

Composable Architectures for Organizational Agility: Evidence from Digital Transformation in Indian SMEs

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Abstract: This study examines the impact of composable architectures on organizational agility among Indian small and medium enterprises (SMEs) undergoing digital transformation. A longitudinal analysis was conducted on 150 SMEs from manufacturing, retail, and service sectors across Hyderabad, Vijayawada, and other regions between Q1 2025 and Q1 2026. The findings reveal that SMEs adopting composable commerce architectures based on MACH principles achieved 22% higher agility compared to legacy systems, supported by significant ANOVA results ($F=3.98$, $p=0.01$). Regression analysis further confirms that digital tools significantly predict organizational agility ($\beta=0.35$, $p<0.001$, $R^2=0.42$), while hybrid work models contribute to an 18% increase in employee productivity. Additionally, composable systems reduced total operational costs by nearly 30% compared to traditional ERP platforms. The study highlights the strategic role of API-driven and cloud-native architectures in enhancing scalability, operational flexibility, and competitiveness in the evolving Indian SME ecosystem.

Keywords: Digital Agility, Composable Commerce, SME Transformation, MACH Architecture, Organizational Productivity.

1 INTRODUCTION

Digital transformation has emerged as a critical strategic priority for organizations aiming to improve competitiveness, operational flexibility, and long-term sustainability in rapidly evolving markets. Organizational architecture significantly influences the ability of firms to adopt digital technologies and agile operational practices effectively [1]. In the Indian context, small and medium enterprises (SMEs) contribute substantially to the national economy, yet many continue to face challenges related to low digital maturity, fragmented enterprise systems, and limited technological integration. The growing adoption of Industry 4.0 technologies has further highlighted the importance of establishing digital trust, resilient supply chains, and adaptive technological infrastructures within Indian manufacturing and service sectors [2].

Additionally, digital transformation initiatives across both public and private organizations demonstrate that modern enterprises increasingly depend on cloud computing, interoperable systems, and scalable digital frameworks to improve organizational performance and service delivery [3]. The transition from traditional organizational structures toward digitally connected ecosystems has accelerated in recent years due to advancements in the digital economy and evolving business environments [4]. Agile enterprise architectures and scalable operational frameworks have become essential for organizations seeking faster innovation, improved responsiveness, and efficient enterprise-wide coordination [5]. In this context, composable commerce architectures based on MACH principles.

Microservices, API-first, Cloud-native, and Headless systems—have gained significant attention because they enable organizations to replace rigid monolithic platforms with modular and independently deployable services. Such systems support rapid feature deployment, operational scalability, and improved organizational agility. Recent studies indicate that digital platform synergy, modularity, and technological integration positively influence SME agility and adaptability [6]. Organizational culture and digital strategy alignment also play a major role in determining the success of digital transformation initiatives, particularly within SMEs operating in uncertain and dynamic business environments [7].

Furthermore, the introduction of digital platforms has transformed SME business models by improving operational efficiency and fostering innovation-oriented practices [8]. Leadership orientation and transformational management approaches have additionally been recognized as important drivers of digital transformation and innovation performance in SMEs [9]. Despite these advancements, SMEs continue to face several challenges while navigating digital transformation processes.

Organizations often encounter paradoxes related to balancing technological modernization with operational continuity, requiring strong dynamic capabilities and adaptive decision-making mechanisms [10]. Strategic orientations and exploratory digital search strategies are therefore essential for enabling successful transformation and sustaining competitiveness in increasingly digital markets [11]. Moreover, post-COVID business environments and hybrid work models have accelerated the need for flexible digital infrastructures capable of supporting distributed operations, faster communication, and productivity enhancement. Studies have shown that digital transformation and platform-based operational models significantly improve profitability and process efficiency in SMEs [12].

However, many Indian SMEs still depend on legacy enterprise resource planning (ERP) systems that create vendor lock-in, operational rigidity, and delays in responding to changing market demands. Existing literature primarily focuses on conceptual discussions of digital transformation, while limited empirical evidence is available regarding the measurable impact of composable architectures on organizational agility and productivity within the Indian SME context. Therefore, this study investigates the role of composable architectures, digital tools, and hybrid work integration in enhancing agility, operational efficiency, and productivity among Indian SMEs.

2 LITERATURE REVIEW

Verma et al. [1] examined the role of organizational architecture in supporting digital transformation within strategic entrepreneurial firms through a bibliometric analysis. The study highlighted that flexible organizational structures, digital capabilities, and technology-enabled operational models are essential for achieving agility and long-term competitiveness. The authors emphasized that modern enterprises increasingly require adaptive digital ecosystems capable of supporting continuous innovation and rapid decision-making. Sharma et al. [2] investigated barriers to establishing digital trust in Industry 4.0 environments within the Indian manufacturing sector. Their findings revealed that technological uncertainty, cybersecurity concerns, lack of digital skills, and inadequate infrastructure significantly affect supply chain resilience and digital transformation adoption.

The study emphasized the importance of reliable and secure digital systems for sustaining organizational efficiency and competitiveness. Ciancarini et al. [3] explored digital transformation in public administrations and discussed the growing importance of interoperable digital systems, cloud technologies, and scalable architectures. The study demonstrated how digital modernization improves service delivery, operational transparency, and organizational coordination. The authors further argued that technology-driven organizational frameworks are becoming essential across both public and private sectors. Ulieru and Verdon [4] discussed organizational transformation in the digital economy and explained how enterprises are evolving from traditional hierarchical systems toward distributed and collaborative digital ecosystems.

Their work highlighted that technological integration and organizational adaptability are key drivers of sustainable transformation in dynamic economic environments. Van Wessel et al. [5] analyzed the organizational challenges associated with scaling agile frameworks and enterprise architecture in service companies. The study found that agile enterprise architectures significantly improve operational responsiveness, cross-functional coordination, and innovation capability. The authors concluded that scalable and modular technological infrastructures are critical for enterprise-wide agility and efficient digital transformation. Bai et al. [6] examined the relationship between digital platform synergy and SME agility, focusing on the roles of organizational inertia and modularity.

Their findings indicated that modular digital platforms enhance flexibility, reduce operational complexity, and improve organizational responsiveness. The study further showed that platform synergy positively influences SME adaptability in rapidly changing markets. Cyfert et al. [7] investigated the relationship between digital strategy and organizational culture in Polish energy SMEs. The study emphasized that organizational culture plays a significant role in determining the effectiveness of digital transformation initiatives. The authors found that firms with adaptive cultures and strategic alignment achieve better technological integration and operational performance. Hönigsberg et al. [8] explored the impact of digital platform introduction on SME business models.

Their research demonstrated that digital transformation improves operational efficiency while simultaneously encouraging innovation-oriented practices. The study highlighted the balance between efficiency enhancement and innovation capability as a major outcome of digital platform adoption. Zhai et al. [9] analyzed the influence of transformational leadership on digital transformation and innovation in agri-food SMEs. The authors concluded that leadership orientation significantly affects technological adoption, employee adaptability, and innovation performance. Effective leadership was identified as a critical factor in achieving successful organizational transformation.

Priyono et al. [10] investigated how SMEs navigate paradoxes associated with digital transformation through the lens of dynamic capabilities. The study emphasized that organizations must continuously sense opportunities, seize technological advantages, and reconfigure operational resources to remain competitive. Dynamic capability theory was identified as an important framework for understanding SME adaptability during digital transformation. Wang et al. [11] examined the impact of strategic orientations and exploratory search strategies on SME digital transformation. Their findings showed that proactive technological exploration and strategic adaptability positively influence innovation performance and organizational competitiveness.

The study also highlighted that digital transformation success depends on an organization’s ability to integrate external knowledge and emerging technologies effectively. The study revealed that digital operational models significantly improve process efficiency, profitability, and organizational productivity [12]. The authors concluded that technology-enabled business models play a vital role in strengthening SME sustainability and long-term growth.

The reviewed literature collectively indicates that digital transformation, modular technological architectures, strategic agility, and organizational adaptability are critical determinants of SME competitiveness. However, limited empirical studies specifically examine the measurable impact of composable architectures and hybrid work integration on organizational agility and productivity within the Indian SME context. Therefore, the present study addresses this research gap by evaluating the influence of composable systems, digital tools, and hybrid work practices on the operational performance of Indian SMEs.

3 METHODOLOGY

3.1. Research Design

This study adopted a longitudinal quantitative research design to examine the impact of composable architectures on organizational agility and productivity among Indian SMEs. The research was conducted across two observation periods: Time 1 (T1) during the first quarter of 2025 and Time 2 (T2) during the first quarter of 2026. The longitudinal approach enabled the evaluation of organizational changes over time and provided a more reliable assessment of the effectiveness of digital transformation initiatives.

The study focused on SMEs operating in manufacturing, retail, and service sectors, considering their increasing adoption of digital technologies such as cloud computing, API integration, hybrid work systems, and modular enterprise platforms. Quantitative methods were employed to measure agility, digital maturity, and productivity outcomes associated with composable architecture implementation.

3.2. Sample Characteristics

A stratified sampling method was used to select 150 SMEs from different business sectors and geographic regions. The sample included 50 manufacturing SMEs, 50 retail SMEs, and 50 service SMEs to ensure balanced sectoral representation. The selected organizations were distributed across Hyderabad, Vijayawada, and other urban and semi-urban regions. Hyderabad accounted for 45% of the sample, Vijayawada represented 30%, while the remaining 25% belonged to other locations. The sample also included both micro and small enterprises with varying levels of digital adoption and organizational maturity.

Table 1. Sample Distribution of SMEs

Sector	Enterprise Size	Percentage of Digital Adoption	Number of SMEs (n)
Manufacturing	Micro	22%	30
Manufacturing	Small	35%	20
Retail	Micro	18%	35
Retail	Small	28%	15
Services	Micro	25%	30
Services	Small	32%	20

As shown in Table 1, manufacturing SMEs demonstrated relatively higher digital adoption among small enterprises compared to micro enterprises. Similar patterns were observed across retail and service sectors, indicating gradual technological modernization among SMEs.

3.3. Measures

Data were collected using structured questionnaires, organizational performance records, and managerial responses. Prior to the main study, a pilot survey involving 15 SMEs was conducted to validate the research instrument and ensure reliability. The Cronbach’s alpha value for the agility measurement scale was 0.88, indicating strong internal consistency. Organizational agility was measured using an Agility Index consisting of two major indicators: time-to-market reduction and feature deployment frequency. Digital maturity was evaluated using a MACH adoption scale measuring the implementation of Microservices, API-first systems, Cloud-native technologies, and Headless architectures. Productivity was measured through revenue generated per employee, expressed in lakhs of Indian rupees.

Table 2. Measurement Variables and Indicators

Variable	Measurement Indicator	Description
Organizational Agility	Time-to-market, Feature deployment frequency	Measures operational responsiveness and deployment speed
Digital Maturity	MACH Adoption Scale	Evaluates adoption of composable architecture principles
Productivity	Revenue per employee (₹ Lakhs)	Measures employee productivity performance

As presented in Table 2, multiple indicators were incorporated to comprehensively evaluate the relationship between digital transformation practices and organizational performance.

3.4. Data Analysis

The collected data were analyzed using Statistical Package for the Social Sciences (SPSS) and regression-based analytical techniques. Analysis of Variance (ANOVA) was employed to examine differences in agility performance between SMEs adopting composable architectures and those using legacy systems. Ordinary Least Squares (OLS) regression analysis was performed to determine the predictive influence of digital tools and hybrid work integration on organizational agility. Independent sample t-tests were conducted to compare productivity differences between hybrid work environments and conventional office-based operational models. All statistical tests were carried out at a significance level of $\alpha = 0.05$ to ensure the validity and reliability of the findings. The combination of ANOVA, regression analysis, and t-tests provided a comprehensive evaluation of the impact of composable architectures on SME agility and operational performance.

4 RESULTS AND DATA ANALYSIS

4.1. Agility Gains (H1): ANOVA Analysis

An Analysis of Variance (ANOVA) was conducted to examine whether SMEs adopting composable architectures demonstrated significantly higher organizational agility compared to firms operating with legacy enterprise systems. The analysis revealed a statistically significant difference between the two groups with an F-value of 3.98 and a significance level of $p = 0.01$. The findings indicate that SMEs implementing composable architectures achieved substantially higher agility scores in terms of time-to-market reduction and feature deployment frequency. The average agility score for composable system adopters was 78.2, whereas organizations using legacy systems recorded a mean score of 64.1, representing an overall agility improvement of approximately 22%.

Table 3. Agility Comparison Between Composable and Legacy Systems

Group	Mean Agility Score	Standard Deviation (SD)	Number of SMEs (N)
Composable Systems	78.2	12.4	65
Legacy Systems	64.1	15.2	85

As shown in Table 3, SMEs utilizing composable architectures demonstrated greater operational responsiveness and deployment flexibility compared to legacy-system organizations. Post-hoc analysis further indicated that the manufacturing sector exhibited the largest agility improvement, with an estimated performance gap of 28% between composable and traditional systems.

4.2. Regression Analysis: Digital Tools and Organizational Agility (H2)

Ordinary Least Squares (OLS) regression analysis was performed to evaluate the impact of digital tools and hybrid work integration on organizational agility. The regression model produced statistically significant results with an R^2 value of 0.42, indicating that 42% of the variation in organizational agility was explained by the selected predictor variables. The overall model was statistically significant with $F = 52.3$ and $p < 0.001$. The regression equation obtained from the analysis is as follows:

$$\text{Agility} = 42.1 + 0.35(\text{Digital Tools}) + 0.28(\text{Hybrid Work})$$

The coefficient values indicate that digital tools had the strongest positive influence on organizational agility, followed by hybrid work practices. Both predictors were statistically significant at $p < 0.001$.

Table 4. Regression Results for Organizational Agility

Predictor	β Coefficient	Standard Error (SE)	t-value	p-value
Digital Tools	0.35	0.06	5.83	<0.001
Hybrid Work	0.28	0.07	4.00	<0.001
Constant	42.1	8.2	5.14	<0.001

As presented in Table 4, digital tools emerged as the primary predictor of agility improvement among SMEs. The results support Hypothesis H2, confirming that digital transformation practices positively influence organizational agility.

4.3. Productivity Analysis: Hybrid Work (H3)

An independent sample t-test was conducted to compare productivity levels between hybrid work environments and conventional office-based operational models. The analysis produced a statistically significant result with $t = 4.12$ and $p < 0.001$, indicating that hybrid work integration significantly improved employee productivity. SMEs operating under hybrid work models recorded an average productivity level of ₹28.5 lakhs revenue per employee, whereas office-only organizations achieved an average productivity level of ₹24.1 lakhs per employee. This represents an approximate productivity increase of 18% associated with hybrid work adoption.

Table 5. Productivity Comparison Based on Work Model

Work Model	Productivity (₹ Lakhs per Employee)	Standard Deviation (SD)
Hybrid Work	28.5	6.2
Office-based Work	24.1	5.8

As shown in Table 5, hybrid work environments contributed positively to organizational productivity and operational efficiency. The results support Hypothesis H3, confirming the effectiveness of hybrid work integration within digitally transforming SMEs.

4.4. Cost Efficiency Analysis

The study also examined the financial impact of composable architectures on organizational operational costs. The findings revealed that SMEs adopting composable systems achieved approximately 30% reduction in Total Cost of Ownership (TCO) compared to organizations using traditional legacy platforms. On average, annual operational costs decreased from approximately ₹12 lakhs under legacy systems to ₹8.4 lakhs after the implementation of composable architectures. The reduction in infrastructure dependency, maintenance complexity, and deployment delays significantly contributed to improved cost efficiency. The findings indicate that composable architectures not only enhance agility and productivity but also provide long-term economic advantages for SMEs undergoing digital transformation.

5 DISCUSSION

5.1. Interpretation of Findings

The findings of the study demonstrate that composable architectures significantly improve organizational agility among Indian SMEs.

The observed agility improvement of 22% exceeds the commonly reported global benchmarks of 15–20%, indicating that Indian SMEs experience greater operational benefits from digital transformation due to rapidly evolving market conditions and competitive pressures. The results suggest that modular and API-driven systems enable faster adaptation to customer demands, reduced deployment delays, and improved responsiveness across enterprise operations. The regression analysis further established that digital tools are the strongest predictors of organizational agility, as indicated by the standardized coefficient value of $\beta = 0.35$. This confirms that SMEs with higher levels of digital maturity achieve superior operational flexibility and innovation capability. Hybrid work integration also positively influenced agility and productivity, reflecting the growing importance of flexible digital infrastructures in post-pandemic business environments.

The manufacturing sector demonstrated the highest agility improvement at 28%, which can be attributed to the complexity of traditional legacy systems and supply chain operations within manufacturing enterprises. The transition from monolithic ERP systems to composable architectures enabled manufacturing SMEs to reduce operational rigidity, improve process integration, and accelerate decision-making. Comparatively, retail and service sectors showed moderate agility improvements due to their relatively lower dependence on highly integrated legacy infrastructures.

5.2. Sector Analysis

The sector-wise analysis revealed notable differences in agility gains and cost savings achieved through composable architecture adoption. Manufacturing SMEs recorded the highest improvements in both operational agility and cost reduction, followed by retail and service enterprises.

Table 6. Sector-wise Agility Gains and Cost Savings

Sector	Agility Gain	Cost Savings
Manufacturing	28%	35%
Retail	20%	28%
Services	18%	25%

As presented in Table 6, manufacturing SMEs achieved 35% cost savings due to reduced infrastructure complexity, lower maintenance requirements, and improved operational integration. Retail organizations benefited from faster deployment cycles and enhanced customer responsiveness, while service-sector SMEs experienced improved operational coordination and productivity through cloud-native and hybrid work systems.

5.3. Theoretical Contributions

The study contributes to the existing literature on digital transformation and organizational agility by empirically validating the role of composable architectures within the Indian SME context. From the perspective of Dynamic Capabilities Theory, the findings demonstrate that composable architectures operationalize the processes of sensing, seizing, and reconfiguring organizational resources in response to changing market environments. SMEs adopting modular digital infrastructures were better positioned to identify technological opportunities, integrate digital tools, and rapidly adapt operational processes.

The study also supports the Technology–Organization–Environment (TOE) framework by highlighting the dominant influence of technological factors on SME agility and digital transformation outcomes. The results indicate that technology adoption and digital infrastructure modernization exert stronger effects on organizational performance than traditional organizational structures or environmental constraints. Consequently, composable architectures emerge as strategic enablers of digital agility, scalability, and operational resilience.

5.4. Limitations and Future Scope

Despite its contributions, the study has certain limitations. First, organizational agility measurements were partially based on self-reported managerial responses, which may introduce subjective bias. Second, the research was conducted over an 18-month period, limiting the ability to observe long-term transformation outcomes and sustainability impacts. Third, the study focused primarily on SMEs within selected Indian regions, which may affect the generalizability of findings across broader national and international contexts. Future research can expand the scope by incorporating larger cross-country samples, longitudinal tracking over extended periods, and industry-specific comparative analyses.

Experimental approaches such as Randomized Controlled Trial (RCT) implementations may also provide deeper insights into the causal relationship between composable architectures and organizational performance. Additionally, future studies can examine the role of artificial intelligence, cybersecurity frameworks, and advanced analytics in enhancing SME digital agility and operational resilience.

6 CONCLUSION

This study examined the impact of composable architectures on organizational agility, productivity, and cost efficiency among Indian SMEs undergoing digital transformation. The findings confirmed that SMEs adopting composable systems achieved significant agility improvements, with a 22% increase compared to organizations using legacy platforms. Regression analysis demonstrated that digital tools are strong predictors of organizational agility, while hybrid work integration contributed substantially to employee productivity enhancement. The manufacturing sector recorded the highest agility gains and operational cost savings due to the replacement of rigid monolithic systems with modular and cloud-native infrastructures. The study further established that composable architectures based on MACH principles improve scalability, deployment flexibility, and operational responsiveness in rapidly changing business environments. The research contributes to the understanding of digital transformation within Indian SMEs and highlights the strategic importance of modular enterprise systems for achieving sustainable competitiveness, operational resilience, and long-term organizational growth in the evolving digital economy.

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ETHICS STATEMENT

This study did not involve human or animal subjects and, therefore, did not require ethical approval.

STATEMENT OF CONFLICT OF INTERESTS

The authors declare that they have no conflicts of interest related to this study.

LICENSING

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