Keywords: *energy, energy efficiency, priority thematic areas, medium-term priority areas, research (scientific and technical) works, scientific (scientific and technical) output.*

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DIGITALIZATION AND ECONOMIC PERFORMANCE IN AZERBAIJAN'S NEW ECONOMY

Abstract. *The article examines how digitalization affects economic performance in Azerbaijan within the framework of the new generation economy. Although digital transformation is increasingly treated as a decisive source of productivity growth, competitiveness, and structural modernization, its mechanisms remain insufficiently quantified in developing economies. The objective of the study is to identify and empirically measure the channels through which digitalization influences firm-level economic outcomes in Azerbaijan. The empirical base combines a structured survey of 450 enterprises, including 200 firms from the general sample and 250 small and medium-sized enterprises, with a composite indicator system labelled AZ-NGE-DI. The study applies structural equation modelling in two stages: first, the measurement model is validated for latent constructs describing digital infrastructure, human capital, policy and regulation, the level of digitalization, and economic outcomes; second, the structural model is estimated using maximum likelihood procedures in AMOS v.24. The results show that the level of digitalization has a strong positive and statistically significant effect on economic outcomes (gamma ≈ 0,50; p < 0,001). Digital infrastructure (beta ≈ 0,30) and human capital (beta ≈ 0,25) are identified as the strongest determinants of digitalization, while the direct effects of infrastructure, skills and policy variables on final economic outcomes are weak and statistically insignificant. This confirms the mediating role of digital transformation: infrastructure and competencies improve firm performance primarily through a higher level of digital adoption. The AZ-NGE-DI assessment additionally shows that Azerbaijan has reached a medium level of digital development, with relatively stronger readiness indicators than maturity and results indicators. The study contributes to the literature by providing one of the first SEM-based empirical assessments of the economic effects of digitalization in Azerbaijan. Its practical value lies in the policy implications: the findings support prioritizing broadband and platform infrastructure, advanced digital skills, SME support mechanisms, and a more coherent innovation ecosystem in order to narrow the gap between digital readiness and measurable economic returns.*

Keywords: *new generation economy, digitalization, structural equation modelling, economic performance, Azerbaijan, SEM.*

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INTRODUCTION

In the twenty-first century, the rapid diffusion of digital technologies has become one of the central forces transforming economic systems. According to widely cited international assessments, the digital economy already accounts for a substantial share of global output and continues to expand as data, platforms, cloud services and digital public infrastructure reshape production, exchange and governance [14; 16]. In this environment, digitalization should be interpreted not only as a technological trend, but also as an economic mechanism that affects productivity, cost structures, innovation and long-term competitiveness.

Azerbaijan has also intensified its participation in global digital transformation processes. The expansion of e-government services, digital public platforms and communication infrastructure has improved the country's institutional and technical readiness. The United Nations E-Government Survey 2024 places Azerbaijan in the very high EGDI group, which indicates meaningful progress in digital public administration and infrastructure development [13]. At the same time, the existence of a gap between digital capacity and realized economic outcomes suggests that infrastructure alone is not enough. Human capital shortages, uneven sectoral adoption and institutional bottlenecks continue to limit the full return from digital investment.

Against this background, the economic effects of digitalization in Azerbaijan require a more rigorous empirical assessment. This is particularly important for an economy seeking to strengthen non-oil growth drivers, improve business productivity and accelerate innovation-based diversification.

STATEMENT OF THE PROBLEM AND RESEARCH OBJECTIVE

The central research problem addressed in this article is the insufficient quantitative understanding of how digitalization affects economic outcomes in developing economies and, more specifically, in Azerbaijan. Existing international studies demonstrate that digital technologies can increase productivity and business performance, but the transmission channels are often context-specific and depend on infrastructure quality, organizational change, skills and the policy environment [5; 10].

The research objective is therefore to identify and empirically estimate the mechanisms through which digitalization influences economic performance in Azerbaijan by applying structural equation modelling and by complementing the econometric results with the AZ-NGE-DI composite index. The study tests whether digital infrastructure, human capital and policy-regulatory conditions influence economic outcomes mainly directly or primarily through their impact on the overall level of digitalization.

The scientific novelty of the article lies in the fact that it offers one of the first SEM-based empirical measurements of the economic effects of digitalization in Azerbaijan using survey evidence from 450 enterprises. This makes it possible to move beyond descriptive discussion and to assess, in a structured way, the mediating role of digital transformation in business performance.

ANALYSIS OF USED PUBLICATIONS

The relationship between digitalization and economic growth has long attracted the attention of economists. Early debates were strongly influenced by the so-called productivity paradox, according to which large investments in information technology were not immediately visible in aggregate productivity indicators [12]. Subsequent empirical work, however, demonstrated that once measurement improved and organizational adaptation was taken into account, information technology investment was associated with substantial gains in productivity and firm performance [4; 5].

Comparative international studies also confirm that the contribution of information and communication technologies to economic growth is not limited to advanced economies. Niebel shows that ICT investment contributes positively to growth in developed, emerging and developing countries, although the scale of the effect may differ because of institutional and structural factors [10]. Research on African economies likewise indicates that greater ICT penetration is associated with higher income levels and broader development gains [7].

At the firm level, the economic effect of digitalization is usually transmitted through several channels. First, automation and process optimization allow firms to produce more output with the same or fewer resource. Second, digital tools accelerate innovation, facilitate new business models and reduce transaction costs. Third, digital adoption can strengthen market intelligence and customer interaction. Recent panel evidence also suggests that digitalization positively affects entrepreneurial activity and sustainable competitiveness [6]. OECD-based analyses further indicate that firms adopting digital tools earlier tend to achieve higher productivity over time, but these gains usually depend on complementary investments in skills, management practices and organizational redesign [8; 11].

In the context of Azerbaijan, recent studies have addressed the digital economy, digital transformation and e-government development from

theoretical, policy and sectoral perspectives [1–3; 9]. These contributions are important because they document the country's progress and identify institutional priorities. However, they rely mainly on descriptive statistics and conceptual interpretation. A comprehensive empirical model that tests the latent relationships between digitalization drivers and economic outcomes has remained underdeveloped. This article seeks to fill that gap.

PRESENTATION OF THE MAIN MATERIAL

The methodological design of the study consists of three integrated stages: development of the conceptual framework, collection of primary survey data, and estimation of a structural equation model. This approach makes it possible to connect theoretical constructs with observable indicators and to test both direct and indirect effects within one analytical system.

Conceptual model

The conceptual model reflects the main determinants of digital transformation identified in the literature and adapts them to the Azerbaijani context. Three latent exogenous constructs are specified: digital infrastructure, human capital and digital skills, and state digital policy with the regulatory environment. These constructs are assumed to influence the central mediating construct, namely the level of digitalization. The final endogenous construct is economic outcomes, which captures productivity, profitability, innovation and competitiveness.

The key hypothesis is that digital infrastructure, human capital and policy factors improve economic outcomes primarily indirectly through the level of digitalization. The model also allows the direct effects of these factors on economic outcomes to be tested, which makes it possible to identify whether the transmission mechanism is mainly mediated or mixed.

Data collection and survey design

Primary data were collected through a specially designed questionnaire aimed at measuring the state of digital transformation and its perceived results across Azerbaijani enterprises. Data collection took place in the first half of 2024 using two channels: an online questionnaire distributed by e-mail and structured telephone interviews.

A purposive sampling strategy was used in order to cover the major sectors of the economy, including manufacturing, services, trade and finance. In total, 200 valid responses were collected from the general enterprise sample. In addition, a separate survey of 250 small and medium-sized enterprises was conducted. The full sample therefore consists of 450 observations. Approximately 25 % of respondents represented large enterprises, 50 % medium-sized enterprises and 25 % small enterprises. Around 70 % of the surveyed firms were located in the Baku-Absheron economic region and 30 % in other regions of the country.

To test the internal consistency of the measurement instrument, Cronbach's alpha and composite reliability statistics were used. For all latent variables, composite reliability exceeded 0,70 and Cronbach's alpha was approximately 0,80, confirming satisfactory internal consistency of the questionnaire.

Application of the SEM model

Based on the collected data, a structural equation model was estimated in two stages. At the first stage, the measurement model was assessed in order to test the relationship between latent constructs and their indicators. At the second stage, the structural model was estimated to test the hypothesized links among the constructs. The SEM analysis was performed in AMOS v.24 using the maximum likelihood method.

Five latent variables were included in the model: digital infrastructure, human capital, policy/regulation, level of digitalization and economic outcomes. The indicators for each construct were derived from the survey instrument. This setup made it possible to jointly estimate the adequacy of the measurement system and the structural effects among constructs.

Measurement model results

The measurement model demonstrated acceptable statistical quality. Most factor loadings exceeded 0,60, while CFI and TLI were above 0,90 and RMSEA was below 0,08. These indicators confirm that the measurement model is both reliable and adequately fitted. Convergent validity was supported by average variance extracted values above 0,50 for each construct, and discriminant validity was checked using the Fornell-Larcker criterion.

Table 1 presents the main indicators of the measurement model. The strongest loadings were observed for the digitalization level construct, which suggests that the selected indicators capture digital adoption in a relatively coherent way.

Structural model results

The structural model results indicate that digital infrastructure has the strongest effect on the level of digitalization (beta = 0,30; $p < 0,001$). This means that high-speed internet access, stable networks, digital tools and technical support significantly raise the probability and intensity of digital transformation at the firm level. Human capital also has a positive and statistically significant effect on digitalization (beta = 0,25; $p = 0,005$), confirming the importance of employee skills, training intensity and training quality.

The effect of policy and regulation on digitalization is smaller but still statistically significant (beta = 0,18; p = 0,010). The most important relationship in the model is the effect of digitalization on economic outcomes (gamma = 0,50; p < 0,001). This confirms the core hypothesis of the study: as the level of digital transformation increases, enterprise performance improves in a statistically meaningful way. By contrast, the direct effects of infrastructure, human capital and policy variables on final economic outcomes are weak and statistically insignificant. The results therefore support a mediated effect structure.

The explanatory power of the model is also relatively high for social science research. The coefficient of determination is approximately 0,55 for the level of digitalization and 0,65 for economic outcomes, which indicates good predictive capacity of the proposed model **(Table 2)**.

AZ-NGE-DI index and benchmarking

In the second part of the empirical analysis, the country's digital development was assessed

Table 1

Indicators of the measurement model

Latent variable	Indicators	Factor loadings	AVE (>0,5)	Composite reliability (CR > 0,7)
Digital infrastructure	Internet speed, digital tools, network stability, technical support	0,72–0,84	0,58	0,81
Human capital	IT knowledge level, number of trainings, training quality	0,69–0,81	0,61	0,84
Policy and regulation	Support level, legal compliance, regulatory stability	0,66–0,78	0,56	0,80
Level of digitalization	Digitalization index, share of digital processes, online operations	0,74–0,88	0,63	0,86
Economic outcomes	Productivity, profitability, number of innovations, competitiveness	0,70–0,85	0,60	0,83

Source: compiled by the author based on AMOS v.24 outputs and survey data, 2024.

Table 2

Coefficients and significance of the structural equation model

Path	Standardized coefficient	Standard error	t-value	p-value	Result
Digital infrastructure -> Digitalization	0,30	0,08	3,75	0,000	Significant
Human capital -> Digitalization	0,25	0,09	2,78	0,005	Significant
Policy environment -> Digitalization	0,18	0,07	2,57	0,010	Significant
Digitalization -> Economic outcomes	0,50	0,11	4,55	0,000	Significant
Digital infrastructure -> Economic outcomes	0,10	0,09	1,11	0,267	Not significant
Human capital -> Economic outcomes	0,08	0,10	0,80	0,424	Not significant
Policy environment -> Economic outcomes	0,05	0,08	0,63	0,529	Not significant

Source: compiled by the author based on AMOS v.24 outputs and survey data, 2024.

Table 3

Assessment of the main AZ-NGE-DI blocks in 2024

Block	Number of indicators	Average normalized score (0-1)	Strongest indicator	Weakest indicator
Readiness	12	0,61	Internet use (0,89)	Advanced digital skills (0,40)
Maturity	10	0,52	Cloud services (0,60)	Production automation (0,35)
Result	8	0,48	Productivity growth (0,55)	High-technology exports (0,25)
Overall index (AZ-NGE-DI)	30	0,54	–	–

Source: compiled by the author based on the survey and official statistical data, 2024.

using the AZ-NGE-DI composite index. The overall index value equals 0,54, which corresponds to a medium level of digital development. At the same time, the block structure of the index reveals a clear imbalance. The readiness block scores 0,61, the maturity block 0,52 and the results block 0,48. This pattern suggests that the first stage of digital development – readiness in terms of access and basic conditions – has progressed further than the stage in which digital capabilities are converted into broad and measurable economic returns.

The strongest indicator in the readiness block is internet use, while advanced digital skills remain the weakest element. Within the maturity block, cloud service adoption performs relatively better than production automation. In the results block, productivity growth exceeds high-technology export performance. Taken together, these results imply that Azerbaijan's digital economy has developed a measurable foundation, but still lacks depth in advanced skills, industrial digitalization and innovation commercialization **(Table 3)**.

Discussion

The empirical findings are broadly consistent with the international literature, but they also reveal a specific pattern characteristic of Azerbaijan. The study suggests that digitalization should not be understood as a purely technological process. Its economic effect depends on complementary assets, especially human capital. Infrastructure matters because it enables digital adoption, but infrastructure without skills and organizational adaptation does not automatically generate productivity gains.

The sectoral dimension is also important. Survey responses indicate that digitalization is stronger in finance, telecommunications and information technology, whereas sectors such as construction and transport remain less transformed. This means that the emergence of a new generation economy is associated not only with aggregate growth, but also with a reconfiguration of the economic structure. Public digitalization initiatives, particularly in e-government, may additionally create indirect incentives for private firms to digitize internal processes and external interactions.

CONCLUSIONS

The article empirically assessed the economic effects of digitalization in Azerbaijan using structural equation modelling and the AZ-NGE-DI composite index. The results demonstrate a strong positive relationship between the level of digitalization and economic outcomes. Digital infrastructure and human capital are the main determinants of digitalization, while their direct effects on economic results are weak. This indicates that digital transformation functions as the principal transmission channel through which infrastructure, skills and policy conditions influence business performance.

The findings allow several policy conclusions to be drawn. First, investments in broadband infrastructure, stable digital platforms and regionally balanced connectivity should remain a priority. Second, digital skills development must be strengthened at the school, university and enterprise levels, with special attention to advanced skills rather than only basic access. Third, small and medium-sized enterprises require more targeted support instruments to finance and manage digital transformation. Fourth, the innovation ecosystem should better connect digital adoption with commercialization, technology upgrading and productivity growth.

The study has several limitations. It relies mainly on cross-sectional data, which prevents long-term causal analysis. Future research may therefore use panel data to identify dynamic

effects over time and to compare sectoral patterns more deeply. Even with these limitations, the article provides a grounded analytical basis for understanding how digitalization can contribute to Azerbaijan's transition toward a more productive and innovation-oriented economy.

REFERENCES

1. Abdullayev, K., Badalova, S., Mustafayev, A., Zeynalov, M., & Babayeva, A. (2024). Assessment of the current state and prospects for the development of the digital economy of the Republic of Azerbaijan. *Theoretical and Practical Research in Economic Fields, 15* (2), 217-231.
2. Abdullayev, K., Allahyarov, R., Teymurova, G., Zeynalov, M., & Fataliyeva, G. (2023). The role of digital transformation in building a competitive economy: A case study of Azerbaijan. *Economic Affairs, 68* (Special Issue), 705-710.
3. Babayev, E. A. (2018). Electronic government as an element of the digital economy: Experience of the Republic of Azerbaijan. *Administrative Consulting, 8,* 137-147.
4. Bloom, N., Sadun, R., & Van Reenen, J. (2012). Americans do IT better: US multinationals and the productivity miracle. *American Economic Review, 102* (1), 167-201.
5. Brynjolfsson, E., & Hitt, L. M. (2000). Beyond computation: Information technology, organizational transformation and business performance. *Journal of Economic Perspectives, 14* (4), 23-48.
6. Dabbous, A., Barakat, K. A., & Kraus, S. (2023). The impact of digitalization on entrepreneurial activity and sustainable competitiveness: A panel data analysis. *Technology in Society, 73*, 102224.
7. David, O. O. O., & Grobler, W. (2020). Information and communication technology penetration level as an impetus for economic growth and development in Africa. *Economic Research-Ekonomska Istraživanja, 33* (1), 1394-1418.
8. Dedrick, J., Gurbaxani, V., & Kraemer, K. L. (2003). Information technology and economic performance: A critical review of the empirical evidence. *ACM Computing Surveys, 35* (1), 1-28.
9. Isayeva, X. I. (2023). Development of financial accounting methods for the digital economy in Azerbaijan. *Scientific Bulletin (Social and Technical Sciences Series), 1,* 216-222.
10. Niebel, T. (2018). ICT and economic growth: Comparing developing, emerging and developed countries. *World Development, 104*, 197-211.
11. OECD. (2022). Promoting enterprise digitalisation in Azerbaijan. Retrieved from: https://surl.lt/kswrny.
12. Solow, R. M. (1987, July 12). We'd better watch out. The New York, Times Book Review.
13. United Nations. (2024). E-Government Survey 2024: Accelerating digital transformation for sustainable development. United Nations, 205 p. Retrieved from: https://surl.li/ifbtxx
14. UNCTAD. (2019). Digital Economy Report 2019: Value creation and capture. *United Nations Publications.* Retrieved from: https://unctad.org/publication/digital-economy-report-2019.
15. Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research, 122* (4), 889-901. DOI: 10.1016/j.jbusres.2019.09.022.
16. World Bank. (2016). World Development Report 2016: Digital dividends. *World Bank.* Retrieved from: https://www.worldbank.org/en/publication/wdr2016.

Гусейн Еркен огли САЛІМЛІ, аспірант

ЕКОНОМІЧНІ ЕФЕКТИ ЦИФРОВІЗАЦІЇ В ЕКОНОМІЦІ НОВОГО ПОКОЛІННЯ АЗЕРБАЙДЖАНУ

Резюме. *У статті досліджено вплив цифровізації на економічну результативність Азербайджану в контексті економіки нового покоління. Попри те, що цифрова трансформація дедалі частіше розглядається як ключове джерело зростання продуктивності, конкурентоспроможності та структурної модернізації, механізми її впливу в країнах, що розвиваються, залишаються недостатньо виміряними кількісно. Метою дослідження є виявлення та емпіричне вимірювання каналів, через які цифровізація впливає на економічні результати підприємств в Азербайджані. Емпіричну базу становлять дані структурованого опитування 450 підприємств, зокрема 200 підприємств із загальної вибірки та 250 малих і середніх підприємств, а також система композитних індикаторів AZ-NGE-DI. У статті застосовано моделювання структурними рівняннями у два етапи. Спочатку перевірено вимірювальну модель для латентних конструкцій, що описують цифрову інфраструктуру, людський капітал, політику, регуляторне середовище, рівень цифровізації, а також економічні результати. Потім структурну модель оцінено методом максимальної правдоподібності в AMOS v.24. Результати засвідчують, що рівень цифровізації має сильний позитивний і статистично значущий вплив на економічні результати (gamma ≈ 0,50; p < 0,001). Найсильнішими детермінантами цифровізації є цифрова інфраструктура (beta ≈ 0,30) та людський капітал (beta ≈ 0,25), тоді як прямі впливи інфраструктури, навичок і політичних чинників на кінцеві економічні результати є слабкими та статистично незначущими. Це підтверджує опосередковану роль цифрової трансформації: інфраструктура та компетенції поліпшують результати підприємств насамперед через вищий рівень упровадження цифрових технологій. Додаткова оцінка AZ-NGE-DI підтверджує, що Азербайджан досяг середнього рівня цифрового розвитку, причому показники готовності перевищують показники зрілості та результативності. Наукова новизна статті полягає в проведенні одного з перших для Азербайджану емпіричних вимірювань економічних ефектів цифровізації на основі SEM, а практична цінність — у формулюванні рекомендацій щодо пріоритетності інвестицій у розвиток широкосмугової інфраструктури, цифрових навичок, підтримку малих та середніх підприємств і вдосконалення інноваційної екосистеми для скорочення розриву між цифровою готовністю та реальними економічними результатами.*

Ключові слова: *економіка нового покоління, цифровізація, моделювання структурними рівняннями, економічна результативність, Азербайджан, SEM.*

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