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Strategic Management of Organizations in Conditions of High Uncertainty (VUCA and BANI World): Agile Methodologies

Nikita Nazarov

Department of Management, Business and Administration, Institute of Management and Marketing, Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine;
nik.nazarov.88@gmail.com

Olga Goloven

Lea Foods Inc, Elk Grove Village, United States

Sergii Bataiev

Director of Technology and Architecture, ELEKS HOLDING OÜ, Tallinn, Estonia

Oleh Kalinichenko

Department of Management, Faculty of Economics, Management and Psychology, State University of Trade and Economics, Kyiv, Ukraine

Oksana Tsizhma

Department of Entrepreneurship, Trade and Applied Economics, Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine

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Abstract

Modern organizational environments are characterized by instability, complexity, and unpredictability, reflected in the concepts of VUCA and BANI. Traditional strategic management approaches based on long-term planning are losing effectiveness, necessitating adaptive models, particularly Agile methodologies and the theory of dynamic capabilities. This study empirically examines the role of macroeconomic adaptability of the business ecosystem as a contextual factor influencing the relationship between uncertainty and economic performance under conditions of high turbulence. Using panel data from 217 countries for 2015–2024, a two-way fixed-effects model was developed. Real GDP growth serves as the dependent variable, business ecosystem adaptability is operationalized through the density of newly created enterprises, and uncertainty is measured using the World Uncertainty Index. Estimation was conducted using the least squares method with clustered stan-

dard errors. The results demonstrate a persistent negative effect of macroeconomic uncertainty on economic growth and a positive but unstable effect of business environment dynamism. The interaction effect was statistically insignificant, indicating that external entrepreneurial dynamics alone are insufficient to mitigate the adverse effects of uncertainty. These findings align with dynamic capabilities theory, suggesting that strategic adaptability is primarily developed through internal organizational processes. In this context, Agile practices combined with digitalization and digital management are considered key mechanisms for enhancing organizational flexibility. The study emphasizes the need to systematically develop internal adaptive capacities, enabling organizations to maintain resilience and flexibility regardless of changes in the external environment.

Keywords: strategic management, organizational flexibility, Agile, dynamic abilities, digitalization, digital management.

1. INTRODUCTION

The current stage of development of the global economy is characterized by an increase in instability, complexity and unpredictability, which is conceptualized through the VUCA (volatility, uncertainty, complexity, ambiguity) and BANI (brittle, anxious, non-linear, incomprehensible) models [1, 2]. Under such conditions, traditional approaches to strategic management, based on long-term planning and the assumption of relative stability of the external environment, lose their effectiveness because they do not provide sufficient speed of response to unpredictable changes and increasing turbulence [3–5]. This necessitates a transition to more flexible, adaptive and dynamic models of management of organizations.

Agile approaches that emerged in the field of software development are now considered as a broader management paradigm capable of providing iterativity, quick feedback and decentralization of decisions. At the same time, their effectiveness largely depends on the characteristics of the external environment. Of particular relevance is the question whether the macroeconomic dynamism of the business ecosystem creates conditions that mitigate the negative impact of uncertainty on the effectiveness of economic systems and, accordingly, contribute to the strategic adaptation of organizations.

An important factor in strengthening adaptive capabilities is digitalization and digital management, which reduce the cost of monitoring the environment, accelerate training cycles and provide a technological basis for the implementation of Agile practices. However, empirical studies of the relationship between macro-level flexibility of the business environment, uncertainty and economic performance remain fragmented.

The article is aimed at empirically checking the role of adaptability of the business ecosystem as a contextual factor of strategic adaptation of organizations in conditions of high macroeconomic uncertainty. The study combines the theoretical provisions of strategic management, the theory of dynamic abilities and the economics of uncertainty with a panel analysis of data from 2015–2024.

2. LITERATURE REVIEW

Classical strategic theory has long considered competitive advantages as a result of positioning a firm in the industry structure and choosing a competitive strategy [6]. However, in the context of increasing uncertainty and dynamism of the environment, the focus of research has shifted from static competitive positions to procedural and adaptive characteristics of organizations. In particular, the dynamic capabilities approach emphasizes that sustainable competitiveness is determined by the ability of a firm to integrate, form and reorganize internal and external competencies in response to rapid changes in the external environment [7, 8]. This approach focuses on organizational flexibility, learning and transformation processes as key mechanisms for strategic adaptation.

In this context, the importance of Agile management approaches that have emerged in the IT sector as a response to the limitations of traditional, rigidly structured development models is growing [9]. In modern research, Agile is seen as a broader organizational approach that goes beyond software engineering and is applied in various areas of management [10]. Agile methodologies are based on iterativeness, incremental value creation, constant feedback, and the ability to quickly adapt to changes in the external environment. At the organizational level, this involves the development of cross-functional interaction, delegation of authority and the formation of adaptive management structures. Systematic reviews in recent years confirm that organizational agility built through Agile practices has a positive impact on performance, including innovation, responsiveness, and overall effectiveness, although the effects depend on the context of implementation and the level of maturity of the organization [11, 12].

At the same time, integrating Agile into the strategic management of organizations remains a complex and debatable task. Current research shows that Agile approaches most often demonstrate high efficiency at the level of teams and operations, in particular through increased adaptive performance and flexibility in goal setting [13]. At the same time, scaling Agile to a strategic level requires a systemic transformation of the organization, including a change in management practices, culture, and coordination mechanisms [14]. In this context, the concept of strategic agility is becoming more and more widespread, which implies the ability of an organization not only to respond quickly to changes, but also to proactively rethink its strategy and business model [15]. Therefore, Agile is considered not only as a tool for operational efficiency, but as the basis for the formation of an adaptive logic of strategic management, which allows organizations to function in conditions of high uncertainty and constant change [16, 17].

An important area of modern research is the analysis of the relationship between organizational flexibility and the characteristics of the external environment. Within the framework of the development of the contingent approach, it is emphasized that the effectiveness of management practices is determined not by the universality of tools, but by their correspondence to the level of dynamism, complexity and uncertainty of the environment [18]. In the context of VUCA and BANI environments, this means the need to form organizations capable of continuous monitoring of changes, interpreting weak signals, and rapidly adapting strategic decisions [19]. Current research also emphasizes that organizational agility is the result of a combination of dynamic abilities, analytical capacity, and uncertainty-focused leadership, which allows not only to respond to change, but also to proactively shape new opportunities in a turbulent environment [4, 20, 21].

In modern research, organizational agility is considered as an organization's ability to recognize changes in a timely manner, quickly redeploy resources, and transform business processes in a dynamic environment [20, 22]. Empirical evidence suggests that such capabilities increase the resilience of organizations to crisis shocks, but their impact on performance is context-dependent and not always direct [4, 23]. In particular, in conditions of high turbulence, the positive effect of flexibility can manifest itself indirectly through other organizational mechanisms [24].

A separate area of modern research associates strategic management with a high level of uncertainty, which complicates forecasting and increases the risks of decision-making [25, 26]. In response, organizations are employing adaptive tools, including scenario planning, real options, and strategic flexibility [27, 28]. At the same time, significant gaps remain: empirical research remains fragmented between micro and macro levels, there is no unified operationalization of organizational flexibility, and its role in mitigating the negative effects of uncertainty remains debatable [22, 23].

Thus, the scientific problem is the need for empirical substantiation of the role of flexibility as a mechanism for strategic adaptation of organizations in the VUCA/BANI environment, taking into account the interaction between the characteristics of the external environment and internal management practices. This requires a combination of theoretical approaches to strategic management, organizational behavior, and the economics of uncertainty.

An important methodological limitation of the study should be noted. Since there are currently no direct comparable data on the level of Agile maturity of organizations in the cross-country dimension, in this study we empirically test only the macro-level prerequisite for organizational adaptability – the dynamism of the business ecosystem (measured in terms of the density of newly created enterprises). The theoretical mechanism of "Agile practices → organizational agility → strategic adaptation" remains conceptual and requires further microlevel empirical research. Thus, the results obtained are interpreted as evidence of the role of external conditions, and not as a direct test of the effectiveness of Agile methodologies at the level of individual organizations.

3. MATERIALS AND METHODS

The empirical study covers the period 2015–2024. and is based on an unbalanced panel that includes up to 217 countries. The choice of the time interval is due to a sharp increase in global macroeconomic uncertainty associated with successive systemic shocks (trade conflicts, COVID-19 pandemic, geopolitical tensions and energy crisis). The data is collected from open international sources, which ensures the reproducibility of the analysis.

The dependent variable is the growth rate of real GDP (GDP growth, annual %), which reflects the macroeconomic performance of national economic systems [29]. The main predictor of the adaptability of the business ecosystem (Ecosystem Agility) is the density of newly created enterprises (New Business Density) – an indicator that characterizes the intensity of structural renewal of the economy through the entry of new players [30]. The level of macroeconomic uncertainty is measured using the World Uncertainty Index [31], which aggregates the frequency of mentions of uncertainty in the reports of the Economist Intelligence Unit.

Given the multi-level nature of organizational agility and the lack of global standardized data on the Agile maturity of individual organizations, New Business Density is used as a macro-level proxy for the dynamism of the business environment. This indicator does not directly measure internal management practices, but reflects the external conditions under which organizations are forced to develop adaptive strategies.

The empirical model is specified as panel regression with two-way fixed effects. The estimation was carried out by the method of least squares (OLS) with the inclusion of two sets of fixed effects. To ensure the robustness of statistical conclusions, standard errors clustered at the country level are calculated. Model diagnostics included the Breusch-Pagan heteroscedasticity test and the calculation of variance inflation factors (VIFs). Both tests did not reveal significant violations of the basic assumptions of the regression model, which allows us to consider the obtained estimates suitable for further interpretation.

4. RESULTS

Before presenting empirical results, it is important to clearly delineate the boundaries of interpretation. In the study, Agile is considered as a theoretical mechanism for the formation of organizational agility through iterativeness, experimentation, and continuous learning. However, due to the lack of global standardized data on the level of Agile maturity of organizations, the empirical part focuses exclusively on the macro-level premise of adaptability – the dynamism of the business ecosystem. The logical chain of theoretical and empirical constructions is shown in Figure 1.

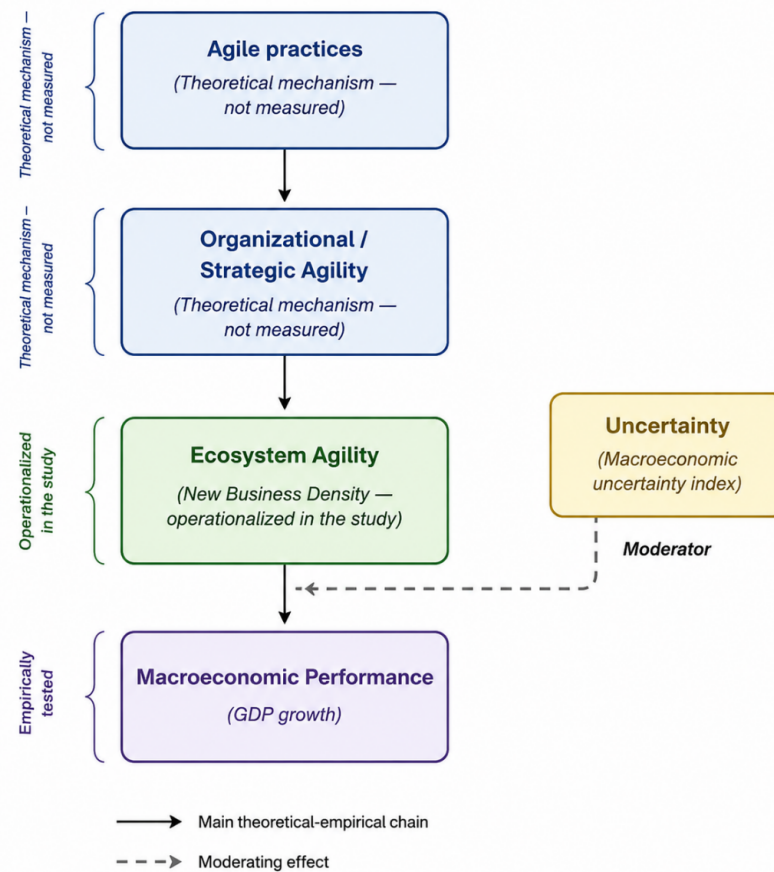


Figure 1. Theoretical and Empirical Research Chain: From Agile Practices to Macroeconomic Performance. Source: built by the authors

As can be seen from the diagram, only the last link is empirically measured – the relationship between the conditions of the business ecosystem (Ecosystem Agility), macroeconomic uncertainty and performance. Internal organizational processes (Agile practices and organizational agility) remain theoretically grounded, but not operationalized in panel data. This limitation is taken into account when interpreting all subsequent results.

In a VUCA and BANI environment characterized by high uncertainty, nonlinearity, and limited predictability, traditional approaches to strategic management are losing their effectiveness [2]. Under these conditions, organizational agility is considered as a key mechanism for ensuring adaptability [19, 22].

Agile approaches originating from the field of software development [9] are today interpreted as a broader management paradigm that provides iterativity, quick feedback, and decentralization of decision-making [12]. In this study, Agile is considered as an organizational mechanism for the formation of strategic adaptability, which manifests itself through the speed of decision-making, iterativity, experimentation and continuous learning. At the same time, given the lack of global standardized databases on the level of Agile maturity of individual organizations, the empirical part focuses on assessing the broader context of the adaptability of the business environment in which Agile approaches are implemented.

From the standpoint of the theory of dynamic abilities, organizational flexibility is manifested through the processes of sensing, seizing and transforming [8, 22]. Agile approaches operationalize these processes through iterativeness, experimentation, and continuous learning [32]. At the same time, these characteristics are difficult to directly quantify at the macro level, which creates a need for the use of proxy indicators.

Table 1. Comparison of traditional and Agile approaches in the context of organizational adaptability

Managerial dimension	Traditional approaches	Agile approaches	Strategic interpretation
Planning	Linear, long-term	Iterative, adaptive	Increasing adaptability to environmental changes
Decision-making	Centralized	Decentralized	Reduction of response time to external shocks
Risk management	Risk minimization	Accepting uncertainty	Increasing Uncertainty Tolerance (VUCA/BANI)
Innovation	Periodic	Continuous	Ensuring continuous transformation of the business model
Organizational structure	Hierarchical	Cross-functional	Dynamic resource allocation
Feedback	Deferred	Continuous	Accelerated organizational learning
Adaptability	Limited	High	Formation of organizational agility

Source: Beck et al. [9]; Rigby et al. [32]; Schoemaker et al. [19]; Teece [22]; Walter [12]

As shown in Table 1, Agile approaches change the management logic from stability to adaptability, which theoretically increases the ability of organizations to respond to the turbulence of the environment.

In cross-country empirical research, measuring organizational flexibility is methodologically complex due to its multi-level nature – from intra-organizational processes to macroeconomic dynamics. In view of this, the study applies a hierarchical approach to the operationalization of organizational agility, which allows justifying the choice of macro-level proxy indicators (Table 2).

Table 2. Multilevel operationalization of organizational flexibility in empirical research

Level of analysis	Theoretical concept	Indicator Type	Examples of indicators	Methodological limitations
Command/Micro Level	Agile practices	Direct	Scrum, Kanban, autonomy, team responsiveness	High subjectivity and low cross-country comparability
Organizational level	Organizational agility	Direct	Agile maturity, strategic agility, adaptive capabilities	Lack of global standardized databases
Industry level	Sectoral dynamism	Aggregated	Innovation intensity, firm turnover, technological change	Industry specifics
Macro level	Ecosystem agility	Indirect	New business density, entrepreneurship activity	Does not reflect internal management practices

Source: Wenzel et al. [4]; Kuckertz et al. [24]; Audretsch & Thurik [33]; Teece [22]

In this study, the density of new business enterprises is used as a proxy indicator of macro-level agility of the business ecosystem [33]. Accordingly, all further results are interpreted solely as the effects of adaptability of the business ecosystem, and not as a direct impact of Agile practices at the level of firms.

Previous research suggests a predominantly negative impact of uncertainty on economic activity, particularly investment and economic growth [25, 26]. At the same time, adaptive economic systems are able to partially mitigate these effects through accelerated decision-making and reallocation of resources [20, 22].

Thus, the study suggests that the adaptability of the economic environment plays the role of a moderator in the relationship between uncertainty and economic performance.

Therefore, although Agile approaches form a micro-level basis of organizational flexibility, in cross-country analysis, their direct measurement is limited. Therefore, the empirical model uses a macro-level proxy – new business density, which reflects the adaptability of the economic environment.

Accordingly, the empirical model includes an interaction term between indicators of uncertainty and flexibility, which allows you to estimate the moderation effect of the adaptability of the economic environment on the relationship between uncertainty and economic results.

Within the framework of the study of strategic management of organizations in conditions of high uncertainty characteristic of the VUCA and BANI environment, special attention is paid to empirical verification of the role of system flexibility as a contextual factor that forms conditions for adaptive strategies of organizations. The analysis period covers 2015–2024. and covers 217 countries, reflecting a sharp increase in global uncertainty related to economic crises, the COVID-19 pandemic, geopolitical conflicts and structural transformations.

In this context, a research question arises: is macroeconomic flexibility (as a characteristic of the environment in which organizations operate) related to mitigating the negative impact of uncertainty on the effectiveness of economic systems that create conditions for strategic adaptation of organizations?

For empirical verification of this hypothesis, a panel model was used, which allows taking into account inter-country differences and temporal dynamics at the same time. This approach is especially relevant for the study of macro-level processes, as it allows you to control unobservable factors that remain stable within a country, but differ between countries, as well as global shocks common to all economies in certain years.

Taking this into account, the model includes fixed effects of countries and years, which makes it possible to eliminate the influence of structural characteristics of national economies (institutional, political, cultural) and global trends. The generalized specification of the model is as follows:

$$Performance_{it} = \alpha + \beta_1 EcosystemAgility_{it} + \beta_2 Uncertainty_{it} + \beta_3 (Agility_{it} \bullet Uncertainty_{it}) + \gamma_i + \delta_t + \varepsilon_{it},$$

where $Performance_{it}$ reflects the performance of the country's economy in the year; $EcosystemAgility_{it}$ – the level of macroeconomic adaptability of the country's business environment, which creates conditions for organizational flexibility; $Uncertainty_{it}$ – the level of macroeconomic uncertainty; γ_i – fixed effects of countries; δ_t – fixed effects of years, and the interaction term allows you to estimate the moderation effect of flexibility.

The real GDP growth rate is used as an indicator of performance [29]. The indicator of ecosystem adaptability (Ecosystem Agility) is operationalized through the density of newly created enterprises (New Business Density) [30]. The level of uncertainty was estimated using the World Uncertainty Index [31].

Before evaluating the model, the Ecosystem Agility and Uncertainty variables were centered relative to the mean-centering, which provided a more correct interpretation of the principal effects in the presence of an interacting member and minimized potential multicollinearity.

The estimation was carried out by the method of least squares with the inclusion of two sets of fixed effects (country and year). Additionally, robust standard errors clustered at the country level were calculated, which provides a statistically correct conclusion in the presence of a possible intragroup dependence of observations.

Before interpreting the results, a diagnosis of the model was performed. The Breusch-Pagan test did not reveal statistically significant heteroscedasticity ($BP = 4.496$; $p = 0.213$), which confirms the fulfillment of the assumption of residual variance constancy. The multicollinearity test also found no problems: the values of the VIF scores for all explanatory variables were close to one (Ecosystem Agility_c – 1.004; Uncertainty_c – 1.054; Ecosystem Agility_c x Uncertainty_c – 1.055), which indicates the practical absence of multicollinearity even in the presence of an interaction effect.

The results of diagnostic tests indicate the absence of significant violations of the basic assumptions of the regression model. Thus, the constructed specification can be used for further interpretation of coefficients and assessment of the impact of flexibility and macroeconomic uncertainty on the performance of economic systems.

The main results of the panel regression estimation are shown in Table 3.

Table 3. Results of Panel Regression with Fixed Effects (Baseline Model)

Variable	β	Std. Error	t	p-value
Ecosystem Agility	0.165	0.080	2.056	0.040*
Uncertainty	-1.249	0.612	-2.040	0.042*
Ecosystem Agility $\times$ Uncertainty	-0.015	0.112	-0.132	0.895

Source: calculated by the authors

Note: Estimation is based on the least squares method with two-sided fixed effects.

As can be seen from Table 1, the indicators of Ecosystem Agility ($\beta = 0.165$; $p = 0.040$) and Uncertainty ($\beta = -1.249$; $p = 0.042$) are statistically significant at the level of 5%. A positive coefficient in Ecosystem Agility indicates that a higher dynamism of the business environment is associated with better macroeconomic performance. The negative impact of Uncertainty confirms that macroeconomic uncertainty reduces the effectiveness of the systems in which organizations operate. The absence of a meaningful moderation effect is a theoretically important result. It shows that the higher dynamism of the business ecosystem does not in itself act as a buffer against macroeconomic uncertainty. This is consistent with the theory of dynamic abilities [8, 22]: the external environment can create opportunities for adaptation, but does not replace the internal organizational processes of sensing, seizing and transforming. Thus, even in countries with a high density of new enterprises, organizations do not receive automatic protection against VUCA/BANI shocks.

The result obtained allows you to distinguish between external and internal flexibility of organizations. Even in the presence of a dynamic entrepreneurial environment, organizations do not receive an automatic ability to adapt to VUCA/BANI shocks. This confirms the position of the theory of dynamic abilities, according to which competitive stability is formed not only under the influence of external conditions, but through the internal ability of the organization to sensing, seizing and transforming.

The Within $R^2 = 0.008$ score demonstrates that, after taking into account the fixed effects of countries and years, the contribution of the studied variables to the explanation of internal variation in performance is comparatively small. This result is expected in the context of the VUCA and BANI environment, where systemic (institutional, geopolitical, pandemic) factors dominate. At the same time, the low within variation limits the possibilities of short-term forecasting based on selected macropoxies and further emphasizes the need for micro-level studies that directly measure organizational agility and Agile practices.

For additional verification of the adequacy of the constructed panel model, an analysis of the correspondence of the actual values of the dependent variable to the predicted values obtained on the basis of the estimated regression equation was carried out. The results of the visualization are shown in Figure 2.

As can be seen from Figure 2, there is a positive linear relationship between the actual (Observed) and predicted (Predicted) values of the Performance indicator. Most of the observations are located around the trend line, which indicates that the model is sufficiently consistent with the empirical data.

The result obtained is consistent with the high level of the overall explanatory capacity of the model: the coefficient of determination is $R^2 = 0.612$, and the adjusted coefficient of determination is Adjusted $R^2 = 0.559$. This means that about 56% of the variation in performance is explained by the factors included in the model, taking into account the fixed effects of countries and years.

At the same time, it should be taken into account that a significant part of the explanatory power of the model is formed precisely due to temporal and cross-country effects, while the contribution of the Ecosystem Agility and Uncertainty variables is relatively limited. Such a result is logical in the context of the VUCA and BANI environment, where external system factors can significantly determine the effectiveness of organizations regardless of internal management flexibility.

Taking into account the panel data structure, the model was additionally evaluated using country-clustered standard

errors, which ensures the robustness of statistical conclusions about the possible correlation of residuals within the panels (Table 4).

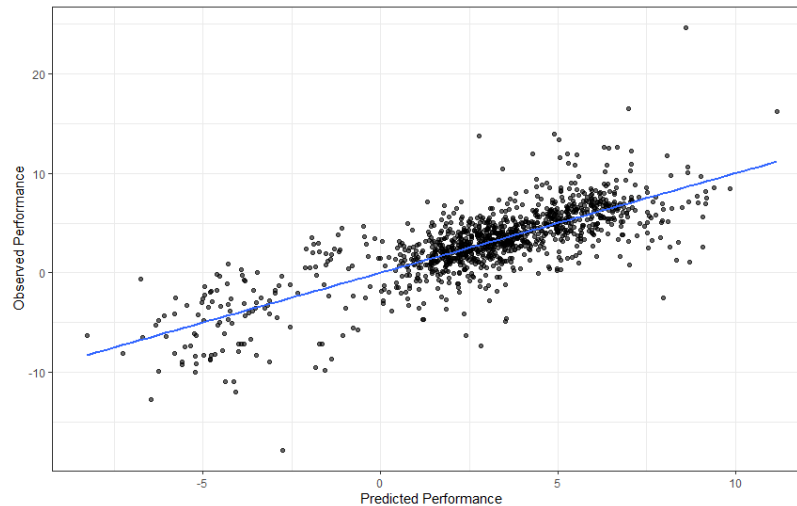


Figure 2. Correlation of actual and predicted performance values in a panel model with fixed effects (basic model). Source: built by the authors

Table 4. Panel regression with clustered standard errors

Variable	β	Std. Error (clustered)	t	p-value
Ecosystem Agility	0.165	0.103	1.595	0.113
Uncertainty	-1.249	0.630	-1.984	0.049*
Ecosystem Agility $\times$ Uncertainty	-0.015	0.096	-0.154	0.878

Source: calculated by the authors

After using clustered standard errors, the positive effect of Ecosystem Agility loses statistical significance ($p = 0.113$), while the negative impact of Uncertainty remains significant ($p = 0.049$). The interaction effect is still insignificant. This indicates insufficient sustainability of the positive effect of systemic (ecosystem) adaptability and a more reliable negative impact of macroeconomic uncertainty. For the strategic management of organizations, the resulting pattern emphasizes that even in a dynamic entrepreneurial environment, organizations cannot rely only on external conditions. It becomes necessary to purposefully develop internal organizational flexibility – the introduction of Agile methodologies, modular structures, fast feedback loops and strategies based on real options.

The results obtained indicate that the use of robust clustered standard errors does not change the signs and magnitude of the estimated coefficients, but only affects the statistical conclusion about their significance. This confirms the robustness of the model specification and demonstrates that the main empirical findings are independent of the way standard errors are estimated.

In general, the results of the panel analysis show that in the conditions of the VUCA and BANI environments, the effectiveness of economic systems is largely determined by the structural features of countries and temporary macroeconomic shocks. System flexibility (measured in terms of the density of new enterprises) shows a positive but unstable relationship with performance, while the negative impact of macroeconomic uncertainty is more stable. The moderation effect of the interaction is not empirically confirmed. These findings are important for the strategic management of organizations: they show that the external environment, even in the presence of high dynamism, does not neutralize the consequences of uncertainty. Accordingly, the key task of management is the formation of the internal adaptive capacity of the organization through agile methodologies (Agile) and complementary mechanisms of strategic flexibility.

5. DISCUSSION

The results obtained allow us to clarify the place of organizational flexibility in the strategic management system in the conditions of the VUCA and BANI environment and at the same time to outline the boundaries of macro-level proxy approaches. The key empirical pattern – the persistent negative impact of macroeconomic uncertainty on real GDP growth rates, the positive but unstable effect of the density of newly created enterprises and the statistically insignificant interaction between these variables – has several important theoretical and practical implications.

First, the lack of a meaningful moderation effect indicates that the dynamism of the business ecosystem does not in itself act as an automatic buffer against uncertainty shocks. This result is consistent with the theory of dynamic abilities [8, 22]: external conditions can create opportunities for sensing, seizing and transforming, but do not replace the internal

organizational processes through which these possibilities are realized. Thus, even in countries with a high density of new enterprises, organizations do not receive "ready-made" strategic adaptability. This highlights the fundamental difference between ecosystem-level dynamism and organizational agility.

Secondly, the results confirm that in conditions of high turbulence, the effectiveness of economic systems is largely determined by structural and temporal factors, which are fixed by bilateral effects. A low within R^2 (0.008) indicates limited explanatory power of the selected macroproxies after controlling for country and annual fixed effects. Such a result is expected for the VUCA/BANI context, where systemic shocks (pandemic, geopolitical conflicts, energy crises) dominate, and at the same time serves as an additional argument in favor of the need for micro-level studies that directly measure Agile practices and organizational flexibility.

Third, the findings have direct implications for the strategic management of organizations. The external business environment, even dynamic, does not neutralize the negative effects of uncertainty. Accordingly, the key task of management is the purposeful formation of internal adaptive capacity. In this context, the processes of digitalization and digital management are of particular importance. Digital technologies (real-time analytics, collaboration platforms, digital twins, AI-supported scenario planning) significantly reduce sensing costs and speed up feedback loops, which is the core of Agile logic. Digital management, in turn, provides an organizational infrastructure for decentralized decision-making, modular structure, and continuous experimentation – that is, those mechanisms that the theory of dynamic abilities considers as micro-foundations of strategic flexibility.

Table 5 summarizes the main theoretical and managerial implications of the results obtained.

Table 5. *Theoretical and practical implications of the research results*

Aspect	Key Result	Theoretical interpretation	Managerial consequences
Influence of uncertainty	Persistent negative effect	Supports the literature on uncertainty shocks [25, 26]	The need for continuous sensing and scenario planning; Digital Weak Signal Monitoring Panels
Ecosystem Agility	Positive but unstable effect	External dynamics create opportunities, but do not guarantee adaptation	Do not rely only on the "entrepreneurial climate"; invest in internal capability
Moderation effect	Statistically insignificant	External environment $\neq$ organizational agility [22]	Agile practices and strategic agility need to be consciously implemented, and do not arise automatically
Low within R^2	Limited explanatory power of macroproxies	Dominance of systemic shocks in VUCA/BANI	Priority of microlevel adaptation mechanisms; Digitalization as an enabler of speed and scalability
General conclusion	External flexibility is insufficient	Complementarity of external conditions and internal processes is required	Digital Management + Agile as an Integrated System of Strategic Adaptation

Source: built by the authors

The results obtained also allow us to clarify the place of Agile in modern strategic theory. Agile approaches should not be considered solely as an operational tool to improve team productivity. In a VUCA/BANI environment, they act as an organizational mechanism that operationalizes dynamic abilities through iterativeness, experimentation, and rapid feedback. Digitalization significantly strengthens this mechanism: digital platforms reduce the transaction costs of coordination, and advanced analytics tools improve the quality of sensing. Therefore, digital management becomes not an auxiliary, but a constitutive element of strategic flexibility.

At the same time, the methodological limits of the study should be recognized. Using New Business Density as an ecosystem agility proxy is a forced decision in the absence of global standardized data on the Agile maturity of organizations. This indicator reflects only external conditions, not internal management practices. Therefore, the results are interpreted solely as evidence of the role of the macro context, and not as a direct test of the effectiveness of Agile methodologies. Future research should focus on the micro-level operationalization of organizational agility (e.g. through survey-based Agile maturity indices, data on digital transformation of companies or panel data at the firm level) and on the interaction between digital capability and strategic agility.

Thus, the study confirms the central thesis: in conditions of high uncertainty, the strategic stability of organizations is formed not automatically from the dynamism of the external environment, but through the purposeful development of internal adaptive mechanisms. Agile methodologies in combination with digitalization and digital management processes create exactly the organizational infrastructure that allows you to turn external opportunities into a real strategic advantage. This shifts the focus of strategic management from attempts to predict the future to the ability to quickly learn, experiment and transform – regardless of the level of entrepreneurial dynamics of the national economy.

6. CONCLUSIONS

The study confirms that in the conditions of VUCA and BANI environments, macroeconomic uncertainty has a persistent negative impact on the performance of economic systems. The dynamism of the business ecosystem (measured by the density of start-ups) demonstrates a positive, but unstable, relationship with economic growth. No statistically

significant moderation effect was found: external business dynamics by itself does not neutralize the consequences of high uncertainty.

The results obtained are consistent with the theory of dynamic abilities and indicate that the strategic adaptability of organizations is formed not automatically from the characteristics of the external environment, but through the internal processes of sensing, seizing and transforming. In this context, Agile methodologies become important not only as an operational tool, but as a mechanism for operationalizing organizational flexibility. Digitalization and digital management are critical enablers of these processes, providing feedback speed, quality analytics, and decentralized decision-making.

The practical consequence is the need for purposeful development of the internal adaptive capacity of organizations regardless of the level of entrepreneurial activity of the national economy. Future research should focus on the micro-level operationalization of organizational agility and the interaction of digital capability with strategic agility.

AUTHORSHIP AND CONTRIBUTIONS

Nikita Nazarov contributed to the conceptualization of the study, development of the methodology, formal analysis, investigation, and supervision, and was responsible for writing the original draft and reviewing and editing the manuscript. Sergii Bataiev contributed to the conceptualization and investigation of the study, data curation, and analysis, and participated in writing the original draft. Olga Goloven contributed to the investigation, data curation, and formal analysis, and participated in writing the original draft as well as reviewing and editing the manuscript. Oleh Kalinichenko contributed to the development of the methodology, formal analysis, and interpretation of the results, and participated in reviewing and editing the manuscript. Oksana Tsizhma contributed to the investigation and interpretation of the results and participated in writing the original draft, as well as reviewing and editing the manuscript. All authors made substantial contributions to the conception and development of the study, critically reviewed and revised the manuscript, approved the final version for publication, and agreed to be accountable for all aspects of the work, including the accuracy and integrity of the study and the appropriate investigation and resolution of any issues arising from the research.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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DATA AVAILABILITY

The data used in this study are available from the corresponding author upon reasonable request.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

In the course of preparing this manuscript, the authors employed ChatGPT to improve the linguistic quality and readability of the content. After utilizing this AI tool, the authors conducted comprehensive review and necessary revisions to ensure the accuracy, integrity, and scientific rigor of the manuscript. All authors bear full responsibility for the final content of the published work, including any errors or inconsistencies that may arise.

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