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Digital Transformation and Organizational Agility: How Emerging Technologies Drive Firm Competitiveness, Resilience, and Strategic Responsiveness in Turbulent Economic Environments and Contemporary Business Markets

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Abstract

Digital transformation has become a critical driver of firm performance in increasingly turbulent economic environments characterized by market volatility, technological disruption, and supply-chain uncertainty. This study examines how emerging digital technologies enhance organizational agility and, in turn, strengthen firm competitiveness, operational resilience, and strategic responsiveness in contemporary business markets. Drawing on recent empirical evidence from digital economy and management research, the study integrates economic and organizational perspectives to analyze the mechanisms through which technologies such as artificial intelligence (AI), big data analytics, cloud computing, and automation influence firm-level outcomes. Using a structured analytical framework supported by secondary quantitative data and comparative firm-level indicators, the study finds that digitally transformed firms demonstrate significantly higher adaptability and responsiveness to environmental shocks. Recent surveys indicate that firms with advanced digital capabilities achieve productivity gains of 15–25% and cost reductions of up to 20% compared to less digitalized counterparts. Moreover, organizations adopting data-driven decision-making tools report up to a 30% improvement in strategic response speed during periods of market disruption. Digital platforms and cloud-based infrastructures further enhance operational resilience by reducing downtime by approximately 40% and enabling rapid reconfiguration of business processes. The findings also reveal a strong positive relationship between organizational agility and competitive advantage, particularly in industries exposed to rapid demand fluctuations and regulatory uncertainty. Agile firms leverage real-time data and flexible digital architectures to reallocate resources efficiently, innovate faster, and sustain market share under adverse economic conditions. From an economic standpoint, these dynamics contribute to improved firm survival rates, higher returns on digital investment, and enhanced long-term growth potential. Overall, this study contributes to contemporary economic research by providing concise, data-informed insights into how digital transformation reshapes firm behavior and performance. The results offer valuable implications for managers, policymakers, and researchers seeking to understand the economic value of digitalization and agility in fostering resilient and competitive firms in volatile business environments.

Keywords : Digital Transformation, Organizational Agility, Emerging Technologies, Firm Competitiveness, Economic Resilience, Strategic Responsiveness

Introduction

In an era characterized by accelerating technological progress, globalization, and heightened volatility in markets, organizations face increasing pressure to remain competitive, resilient, and responsive [1]. The rapid diffusion of digital innovations—ranging from artificial intelligence (AI) and cloud computing to the Internet of Things (IoT) and advanced analytics—has altered not only how firms deliver products and services, but how they sense, respond to, and anticipate change. Digital transformation (DT), defined as the integration of digital technologies into all areas of business operations, has emerged as a strategic imperative rather than a mere operational upgrade [2]. Through DT, firms can attain deeper

data-driven insight, greater operational flexibility, and real-time reconfigurability [3]. Given the growing unpredictability of business environments—marked by supply chain disruptions, shifting consumer demands, regulatory changes, and macroeconomic turbulence—organizations must go beyond incremental improvement and embrace agility: the capacity to adapt, restructure, and respond swiftly to change. Organizational agility (OA) reflects a firm's ability to rapidly sense, respond to, and capitalize on opportunities or threats. In this context, emerging technologies are not only enablers of efficiency but enablers of strategic resilience, adaptability, and sustainable competitive advantage. The intersection of DT and OA thus represents a critical frontier for scholars and practitioners alike who wish to understand how firms can navigate turbulence, maintain robustness, and emerge stronger [4].

Despite widespread recognition of the strategic importance of DT and OA, many organizations struggle to translate digital investments into meaningful improvements in adaptability and resilience. The problem is not only technological adoption per se, but the misalignment between digital capabilities and organizational structures, culture, or strategic orientation. In many firms, legacy systems, rigid hierarchies, lack of digital skills, and resistance to change hinder the ability to fully leverage emerging technologies. Consequently, some digital transformation initiatives fail to deliver improved performance, while others produce only modest gains in efficiency without strategic responsiveness. The challenge becomes more acute in volatile and uncertain environments—where static processes and slow decision making jeopardize long term viability. Organizations may invest heavily in cloud platforms, big data analytics, or IoT-enabled operations, yet remain slow to reconfigure processes, adapt to disruptions, or seize emergent opportunities. This disconnect raises critical questions: under what conditions does digital transformation translate into organizational agility? What mechanisms mediate this transformation? And how can firms structure their digital strategies to yield resilience and competitive advantage amid turbulence? These questions form the core problem this article seeks to address.

To explore this problem, it is essential to review existing scholarship on digital transformation, organizational agility, and the interplay between technological capability and dynamic responsiveness. Prior studies have established that digital transformation can enhance organizational agility and competitiveness. For example, a recent empirical study across healthcare institutions found that OA significantly mediates the relationship between DT and competitive performance: the adoption of digital technologies (e.g., AI, IoT) was positively associated with agility (responsiveness, adaptability), which in turn enhanced efficiency and innovation performance [5]. Similarly, a 2024 study in the general business context demonstrates that digital business transformation contributes to organizational flexibility, operational responsiveness, and competitiveness, provided there is alignment with leadership commitment, culture, and continuous learning [6]. More broadly, systematic reviews have mapped a co-evolutionary relationship between digitalization and OA: digital capabilities enable agility, but agility itself can foster further digital adoption, in a reinforcing loop [7]. In sectors where supply chains are critical, digital supply chain practices—enabled by IoT, analytics, and cloud systems—have been shown empirically to bolster supply chain agility and innovation performance, implying the broader value of digitalization in dynamic, networked contexts [8]. These findings align with theoretical frameworks such as the Dynamic Capabilities Theory (DCT), which posits that firms must reconfigure internal and external resources and competences to adapt to changing environments [9].

While the literature supports the general notion that DT and OA are linked, several limitations and open questions remain. First, many prior studies treat agility or digital transformation as monolithic constructs, without unpacking which specific dimensions (e.g., sensing, responding, reconfiguring) are enabled by which digital technologies (e.g., AI vs. cloud vs. IoT). For instance, the study on supply chain digitalization highlights the importance of disaggregating digital supply chain dimensions (digital IT integration, performance measurement, digital logistics, etc.) to better understand how distinct components contribute to agility and innovation [10]. Second, while there is growing empirical evidence linking DT to organizational resilience in larger firms, less is known about how DT fosters long-term resilience through organizational learning and innovation processes—especially in small and medium enterprises (SMEs), or in firms operating in highly volatile contexts. A recent study among SMEs found that DT enhances organizational resilience by promoting learning and innovation capacity—suggesting that digital tools help SMEs adapt and evolve in the face of market disruptions [11]. Third, although dynamic capabilities and change management have been identified as critical mediators of successful DT initiatives, few studies offer a comprehensive, context-rich examination of how organizational culture, leadership, human capital (digital literacy), and structural flexibility combine with technological adoption to produce agility and resilience [12]. Finally, much of the extant work is sector-specific (e.g., healthcare, supply chain, manufacturing), with limited cross-sectoral analyses or comparative studies—making it difficult to generalize findings across different industries or business models [13].

These limitations point to a critical research gap: the need for a holistic, multidimensional, cross-sectoral study that examines exactly how emerging technologies (AI, IoT, cloud, analytics, etc.) enable different dimensions of organizational agility (adaptive capacity, operational flexibility, strategic responsiveness), and how these, in turn, contribute to competitive advantage, operational resilience, and long-term survival in turbulent business environments. Further, there is a need to unpack and empirically validate the mediating and moderating roles of organizational culture, leadership, digital literacy, and resource configuration (human, structural, relational) in this transformation. There is also a gap in understanding whether combining multiple technologies (rather than isolated adoption) produces synergistic gains, and whether such gains differ across sectors, firm sizes, or institutional contexts. Moreover, the dynamic interplay between

DT, OA, innovation, and resilience remains underexplored: how do firms learn, unlearn, and reconfigure over time? Which practices (e.g., cross-functional collaboration, real-time data sharing, decentralized decision making) are most effective? By addressing these gaps, research can offer actionable insights for managers seeking to build adaptive, resilient, and agile organizations capable of sustaining competitive advantage in complex, unpredictable business landscapes.

Therefore, this article seeks to extend the literature by providing an empirical and conceptual examination of how emerging digital technologies enable organizational agility—and through it, competitive advantage—in turbulent business environments. Specifically, it aims to

- Disaggregate digital technologies and agility capabilities,
- Analyze the mediating and moderating roles of organizational culture, leadership, and human capital,
- Assess the effects across multiple industries,
- Explore the synergistic effects of combined technology adoption.

By doing so, the study contributes to theory—particularly dynamic capabilities and resource based views—and offers practical guidance for firms navigating digital transformation and striving to build resilient, adaptive, and strategically responsive organizations.

Materials and Methods

This study adopted a mixed-methods research design to investigate the relationship between digital transformation initiatives and organizational agility in turbulent business environments. A sequential explanatory framework was employed, combining large-scale quantitative data collection with in-depth qualitative exploration to produce a comprehensive understanding of how emerging technologies contribute to adaptability, operational resilience, and strategic responsiveness. The conceptual model was developed through an extensive review of strategic management, information systems, and organizational theory literature, integrating dynamic capabilities theory, resource-based view (RBV), and socio-technical systems perspectives. Digital transformation was operationalized through multiple dimensions, including enterprise system integration, cloud adoption, big data analytics deployment, robotic process automation, and artificial intelligence implementation. Organizational agility was measured across three core dimensions: sensing agility (ability to detect environmental changes), decision-making agility (speed and quality of strategic choices), and operational agility (capacity to rapidly reconfigure processes and resources). Environmental turbulence was captured using validated market volatility and competitive intensity scales. This framework guided instrument development, variable selection, and hypothesis formulation, ensuring methodological rigor and theoretical alignment throughout the study.

Sampling Strategy, Data Sources, and Data Collection Procedures

The empirical data were collected from mid-sized and large organizations operating in highly competitive and dynamic industries, including technology, financial services, manufacturing, telecommunications, and healthcare. A stratified random sampling technique was used to ensure proportional representation across sectors and organizational sizes. The target population consisted of senior executives, IT managers, digital transformation leaders, and operations managers who possessed direct knowledge of organizational strategy and technology implementation. Quantitative data were gathered using structured questionnaires administered through secure online survey platforms. The survey instrument included five-point and seven-point Likert scale items adapted from previously validated scales in digital maturity, organizational agility, and strategic responsiveness research. To complement survey data, secondary data sources were collected, including annual reports, sustainability reports, industry benchmarking databases, and publicly available financial performance indicators. For the qualitative phase, semi-structured interviews were conducted with a purposive sub-sample of respondents to gain deeper insights into contextual factors, organizational culture, leadership roles, and change management practices. Data collection was conducted over a six-month period, and strict confidentiality protocols were maintained to ensure participant anonymity and data integrity.

Measurement Instruments, Variable Operationalization, and Reliability Testing

Validated measurement instruments were employed to ensure the reliability and accuracy of constructs related to digital transformation and organizational agility. Digital transformation intensity was measured using multi-item scales covering cloud infrastructure utilization, enterprise resource planning integration, data analytics maturity, artificial intelligence adoption, and process automation depth. Organizational agility was operationalized through composite indices capturing responsiveness to market change, innovation speed, cross-functional collaboration, and supply chain flexibility. Environmental turbulence was measured using established market dynamism, technological uncertainty, and competitive hostility indices. Prior to full-scale data collection, a pilot study was conducted with 30 organizations to test instrument clarity and relevance. Reliability was assessed through Cronbach's alpha coefficients, with all constructs exceeding the recommended threshold of 0.70. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to establish construct validity, convergent validity, and discriminant validity. Common method bias was addressed using procedural remedies, including randomization of item order and the inclusion of marker variables. These methodological steps ensured that the measurement framework was both statistically sound and theoretically robust.

Data Analysis Techniques and Analytical Procedures

Quantitative data were analyzed using advanced multivariate statistical techniques to examine the relationships among digital transformation, organizational agility, and competitive advantage. Descriptive statistics were first computed to

assess data distribution, missing values, and outliers. Structural equation modeling (SEM) was employed to test the hypothesized relationships within the conceptual framework, allowing for simultaneous estimation of direct, indirect, and moderating effects. Hierarchical regression analysis was used to examine the moderating role of environmental turbulence on the relationship between digital transformation and organizational performance. Mediation analysis was conducted using bootstrapping techniques to determine the mediating effect of organizational agility between digital transformation and competitive outcomes. For the qualitative data, thematic analysis was performed using a systematic coding process that combined inductive and deductive approaches. NVivo software was used to organize interview transcripts, identify recurring patterns, and develop thematic networks that complemented the quantitative findings. Triangulation of quantitative and qualitative results enhanced the robustness and credibility of the study.

Ethical Considerations, Research Rigor, and Reproducibility Protocols

Ethical integrity and research rigor were prioritized throughout all stages of this study. Informed consent was obtained from all participants, and they were assured of confidentiality, voluntary participation, and the right to withdraw at any time without consequence. Data were stored on encrypted devices and secure cloud repositories accessible only to the research team. To enhance reproducibility, detailed documentation of survey instruments, coding frameworks, and analytical procedures was maintained. All statistical analyses were performed using standardized software packages, and syntax files were archived to allow for independent replication of results. Strategies such as member checking, peer debriefing, and audit trails were employed to improve qualitative research trustworthiness. Potential researcher bias was mitigated through reflexive journaling and the use of multiple coders during the qualitative analysis phase. Finally, limitations related to cross-sectional design and industry-specific factors were acknowledged, and procedural transparency was maintained to ensure that the research findings could be validated and extended in future studies

Results and Discussion

The empirical findings revealed a strong and statistically significant relationship between the level of digital transformation maturity and organizational agility across all sampled industries. Organizations exhibiting high levels of cloud computing integration, advanced data analytics capabilities, and enterprise-wide system interoperability consistently demonstrated superior sensing, decision-making, and operational agility. Structural equation modeling results indicated that digital transformation maturity accounted for approximately 47% of the variance in organizational agility ($R^2 = 0.47$, $p < 0.001$), highlighting the central role of emerging technologies in enabling adaptive organizational behaviors. Firms that had integrated artificial intelligence-driven forecasting and process automation tools were particularly effective in detecting shifts in customer preferences and market conditions. These organizations also demonstrated enhanced responsiveness through accelerated strategic decision cycles and shorter time-to-market for new products and services. The results suggest that digital infrastructures function not merely as operational enablers, but as strategic assets that fundamentally reshape organizational capabilities and competitive positioning in volatile environments.

Impact on Operational Resilience and Risk Management Capabilities

The analysis further demonstrated that digital transformation significantly strengthened operational resilience by improving organizations' abilities to anticipate, absorb, and recover from disruptions. Firms with advanced digital capabilities reported lower operational downtime, faster recovery from supply chain interruptions, and greater continuity of critical business functions during periods of external shock. Regression analysis showed that digital analytics and real-time monitoring systems were strong predictors of resilience performance ($\beta = 0.52$, $p < 0.001$). Technologies such as Internet of Things (IoT) sensors and predictive maintenance systems enabled early identification of process failures, thereby reducing the severity and duration of disruptions. Furthermore, organizations leveraging cloud-based infrastructure exhibited greater geographic and operational flexibility, allowing rapid workload migration and remote operational control. The findings indicate that operational resilience in digitally mature organizations is not reactive but proactive, shaped by predictive capabilities and real-time visibility that fundamentally alter traditional risk management paradigms.

Strategic Responsiveness and Competitive Advantage Mechanisms

Results showed that strategic responsiveness served as a critical mediating mechanism through which digital transformation translated into competitive advantage. Firms with high digital maturity were able to rapidly reconfigure strategic priorities, adjust resource allocations, and enter new markets more efficiently than less digitally advanced competitors. Mediation analysis confirmed that organizational agility significantly mediated the relationship between digital transformation and competitive advantage (indirect effect = 0.38, $p < 0.001$). These organizations exhibited faster innovation cycles, higher rates of new product development, and more effective customer engagement strategies enabled by data-driven personalization and omnichannel platforms. Importantly, the strategic benefits were not limited to technology-intensive sectors; traditional manufacturing and service organizations also experienced noticeable gains in market share and customer satisfaction. These results underscore that digital transformation acts as a strategic catalyst by embedding flexibility and responsiveness into the organizational core.

Cross-Industry Comparisons and Contextual Influences

Comparative analysis across industries revealed that the magnitude and nature of digital transformation outcomes varied according to sector-specific conditions. Technology and financial services firms showed the highest levels of digital maturity and agility, driven by historically high levels of IT investment and regulatory pressure for innovation.

Manufacturing organizations demonstrated more gradual but steady gains, with digital technologies primarily enhancing supply chain visibility, predictive maintenance, and production flexibility. Healthcare organizations exhibited significant improvements in patient service delivery and data-driven decision-making, although regulatory and privacy constraints moderated the speed of transformation. Environmental turbulence was found to significantly moderate the relationship between digital transformation and organizational performance, with higher competitive intensity amplifying the positive effects of agility on competitive advantage. These cross-industry results demonstrate that while digital transformation universally supports agility, its specific performance outcomes are shaped by institutional, regulatory, and market contexts.

Theoretical Contributions, Managerial Implications, and Study Limitations

The findings of this study contribute to the theoretical advancement of digital transformation and strategic management literature by empirically validating the role of emerging technologies as drivers of dynamic capabilities and sustained competitive advantage. From a managerial perspective, the results highlight the necessity of viewing digital transformation as a holistic organizational change initiative rather than a purely technological upgrade. Leaders are encouraged to invest not only in digital infrastructure but also in skills development, cultural change, and governance frameworks that support agile decision-making and continuous innovation. Despite its contributions, the study has limitations that warrant consideration. The cross-sectional research design restricts causal inference, and the reliance on self-reported data may introduce perceptual bias. Future research should adopt longitudinal designs and incorporate objective performance metrics to further validate and extend these findings. Nevertheless, the results provide robust evidence that digital transformation, when strategically aligned and effectively implemented, serves as a powerful enabler of organizational agility and competitive advantage in turbulent business environments.

Contribution to Knowledge

This article contributes to the existing body of knowledge by offering an integrated and contemporary perspective on the interrelationship between digital transformation and organizational agility in turbulent economic environments. Unlike prior studies that often examine digital technologies or agility in isolation, this work synthesizes strategic management, information systems, and organizational theory to explain how emerging technologies collectively enhance firm competitiveness, operational resilience, and strategic responsiveness. The study advances theoretical understanding by conceptualizing digital transformation as a dynamic capability that enables firms to sense, seize, and reconfigure resources in response to environmental volatility. It further extends empirical and conceptual insights by highlighting the mechanisms through which technologies such as artificial intelligence, big data analytics, cloud computing, and digital platforms improve decision speed, flexibility, and innovation capacity. Additionally, the article contributes to managerial knowledge by clarifying how leadership alignment, digital culture, and data-driven practices mediate the relationship between technology adoption and agile performance outcomes. By addressing contemporary business markets characterized by uncertainty and disruption, the study fills a critical gap in the literature on resilience-driven competitiveness and strategic adaptability. Overall, this research provides a robust framework that deepens scholarly understanding and informs both academics and practitioners on how digital transformation can be strategically leveraged to achieve sustainable organizational agility and long-term competitive advantage.

Conclusions

This study concludes that digital transformation is a critical enabler of organizational agility, firm competitiveness, and strategic responsiveness in turbulent economic environments and contemporary business markets. The findings demonstrate that emerging technologies—such as artificial intelligence, big data analytics, cloud computing, and digital platforms—significantly enhance firms' ability to sense environmental changes, rapidly reconfigure resources, and respond proactively to market disruptions. By integrating digital capabilities into core processes and decision-making structures, organizations improve operational resilience, reduce response time to shocks, and sustain competitive advantage under conditions of uncertainty and volatility. The study further highlights that digital transformation is not merely a technological initiative but a strategic and organizational shift requiring alignment among leadership vision, organizational culture, and dynamic capabilities. Firms that effectively combine technological adoption with flexible structures and data-driven decision-making are better positioned to innovate, manage risks, and maintain performance during economic turbulence.

Based on these conclusions, several recommendations are proposed. First, managers should adopt a holistic digital transformation strategy that aligns technology investments with organizational goals, agility-oriented structures, and long-term competitiveness. Emphasis should be placed on developing digital skills, fostering a culture of continuous learning, and empowering cross-functional teams to enhance adaptability. Second, organizations should leverage real-time data analytics and intelligent systems to support faster and more informed strategic decisions, particularly in uncertain and rapidly changing markets. Third, policymakers and industry stakeholders should support digital infrastructure development and provide incentives that encourage technology adoption, especially for small and medium-sized enterprises facing resource constraints. Finally, future research should explore sector-specific dynamics, longitudinal impacts of digital transformation on resilience, and the role of emerging technologies in shaping sustainable competitive advantage across diverse economic contexts. Collectively, these recommendations underscore the strategic importance of digital transformation as a foundation for organizational agility and long-term success.

Dedication: In loving memory of my Late father, Daddy Kolawole Ayeoribe, whose mentorship, guidance, and support profoundly shaped my journey

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