Relating Digital Platform Synergy and SME Agility: The Roles of Organizational Inertia and Modularity

Abstract: Organizational agility is vital for the survival of small and medium-sized enterprises (SMEs) in turbulent environments. While several studies have examined the role of digital platforms in shaping organizational agility, the impact of digital platform synergy on organizational agility in the context of SMEs remains underresearched. To address this gap, we examine the impact of SMEs' digital platform synergy on their organizational agility and identify the mechanisms underlying this relationship. Using a sample of 421 Chinese manufacturing SMEs, the analysis demonstrates that digital platform synergy inhibits organizational agility. Furthermore, organizational inertia mediates this relationship, while organizational modularity negatively moderates the positive effect of digital platform synergy on organizational inertia, thereby reducing the mediating effect of organizational inertia. The study advances the growing literature on the factors influencing the agility of SMEs in digital contexts by illuminating the nuanced roles of digital platform synergy, organizational inertia, and modularity.

Keywords: digital platform synergy; organizational inertia; organizational modularity; SME agility

1. INTRODUCTION

Organizations today operate in environments characterized by volatility, uncertainty, complexity, and ambiguity (VUCA), forcing them to adapt rapidly to unpredictable changes [1]. In this context, organizational agility—, the ability to sense and respond

swiftly and innovatively to emerging opportunities and threats, has become a critical dynamic capability for maintaining competitiveness and fostering innovation [2,3]. This need is particularly acute for small and medium-sized enterprises (SMEs). Owing to their typically informal, streamlined, and flat structures, SMEs often exhibit greater flexibility than larger firms when adapting to external changes [4]. However, limited financial, technological, and human resources frequently constrain their ability to fully develop and maintain agility. For instance, during the COVID-19 pandemic, large airline companies adapted quickly by leveraging extensive resources, while many resource-constrained smaller and medium-sized airlines struggled to respond with similar effectiveness, missing opportunities and failing to mitigate disruptions. This situation underscores the importance of investigating how resource-constrained SMEs can enhance agility, particularly through the strategic use of digital platforms.

Digital platforms, online ecosystems that facilitate interactions, data exchange, and collaboration among diverse users, have emerged as powerful tools for organizational adaptation and innovation [5]. Depending on their primary function, digital platforms can be categorized as trading, innovation, or information platforms [6]. This study focuses on digital innovation platforms (hereinafter referred to as digital platforms), which provide core technological architectures that integrate offerings from multiple independent firms, enabling the co-creation of innovative and customized solutions for customers [6]. By aggregating external knowledge and supporting collaborative efforts within their

ecosystems, digital platforms help firms navigate VUCA conditions more effectively [7,8].

To exploit these benefits, SMEs often pursue digital platform synergy, defined as the extent of their integration with a specific platform [9,10]. While various resource-, organization-, and process-related factors contribute to digital platform synergy, here we focus particularly on the synergy arising through collaborative interactions with other platform participants, enabling firms to align the platform's evolving resources with their own operations [11]. Although such synergy enhances innovation and competitiveness [10,12], it may introduce potential risks to organizational agility [13,14]. For instance, Li et al. [15] note that Alibaba's digital platforms impose strict rules that SMEs must follow to access its technological capabilities. While necessary for effective engagement, these constraints can limit SMEs' autonomy and responsiveness to changing market conditions. Moreover, not all SMEs with strong platform synergy achieve agility. SMEs that strategically integrate platform resources while maintaining adaptability derive the greatest benefits, whereas those characterized by high organizational inertia or poor strategic alignment may improve efficiency but struggle to respond dynamically to change.

Despite the increasing relevance of digital platforms for SMEs, the relationship between digital platform synergy and organizational agility remains underexplored. This study addresses this gap by examining how SMEs' engagement with digital platforms

influences their agility within a VUCA environment. We draw on resource dependence theory to underpin our theorization of this relationship. The theory posits that excessive reliance on external resources can weaken a firm's ability to adapt to changing market conditions [16,17]. As SMEs deepen their synergy with digital platforms, their dependence on platform-specific resources and capabilities increases, creating lock-in risks. This dependency can constrain strategic choices and reduce responsiveness to environmental shifts [13,14], ultimately undermining organizational agility. Accordingly, we argue that digital platform synergy may negatively affect SMEs' agility by limiting their flexibility in dynamic and competitive environments.

To understand how digital platform synergy influences SMEs' organizational agility, it is essential to consider the role of organizational inertia—the tendency to persist with established routines rather than adapt to environmental changes [18]. SMEs typically operate on a smaller scale and rely on centralized and highly specialized resources, capabilities, and processes to serve specific niche markets, customers, and industry domains [4,19]. As such, unlike large firms, SMEs lack abundant slack resources and the capabilities to develop routines and processes that facilitate organizational agility [4,20] and, consequently, are particularly susceptible to organizational inertia. Moreover, strategic decisions in SMEs are made by top management teams or owner-managers [20] who are faced with resource and cognitive limitations and thus have incomplete awareness of emerging industry trends and developments and may exhibit a strong

preference for adhering to established routines [4,20], thereby increasing organizational inertia. However, previous studies typically focus on large firms, and thus the indirect effects of inertia on SMEs remain underexplored [4,15]. Building on these observations, here we examine how organizational inertia mediates the relationship between digital platform synergy and SME agility. As the integration of SMEs and digital platforms deepens, existing routines and developmental paths are reinforced, limiting SMEs' ability to respond to environmental shifts.

Furthermore, to enhance our understanding of this mediating effect, we explore the moderating role of organizational modularity. Rooted in modular systems theory, modularity enables complex systems to manage interdependencies through loosely coupled, standardized components [21]. We define organizational modularity as the extent to which an SME is loosely coupled with a digital platform and interacts through standardized interfaces [22,23]. Organizational modularity encompasses two key dimensions: loose coupling, in which internal changes within the SME do not necessitate platform adjustments, and interface conformance, or adherence to the platform's technical and procedural specifications. High modularity provides SMEs with greater autonomy, allowing independent adaptation while maintaining platform compatibility. Building on this, we adopt a moderated mediation approach [24] to explore how organizational modularity influences the mediating role of inertia. We propose that organizational modularity weakens the effect of digital platform synergy on inertia and mitigates

inertia's detrimental impact on agility. Our analysis of 421 Chinese manufacturing SMEs supports these theoretical predictions and yields two key contributions.

First, we advance the understanding of the factors influencing the organizational agility of SMEs by identifying and explaining the negative effect of digital platform synergy. Previous research has primarily explored the factors that promote organizational agility [25], while less attention has been paid to those that may inhibit it. Although most studies assume that digital platforms can enhance organizational agility [7,26], there is a limited understanding of how SMEs' digital platform synergy affects their organizational agility. Drawing on resource dependence theory, this study reveals the inhibitory effect of SMEs' digital platform synergy on their organizational agility. In doing so, it also provides insights into how an organization's digitalization influences its agility [27], broadening the understanding of organizational agility in digital contexts.

Second, the study provides insights into the mechanisms through which SMEs' digital platform synergy affects organizational agility. While some studies have identified the existence of the IT–agility contradiction, in which investment in IT does not necessarily promote organizational agility and may even hinder it [2,24], the mechanisms underlying this relationship in the context of digital platforms have not been thoroughly explored. To address this gap, we explain why organizational inertia becomes a critical mediating mechanism linking SMEs' digital platform synergy to organizational agility.

Previous studies have examined how firms operating on digital platforms use organizational modularity to reduce coordination costs [22,23] and manage their dependence on digital platforms. However, the impact of organizational modularity on the mediating role of organizational inertia in the relationship between SMEs' digital platform synergy and organizational agility remains insufficiently explored. This study addresses this gap by investigating how organizational modularity influences the relationships between digital platform synergy and organizational inertia, as well as how this affects the mediating role of organizational inertia. This approach contributes to a deeper understanding of the mediating role of organizational inertia and further clarifies the mechanisms underlying the relationship between SMEs' digital platform synergy and organizational agility.

2. LITERATURE REVIEW

2.1. Determinants of Organizational Agility

The concept of organizational agility has been defined from multiple perspectives. Lu and Ramamurthy [2] describe it as a firm's capability to rapidly respond to unexpected environmental changes through innovative market responsiveness and operational adjustments. Teece et al. [3] define it as a dynamic capability that enables firms to quickly reallocate resources in response to shifting internal or external conditions to capture value, and Barlette and Baillette [28] characterize it as a firm's ability to

quickly identify, analyze, and respond effectively to both current and emerging opportunities and threats. Despite these variations, research across strategy, management, and information systems converges on the common view that organizational agility reflects a firm's capacity to perceive change early and respond proactively to capitalize on new opportunities [25,27].

Organizational agility is crucial for SMEs, given their heightened exposure to risk in VUCA environments. These vulnerabilities are further exacerbated by limited financial, technological, and operational resources [1,29]. In today's digital economy, marked by constant technological disruption and shifting market expectations [30], agility enables SMEs to adapt rapidly, innovate continuously, and sustain competitiveness. Without such capabilities, SMEs face an elevated risk of stagnation or failure amid escalating environmental turbulence.

Previous research has identified a range of factors influencing organizational agility, including technological enablers (e.g., IT systems), behavioral dimensions (e.g., leadership style, innovation culture), organizational attributes (e.g., strategic orientation, business model), and external conditions (e.g., market dynamism, uncertainty) [25,28,31]. However, these studies focus primarily on large firms, leaving the unique determinants of agility in SMEs underexplored. Although SMEs are often characterized as inherently agile owing to their flatter structures and faster decision making [4], this generalization can obscure significant resource and capability constraints that hinder true

agile responsiveness [19]. This gap underscores the need for a more nuanced and SME-specific understanding of agility drivers.

In response to internal resource limitations, many SMEs turn to third-party digital platforms to access external capabilities [15,32]. Such platforms help firms integrate resources and enhance responsiveness, innovation, and agility [7,8,26]. However, research specifically examining how SMEs leverage digital platforms to enhance organizational agility remains limited.

Although digital platforms offer SMEs potential benefits, including improved resource access, faster market integration, and greater innovation [5,6], they also present distinct challenges, including barriers to technological adoption, relational uncertainty, difficulty navigating internal and external change, and greater strategic risks [7]. Consequently, many SMEs struggle to realize the value of such platforms, with some initiatives failing altogether.

To address these limitations, the concept of digital platform synergy has emerged as a promising approach. It refers to the effective alignment and integration between an SME and a digital platform, enabling the firm to leverage platform resources more strategically [10,11]. Although prior research suggests that such synergy strengthens SMEs' innovation performance and competitive advantage [10,12], its specific influence on organizational agility remains largely unexplored. Moreover, recent studies have

identified asymmetric dependencies in SME–platform relationships, with overreliance on platform resources leading to strategic rigidity—paradoxically undermining the agility that firms seek to achieve [13,14]. This study aims to fill these gaps by examining how digital platform synergy affects SMEs' organizational agility and uncovering the internal mechanisms that shape this relationship.

2.2. Resource Dependence Theory

Resource dependence theory serves as the overarching theoretical foundation for our study. This theory emphasizes that organizations cannot achieve self-sufficiency and must exchange resources with their environment to survive [17]. This theory postulates that (1) organizations do not internally possess all necessary resources, making them reliant on external sources; (2) external resources originate from an organization's environment, primarily other organizations; (3) organizations within an environment are interdependent; (4) resources underpin power relationships, and thus an organization's power over another is proportional to the other's dependency on its resources; and (5) power is inherently interactive and contextual [16,17]. The central analytical focus of resource dependence theory is on the interorganizational relationship, especially power dynamics arising from resource interdependencies. Consequently, the theory highlights organizations' challenges in balancing autonomy with resource acquisition for survival and growth.

Resource dependence theory further differentiates between joint and asymmetric dependence [33]. Joint dependence occurs when two organizations mutually depend on each other's resources owing to their limited internal resources, necessitating resource exchanges. Asymmetric dependence describes a relationship in which one organization has significantly lower dependence and, consequently, greater power relative to the other [33].

Synergy between SMEs and digital platforms exemplifies asymmetric dependence. Typically, SMEs heavily rely on resources offered by digital platforms, whereas digital platforms themselves have minimal dependence on SMEs for their own growth [13,34]. Such asymmetric dependence can lead to power imbalances that disadvantage SMEs [33]. Positioned as weaker actors, SMEs must closely align their strategic goals, technology paths, and operations with the digital platform's rules and objectives. Although aligning strategies and technological trajectories with digital platforms is essential for SMEs to access resources and innovations [10,35], conflicts can arise when SMEs' interests diverge from digital platform mandates [34]. For example, digital platforms may impose rules designed to establish market dominance, requiring SMEs to comply and sacrifice autonomy. Consequently, SMEs risk becoming locked into these digital platforms, constraining their agility and limiting their ability to identify and respond to emerging market opportunities [13,14,35]. Building on this theoretical foundation, this study explores the relationship between SMEs' digital platform synergy

and organizational agility.

3. HYPOTHESIS DEVELOPMENT

3.1. Digital Platform Synergy and Organizational Agility

Digital platform synergy stems from the broad notion of "synergistic specificity," which refers to how one system gains greater functionality by being fine-tuned specifically to another system [9]. In the context of digital platforms, SMEs often rely on these digital platforms for their development, while digital platforms are rarely dependent on SMEs for their growth [10]. This creates a largely unilateral synergy in which SMEs leverage the evolving resources and capabilities of the digital platform [10,11]. However, this dynamic can shift depending on the extent to which an SME is integrated into a particular digital platform [9]. To achieve such integration, SMEs need to continuously interact with digital platform owners, align with and adopt the operational routines of external digital platforms, and incorporate platform-provided services in their own processes. Achieving this alignment requires adaptations within SMEs, including modifications to internal systems and workflows. Therefore, the greater the digital platform synergy, the more extensively SMEs integrate and leverage the resources of a particular digital platform [10,11]. This suggests that the dependence of SMEs on the digital platform's resources is growing.

Drawing on resource dependence theory, we expect an asymmetric resource

dependence between SMEs and digital platforms [13,33]. Digital platform synergy intensifies this asymmetric dependency by putting SMEs in a position where, constrained by resource limitations, they need to balance their autonomy with external resource acquisition [14,35]. For instance, SMEs are often required to align with the strategic objectives and governance logic set by dominant digital platforms, which may compromise some of their decisions. Such alignment and integration with digital platform-specific processes and standards also restricts their external coordination flexibility. In addition, as data sharing and analytics are typically mediated through digital platform-controlled systems, SMEs' control over information and data independence is significantly reduced. To ensure continued access to essential resources and digital platform support, SMEs must adapt their business strategies and routines to meet the digital platform's requirements, thus reducing their autonomy [13,34]. Hence, for several reasons, we expect SMEs' digital platform synergy to inhibit their organizational agility.

First, digital platform synergy exacerbates the power imbalance between SMEs and digital platforms. Such an imbalance undermines SMEs' autonomy and threatens their organizational agility. The asymmetric resource dependence between SMEs and digital platforms creates an unequal power dynamic [13,14]. As SMEs deepen their synergy with digital platforms, their reliance on platform resources increases, further reinforcing this power imbalance. In such situations, digital platforms can unilaterally dictate the rules and dominate the logic underlying such synergy [36]. This in turn compels SMEs to

prioritize the digital platform's strategic needs at the expense of their agility in exploring new opportunities and markets and pursuing technological innovation [35]. For example, following each update of Apple's iOS platform, many existing applications may become obsolete or unusable unless SME developers implement the required updates according to a set of specifications [37]. The rules and update requirements imposed by the digital platform are typically mandatory, leaving SMEs with little discretion. This heightens SMEs' dependence on the digital platform and reduces their ability to adapt quickly in dynamic market environments. Furthermore, when SMEs' strategic goals conflict with those set by digital platforms, they often are forced to align with the platform's objectives to maintain access to platform resources, despite potential misalignment with their own goals and market changes [14,36]. For instance, Alibaba frequently adjusts commission rates and product display rankings, requiring SMEs to modify their pricing and marketing strategies accordingly. SMEs have little choice but to comply, which limits their responsiveness to evolving market and internal strategic demands. Consequently, in the process of synergizing with digital platforms, SMEs may suffer from a lack of organizational agility, as their capacity for rapid adaptation is constrained by the need to comply with externally imposed platform rules and objectives [13,34].

Second, digital platform synergy imposes high switching costs on SMEs, also limiting their organizational agility. To achieve synergy with digital platforms, SMEs typically must make platform-specific investments, such as adhering to the platform's

technical standards and operational procedures [9,10]. When SMEs seek to switch to other digital platforms or adjust their existing digital platform usage, they encounter substantial switching costs [38,39]. Such costs can lead to platform lock-in and weaken SMEs' ability to respond quickly to evolving market conditions [35]. During synergy, the digital platform's technical architecture becomes increasingly embedded in the SMEs' core business processes, meaning that even minor adjustments to products or services necessitate corresponding changes in platform configurations [22,23]. Given that SMEs do not have control over these external platform resources [14], such changes often are technically complex and time-consuming, reducing their agility. For example, Chinese manufacturing SMEs that use Tencent's WeMake platform rely heavily on its proprietary data analytics tools and standardized processes. When these SMEs need to modify their business models due to market shifts, challenges associated with the compatibility of existing tools and procedures lead to substantial technical integration costs. This kind of technological lock-in undermines their capacity to adjust their technology strategies and diminishes their responsiveness to changing market demands. Moreover, digital platform synergy makes SMEs' operational models highly dependent on platform-imposed workflows and managerial norms, resulting in procedural lock-in [38,39]. For instance, Apple's iOS platform enforces strict rules for application development and operation. Once SME developers become accustomed to these rules, switching to other digital platforms involves a steep learning curve and significant adaptation costs, hindering quick adaptation to new platform environments. Therefore, even if SMEs recognize that

overreliance on a specific digital platform could harm their organizational agility, the high switching costs may compel them to forgo new market opportunities that exist outside the current digital platform. Hence, we propose the following:

Hypothesis 1 (H1): Digital platform synergy inhibits organizational agility.

3.2. Mediating Role of Organizational Inertia

We further propose that organizational inertia mediates the relationship between digital platform synergy and organizational agility. Organizational inertia reflects an organization's tendency to maintain its established organizational routines, strategies, and structures [18]. It primarily manifests in two forms: resource rigidity and routine rigidity [18]. While resource rigidity captures the difficulty that firms face in changing their resource investment patterns, routine rigidity reflects the difficulty of altering the organizational processes and business models that use these resources [18,40]. When SMEs try to achieve synergy with digital platforms, organizational inertia can take the form of structural rigidity, cognitive framing, and procedural lock-in. Structural rigidity in SMEs stems from the institutionalization of digital platform–specific technical architectures and standards. As SMEs adapt their internal systems to align with a digital platform, these integrated structures become embedded, making it challenging to reconfigure internal resources or switch to alternative technological solutions, thereby increasing inertia. Cognitive framing arises because SMEs often rely on centralized

decision making by owner-managers or top management teams. These individuals tend to develop mental models shaped by their prior success with specific digital platforms, which can bias future decisions and hinder their openness to new market opportunities and technologies. Procedural lock-in occurs when the routinized workflows that SMEs establish through repeated interaction with digital platforms become internalized and resistant to change, reinforcing inertia at the operational level.

Organizational inertia can entrench an organization's operational models and strategic directions, preventing it from achieving agility in a rapidly changing environment [18,40]. Although a high level of digital platform synergy enables SMEs to leverage the platform's evolving capabilities and resources, resource dependence theory suggests that such deep integration may limit access to alternative platforms and resources. This dependency reinforces organizational inertia by reducing flexibility and increasing resistance to change. Based on this logic, we propose that organizational inertia mediates the relationship between SMEs' digital platform synergy and their organizational agility.

First, SMEs' digital platform synergy enhances their organizational inertia. This occurs through two mechanisms. The first is enhanced resource rigidity. As SMEs deepen their synergy with a digital platform, they become increasingly reliant on its unique resources and functionalities for growth [11]. This resource dependence creates coercive pressure [17], compelling SMEs to maintain their reliance on the current digital platform

instead of exploring alternatives. Moreover, such synergy drives SMEs to integrate digital platform resources with internal resources, which induces technical complexity that hinders change. For instance, when an SME attempts to optimize product design or adjust business processes, it requires concurrent adjustments on the digital platform side [22,23]. However, because SMEs do not control platform resources [14], these modifications are difficult to execute independently, leading to incompatibilities with existing platform functionalities. Hence, this dependency increases structural rigidity, restricting SMEs' flexibility to reallocate resources in response to market shifts. Additionally, SMEs often incur significant sunk costs during the development of platform-based products and services, including initial setup, adaptation, and learning expenses [41]. Switching to another digital platform entails steep learning curves and uncertain risks, incentivizing SMEs to maintain existing digital platform arrangements [42]. Given these high costs and uncertain returns from pursuing alternative market opportunities, SMEs may prefer maximizing immediate value from existing digital platform resources rather than exploring new paths [43]. Consequently, previously valuable digital platform resources may evolve into sources of rigidity, constraining SMEs' organizational agility and innovation capabilities.

SMEs' digital platform synergy also enhances their organizational inertia by increasing routine rigidity, exhibited as procedural lock-in and cognitive framing. Through sustained synergy, SMEs accumulate operational routines in practice, which

gradually evolve into widely accepted default behaviour norms within the organization [44]. Although these routines initially provide competitive advantages, they also can lead to path dependency [40], resulting in procedural lock-in that makes future adjustments challenging. For example, SMEs that achieve early success through digital platform synergy may replicate the same strategic paths rather than experiment with new forms of engagement or explore different market domains. Furthermore, these routines can become embedded within organizational cognition, reinforcing cognitive framing [18]. SMEs often develop a habitual response pattern shaped by previous successes, relying on familiar behaviours and assumptions when interacting with the digital platform. These patterns are continuously strengthened at cognitive levels, making it difficult for the organization to identify and adopt new strategic approaches [40]. Hence, even when external market environments shift, SMEs may maintain their established routines, as their motivation and ability to adopt new strategies or pursue active learning are hindered [45]. For instance, in highly synergistic digital platform contexts, decisions such as how to configure digital platform resources or which software to use for specific business functions often become taken-for-granted assumptions. Over time, these assumptions become institutionalized, enhancing reliance on the status quo, heightening resistance to change, and eroding organizational agility [45].

Second, organizational inertia can constrain SMEs' organizational agility considerably. Organizational inertia arises from path dependency and historical practices

[18], while organizational agility is a dynamic capability developed by firms [3]. The literature acknowledges inertia as a factor that can limit agility [40,46]. Firms experience inertia when their efforts and costs discourage them from changing or completely abandoning existing digital platform resources, thereby limiting their responsiveness to environmental changes [47]. Effective adaptation to environmental shifts requires that firms innovate by introducing new products, services, and digital solutions [48]. However, for SMEs, such adaptation entails steep learning curves and significant development costs [42]. Consequently, inertia can further increase path dependency, restricting firms' proactivity in exploring alternative strategies, and reconfiguring resources in response to market dynamics [44]. Persistent and rigid routines can further reinforce inertia. When SMEs are cognitively confined to existing ways of operating, they are less likely to perceive, let alone respond to, external changes [40]. Overall, owing to inertia related to resources and routines, SMEs are either unable or unwilling to implement internal changes in response to external changes actively [4,46]. This dual constraint further undermines SMEs' organizational agility. Hence, we propose the following:

Hypothesis 2 (H2): Organizational inertia mediates the relationship between digital platform synergy and organizational agility.

3.3. Moderating Role of Organizational Modularity

Modular systems theory posits that complex systems, technical or organizational, comprise interdependent subsystems that interact in unpredictable ways [21]. To manage this complexity, modularity serves as a design principle that minimizes interdependencies, allowing subsystems to evolve independently while remaining interoperable [49,50]. Drawing on Tiwana's [22,23] work, we conceptualize organizational modularity as comprising two dimensions: loose coupling and interface conformance. Loose coupling means that internal changes in the firm do not require parallel changes in the digital platform, while interface conformance refers to the firm's adherence to standardized platform interfaces. These are distinct but complementary structural properties [22].

First, organizational modularity helps counteract resource rigidity, a common byproduct of digital platform synergy and resource dependence. As SMEs become more reliant on digital platform-specific resources, they risk lock-in effects that reinforce inertia [10,17]. Modularity alleviates this effect by enabling SMEs to decouple internal operations from platform-level changes, thus preserving strategic flexibility. This allows firms to reconfigure processes, test new strategies, and adapt without being constrained by the digital platform's evolution or requiring time-consuming coordination [10]. Moreover, high modularity reflects the existence of standardized and well-defined interfaces between SMEs and digital platforms covering data exchange, resource integration, and process execution [8,50]. These standardized interfaces further simplify

technical integration, reduce coordination costs, and enable selective integration, allowing SMEs to draw value from digital platform resources when needed while maintaining operational independence [8]. This modular architecture buffers the SME–platform relationship, concealing internal complexity and reducing sunk costs associated with deep integration [22]. As a result, SMEs can pursue new opportunities or pivot strategies with minimal disruption.

Second, organizational modularity reduces routine rigidity, a key source of organizational inertia often intensified by digital platform synergy. When routines are tightly embedded in digital platform structures, SMEs may struggle to adapt operations amid market shifts. High modularity, through loose coupling, allows SMEs to innovate internally without being constrained by digital platform configurations [22,23]. This structural separation enhances strategic autonomy and reduces the need for constant synchronization with the digital platform. Standardized interfaces further streamline workflows, lower coordination costs, and support agility [10]. As modularity increases, SMEs gain independence from platform decision making processes [13]. Although this may limit insight into the digital platform's long-term strategy, it prevents cognitive inertia—overreliance on platform cues that can reduce market responsiveness. Instead, SMEs can remain focused on external signals and seize new opportunities more quickly [50].

In summary, high organizational modularity enables SMEs to counter resource

dependence and to pursue innovation and adaptation independently of the digital platform. By reducing the need for continuous alignment with the platform, modularity frees up strategic bandwidth and mitigates the organizational inertia often induced by deep platform integration. Through its ability to weaken both resource rigidity and routine rigidity, modularity decreases the mediating effect of inertia in the relationship between digital platform synergy and organizational agility. Thus, modularity functions as a critical moderating mechanism, allowing SMEs to remain agile, innovative, and responsive in dynamic and uncertain environments. Hence, we propose the following:

Hypothesis 3 (H3): The mediating effect of organizational inertia weakens when organizational modularity is high, as it alleviates the reinforcing influence of digital platform synergy on organizational inertia.

4. METHODOLOGY

4.1. Data Source and Samples

We test the hypotheses using data on SMEs in the Chinese manufacturing industry, a highly suitable setting for this study. First, China has experienced rapid digital growth and has become a major manufacturing hub for various digital industries. Numerous industrial internet platforms (e.g., COSMOPlat) have been established, serving as key digital platforms within the manufacturing industry [51]. These digital platforms have been instrumental in driving the growth and innovation of Chinese manufacturing SMEs

[32]. Second, industrial internet platforms represent the most widely adopted form of digital platforms among manufacturing firms in China [8,51]. In contrast to other general digital platforms, industrial internet platforms are specifically designed to serve manufacturing firms [51]. These characteristics significantly mitigate the impact of heterogeneity in digital platform types on this study [6].

To collect data, we distributed questionnaires to SMEs that had joined an industrial internet platform within the past 4 years and continued participation. We applied three criteria to select the sample: (1) the firm must qualify as an SME in the Chinese manufacturing sector, meaning it is headquartered in China and employs fewer than 1000 people, which is based on the "Standards for Classification of Small and Medium-sized Enterprises" established by the Ministry of Industry and Information Technology of China[1] [32]; (2) the firm must have undergone digitalization through an industrial internet platform within the last 4 years without quitting (meaning that the firm conducts business and provides products and services to current and prospective customers through an industrial internet platform); and (3) the firm must have used the industrial internet platform for more than 1 year, to mitigate the interference of internal factors on organizational inertia and agility before the firm's digitalization with the digital platform.

Our study relies on a paired data collection approach. Each SME in the sample received two distinct questionnaires aimed at different representatives within the firm;

[1] https://www.gov.cn/zwgk/2011-07/04/content_1898747.htm

one was completed by a project manager or executive responsible for the firm's interaction with the third-party digital platform, addressing topics such as digital platform synergy, organizational modularity, and digital platform-level control variables. The second questionnaire was completed by the firm's CEO or senior business executive, focusing on the firm's organizational inertia and organizational agility, as well as enterprise-level control variables. This approach enabled us to capture complementary insights from both operational and strategic perspectives within each firm.

In the final survey stage, we randomly selected 800 enterprises from a list of firms participating in industrial internet platforms, as provided by the Industrial Internet Platform Innovation Cooperation Center. With the Center's support, we conducted onsite surveys to address our research questions, ensure respondent suitability, and collect high-quality data. Initial contact was made via phone with senior managers or CEOs to explain the study's purpose and obtain consent for participation. We then conducted in-person visits, during which questionnaires were distributed and collected directly. These questionnaires covered such topics as basic firm information, organizational inertia, and organizational agility. Following the first round of data collection, we asked the primary respondents to nominate another project manager familiar with the firm's interaction with third-party digital platforms. We applied the same process to gather data on digital platform synergy and organizational modularity. In cases in which firms engaged with multiple platforms, respondents were instructed to focus on the platform with which they

interacted most frequently.

All surveys were administered face-to-face to ensure clarity and engagement. To improve response accuracy, we assured respondents of confidentiality, encouraging open and unbiased feedback to strengthen the reliability of our dataset. Out of 800 firms contacted, 518 agreed to participate. During onsite visits, we excluded 97 responses because of ineligibility or unmatched questionnaires. This resulted in 421 valid and successfully paired observations, yielding an effective response rate of 52.63%.

Table 1 in the Appendix presents the key characteristics of our sample. Among the SMEs, 56.3% had a staff count ranging from 20 to 300 employees, while 28.3% had 301 to 1000 employees. With respect to firm age, 60.6% had been registered for longer than 5 years before our survey. In terms of distribution by ownership type, 15.0% were private enterprises, 43.9% were state-owned enterprises, 20.2% were collectively run enterprises, and 20.9% were foreign-invested enterprises. Only 53.4% of SMEs in the sample engaged with multiple digital platforms, with the remaining 46.6% exclusively on a single digital platform. Finally, 29.9% joined a digital platform within 2 years, 44.7% joined within 3 years, and 25.4% within 4 years.

4.2. Measures

Drawing on prior literature, we developed and adapted the questionnaire to align with the study's specific context. To ensure semantic equivalence between the Chinese

and English versions, we undertook a three-step validation process. First, the original English questionnaire was translated into Chinese and then back-translated into English by a separate bilingual expert. By comparing the back-translated version with the original, we identified and resolved discrepancies, refining the translation for greater accuracy and consistency. Second, a pilot study was conducted with 30 managers. Based on their feedback, we revised the questionnaire to improve the clarity, precision, and conciseness of the items. Third, we sought input from two academic experts specializing in digitalization and two senior administrators involved in SME digital transformation initiatives. Their evaluations helped refine the content and structure of the questionnaire, enhancing its readability, relevance, and comprehensiveness. Unless indicated otherwise, all survey items were measured using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The specific operationalization of each variable is described below.

Dependent Variable: Organizational Agility. To assess organizational agility, we built on the research of Lu and Ramamurthy [2], operationalizing it through two dimensions: market capitalizing agility and operational adjustment agility. Market capitalizing agility was operationalized using three items that reflect a firm's ability to swiftly respond to and capitalize on changes through continuous monitoring and the rapid enhancement of products and services to meet customer demands. Operational adjustment agility was assessed through three items that reflect an enterprise's capacity to

physically and rapidly respond to shifts in market demand and changes within its internal business processes.

Independent Variable: Digital Platform Synergy. For the measurement of digital platform synergy, we fine-tuned the measurement items based on the research of Tiwana [10]. In that study, which centered exclusively on the Blackberry OS digital platform, the measurement criteria were established to gauge the degree of synergy between applications and the Blackberry digital platform. Using five specific measurement parameters, the study evaluated the depth to which applications leverage the native features, APIs, and services of the Blackberry digital platform, as well as their capacity to enhance and supplement its existing features. Among them, APIs are a form of boundary resources of digital platforms [52]. However, in the empirical context of this study, the boundary resources of industrial internet platforms are in various forms, primarily categorized as application boundary resources (ABR), development boundary resources (DBR), and social boundary resources (SBR), with specific and different manifestations [53]. For this reason, we replaced the APIs in the measurement items with the broader concept of boundary resources. The concept of boundary resources was elaborated in detail in the questionnaire and was illustrated with the example of the Siemens Industrial Internet Platform MindSphere to help respondents understand the term and ensure the quality of the measurement.

Mediator Variable: Organizational Inertia. To measure organizational inertia, we

adapted the scale developed by Liang et al. [40]. Given that our sample companies are actively engaged in digitalization and are willing to seek new development opportunities, we excluded the item "we are reluctant to seek new development directions" from the original scale, because it does not align with our research context. We developed a scale comprising five measurement items to assess scenarios in which businesses resist and cannot alter their investment strategies, developmental paths, and business models in response to external changes, thereby capturing the two components of inertia: resource rigidity and routine rigidity.

Moderator Variable: Organizational Modularity. To measure organizational modularity, this study drew on Tiwana's [22] research, assessing it through combining the measurements of these two dimensions: loose coupling and interface conformance. The three items related to loose coupling evaluate the degree to which the linkage between an SME and the digital platform is characterized by loose coupling, a limited number of interdependencies, and minimal unnecessary dependencies. The five items measuring interface conformance evaluate the extent to which an SME interacts with the digital platform through clearly specified, stable, well-documented, and standardized interface standards and protocols.

Control Variables: We included the following control variables to filter out other alternative explanations. First, firm age was controlled, as younger firms may be more agile in the market [4]. Firm age was defined as the number of years since the founding

of the SME. Second, we accounted for firm size, measured by the number of employees [54]. This measure was relevant because larger firms may have more difficulty responding quickly to the market. Third, we controlled for firm ownership structure and categorize ownership using a categorical variable (i.e., state-owned enterprises, privately-owned enterprises, collectively-owned enterprises, or foreign-invested enterprises) following Xie et al. [32]. Private firms may perceive and respond more to market changes than other ownership types. Fourth, we controlled for multihoming, defined as whether a firm engages with multiple digital platforms (1 = yes; 0 = no) [38], as participation in several digital platforms may allow firms to have a wider range of digital choices, avoiding the lock-in effect that comes with single-homing a particular digital platform. Finally, we accounted for the firm's time with the digital platform, as longer engagement may lead to greater familiarity with the digital platform, increasing the likelihood of their dependence on the capabilities and resources of the digital platform and thereby decreasing its agility in the marketplace. This variable was measured as the number of years that the SME has been a digital platform member, with durations of less than 1 year recorded as 1 year [32].

4.3. Nonresponse and Common Method Bias

To assess nonresponse bias [55], we compared early and late participants by conducting a t-test on the primary variables. The results in Table 2 in the Appendix indicated that the t-statistics for digital platform synergy ($t = -0.880$, $p = 0.380$),

organizational inertia (t = 1.163, p = 0.245), organizational modularity (t = 1.229, p = 0.220), and organizational agility (t = 1.518, p = 0.130) were all statistically insignificant. Hence, we concluded that our study exhibited no significant nonresponse bias.

To mitigate the potential concern of common method bias (CMB), we took several steps to reduce its effects. First, we intermixed the items from the different constructs within the questionnaires to reduce respondent anticipation and informed participants that their responses would remain strictly confidential. Additionally, we used two methods to assess the likelihood of CMB. Following the recommendations of Podsakoff and Organ [56], we used Harman's single-factor test to detect potential CMB. An exploratory factor analysis on the measurement items within the model found that the six factors had eigenvalues above 1 and the first factor explained 16.859% of the variance, which was lower than the critical standard of 40%. Second, in line with the recommendation of Liang et al. [57], we integrated a common method factor into the PLS model, with its indicators encompassing all principal constructs. We then computed each indicator's variance substantively, which was explained by the principal construct and method. As shown in Table 3 in the Appendix, the average substantively explained variance of the indicators was 0.759, while the average method-based variance was 0.001. The ratio of substantive variance to method variance was approximately 759:1. In addition, most method factor loadings were insignificant. The small magnitude and insignificance of the method variance indicate that the CMB did not significantly distort the model of this

study.

5. RESULTS

5.1. Measurement Model

The outer model's quality can be evaluated through an indicator reliability test, revealing that none of the items exhibited an outer loading below the minimum threshold of 0.6, as Chin [58] suggested. Our constructs were judged to be reliable, as the Cronbach's alpha [59], Dillon-Goldstein's rho [58], and composite reliability [59] values of these constructs all exceed 0.7. The constructs also passed the convergent validity test [59], as the extracted average variance (AVE) was consistently above 0.50 (with the lowest AVE of 0.602 for organizational modularity) (Tables 4 and 5 in the Appendix).

In addition, we also used the correlation ratio of the heterotrait-monotrait (HTMT) test proposed by Henseler et al. [60] to test the discrimination validity, which suggested 0.85 as the standard value of the construct measurement model. Tables 6 and 7 in the Appendix show that these values vary from 0.085 to 0.566, demonstrating that all constructs of the model have achieved discriminant validity. To summarize, our final model meets all the measurement model validity criteria.

5.2. Structural Model and Hypothesis Testing

To test our model hypothesis, we followed the approach outlined by Hair et al. [59],

analyzing the structural path coefficients via bootstrapping with 5000 resamples. Additionally, we gauged the predictive power of the constructs through the R^2 value. Table 8 and Figure 1 in the Appendix present the results.

These results confirm all of our hypotheses. In particular, the path coefficients of the PLS-SME analysis indicate that digital platform synergy significantly inhibits organizational agility (β = -0.280; t = 5.610; p = 0.000). Therefore, H1 is supported. The R^2 and adjusted R^2 values are 0.230 and 0.217, respectively, indicating that digital platform synergy explains 21.7% of the variance in organizational agility.

The outcomes of the PLS-SEM analysis also reveal a significant and positive impact of digital platform synergy on organizational inertia (β = 0.306; t = 5.185; p = 0.000), while organizational inertia exert a significant inhibitory effect on organizational agility (β = -0.250; t = 4.905; p = 0.000). The significant effect of digital platform synergy on organizational inertia, coupled with the significant impact of organizational inertia on organizational agility, indicates the existence of a mediating effect. Additionally, the PLS-SEM results demonstrate a significant indirect effect of digital platform synergy on organizational agility, mediated by organizational inertia (β = -0.076; t = 3.760; p = 0.000), thereby supporting H2.

Table 8 in the Appendix further illustrates the moderating effect of organizational modularity, which negatively and significantly moderates the relationship between digital

platform synergy and organizational inertia (β = -0.143; t = 2.554; p = 0.011). Furthermore, following the previous study [61], we introduced the moderator variable in the analysis of the mediation effect, and Table 9 in the Appendix presents the moderated mediation effect. The results indicate that the bias-corrected bootstrap 95% confidence intervals (CIs) either contained 0 or did not contain 0, suggesting that the mediating effect of organizational inertia is significant at low and mean moderator levels but insignificant at the high moderator levels. Specifically, as the levels of the moderators increased, the indirect effect of organizational inertia diminished, thus supporting H3. The R^2 and adjusted R^2 values are 0.139 and 0.132, respectively, indicating that the model explains 13.2% of the variation in the outcome variable.

5.3. Robustness Test

We performed several robustness tests to validate the key findings. First, we constructed a model incorporating a quadratic term to examine the potential existence of an inverted U-shaped relationship between digital platform synergy and organizational agility. As shown in Table 10 in the Appendix, the coefficient of the squared term for digital platform synergy is negative (β = -0.112; t = 2.771; p = 0.006), implying a possible nonlinear effect. However, to further investigate this relationship, we followed the criteria established in the literature [62], suggesting that an inverted U-shaped relationship can be confirmed when three conditions are met simultaneously: (1) the coefficient of the quadratic term is significant and negative; (2) the slope of the curve is

sufficiently steep at both ends of the range; and (3) the turning point and its CI are well within the data range.

Accordingly, we calculated the slopes of the curve at the minimum and maximum values of digital platform synergy, as recommended by Lind and Mehlum [62]. The results indicate that the slope at the minimum value (X = 1) is -0.559 and the slope at the maximum value (X = 7) is -1.903. Both slopes are negative and statistically significant, indicating that the marginal effect of digital platform synergy on organizational agility remains negative throughout the observed range. This lack of slope reversal provides no support for the existence of an inverted U-shaped relationship. We also calculated the turning point of the curve as -1.496 (95% CI, -2.651 to -0.341). The findings that this turning point and its 95% CI lie outside the actual observed range of digital platform synergy further confirms the absence of an inverted U-shaped relationship between digital platform synergy and organizational agility. The foregoing analyses rule out the possibility of an inverted U-shaped relationship. Although the quadratic term for digital platform synergy is statistically significant, this finding does not contradict the hypothesized main effect. On the contrary, it reinforces our argument by suggesting that as the level of digital platform synergy increases, its negative effect on organizational agility becomes stronger.

Second, recognizing that firms of different sizes may vary in their resources, capabilities, intensity of organizational inertia, and strategic agility, we conducted

additional robustness checks based on firm size. Based on the classification scheme from the Ministry of Industry and Information Technology of China[2], we first divided the sample into three groups: micro-sized enterprises (fewer than 20 employees), small-sized enterprises (20-300 employees), and medium-sized enterprises (301-1000 employees). We then conducted multigroup analyses to investigate whether the effects observed in our study vary across firms of different sizes. As illustrated in Table 11 in the Appendix, the results indicate no significant differences across the three groups, confirming the robustness of our findings.

Third, to examine the robustness of our findings across firms of different ages, we conducted a multigroup analysis based on firm age. Specifically, we divided the sample into a younger group and an older group (using the median firm age as the dividing threshold) and tested whether the path coefficients and their levels of significance differ between the two groups. As shown in Table 12 in the Appendix, the direction and significance of the main coefficients remain consistent across the 2 groups, with no statistically significant differences observed. This indicates that the findings are robust across firms at different stages of organizational development.

Finally, manufacturing encompasses multiple sectors (e.g., automotive, fashion), each of which may have nuances that potentially could have influenced the outcomes of our study. To mitigate the influence of these nuances, we classified the manufacturing

[2] https://www.gov.cn/zwgk/2011-07/04/content_1898747.htm

industry into low-tech, medium-tech, and high-tech sectors, based on the classification of manufacturing technology intensity established by the Organization for Economic Cooperation and Development (OECD)[3]. This approach allowed us to examine how SMEs' digital platform synergy influences their organizational agility across various subindustry contexts. The results presented in Table 13 in the Appendix reveal no significant differences across various subindustries, further supporting our findings.

6. DISCUSSION

6.1. Theoretical Implications

First, this study enhances the understanding of organizational agility within the context of SMEs. Although prior research has identified a variety of determinants of organizational agility, including technological, behavioral, organizational, and environmental factors [24,25,31], these studies have focused on large firms, with only limited attention to SMEs [1,4]. Although some scholars have highlighted the enabling role of digital technologies in enhancing agility within SMEs [1,63], few have explicitly examined the impact of digital platforms, particularly the role of digital platform synergy, which represents a dominant mode of digital platform engagement among SMEs [10,11]. As a result, our understanding of how digital platform synergy influences organizational agility in SMEs remains underdeveloped. While large firms can independently develop

[3] https://www.oecd.org

and control digital platforms using their own resources [32], SMEs often rely on third-party digital platforms, and this dependence might not always yield positive outcomes [15]. Our findings reveal that digital platform synergy may in fact inhibit organizational agility in SMEs, suggesting that synergy with digital platforms can create structural rigidity rather than flexibility. This insight contributes a novel perspective to the literature by highlighting the context-dependent nature of agility determinants. It also deepens our understanding of the nuanced ways in which SMEs may benefit from or struggle with digital platform engagement.

Second, the study enriches the literature on organizational inertia, especially in the context of SMEs. Prior research has typically associated inertia with large firms' failures in managing organizational change and innovation [18,30,44], and only a few studies have explored how inertia develops in SMEs and affects their adaptability [4,15]. Large firms often resist investing in emerging technologies to protect their existing competitive advantages, which ultimately can lead to missed opportunities, as exemplified by Kodak and Nokia [4]. In contrast, SMEs are more agile and responsive to new technologies. Nonetheless, owing to their smaller scale and concentrated operational structures [19], they also are vulnerable to the development of organizational inertia, which may hinder adaptation over time [4]. Yet limited research has examined how this inertia occurs in digital platform contexts, particularly in SMEs. This study addresses that gap by demonstrating the mediating role of organizational inertia in the relationship between

digital platform synergy and organizational agility. The results reveal that inertia acts as a critical inhibitor, limiting the ability of SMEs to adapt despite digital platform engagement. By highlighting this mediating mechanism, the study identifies and explains the structural and behavioral constraints shaping SMEs' digital transformation.

Finally, our study contributes to the literature on modular systems theory. Current research on modularity is multifaceted [64], but it has not reached a conceptual consensus on modularity [65]. Despite many definitions, modularity is generally viewed as a design principle to minimize interdependencies between subsystems [49,66]. Prior research in the digital platform context has concentrated on the modularity of digital platform architecture design [67,68] while neglecting the modularity of design choices made by firms regarding their linkages to these digital platforms [22,23]. This study conceptualizes SMEs and the digital platforms with which they synergize as a complex organizational system. It further defines organizational modularity as the loose coupling of the linkages between SMEs and digital platforms, along with the degree of conformance in the interfaces used to interact with the digital platforms [22,23]. By introducing and theoretically conceptualizing organizational modularity within the context of digital platforms, this study broadens the applicability and analytical scope of modular systems theory. Furthermore, although scholars have largely endorsed the argument of "the power of modularity," highlighting its potential benefits, existing research lacks valid empirical evidence demonstrating the superiority of modular design

[49]. The results of this study suggest that organizational modularity can mitigate the creation of organizational inertia caused by SMEs' digital platform synergy, which in turn enables them to maintain agility when rapidly responding to market changes. To this end, our results provide empirical support for the argument related to "the power of modularity" [49].

6.2. Managerial Insights

First, SMEs must be cautious of the potential threats to organizational agility when synergizing with third-party digital platforms. As digital platforms proliferate and the accumulation of industrial big data provides deeper insights into customer needs, many SMEs seek to leverage these platforms to enhance product and service responsiveness in increasingly competitive markets. However, this often leads to the mistaken assumption that simply adopting a digital platform guarantees agility and innovation benefits. This study shows that overreliance on digital platform resources, particularly in manufacturing sectors engaged with industrial internet platforms, can limit SMEs' responsiveness to market dynamics. Although digital platforms offer convenience and valuable infrastructure, path dependence can emerge, restricting strategic agility. As Teece et al. [3] suggest, SMEs should calibrate their agility to their unique strategic and operational contexts, ensuring that they maintain adaptive capacity rather than becoming locked into rigid digital pathways.

Second, our findings reveal that digital platform synergy can foster organizational inertia in SMEs, ultimately hindering their agility. Although SMEs are traditionally viewed as more agile owing to their informal, streamlined, and flat organizational structures, this perception can lead managers to underestimate the potential for inertia within their firms. Nonetheless, SMEs often face resource and routine rigidity, stemming from their smaller scale and centralized business models. When engaging with third-party digital platforms, SMEs typically operate from a relatively disadvantaged position [13], making them more susceptible to platform-imposed rules and constraints. This dependence increases the risk of structural rigidity and accelerates the development of organizational inertia. This manifests in two primary ways: first, a rigid investment pattern in digital platform resources that limits the ability to break free from existing frameworks, and second, a narrow understanding of available digital platform resources, leading to missed opportunities for exploring and utilizing broader resource channels. To mitigate these effects, SMEs must actively monitor the emergence of organizational inertia and implement preventive strategies. For instance, managers should pursue diversified investments in digital technologies, allowing them to maintain multiple strategic options and respond more effectively to market volatility. By broadening their digital portfolio, SMEs can reduce dependency on any single digital platform and enhance their organizational adaptability.

Finally, our findings highlight the moderating role of organizational modularity,

showing that SMEs can mitigate the negative effects of digital platform synergy by adopting modular organizational strategies during value-creating activities on digital platforms. Although digital platform synergy is often a necessary condition for SMEs to co-create value, it also can result in dependency and reduced agility. By implementing organizational modularity, characterized by loosely coupled linkages and standardized interfaces, SMEs can reduce the complexity of managing platform dependencies. This modular approach weakens the constraints imposed by digital platforms, granting SMEs greater autonomy to respond flexibly to market dynamics. In practice, this means establishing modular connections with digital platforms that preserve strategic agility. For example, in the context of industrial internet platforms, manufacturing SMEs should adopt modular and flexible cooperation models while ensuring interface consistency to maintain seamless integration with digital platforms. Nonetheless, it is important to acknowledge that organizational modularity involves implementation costs. SME managers should carefully evaluate the trade-offs, considering their firm's strategic objectives, market positioning, and risk preparedness. The decision to pursue modularity should be guided by an assessment of whether its agility-enhancing benefits outweigh the associated investments in reconfiguration, coordination, and system integration.

6.3. Limitations and Future Research Directions

First, the study's core findings stem from manufacturing SMEs in China, indicating a potential limitation to a specific industry or region. While focusing on one region and

industry mitigates cross-region and cross-industry confounding effects, diminishes aggregation bias, and bolsters internal validity, it also limits the generalizability of the findings. Thus, future research should consider employing a dynamic panel dataset across industries and validating it in diverse economies to broaden the generalizability of the relationships identified in this study.

Second, using a questionnaire to gather data is susceptible to respondents' perceived biases and may compromise result accuracy. Even though our analysis revealed insignificant common method bias issues, future studies should validate findings using multiorigin and multisource data. Moreover, the cross-sectional design used in this study poses limitations in addressing process-oriented concerns or unveiling causal relationships. Longitudinal research designs in future studies can expose the causal dynamics between SMEs' digital platform synergy and their organizational agility.

Third, our research sample confined the scope of this study to a single industrial internet platform with which SMEs were most familiar, restricting generalizability to diverse multiplatform scenarios despite using multihoming as a control variable. Future research should delve into how cross-platform heterogeneity impacts SMEs' organizational agility. Moreover, our study did not account for variations in SMEs' level of digital maturity, which may influence their ability to achieve synergy with digital platforms and respond to the demands of digital transformation. Future studies could consider digital maturity as a critical contingent factor to better capture heterogeneous

agility outcomes among SMEs. Additionally, SMEs represent only one facet of the digital platform ecosystem; given the intricate interdependencies among various ecosystem players, future research should explore the dynamic interactions between SMEs and other stakeholders within the digital platform ecosystem. Such endeavors may elucidate how these interactions influence the process by which SMEs achieve organizational agility within digital platform contexts.

Finally, while organizational modularity could influence the direct relationship between digital platform synergy and organizational agility, we did not include it as a moderator in this study. This decision aligns with our primary focus on examining the mediating effect of organizational inertia. Future research should focus on how organizational modularity influences the direct link between digital platform synergy and organizational agility.

7. CONCLUSION

Our study centers on the question "how does SMEs' digital platform synergy influence their organizational agility?" To address this question, we leverage resource dependency theory to explore the relationship between these constructs, offering insights into the underlying mechanisms and boundary conditions shaped by organizational inertia and modularity. The study also advances the literature in the rapidly expanding field of organizational agility within digital contexts. Additionally, by examining the relationship

between digital platform synergy and organizational agility in SMEs, we highlight potential risks associated with digital platform synergy, offering SME managers practical guidance for navigating these challenges.

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APPENDIX

Table 1

Sample characteristics.

		Mean	S.D.	Frequency	Percentage%
Age	≤ 3 years	2.92	1.265	62	14.7
	3 < Age ≤ 5years			104	24.7
	5 < Age ≤ 10years			127	30.2
	10 < Age ≤ 15years			63	15.0
	> 15years			65	15.4
Size	≤ 20 employees	2.13	0.649	65	15.4
	20 - 300 employees			237	56.3
	301 - 1000 employees			119	28.3
Ownership	Private enterprises (PEs)	1.18	1.203	63	15.0
	State-owned enterprises (SOEs)			185	43.9
	Collectively run enterprises (CREs)			85	20.2
	Foreign-invested enterprises (FIEs)			88	20.9
Multihoming	No	0.47	0.499	225	53.4
	Yes			196	46.6
Time with the digital platform	≤ 2years	2.95	0.743	126	29.9
	2 - 3years			188	44.7
	> 3years			107	25.4

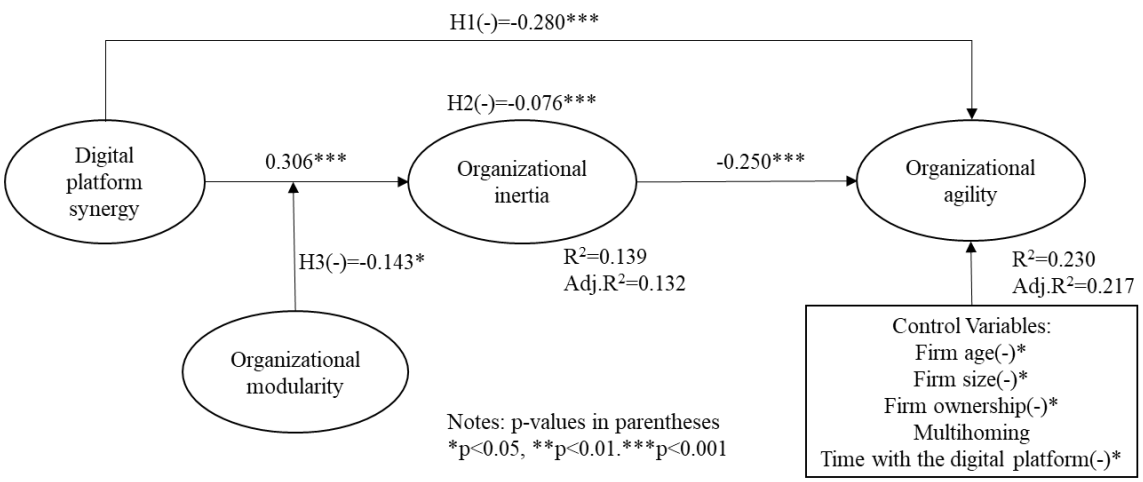

Figure 1: Results of the structural model.

Table 2

Independent samples test.

		Levene's Test for Equality of Variances								
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Digital Platform Synergy	Equal variances assumed	3.544	0.060	-0.880	419.000	0.380	-0.099	0.112	-0.319	0.122
	Equal variances not assumed			-0.886	419.000	0.376	-0.099	0.111	-0.318	0.120
Organizational Inertia	Equal variances assumed	3.698	0.055	1.163	419.000	0.245	0.135	0.116	-0.093	0.364
	Equal variances not assumed			1.169	418.546	0.243	0.135	0.116	-0.092	0.362
Organizational Modularity	Equal variances assumed	2.839	0.093	1.229	419.000	0.220	0.154	0.126	-0.093	0.401
	Equal variances not assumed			1.234	418.155	0.218	0.154	0.125	-0.091	0.400
Organizational Agility	Equal variances assumed	0.732	0.393	1.518	419.000	0.130	0.192	0.126	-0.057	0.441
	Equal variances not assumed			1.523	416.948	0.129	0.192	0.126	-0.056	0.440

Table 3

Common method bias analysis.

Construct	Indicators	Substantive Factor (R1)	$R1^2$	Method Factor Loading (R2)	$R2^2$
Digital Platform Synergy	DPS1	0.815***	0.664	-0.036	0.001
	DPS2	0.835***	0.697	-0.007	0.000
	DPS3	0.806***	0.650	0.034	0.001
	DPS4	0.848***	0.719	-0.034	0.001
	DPS5	0.836***	0.699	0.043	0.002
Organizational Inertia	OI1	0.789***	0.623	-0.063	0.004
	OI2	0.846***	0.716	0.046	0.002
	OI3	0.854***	0.729	-0.020	0.000
	OI4	0.857***	0.734	0.008	0.000
	OI5	0.836***	0.699	0.025	0.001
Organizational Modularity	LC1	0.895***	0.801	0.043	0.002
	LC2	0.929***	0.863	-0.013	0.000
	LC3	0.910***	0.828	-0.028	0.001
	IC1	0.873***	0.762	0.013	0.000
	IC2	0.867***	0.752	-0.021	0.000
	IC3	0.908***	0.824	0.021	0.000
	IC4	0.891***	0.794	0.021	0.000
	IC5	0.901***	0.812	-0.035	0.001
Organizational Agility	OAA1	0.882***	0.778	-0.001	0.000
	OAA2	0.916***	0.839	-0.002	0.000
	OAA3	0.920***	0.846	0.003	0.000
	MCA1	0.877***	0.769	0.093**	0.009
	MCA2	0.898***	0.806	-0.040	0.002
	MCA3	0.902***	0.814	-0.053	0.003
	Average	**0.870**	**0.759**	**0.000**	**0.001**

Notes: *p< 05; **p< 01; ***p<0.001

Table 4

Measurement model results for first-order constructs (Model A) (Step 1).

Constructs and items	Item wording	S.L.	S.D.	t-Val.	α	rho_a	C.R.	AVE
Digital Platform Synergy DPS					0.885	0.891	0.916	0.685
DPS1	We leveraged the platform's boundary resources.	0.813	0.023	34.921				
DPS2	We leveraged the platform's services.	0.833	0.021	38.932				
DPS3	We built on the platform's functionality.	0.790	0.026	30.648				
DPS4	We leveraged the platform's native capabilities.	0.859	0.016	53.374				
DPS5	We complemented the platform.	0.842	0.019	43.601				
Organizational Inertia OI					0.893	0.894	0.921	0.700
OI1	We are unwilling to change our current business model.	0.793	0.023	35.035				
OI2	We are unwilling to change our investment patterns.	0.840	0.017	49.850				
OI3	We are unable to seek new development directions.	0.853	0.020	42.347				
OI4	We are unable to change our current business model.	0.855	0.019	44.476				
OI5	We are unable to change our investment patterns.	0.841	0.021	40.591				
Loose Coupling LC					0.898	0.903	0.936	0.831
LC1	We are loosely coupled with the platform.	0.892	0.014	61.704				
LC2	We have a small number of interdependencies with the platform.	0.933	0.009	103.475				
LC3	We have minimal unnecessary interdependencies with the platform.	0.909	0.013	71.985				
Interface Conformance IC					0.933	0.933	0.949	0.789
IC1	The interface standards and protocols we used to interact with the platform are clearly specified.	0.876	0.017	51.586				

Constructs and items	Item wording	S.L.	S.D.	t-Val.	α	rho_a	C.R.	AVE
IC2	The interface standards and protocols we used to interact with the platform are unambiguous.	0.866	0.018	48.932				
IC3	The interface standards and protocols we used to interact with the platform are stable.	0.908	0.011	85.786				
IC4	The interface standards and protocols we used to interact with the platform are well documented.	0.890	0.014	63.691				
IC5	The interface standards and protocols we used to interact with the platform are standardized.	0.900	0.014	65.591				
Operational Adjustment Agility OAA					0.891	0.892	0.932	0.821
OAA1	We fulfill demands for rapid-response, special requests of our customers whenever such demands arise; our customers have confidence in our ability.	0.881	0.015	57.593				
OAA2	We can quickly scale up or scale down our production/service levels to support fluctuations in demand from the market.	0.917	0.011	86.064				
OAA3	Whenever there is a disruption in supply from our suppliers, we can quickly make necessary alternative arrangements and internal adjustments.	0.920	0.010	91.461				
Market Capitalizing Agility MCA					0.872	0.873	0.922	0.797
MCA1	We quickly make and implement appropriate decisions in the face of market/customer changes.	0.883	0.013	68.957				
MCA2	We constantly look for ways to reinvent/reengineer our organization to serve our marketplace better.	0.896	0.015	61.345				
MCA3	We treat market-related changes and apparent chaos as opportunities to capitalize quickly.	0.898	0.014	65.732				

Table 5

Measurement model results for Second-order constructs (Model B) (Step 2).

Constructs and items	Path. Coef.	S.D.	t-Val.	p-Val.	α	ρ_A	C.R.	AVE
Organizational Agility OA					0.870	0.871	0.902	0.607
Operational Adjustment Agility	0.873	0.015	56.903	0.000				
Market Capitalizing Agility	0.860	0.017	51.948	0.000				
Organizational Modularity OM					0.904	0.906	0.923	0.602
Loose Coupling	0.763	0.030	25.179	0.000				
Interface Conformance	0.924	0.006	157.086	0.000				

Table 6

Discriminant validity after the step 1: HTMT

	DPS	OI	LC	IC	OAA	MCA
DPS						
OI	0.359					
LC	0.126	0.120				
IC	0.091	0.085	0.497			
OAA	0.343	0.378	0.183	0.182		
MCA	0.349	0.301	0.237	0.224	0.566	

Table 7

Discriminant validity after the step 2: HTMT

	DPS	OI	OM	OA
DPS				
OI	0.359			
OM	0.122	0.115		
OA	0.402	0.395	0.279	

Table 8

Summary of the results.

Structural paths	Path.Coeff.	Sample Mean	Standard Deviation	t-Values	p-Values	Hypothesis
Direct effects						
Digital Platform Synergy -> Organizational Inertia	0.306	0.312	0.059	5.185	0.000	Supported
Organizational Inertia -> Organizational Agility	-0.250	-0.250	0.051	4.905	0.000	Supported
Digital Platform Synergy -> Organizational Agility	-0.280	-0.282	0.050	5.610	0.000	Supported
Moderating effect						
Organizational Modularity x Digital Platform Synergy -> Organizational Inertia	-0.143	-0.145	0.056	2.554	0.011	Supported
Mediating effect						
Digital Platform Synergy -> Organizational Inertia -> Organizational Agility	-0.076	-0.078	0.020	3.760	0.000	Supported
Goodness of model fit						
Goodness of fit = 0.346						
Structural model fit						
R^2 (Organizational Inertia) = 0.139						
R^2 (Organizational Agility) = 0.230						
Predictive relevance of model fit						
Q^2 (Organizational Inertia) = 0.093						
Q^2 (Organizational Agility) = 0.132						

Table 9

Summary of the results of the mediation analysis.

Mediation: Digital Platform Synergy -> Organizational Inertia -> Organizational Agility				
Moderator	Indirect effect	Standard Deviation	Lower CI	Upper CI
Organizational Modularity (High)	-0.045	0.026	-0.100	0.003
Organizational Modularity (Mean)	-0.085	0.024	-0.135	-0.044
Organizational Modularity (Low)	-0.124	0.034	-0.201	-0.066

Table 10

Summary of the results of robust test - Inverted U test.

Structural paths	Path.Coeff.	Sample Mean	Standard Deviation	t-Values	p-Values
Direct effects					
Digital Platform Synergy -> Organizational Inertia	0.306	0.312	0.059	5.185	0.000
Organizational Inertia -> Organizational Agility	-0.220	-0.221	0.053	4.150	0.000
Digital Platform Synergy -> Organizational Agility	-0.335	-0.336	0.056	6.007	0.000
Digital Platform Synergy^2 -> Organizational Agility	-0.112	-0.112	0.040	2.771	0.006
Moderating effect					
Organizational Modularity x Digital Platform Synergy -> Organizational Inertia	-0.143	-0.145	0.056	2.554	0.011
Mediating effect					
Digital Platform Synergy -> Organizational Inertia -> Organizational Agility	-0.067	-0.069	0.020	3.328	0.001
Goodness of model fit					
Goodness of fit = 0.353					
Structural model fit					
R^2 (Organizational Inertia) = 0.139					
R^2 (Organizational Agility) = 0.246					
Predictive relevance of model fit					
Q^2 (Organizational Inertia) = 0.093					
Q^2 (Organizational Agility) = 0.141					

Table 11

Summary of the results of robust test - Multi-group analysis (Size).

Effects	Difference (Group1 - Group2) 2-tailed p-value	Difference (Group1 - Group3) 2-tailed p-value	Difference (Group2 - Group3) 2-tailed p-value	Conclusion
Direct effects				
Digital Platform Synergy -> Organizational Inertia	0.041 (0.747)	0.140 (0.414)	0.099 (0.492)	Non-significant difference
Organizational Inertia -> Organizational Agility	0.022 (0.913)	-0.043 (0.787)	-0.066 (0.583)	Non-significant difference
Digital Platform Synergy -> Organizational Agility	0.156 (0.404)	0.187 (0.331)	0.030 (0.756)	Non-significant difference
Moderating effect				
Organizational Modularity x Digital Platform Synergy -> Organizational Inertia	0.064 (0.604)	0.023 (0.899)	-0.041 (0.735)	Non-significant difference
Mediating effect				
Digital Platform Synergy -> Organizational Inertia -> Organizational Agility	-0.003 (0.982)	-0.045 (0.574)	-0.042 (0.320)	Non-significant difference
Moderated mediating effect				
Organizational Modularity x Digital Platform Synergy -> Organizational Inertia -> Organizational Agility	-0.020 (0.589)	0.000 (0.978)	0.020 (0.551)	Non-significant difference

Table 12

Summary of the results of robust test - Multi-group analysis (Age).

Effects	Difference (Group1 - Group2) 2-tailed p-value	Conclusion
Direct effects		
Digital Platform Synergy -> Organizational Inertia	0.212 (0.065)	Non-significant difference
Organizational Inertia -> Organizational Agility	0.156 (0.137)	Non-significant difference
Digital Platform Synergy -> Organizational Agility	0.032 (0.780)	Non-significant difference
Moderating effect		
Organizational Modularity x Digital Platform Synergy -> Organizational Inertia	0.034 (0.746)	Non-significant difference
Mediating effect		
Digital Platform Synergy -> Organizational Inertia -> Organizational Agility	-0.009 (0.870)	Non-significant difference
Moderated mediating effect		
Organizational Modularity x Digital Platform Synergy -> Organizational Inertia -> Organizational Agility	-0.034 (0.352)	Non-significant difference

Table 13

Summary of the results of robust test - Multi-group analysis (Sector).

Effects	Difference (Group1 - Group2) 2-tailed p-value	Difference (Group1 - Group3) 2-tailed p-value	Difference (Group2 - Group3) 2-tailed p-value	Conclusion
Direct effects				
Digital Platform Synergy -> Organizational Inertia	-0.016 (0.918)	0.005 (0.966)	0.021 (0.869)	Non-significant difference
Organizational Inertia -> Organizational Agility	0.182 (0.195)	-0.001 (0.973)	-0.183 (0.108)	Non-significant difference
Digital Platform Synergy -> Organizational Agility	0.009 (0.952)	0.204 (0.105)	0.195 (0.058)	Non-significant difference
Moderating effect				
Organizational Modularity x Digital Platform Synergy -> Organizational Inertia	0.081 (0.553)	-0.035 (0.792)	-0.117 (0.391)	Non-significant difference
Mediating effect				
Digital Platform Synergy -> Organizational Inertia -> Organizational Agility	0.061 (0.288)	-0.001 (0.975)	-0.063 (0.217)	Non-significant difference
Moderated mediating effect				
Organizational Modularity x Digital Platform Synergy -> Organizational Inertia -> Organizational Agility	-0.053 (0.279)	0.007 (0.917)	0.060 (0.180)	Non-significant difference