial communities in the Lviv region has created prerequisites for improving planning procedures, improving the accuracy of forecasts, strengthening financial control, and reducing transaction risks[39]. The main directions of digitalisation were the introduction of accounting platforms with a modular structure, electronic document management systems, financial data visualisation tools and automated digital controlling mechanisms. The experience of using digital financial services as moderators of the relationship between budget planning and financial results, in particular, recorded in studies on the example of small and medium-sized enterprises in Kenya, confirmed the existence of a positive impact of the digital environment on the quality of the budget process.[40]

39 I. KOLODII, V. KOVALIV, and A. KOLODIY, Diagnosis of financial state and bankruptcy threats of agricultural enterprises of Lviv region in anti-crisis management system. *Scientific Papers. Series: Management, Economic, Engineering in Agriculture and Rural Development*, 22(1), 2022, 321-329.

40 G. JEPLETING, J. TARUS, and Z. SHITOTE, Effects of budget planning on financial performance of selected SMEs in Eldoret town, Kenya moderated by digital finance services. International *Journal of Research and Innovation in Social Science*, 8(11), 2024, 716-729 https://dx.doi.org/10.47772/IJRISS.2024.8110057

A comparative analysis of Lviv region communities by the types of accounting systems used, the level of their automation and the accuracy of forecasting budget indicators (Table 3) showed a substantial differentiation according to these criteria.

Table 3. Characteristics of the use of accounting platforms and the accuracy of budget forecasting in communities

Type of accounting systems used	Level of budget planning automation	Share of communities using (%)	Average deviation of actual indicators from planned ones (%)
Basic accounting systems (without forecasting functions)	Low	44	13.1
Systems with a cost forecasting module	Medium	22	8.4
Integrated platforms with full functionality	High	34	5.7

[Source: compiled by the authors based on [41,42,43,44,45]]

Table 3 demonstrates a clear link between the level of automation of accounting systems and the accuracy of budget forecasting in territorial communities. The highest level of deviation between planned and actual indicators (13.1%) was recorded in communities where basic accounting systems without forecasting functions were used, which indicated limited analytical capabilities and dependence on manual data processing. Significantly better results were shown by communities that implemented systems with a cost forecasting module – they had an average deviation rate of 8.4%. The highest accuracy was achieved by those communities (34% of the sample) that used integrated platforms with full functionality: the average deviation did not exceed 5.7%, which indicated the ef-

41 Ministry of Finance of Ukraine. Budgetary policy, 2025. https://mof.gov.ua/uk/budget-policy

42 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

43 National Agency of Ukraine on Civil Service. Public finance, 2025. https://nads.gov.ua/publichni-finansi

44 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/

45 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

fectiveness of an integrated approach to accounting, planning and reporting based on automated digital infrastructure.

A separate role is played by the interaction of accounting systems with other elements of the digital ecosystem. Electronic document management systems operated in 61% of communities, but only a third of them provided integration of such solutions with financial modules[46]. In those communities where such integration was implemented, the average time for approving financial decisions was reduced by about 36%, which confirms the synergy effect of combining accounting and procedural subsystems. The additional introduction of a digital signature, electronic archive, and online monitoring mechanisms not only reduced the administrative burden but also increased the reliability of accounting operations.[47] In some communities (11%), mostly with a high level of financial autonomy, Big Data analytics was used, which allowed for operational adjustment of budget parameters, forecasting Inter-budget transfers and implementing elements of a program-target approach in cost management. This indicates a shift to an analytically sound data-driven budgeting model.

To assess the effectiveness of budget control in territorial communities, a comparative analysis of key indicators for managing financial deviations depending on the availability of digital controlling tools was conducted. The estimated parameters include the frequency of erroneous transactions, the duration of response to deviations, the regularity of analytical reporting, and the frequency of exceeding budget limits. The comparison identified differences in the organisation of internal control between communities with automated monitoring systems and those where control is manual. The generalised results are presented in Figure 2.

46 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

47 M. GULALIYEV, S. ABASOVA, S. GULIYEVA, E. SAMEDOVA, and M. ORUCOVA, The main problems of building the digital economy of Azerbaijan. *WSEAS Transactions on Business and Economics*, 20, 2023, 1383–1395. https://doi.org/10.37394/23207.2023.20.123

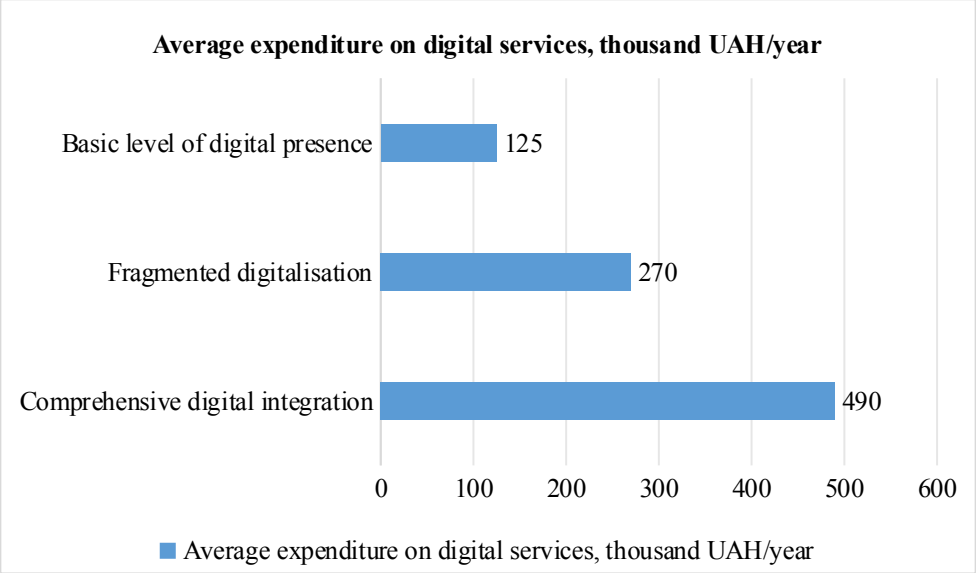

Figure 2. Comparison of the effectiveness of budget control depending on the availability of digital tools in 2024

[Source: compiled by the authors based on [48,49,50,51,52]]

Figure 2 shows a considerable difference in the effectiveness of budget controls depending on the availability of digital tools in communities. In particular, in communities with implemented financial controlling modules, the frequency of exceeding budget limits was only 4.1%, which is almost half as much as in communities without digital solutions (9.6%)[53], and the share of erroneous transactions decreased from 10.3% to 2.8%, indicating a positive impact of automated systems on the accuracy of financial transactions[54]. The average deviation detection time in digitalised communities was 19 hours versus 51 hours in communities without appropriate systems[55], demonstrating a higher speed of risk re-

48 Ministry of Finance of Ukraine. Budgetary policy, 2025. https://mof.gov.ua/uk/budget-policy

49 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

50 National Agency of Ukraine on Civil Service. Public finance, 2025. https://nads.gov.ua/publichni-finansi

51 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/

52 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

53 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

54 National Agency of Ukraine on Civil Service. Public finance, 2025. https://nads.gov.ua/publichni-finansi

55 Ministry of Finance of Ukraine. Budgetary policy, 2025. https://mof.gov.ua/uk/budget-policy

sponse. In addition, the level of regular analytical reporting was more than twice as high in communities with digital control (87% vs. 43%)[56], which showed the dependence of information transparency and monitoring discipline on the degree of automation of budget management. Taken together, these indicators underscore the important role of digital tools as a catalyst for analytical efficiency and financial sustainability of the municipal sector.

Therewith, the effective functioning of digital solutions is impossible without an appropriate resource base. The volume of investment in digital infrastructure is a determining factor in achieving a high level of technological maturity.[57] Average annual expenditures on digital services were compared to identify the relationship between the level of digitalisation of communities and the intensity of budget expenditures. The generalised results of the analysis are presented in Figure 3.

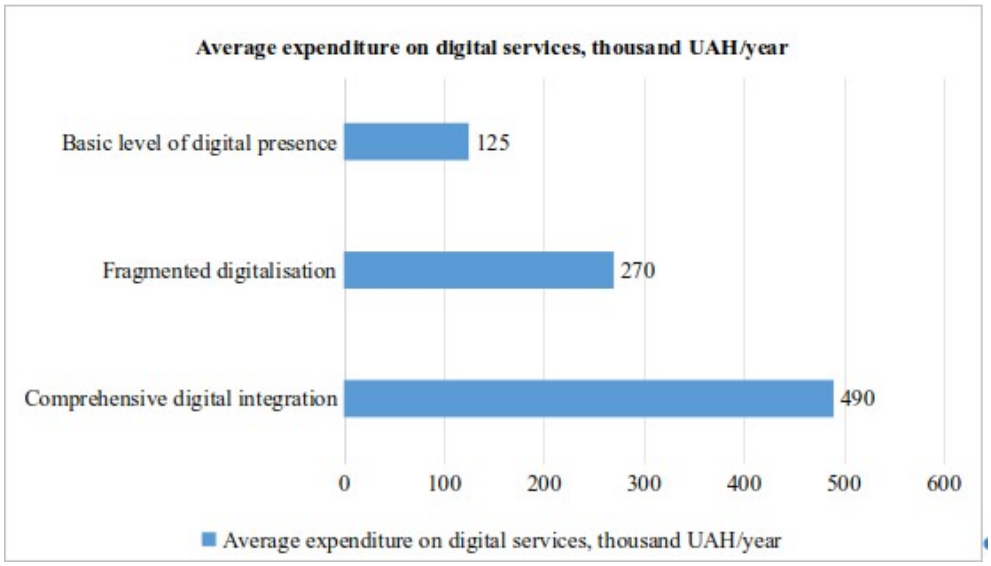

Figure 3. Average annual spending on digital services in communities depending on the level of digital maturity

[Source: compiled by the authors based on [58,59]]

56 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

57 M. ALQSASS, H. JARADAT, B.R. REXHEPI, B.N. ZUREIGAT, J. AL-GASAWNEH, and H. MAALI, The impact of dividends per share and retained earnings per share on share price: A study based on Jordanian companies. *Quality – Access to Success*, 24(197), 2023, 67–74. https://doi.org/10.47750/QAS/24.197.08

58 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/

59 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

Figure 3 displays a clear positive correlation between the level of digital maturity of communities and the volume of annual spending on digital services, which proves the critical dependence of digital transformation on financial investment ability. Thus, in communities with integrated digital integration, the average costs amounted to 490 thousand UAH per year, which is almost twice as high as the corresponding indicators for communities with fragmented digitalisation (270 thousand UAH) and more than three times for communities with a basic level of digital presence (125 thousand UAH)[60]. This dynamic reflects both the depth of implementation of technological solutions and the institutional willingness to invest in IT infrastructure, including electronic document management, analytical platforms, technical support, and staff training. Thus, digital modernisation of management processes is not only a matter of strategic choice but also a direct consequence of resource provision, which determines the ability of communities to maintain the continuity and functionality of digital solutions.

The identified statistically significant relationship between the level of distribution of digital tools and the effectiveness of budget planning and control confirmed the feasibility of spreading the practice of attracting external services in the communities of the Lviv region. This primarily concerned the areas of technical support, administration of digital platforms, software updates, and audit of information flows, which formed the prerequisites for improving the efficiency of public administration.

5. Outsourcing practices in the digital financial management environment

Digitalisation of budget management in the communities of the Lviv region was accompanied by an increasing need for external technical, service, and analytical support. Given the limited number of specialised IT personnel and the need to comply with high standards of security and compatibility of digital solutions, the introduction of outsourcing models for delegating technical support functions to external service providers Prozorro[61] has intensified. This approach provided support for digital processes without expanding the management ap-

60 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/
61 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

paratus or increasing internal costs.

Among the key areas of outsourcing support in territorial communities is the maintenance of accounting information systems, server infrastructure administration, support of electronic document management systems and analytical modules, which allowed avoiding the costs of creating internal IT departments, reducing the risks of technical failures, and ensuring timely software updates in accordance with information security requirements.[62,63,64] The delegation of these functions contributed to the standardisation of accounting procedures, the introduction of innovative data verification mechanisms, and the development of industry expertise, which, in turn, created the basis for the unification of financial statements and improved the quality of management decisions. The integrated digital outsourcing model was especially effective in the field of waste management, where technical integration and analytical support allowed for high accuracy, transparency, and flexibility of the system, as illustrated in Table 4.

Table 4. Structure of a digital waste management model with outsourcing elements

System component	Content of functioning
Digital community platform	Automated accounting of routes, volumes, and payments
Service provider	Providing the service, entering operational data
Budget division	Control of financing, reconciliation of fulfilment of contractual obligations
End user	Access to data via a mobile app or online portal
Analytical module	Generating reports, evaluating performance, and environmental indicators

62 S. ABBASOVA AGAMAMED, F. ASGAROVA ALINAZIM, M. ALIYEVA SHABAN, L. HAMIDOVA ADIL, R. QUSHKHANI NASIR, and L. RZAYEVA YUSIF, Problems and prospects in developing the auditing system in Azerbaijan. *Universidad y Sociedad*, 15(2), 2023, 550–561.

63 R. TORMOSOV, I. CHUPRYNA, G. RYZHAKOVA, V. POKOLENKO, D. PRYKHODKO, and A. FAIZULLIN, Establishment of the rational economic and analytical basis for projects in different sectors for their integration into the targeted diversified program for sustainable energy development. *2021 IEEE International Conference on Smart Information Systems and Technologies (SIST)*, 2021, 9465993. https://doi.org/10.1109/SIST50301.2021.9465993

64 M. UMAIR and S. GULIYEVA, Optimizing welfare and market power: Energy storage strategies in renewable-integrated power markets. *Journal of Energy Storage*, 118, 2025, 116315. https://doi.org/10.1016/j.est.2025.116315

[Source: compiled by the authors based on [65,66,67,68,69,70]]

The proposed structure of the digital waste management model provides for an integrated approach to the distribution of functions between the key participants of the system – the territorial community, the service provider, budget divisions, and end users, with the central role of a digital platform that combines logistics, accounting, schedules and financial transactions in real time. This architecture provides transparency, avoiding duplication of information, minimising the influence of the human factor, and providing prompt access to data for making managerial decisions. An important component of the model is an analytical module that evaluates the effectiveness of contracts, conducts environmental monitoring, and generates reports based on quantitative indicators, which substantially strengthens the managerial capacity of budget divisions. Thereby, digital interfaces ensure that end users – both residents and government officials – are involved in the monitoring and feedback system, which increases the transparency and accountability of performers. Together, the digital model with elements of outsourcing forms the technological basis for strategic environmental management, focused on efficiency, flexibility, and datacentricity.

The effectiveness of outsourcing practices depends on the ability of communities to formalise technical requirements, monitor the quality of services, and ensure that external solutions are compatible with internal digital infrastructure.[71] Practice has shown that the greatest effectiveness was achieved by those communities that clearly defined the expected functional results from outsourcing, agreed on the rules of interaction, and periodically adapted the parameters

65 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/

66 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

67 Law of Ukraine No. 2807-IX "On the National Informatization Program". 2022. https://zakon.rada.gov.ua/laws/show/2807-20#Text

68 Law of Ukraine No. 2456-VI "On Budget Code of Ukraine". 2010. https://zakon.rada.gov.ua/laws/show/2456-17

69 Resolution of the Cabinet of Ministers of Ukraine No. 357 "On Some Issues of Organizing Electronic Interaction of State Electronic Information Resources". 2018. https://www.kmu.gov.ua/npas/deyaki-pitannya-organizaciyi-elektronnoyi-vzayemodiyi-derzhavnih-elektronnih-informacijnih-resursiv

70 Cabinet of Ministers of Ukraine. Reform of public finance management, 2025. https://www.kmu.gov.ua/reformi/efektivne-vryaduvannya/reforma-derzhavnih-finansiv

71 I.M. MURTEZAJ, B.R. REXHEPI, B. DAUTI, and H. XHAFA, Mitigating economic losses and prospects for the development of the energy sector in the Republic of Kosovo. *Economics of Development*, 23(3), 2024, 82–92. https://doi.org/10.57111/econ/3.2024.82

of cooperation in accordance with changes in the management environment. This is consistent with approaches to dividing outsourcing into tactical and strategic, where the former covers operational tasks (accounting, technical support), and the latter is related to supporting long-term management goals, such as functional capacity growth or digital modernisation (Spiller, 2024).

6. Digital technology integration and outsourcing model in strategic community development management

The complexity of budget management in the territorial communities of the Lviv region in the context of decentralisation, stricter requirements for transparency, and an increase in the volume of information interaction led to the need to transform the organisational architecture of management. In the course of the study, it was determined that the combination of digital services, analytical platforms, and outsourcing mechanisms contributed to increasing the adaptability and effectiveness of management decisions. On this basis, a conceptual model for integrating digital technologies and outsourcing into strategic financial management of community development in the region was developed.

The structure of the model was based on the principle of functional differentiation of management, technical, and service blocks, which allowed centralising information processing, providing technical support for digital systems, and maintainig management control over strategic and financial decision-making. The basic element of the system was the digital platform of the community, which combined modules for accounting, forecasting, monitoring budget programmes, and interfaces for interaction with outsourcing performers. Due to the integration of the platform with contract services, automated updating of operational data, monitoring of the fulfilment of contractual obligations, and generating reports in real time were provided.

The digital platform included accounting modules, electronic document management, a Big Data analytics unit, a programme performance assessment system, and analytical data visualisation. External contractors provided infrastructure administration, software maintenance, functionality updates, and specialised analytical queries. The authority to plan, approve the budget, control costs, and apply strategic analysis remained with the management structures of the

community.

The introduction of outsourcing mechanisms in combination with digital technologies provided for a functional differentiation of the technical, analytical, and managerial components of financial administration. This approach helped to delegate operational and service functions to external performers, while retaining the authority to make strategic and budgetary decisions for the community.[72] The structure of the digital platform included a number of modules – from accounting to analytical visualisation, which supported real-time management processes. The generalised components of this integrated model are shown in Table 5.

Table 5. Elements of the digital technology integration and outsourcing model in community financial management

Model component	Functional purpose	Type of interaction
Digital community platform	Centralised data storage, accounting, planning, monitoring	Internal (between structural divisions of the community)
Analytical module (Big Data)	Revenue/expense forecasting, performance analysis	Internal/external (between the community and a specialised analytical contractor)
Joint service centre	Multi-community service: accounting, technical support	Intercommunal (between adjacent communities or their association)
Outsourcing contractor	Technical administration, IT support, service maintenance	External (between the community and the contract supplier company)

72 S. ABBASOVA, V. İSMAYILOV, and N. TRUSOVA, Problems of financing the state budget deficit. *Scientific Bulletin of Mukachevo State University. Series Economics*, 10(4), 2023, 9–19. https://doi.org/10.52566/msu-econ4.2023.09

Community management bodies	Making strategic and financial decisions	Managerial (interaction between management structures and executive blocks)

[Source: compiled by the authors based on [73],[74],[75]]

The presented structure of the model of integration of digital technologies and outsourcing in the financial management of territorial communities reflects a consistent functional distribution between technical, analytical, managerial, and service components. Central to this architecture is the community's digital platform, which provides accounting, planning, monitoring, and centralised data storage, creating conditions for internal information integration between structural divisions. Additional value is an analytical module that can function both based on internal resources and with the involvement of external performers, in particular, in terms of revenue forecasting, cost modelling, and evaluating the effectiveness of budget decisions. This format allows combining technological flexibility with institutional stability, while maintaining strategic control within local governments.

An important element of this model is the joint service centre (JSC), which performs inter-community functions, including accounting, technical support, software updates, and maintenance of IT systems for several united territorial communities at once. The presence of such a tool indicates the relevance of cooperative solutions in conditions of limited resources and the desire to improve the quality of public service by centralising service.[76] Outsourcing companies, in turn, are involved in performing operational functions – digital infrastructure administration, platform maintenance, and implementation of specialised servi-

73 M. FUNDIRA, E.I. EDOUN, and A. PRADHAN, Adapting to the digital age: Investigating the frameworks for financial services in modern communities. *Business Strategy & Development*, 7(1), 2024, e303. https://doi.org/10.1002/bsd2.303

74 V. DEZEM, S. SACHAN, M. MACEDO, and A. ANDRADE LONGARAY, Optimal data-driven strategy for in-house and outsourced technological innovations by open banking APIs. *Future Business Journal*, 10(1), 2024, 116. https://doi.org/10.1186/s43093-024-00397-3

75 M.A. PETCU, M.I. SOBOLEVSCHI-DAVID, and S.C. CUREA, Integrating digital technologies in sustainability accounting and reporting: Perceptions of professional cloud computing users. *Electronics*, 13(14), 2024, 2684. https://doi.org/10.3390/electronics13142684

76 E.R. SAMEDOVA, S.K. MAMEDOVA, M.S. ALIYEVA, M.T. SAMADOVA, and L.A. KASHIYEVA, Exchange rate regime in a crisis: The case of Azerbaijan. *Journal of Eastern European and Central Asian Research*, 9(4), 2022, 679–690. https://doi.org/10.15549/jeecar.v9i4.1107

ces, reducing the burden on the internal human resources potential of communities. However, making strategic and financial decisions and managing budget priorities remain in the exclusive competence of local self-government bodies, which guarantees the preservation of managerial autonomy and compliance of public activities with the interests of the community.[77]

In this context, joint service centres appear as an important tool for improving the efficiency and integrity of the digital transformation of financial management at the local level. Such structures are designed to provide stable support for financial, analytical, and information technology processes, accumulating functional resources of several related communities. The effectiveness of the JSC largely depends on clear regulation of authority, standardisation of information exchange procedures, and consistency of communication between communities and executive contractors. A generalised logic for the operation of a joint service centre is presented in Table 6.

Table 6. Logic of the functioning of the JSC

Process stage	Activity	Interaction with communities	Result / value for the community
Data collection and processing	Consolidation of data from all communities	Providing unified formats	Reduce errors, speed up input, and standardise data
Budget analysis and control	Generating analytical reports, controlling expenses	Data transfer to management bodies	Making informed financial decisions, reducing risks
Software maintenanc e	Technical support, updates, and security	Community access to services	Continuous operation of systems, reducing IT maintenance costs
Communica tion with contractors	Control of contracts with outsourcers	Quality monitoring, cost reduction	Improving the quality of services, transparency of contract interaction

77 G. ARACHI, V. BUCCI, E. LONGOBARDI, P.M. PANTEGHINI, M.L. PARISI, S. PELLEGRINO, and A. ZANARDI, Fiscal reforms during fiscal consolidation: The case of Italy. *FinanzArchiv*, 68(4), 2012, 445–465. https://doi.org/10.1628/001522112X659574

[Source: compiled by the authors based on [78,79,80]]

Table 6 illustrates a logically ordered model of JSC functioning as a coordinating institution that provides comprehensive digital support to communities through unification, centralisation, and analytical integration of financial and administrative processes. At every stage – from data collection to interaction with contractors – the JSC performs not only technical functions but also creates added value for communities, helping to standardise information, reduce errors, and enhance efficiency. Centralised software maintenance provides equal access to digital services and reduces IT infrastructure costs, which is especially important for small or resource-constrained communities. The analytical component of the model allows performing comparative monitoring, identifying deviations in real time, and generating reports necessary for making informed management decisions. Of particular value is the role of the JSC in interaction with outsourcing structures, where centralised control and cost reduction can improve the quality of services and ensure transparency of contracts. As a result, this model promotes economies of scale, minimises data fragmentation, and creates a sustainable digital environment for effective financial administration at the inter-municipal level.

In the context of the growing digital complexity of budget management, communities are increasingly resorting to outsourcing individual functions, in particular accounting support, platform maintenance, and analytical modelling. However, the choice between internal support and external service requires a balanced analysis, considering not only the cost, but also quality, time, organisational, and security parameters. A comparison of key criteria was conducted, supplemented by identifying potential risks when using outsourcing models to evaluate the effectiveness of each approach. The generalised results are presented in

78 E. ASCHAUER, R. QUICK, and M. ISACK, The use of shared service centers in the audit industry and the impact on financial analyst perceptions. *Journal of International Accounting Research*, 24(1), 2025, 143-161. https://doi.org/10.2308/JIAR-2022-021

79 X. CHEN, Q. DAI, and C. NA, How finance shared services affect profitability: An IT business value perspective. *Information Technology and Management*, 25(4), 2024, 367-382. https://doi.org/10.1007/s10799-023-00391-1

80 Y. SHATILA, H. ABDULSATTAR, H. YANG, and J. WANG, Optimization-based control algorithm: Development and testing for dynamic on-demand SAV operation. In: *2024 IEEE 27th International Conference on Intelligent Transportation Systems (ITSC)*. Piscataway: IEEE, 2024, 2856-2862. http://dx.doi.org/10.1109/ITSC58415.2024.10919641

Table 7.

Table 7. Comparative evaluation of the effectiveness of internal support and outsourcing in the financial management of the community

Evaluation criteria	Internal support (own specialists)	Outsourcing (external service providers)	Potential risks of outsourcing
Average maintenance costs	Higher (28.6 thousand UAH/month)	Lower (20.9 thousand UAH/month)	Dependence on external price changes
Reporting accuracy	Errors – 4.9%	Errors – 3.1%	Possibility of quality reduction when changing the contractor
Speed of reporting	Average delay – 3.2 days	Average delay – 1.1 days	Risk of loss of efficiency in the event of technical failures
Technological support	Limited, depends on the available staff	Professional, up-to-date	Potential problems with platform integration
Scalability flexibility	Low	High	Loss of control over critical elements
Monitoring and management	Full internal control	Control is delegated, but an audit is possible	Risk of insufficient transparency of the contractor's activities
Saving expertise	Formed within the community	Partially lost	Loss of internal competence in the long term
Security aspects	Internal access to financial data	Data can be processed outside the community	Risk of leaks or unauthorised access

[Source: compiled by the authors based on [81,82,83,84,85]]

Table 7 data confirm the benefits of the outsourcing model in community financial management, particularly in reducing costs, improving reporting accuracy, and speeding up support procedures, while identifying a number of management and security risks that accompany delegating functions to external sup-

81 Ministry of Finance of Ukraine. Budgetary policy, 2025. https://mof.gov.ua/uk/budget-policy

82 State Statistics Service of Ukraine. About the service, 2025. https://www.ukrstat.gov.ua/

83 National Agency of Ukraine on Civil Service. Public finance, 2025. https://nads.gov.ua/publichni-finansi

84 Open Budget. State budget web portal for citizens, 2025. https://openbudget.gov.ua/

85 Prozorro. What is Prozorro? 2025. https://prozorro.gov.ua/

pliers. The average monthly expenses for accounting services for outsourcing amounted to 20.9 thousand UAH, which is 27% lower than for the maintenance of internal specialists (28.6 thousand UAH), and the share of errors in reporting decreased from 4.9% to 3.1%, pointing to a higher quality of data verification and professional expertise of performers. There was also a remarkable reduction in reporting deadlines (from 3.2 to 1.1 days), which increased the rhythm of the budget process. However, outsourcing was associated with the risks of dependence on third-party organisations, potential loss of control over critical functions, and vulnerability to cyber threats, especially in the case of processing financial data outside the community. In addition, prolonged delegation of functions can lead to a weakening of internal competence, which complicates forming a personnel reserve at the local level. Although outsourcing demonstrates tangible effectiveness in the short term, its implementation requires a balanced approach, accounting for the institutional maturity of the community, risk management, and balancing between economy and managerial autonomy.

Thus, the effectiveness of outsourcing solutions in the financial management of territorial communities requires a comprehensive approach to management decision-making, considering control mechanisms, contractual tools, and quality monitoring systems on top of cost and time parameters. It is advisable to use combined models: technical administration and support can be delegated to external contractors, while the functions of analytical generalisation, strategic forecasting, and control over the targeted use of funds should remain within the management structures of the community. This provides for a balance between resource savings, governance transparency, and institutional sustainability of the budget process.

7. Discussion

The results of the study demonstrate a statistically significant relationship between the level of digital maturity of territorial communities and the effectiveness of budget management implementation. Communities with developed digital infrastructure were characterised by higher accuracy of budget forecasting, lower frequency of transaction errors, increased speed of response to financial deviations, and better analytical support for management decisions.

Integration of automated planning, control, and electronic document management systems has helped optimise budget administration procedures and strengthen financial discipline. The use of outsourcing models in a digital environment reduced the internal staffing burden, standardised functional processes, and provided a flexible response to management challenges.[86,87,88] Nevertheless, the effectiveness of these solutions remained dependent on the level of technical support, the digital competencies of personnel, and the availability of stable mechanisms for institutional interaction.

Evaluation of the effectiveness of digital tools in the budget administration of communities in the Lviv region confirmed a positive correlation between digital maturity and planning effectiveness. This relationship was manifested in improving the accuracy of forecast indicators, reducing the error rate, and expediting the response to changes in budget parameters. Similar patterns were recorded in a study by Tafra and Tankosić[89], who analysed the impact of artificial intelligence, machine learning, and Big Data analytics on the effectiveness of management decisions in the small and medium-sized business sector. The results of the comparison confirmed the similarity of the effects of digital transformation in the public and corporate sectors, with differences due to the scale of application and the level of institutional readiness. For territorial communities, the key limitation remained the uneven distribution of technical resources and digital skills of personnel.[90]

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86 M. ALIYEVA, Company management decision-making based on the analysis of events after the reporting period. *Problems and Perspectives in Management*, 21(4), 2023, 739–756. https://doi.org/10.21511/PPM.21(4).2023.55

87 S. STEFANOV, Construction contracts expenses and revenues reporting. *IOP Conference Series: Materials Science and Engineering*, 951(1), 2020, 012029. https://doi.org/10.1088/1757-899X/951/1/012029

88 S. STEFANOV, D. GEORGIEVA, and J. VASILEV, Issues in the disclosure of financial information by multinational enterprises. *TEM Journal*, 11(1), 2022, 5–12. https://doi.org/10.18421/TEM111-01

89 V. TAFRA, and J.V. TANKOSIĆ, Impact of digital transformation on financial management of small and medium enterprises. *Journal of Agronomy, Technology and Engineering Management*, 8(1), 2025, 1405-1410. https://doi.org/10.55817/RVEW4219

90 A. HUTOROV, Y. LUPENKO, S. SHERSTIUK, Y. PONOMARENKO, O. HUTOROVA, and O. YERMOLENKO, Innovative potential of the agrarian sector of Ukraine: Forming and efficiency of realization. *TEM Journal*, 10(3), 2021, 1228–1238. https://doi.org/10.18421/TEM103-29

The obtained empirical data confirmed the impact of digital solutions – in particular, analytical modules, electronic document management, and automated forecasting platforms – on the growth of accuracy, validity, and efficiency of budget decisions. The dependence of the effectiveness of digital transformation on the level of financial awareness of personnel is revealed, which is consistent with the results of a study by Alkhwaldi[91], dedicated to the functioning of FinTech in Jordan. The author proved that the effectiveness of digital services is determined both by technical parameters and the ability of institutions to perceive the functional advantages of relevant technologies. Comparative analysis confirmed the importance of the human factor in the processes of digital modernisation at the level of local self-government bodies.

Digital transformation was accompanied by the active introduction of innovative tools: FinTech solutions, automated accounting modules, analytical systems based on Big Data, and digital controlling elements.[92,93] These technologies help reduce transaction risks, improve the accuracy of forecasting, and efficiency of budget management procedures. Similar provisions are highlighted by Kamuangu[94], who systematises transformations in the financial sector under the influence of digital tools. The importance of addressing the challenges of information security, regulatory environment, and technological adaptation, which is also critical in the field of public finance, was noted. The results also confirmed the feasibility of an interdisciplinary approach and consideration of the ethical dimension in digital transformation research.

Analysis of the effectiveness of tools based on artificial intelligence in budget management pointed to their positive impact on the accuracy of tax foreca-

91 A.F. ALKHWALDI, Digital transformation in financial industry: Antecedents of fintech adoption, financial literacy and quality of life. *International Journal of Law and Management*, 2024. https://doi.org/10.1108/IJLMA-11-2023-0249

92 O. JOSEPH, E. DAHAN, I. AVIV, I. HADAR, E. BORDO, and D. PEZO, Requirements engineering for integrating quantum key distribution with blockchain systems. *2025 IEEE 33rd International Requirements Engineering Conference Workshops (REW)*, 2025, 375–382. https://doi.org/10.1109/REW66121.2025.00055

93 O. LAKTIONOVA, T. ISMAILOV, O. KALININ, V. GONCHAR, and O. ONOFRIICHUK, Digitalization and management of crypto assets as a source of investment for green projects. *E3S Web of Conferences*, 558, 2024, 01028. https://doi.org/10.1051/e3sconf/202455801028

94 P. KAMUANGU, Digital transformation in finance: A review of current research and future directions in FinTech. *World Journal of Advanced Research and Reviews*, 21(3), 2024, 1667-1675. https://doi.org/10.30574/wjarr.2024.21.3.0904

sting and adaptability of budget planning, along with the reduction of transaction errors. In communities where artificial intelligence algorithms were implemented, a higher level of automation of decision-making processes and developed operational control systems were recorded. A comparison with a study by Mohsen et al.[95] demonstrated the effectiveness of using machine learning and chatbots in improving service and analytics functions. It was also noted that the predictive analytics and process automation tools demonstrate limited performance without adapting business processes with the participation of qualified personnel. This underlines the relevance of the development of internal digital expertise as a prerequisite for the sustainable functioning of the intellectual financial infrastructure of communities.

The impact of digital technologies identified in the study covered not only the functional aspects of budget forecasting and control but also the overall managerial capacity of territorial communities. Using the example of the Lviv region, it is confirmed that the combination of digitalisation with outsourcing support mechanisms contributed to strengthening the flexibility of management decisions and the ability of communities to adapt to organisational and resource constraints. Similar findings were presented by Laajini and Tadjousti[96], where social and territorial innovations in local development management were considered in the context of institutional support for partner models. Comparing these results gave reason to believe that the development of digital infrastructure in Ukraine was associated with the expansion of inclusive management processes, which, in turn, affected the growth of territorial capacity and financial efficiency.

Further analysis confirmed that the synergy of digital solutions with the analytical potential of management structures contributed to the development of integrated approaches to forecasting, controlling, and adaptive budget planning. In this context, the need to develop integrated models for assessing the effectiveness of digital transformation, which would combine economic and insti-

95 S.E. MOHSEN, A. HAMDAN, and H.M. SHOAIB, Digital transformation and integration of artificial intelligence in financial institutions. *Journal of Financial Reporting and Accounting*, 23(2), 2024, 680-699. https://doi.org/10.1108/JFRA-09-2023-0544

96 T. LAAJINI, and H. TADJOUSTI, The contribution of social and territorial innovation to territorial development in Morocco: Insights from a systematic review. *African Journal of Science, Technology, Innovation and Development*, 17(2), 2025, 291-301. https://doi.org/10.1080/20421338.2025.2461206

tutional parameters, has become more relevant. The conceptual foundations of such models were outlined in a study by Rossi et al.[97], which proposes a social welfare index based on a combination of indicators of innovation, scientific activity, and creativity. The authors' proposed use of cluster analysis for spatial typologisation was relevant for assessing the degree of digital integration in municipal administration. The use of such tools helped identify regional imbalances and institutional barriers, and form strategic approaches to digital modernisation of communities.

Within the framework of the study, a considerable unevenness of digital transformation among territorial communities was recorded, which was manifested in differences in the level of integration of digital tools, access to technological resources, and the capacity for institutional renewal. In some communities, digitalisation was limited to basic accounting and control functions, while others introduced comprehensive systems for budget planning, monitoring, and public relations. Such differences were consistent with the provisions of the hierarchical regional innovation system concept proposed by Tartaruga et al.[98], which explains the asymmetry of digital development by the hierarchy of access to resources, centralisation of powers, and socio-economic stratification. Within the framework of local analysis, this concept enabled the interpretation of the uneven digitalisation not only as a consequence of regulatory and organisational factors but also as a manifestation of limited institutional inclusivity. This, in turn, confirmed the importance of adapting inclusive approaches to the introduction of digital innovations in public administration as a component of environmentally and socially oriented municipal policy.

The analysis of digital transformation in the communities of the Lviv region emphasised the importance of forming integrated models of digital interaction focused on combining managerial, social, and environmental dimensions. This approach was particularly relevant for mountainous and remote areas

97 L. ROSSI, M.G. PASCA, G. ARCESE, and S. POPONI, Innovation, researcher and creativity: A complex indicator for territorial evaluation capacity. *Technology in Society*, 77(1), 2024, 102545. https://doi.org/10.1016/j.techsoc.2024.102545

98 I. TARTARUGA, F. SPEROTTO, and L. CARVALHO, Addressing inclusion, innovation, and sustainability challenges through the lens of economic geography: Introducing the hierarchical regional innovation system. *Geography and Sustainability*, 5(1), 2024, 1-12. https://doi.org/10.1016/j.geosus.2023.10.002

characterised by spatial fragmentation. In a study by Sgroi and Modica[99], the effectiveness of using digital technologies for the development of local economies, was demonstrated, in particular, in the field of sustainable tourism. The example of using mobile applications to improve access to services in environmental complexes confirmed the feasibility of digital integration into various areas of territorial administration. This model of cross-sectoral digital interaction was also relevant in the field of municipal property management, logistics, and environmental monitoring. In this context, digital transformation opened up new opportunities for combining budget planning platforms with information ecosystems of accounting, operational support, and feedback, ensuring a holistic adaptation of management systems to territorial challenges.[100]

The study analyses the practice of integrating outsourcing models into local planning processes by delegating certain functions to non-governmental organisations. It is established that this approach combined the potential for improving operational efficiency with organisational risks associated with the regulation of delegated powers and strategic coherence of management goals. The examination of an example of involving a nonprofit organisation in district development planning in Oklahoma City, conducted by Lee and Harris[101], confirmed the effectiveness of flexible interaction with the public through non-institutional mechanisms. However, the authors noted that excessive formalisation of contractual obligations made it difficult to implement long-term strategic intentions. Similar challenges were mentioned in the review of communities in the Lviv region, particularly when implementing outsourcing approaches in the areas of waste management and financial-analytical support. The results proved the need to develop mechanisms for strategic complicity between municipalities and performers to ensure consistent and balanced results, in addition to technical regula-

99 F. SGROI, and F. MODICA, Digital technologies for the development of sustainable tourism in mountain areas. *Smart Agricultural Technology*, 8(1), 2024, 100475. https://doi.org/10.1016/j.atech.2024.100475

100 K. KETNERS, A. JAROCKIS, and M. PETERSONE, State budget system improvement for informed decision-making in Latvia. *Scientific Bulletin of Mukachevo State University. Series Economics*, 11(3), 2024, 86–99. https://doi.org/10.52566/msu-econ3.2024.86

101 C.A. LEE, and J.C. HARRIS, Outsourcing neighborhood planning processes? A case study of a nonprofit in the City of Oklahoma City. *Journal of Planning Education and Research*, 44(3), 2024, 1898-1911. https://doi.org/10.1177/0739456X221131743

tions for delegating functions.

The expansion of outsourcing practices in the context of the digital transformation of public administration was accompanied by the delegation of certain management and service functions to external suppliers. Such processes contribute to increased functional efficiency, while simultaneously increasing the need for careful monitoring of the social consequences of relevant decisions. Kiely et al.[102] explored the phenomenon of skeletal community development, in which partnerships with non-governmental organisations could lead to the reproduction of social inequality and increased mechanisms of control over communities. It is noted that even in conditions of formal transparency, this practice created risks of normalising asymmetries in access to services and resources. In the context of the digital transformation of financial management, these observations pointed to the need to critically evaluate outsourcing strategies not only in terms of economic feasibility but also accounting for the principles of management ethics, inclusivity, and social responsibility.

The dependence of the effectiveness of digital outsourcing solutions on compliance with the principles of sustainability emphasised the relevance of the concept of sustainable outsourcing, which involves the inclusion of economic, environmental, and social parameters in public administration practices. Akbari[103] stressed the need to consider environmental impacts, comply with labour standards, and reinforce the resilience of institutions to external risks. The empirical evidence obtained confirmed that communities that implemented digital outsourcing models in the areas of waste management or analytical support achieved the highest performance, provided that transparent procedures, quality control of services, and compliance of digital tools with current regulatory and ethical requirements were observed. This made moving from traditional outsourcing to responsible delegation models focused on long-term institutional sustainability more feasible.

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102 E. KIELY, R.R. MEADE, and K. SWIRAK, Community development, the carceral state and the necessary challenge of penal abolitionism. *Community Development Journal*, 59(4), 2024, 599-619. https://doi.org/10.1093/cdj/bsae049

103 M. AKBARI, Sustainable outsourcing: Managing global responsibilities. In: M. Akbari, *The Road to Outsourcing 4.0: Next-Generation Supply Chain*. Singapore: Springer, 2024, 119-146. https://doi.org/10.1007/978-981-97-2708-7_6

The study also reviews the dilemma of strategic choice between attracting external outsourcing and developing the internal potential of digital competencies in conditions of limited resources. Langerman and Leung[104] investigated the comparative advantages of Agile and DevOps models in internal digital transformation processes, which provided reduced dependence on external performers and increased the level of autonomy of organisations. The authors underlined the importance of managerial flexibility, prompt implementation of changes, and the motivational level of personnel. In the communities of the Lviv region, such challenges were recorded when choosing between outsourcing IT functions and developing internal service structures, which demonstrates the feasibility of a combined approach in strategic management of financial processes.

The results obtained confirmed the effectiveness of implementing outsourcing strategies in the digital environment, provided that there are clearly defined responsibilities of the parties, functional monitoring of the quality of services, and technical compatibility of external solutions with existing internal information systems. A study by Lok et al.[105] proposed a model of sustainable outsourcing relationships in facilities management that relies on four parameters: asset ownership, control, strategic positioning, and long-term planning. The correlation of this model with the results obtained in the study showed that the effectiveness of delegating functions in communities largely depended on the ability of institutions to formalise the principles of outsourcing interaction, determine strategic priorities, and ensure that delegated functions correspond to municipal development goals.

Summarising the results of the study of digital transformation of financial management in territorial communities confirmed that the combination of digital tools with outsourcing mechanisms contributed to improving the effectiveness of budget planning, financial control, and reporting. Integration of analytical platforms, electronic document management, and modules based on Big Da-

104 J. LANGERMAN, and W.S. LEUNG, The effect of outsourcing and insourcing on Agile and DevOps. *Journal of Information Technology Teaching Cases*, 14(2), 2024, 192-199. https://doi.org/10.1177/20438869231176841

105 K.L. LOK, A. SMITH, A. OPOKU, and C. CHEN, The challenges of sustainable development on facilities management outsourcing services: an investigation in educational facilities. *Sustainability*, 13(15), 2021, 8156. https://doi.org/10.3390/su13158156

ta and AI provided a reduction in the number of errors, improved forecasting accuracy, and reduced decision-making time. In turn, outsourcing practices helped to optimise the use of resources, increase the flexibility of management structures, and adaptability to personnel and technical constraints, which strengthened the institutional capacity of communities to function sustainably in the context of digital transformation overall.

8. Conclusion

Digital transformation of financial management in the territorial communities of the Lviv region was found to be an important tool for organisational modernisation, which affected the accuracy, speed, and transparency of managerial decision-making. Empirical data showed a stable, statistically significant relationship between the level of digital integration and the efficiency of the budget process, reducing time costs, decreasing the number of errors, and improving predictive accuracy. In communities with integrated digital architecture, the share of technical errors in financial documents was 3.2%, while in communities with a basic level of digitalisation – 11.4%. The average deadline for approving a financial decision was reduced from 6.5 days to 1.9 days, and the average processing time for a budget document – from 7.1 to 2.4 days. These results confirm the positive impact of digital tools on the quality of budget administration.

In the typologisation process, three levels of digital maturity were identified: integrated digital integration (21% of the sample), fragmented digitalisation (48%), and the basic level of digital presence (31%). The use of integrated accounting platforms with forecasting modules reduced the average deviation of actual and planned indicators to 5.7%, while in communities using basic accounting systems, this figure was 13.1%. In addition, in communities with implemented digital monitoring modules, the frequency of exceeding budget limits was limited to 4.1%, which is almost half as much as in communities where manual monitoring was used (9.6%). The level of regular analytical reporting in automated systems was 87% compared to 43% in communities without digital mechanisms, indicating a strengthening of analytical capacity through digitalisation.

Outsourcing practices covering accounting support, technical support, and analytical modelling were identified to have major potential to improve ope-

rational efficiency. 38% of communities used contract support for accounting processes, which reduced the average monthly costs to UAH 20.9 thousand, while in the case of maintaining an internal IT specialist, the costs reached UAH 28.6 thousand. In addition, the error rate in outsourcing reporting was 3.1%, and delays in submitting documentation were limited to 1.1 days, which is twice as good as internal support.

Based on the collected data, a conceptual model for integrating digital services and outsourcing into the community financial management system was developed, which provides for a functional differentiation of management, technical, and service functions. The key element of the model is a digital community platform, supplemented with an analytical module, a joint service centre, and contract services. Lowering the cost of IT services, improving the efficiency of reporting and reducing the error rate was also influenced by the inter-community JSCs since the centralised model that provided stable support for digital processes in conditions of resource constraints (in particular, costs were reduced to 20.9 thousand UAH/month, reporting delays – up to 1.1 days, and the share of errors in reporting – up to 3.1%, with an increase in the regularity of analytical reporting to 87%). This model demonstrates high adaptability to the conditions of decentralised governance.

The study had methodological limitations associated with different completeness of access to data, the inability to verify individual digital indicators in communities with a basic level of accounting, and difficulties in standardising analytical reporting. Promising areas of further research are the development of indicators for assessing the effectiveness of digital governance in communities and modelling the impact of analytical digital infrastructure on medium-term budget sustainability.