The Role of Managerial Activities in Achieving Information Technology Ambidexterity and New Product Development Performance in Small and Medium-sized Enterprises

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Abstract

Given their limited portfolio of resources, small and medium-sized enterprises (SMEs) have to manage information technology (IT) exploitation and exploration at the same time to support a major shift in their product focus while maintaining their current array of products. We theorize that SMEs rely on managerial activities to enable IT ambidexterity to enhance the performance of their new product development (NPD). To this end, we hypothesize and test the relationships between managerial activities, IT ambidexterity, and NPD performance. Using multiple respondent data from 292 high-tech SMEs, we find that managerial activities enable IT ambidexterity, and this relationship is moderated by structural configurations. Considering the NPD management challenges ushered in by the digital era, our findings identify IT ambidexterity as a key mechanism to enhance NPD performance in SMEs. Our results contribute novel insights into the effective role of managerial activities in SMEs and help to explain the role of IT ambidexterity in the NPD literature, thereby facilitating continued theory development in this field of research.

Keywords: Managerial activities, IT ambidexterity, formal structural configuration, connectedness, new product development performance.

1 INTRODUCTION

New product development (NPD) performance holds critical importance for small and medium-sized enterprises (SMEs) [1], as it significantly influences their competitive edge and market standing (Varis and Littunen, 2010). In the dynamic and increasingly digital business environment, NPD performance becomes a defining factor of an SME's resilience and capacity for sustained growth (Jamali et al., 2015). One of the key drivers of successful NPD performance in SMEs is information technology (IT) ambidexterity (Miklian and Hoelscher, 2022, Syed et al., 2020b).

Across industries, IT ambidexterity – the capability of a firm to explore new IT applications and exploit existing IT resources and practices simultaneously (Lee et al., 2015) – is both crucial to firm performance and difficult to achieve (Liang et al., 2022). In the current trend toward digital transformation and innovation, IT ambidexterity ensures long-term success by balancing transformative activities, aimed at digital value creation, while maintaining its traditional focus on automation and information (Leonhardt et al., 2017). Simultaneously, the emergence of the digital era has progressively shifted the approaches to, and outcomes of, NPD projects, that is, a shift from delivering commodity services to driving platform innovation (Gregory et al., 2018). The coexistence of different demands challenges the effectiveness of simple IT strategies (Lee et al., 2015) and of either/or approaches, as opposed to both/and approaches in NPD (Lewis et al., 2002). This makes IT ambidexterity imperative for long-term success and for enhancing NPD performance. However, implementing IT ambidexterity is challenging and risky because IT exploration and IT exploitation tend to compete for the same organizational resources, and a trade-off between the two can sabotage performance. For instance, a high level of IT exploration carries the risk of failure or cost beyond the advantages, while a high level of IT exploitation entails the risk of a competency trap or stagnant technology (Levinthal and March, 1993).

The complexities of implementing IT ambidexterity and realizing NPD performance implications are particularly problematic for SMEs (Ebben and Johnson 2005), which are limited in their ability to create separate structures or buffers for exploration and exploitation activities and face higher survival stress and failure rates in NPD – a setting and context that remains under-researched in the extant literature.

[1] Based on the standards generally adopted in the UK and the European Union, this study considers SMEs to be firms with fewer than 250 full-time employees.

NPD presents a critical weapon for SMEs to grow and survive; however, they face higher competitive pressures, as any technological failures may result in their market extinction (Jamali et al., 2015). The short product life cycles and rapid technological advancements require SMEs to pursue IT exploration and IT exploitation at the same time. We argue that SMEs rely on managerial activities for IT ambidexterity to enhance their NPD performance. This expectation draws upon the theoretical reasoning that *"ambidexterity creates demands for senior leadership to support these [exploration and exploitation] contradictory strategies simultaneously"* (Smith and Tushman 2005, p. 388) and is driven by the managerial team's *"internal processes that enable them to handle large amounts of information and decision alternatives and deal with conflict and ambiguity"* (Tushman and O'Reilly, 1997, p. 23). Managerial activities represent the roles, behaviors, and skills of leaders (Salvato, 2009; Korica et al., 2017), and are critical to enabling ambidexterity (Turner et al., 2016). However, O'Reilly and Tushman (2011, p. 8) note that *"what is missing is a clear articulation of those specific managerial actions that facilitate the simultaneous pursuit of exploitation and exploration."* The lack of understanding of managerial activities is also reinforced by Turner et al. (2016, p. 200), suggesting that *"the literature does not fully explore the detailed actions by which managers may achieve ambidexterity."*

Managerial activities in SMEs can be more critical and different from those in large companies because SME managers need to have a variety of skills as a result of the constant requirement to assume different roles (Floren, 2006; Diskienė et al., 2018). SMEs have fewer hierarchical levels and are less constrained by organizational inertia; therefore, managerial activities entail more decision-making powers and are directly concerned with both strategic and operational roles. Managers in SMEs not only ratify and direct their firm strategy but are also involved more directly in the implementation of these strategies. Therefore, they manage and experience the dissonance of competing knowledge demands inherent in the pursuit of ambidexterity (Lubatkin et al., 2006) and NPD performance (Lewis et al., 2002). In addition, studies (i.e., Boumgarden et al., 2012; Turner et al., 2013; Kang and Snell, 2009) argue that managerial efforts in enabling ambidexterity must align with the structural configuration, *"the specific pattern of institutional arrangements through which the planning, allocation, motivation, coordination, and control (i.e., the management) of work processes are attempted"* (Hales and Tamangani, 1996, p. 732). Thus, leaders' managerial activities may not fully realize the expected pursuit of IT ambidexterity if they are misaligned with the firm's structural configuration (Kang

and Snell, 2009). Despite the theoretical arguments and anecdotal evidence, research testing the empirical realities of managerial activities in enabling NPD performance through IT ambidexterity in the context of SMEs remains scant. SMEs represent 99 percent of all firms in a developing economy (Syed et al., 2020a); a lack of clear guidance on enabling IT ambidexterity and its implications for NPD performance could undermine their growth and ability to contribute meaningfully.

This study theoretically explains and tests the relationships between managerial activities, IT ambidexterity, and NPD performance in SMEs. To develop a more nuanced understanding of the boundary conditions surrounding managerial activities – the IT ambidexterity relationship – we test the moderating role of structural configurations in this link. We use multiple respondent survey data in a sample of 292 high-tech SMEs to test that (1) managerial activities enable IT ambidexterity, (2) IT ambidexterity mediates the relationship between managerial activities and NPD performance, (3) IT ambidexterity enhances NPD performance in SMEs, and (4) structural configurations moderate the influence of managerial activities in enabling IT ambidexterity.

Our findings make important contributions in several ways. First, considering NPD management challenges ushered in by the digital era, our findings identify IT ambidexterity as a key mechanism to enhance NPD performance in SMEs. Second, we theorize and test the managerial activities that can enable ambidexterity, responding to the call to pinpoint specific managerial actions (Turner et al., 2016; O'Reilly and Tushman, 2011). While large firms may have multiple managers to exercise different activities for enabling ambidexterity by working together or in tandem (Gregory and Keil, 2014), we evidence that the combination of managerial activities can allow possibilities for managing tradeoffs with limited resources. This implies that SMEs should invest in training managers to develop and hone their ability to constantly adapt their managerial activities in response to the contextual requirements of different tasks and to effectively deal with the tensions arising from IT exploitation and IT exploration. Our post-hoc findings show that the performance benefits of contrasting managerial activities are strengthened when used in combination. Finally, we suggest that SMEs may have to consider and implement the right structural configuration to support managerial activities. More specifically, we demonstrate that specific firm sizes correlate with distinct managerial activities and organizational configurations for optimal outcomes. Altogether, this study theoretically explains and empirically demonstrates

key antecedents and contingency factors that can allow SMEs to develop IT ambidexterity and enhance NPD performance.

2 THEORETICAL BACKGROUND

2.1 Organizational ambidexterity and SMEs

Organizational ambidexterity refers to the firm's ability to balance differing trade-off situations simultaneously (Gibson and Birkinshaw, 2004). These trade-off situations include incremental versus discontinuous innovation (Smith and Tushman, 2005), exploration versus exploitation (March, 1991), alignment versus adaptability (Gibson and Birkinshaw, 2004), and efficiency versus flexibility (Adler et al., 1999). However, the most widely used trade-offs in the organizational ambidexterity literature are between exploration and exploitation (Raisch and Birkinshaw, 2008). *"Exploration includes things captured by terms such as search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution"* (March 1991, p. 71).

The existing research has dominantly focused on ambidexterity capability in large firms (e.g., Tai et al., 2019; Montealegre et al., 2019; Liang et al., 2022); however, SMEs are fundamentally different from larger firms and these differences often make it difficult to extrapolate research findings about larger firms to SMEs. For instance, SMEs often face resource constraints, i.e., financial, infrastructure, or human capital. They might not have the same amount of capital to invest in exploration and exploitation as larger companies, nor do they have access to specialists for each area of IT (Napier et al., 2011). Similarly, the organizational structure of SMEs is often less complex than that of larger firms. Many SMEs are led by owner-managers who play a significant role in strategic decisions (Wijewardena et al., 2008), which might not be the case in larger organizations. This can impact on the firm's approach towards IT ambidexterity and its implementation. Moreover, SMEs are generally more agile than larger firms, which means they can quickly pivot their operations and strategies as needed (Floren, 2006; Syed et al., 2020a). This agility could impact the way they explore and exploit IT resources and practices. For example, they might be more risk-averse due to limited resources, which could impact their willingness to experiment with new IT resources and practices (Jamali et al., 2015). Finally, SMEs often face different market dynamics compared to larger firms. They might serve niche markets, which can

impact their IT strategies (Crick and Spence, 2005). Therefore, the antecedents and consequences of ambidexterity in large firms may not be directly applicable to SMEs and require dedicated research.

The organizational theory literature suggests three approaches to studying organizational ambidexterity: structural, temporal, and contextual (Lavie et al., 2010). Each approach yields one plausible type and way to focus on ambidexterity. For structural ambidexterity, exploration, and exploitation are undertaken in different organizational units (O'Reilly and Tushman, 2004; Im and Rai, 2014). Temporal ambidexterity advocates a temporal sequence in pursuing exploration and exploitation one after another (Tushman and O'Reilly, 1996); in other words, exploration precedes exploitation (Benitez et al., 2018b), or vice versa. Contextual ambidexterity refers to managing contradictory activities within the same context (e.g., in a company) (Gibson and Birkinshaw, 2004).

SMEs are characterized by limited resources and may often have immature firm routines, processes, and administrative hierarchies. Therefore, pursuing structural ambidexterity might be difficult (Syed et al., 2021; Voss and Voss, 2013). These firms may not be able to create different business units to pursue exploration and exploitation separately. Similarly, temporal ambidexterity may not succeed in SMEs because of the fast industry clock speed (i.e., software, semiconductor, computer, and electronics), where the exclusive focus on IT exploration drains finances, while an exclusive focus on IT exploitation may lead to stagnant technology (Napier et al., 2011; Chandrasekaran et al., 2012). Therefore, the concept of contextual ambidexterity seems to be the most effective and natural approach for these firms, which guides our inquiry into the impact of IT ambidexterity on the performance of NPD.

2.2 IT ambidexterity: conceptualization and IS research opportunities

IT ambidexterity implies the application of the theoretical foundations of organizational ambidexterity to the context of the exploration and exploitation of IT resources and practices. Drawing on the prior IS work on agility and the implementation of digital options (Sambamurthy et al., 2003; Overby et al., 2006), we argue that IT exploration and IT exploitation enable the *reach* and *richness* of firm knowledge and processes. Reach refers to the enhancement and accessibility of resources, and richness refers to the quality of information (Overby et al., 2006). IT exploration allows firms to experiment with new IT resources and practices. It extends a firm's reach to invest

resources and managerial time to gain an understanding of different information technologies, to experiment with the most promising ones to learn about their functionalities, and to adopt the technologies most likely to have a positive impact on the current and future business initiatives (Bhatt and Grover, 2005). IT exploitation refers to the firm's ability to manage, leverage, and reuse existing IT resources and practices. It complements *richness* by accurate and efficient usage of existing IT resources to obtain business benefits (Montealegre et al., 2019; Magnusson et al., 2020). This conceptualization of IT ambidexterity is consistent with similar concepts studied in IS research. For example, Subramani (2004) focused on supplier ambidexterity, which refers to the supplier's ability to explore and exploit supply chain management systems. Leidner et al. (2011) studied the impact of ambidexterity in IT strategy (the simultaneous use of innovative and conservative IT strategies) on firm performance. Cao et al. (2013) introduced the concept of ambidexterity in IT outsourcing, which refers to the balance between the governance of contractual and relational IT outsourcing activities. Gregory et al. (2015) extended the analysis of IT ambidexterity by focusing on the impact of ambidexterity in IT transformation programs on the success of business transformation initiatives. They argued that ambidexterity in IT transformation programs balances key IT tensions (see Gregory et al., 2015). Finally, Mithas and Rust (2016) introduced the concept of ambidexterity for the strategic emphasis of IT (the balance between revenue expansion and cost reduction). They found that ambidexterity in the strategic emphasis of IT positively moderates the impact of IT investments on firm performance.

Although prior studies in this stream of research have conceptualized IT ambidexterity and provided some evidence about its impact on firm performance, there are two research opportunities in the existing literature. First, although the crucial challenge for organizations is to learn how to develop the simultaneous pursuit of exploring and exploiting IT resources and IT practices (Napier et al., 2011), it remains unclear how antecedents and contingency factors affect IT ambidexterity in SMEs. Prior studies have focused on the impact of IT capabilities on the development of contextual organizational ambidexterity (Kathuria and Konsynski, 2012), contextual knowledge ambidexterity (Benitez et al., 2018a), contextual inter-organizational relationship ambidexterity (Im and Rai, 2014), and temporal opportunity exploration and exploitation (Tushman and O'Reilly, 1996). Despite the plausible role that managerial activities and structural configuration may play in the development of IT ambidexterity (Montealegre et al., 2019), this research topic is under-theorized in IS research. Second, research on the plausible effect of the simultaneous pursuit of IT

exploration and exploitation on SMEs' focus on NPD performance (major shift versus minor improvement) remains scant. Existing studies have primarily focused on studying the effect of overall IT initiatives on either employee collaboration and NPD activities (e.g., Bala et al., 2017), or NPD dynamic and functional capabilities and NPD competitive advantage (Pavlou and El Sawy, 2006). Thus, the literature indicates a need for a more granular understanding of how managerial activities and structural configurations in SMEs influence IT ambidexterity and, subsequently, the potential impacts on NPD performance. This understanding can provide important insights to further develop the theory of IT ambidexterity within the context of SMEs.

2.3 Conceptualization of managerial activities

SMEs may have to allocate limited resources between supporting a major shift in their product focus (new products, markets, customers) or keeping their current product (with minor incremental improvements) in NPD projects. Similarly, enabling IT ambidexterity requires managing the underlying contradictions in IT exploitation and IT exploration activities at the same time. Such trade-offs trigger managerial responses to confront differing demands simultaneously and seek accommodation (Gregory and Keil, 2014, Lewis et al., 2002). Managerial activities represent the roles, behaviors, and skills of leaders (Salvato, 2009; Korica et al., 2017) and are characterized by the combined use of directive and participative activities following the conceptualization by Lewis et al. (2002) in the NPD context.[2] Directive managerial activities set out clear instructions, schedules, and guidelines for employees to ensure *clarity* of roles and enable a focus on the NPD project (Druskat and Wheeler, 2003; Lorinkova et al., 2013). For instance, Yun et al., (2005) show that directive activities lead to improved performance (patient care) through the assignment of specific actions for the handling of an emergency. Participative managerial activities facilitate *creativity* and improvisation by promoting interactive discussion, regular feedback, and flexibility to encourage the exploration of IT practices (He and King, 2008; Gregory and Keil, 2014). Jing et al. (2017) note that leaders in the R&D department of Volvo Cars actively use shared open rights and encourage diversity initiatives to foster employee participation in decision-making processes and facilitate creativity and innovation. A central argument for why managerial activities may

[2] Turner et al. (2016) identified five managerial actions (buffering, gap filling, integration, role expansion, and tone setting). Given the complex, multifaceted nature of these actions, our study focuses on the tone-setting (directive) and integration (participative) actions and draws on these features to distinguish between a directive and a participative managerial activity. Against this backdrop, we decided to use labels of activities to avoid any confusion with the more comprehensive managerial actions conceptualized in Turner et al. (2016).

benefit from the combined use of participative and directive activities is that these activities can complement one another (Gregory and Keil, 2014, Lewis et al., 2002), especially since NPD project goals and team composition are increasingly diverse in today's digital era (Gregory et al., 2015). In this regard, Lewis et al. (2002) argued that in *"our tough, dynamic, and demanding world, 'either/or' approaches are no longer viable"* and that *"today's challenges of fast change and uncertainty require 'both/and' approaches to thinking and working"* (p. 547). Similarly, Gregory and Keil (2014) identified that managing trade-offs in IS projects can be achieved by two IS project managers working in tandem, where one manager relies on a bureaucratic (directive) approach and the other uses a collaborative (participative) approach. Thus, theorizing and testing the combined use of participative and directive managerial activities by managers in SMEs offers a more practical rationale in this context. While theoretical studies and case examples depicted the interplay of the directive and participative managerial activities to enable organizational ambidexterity (Kang and Snell, 2009; Gregory and Keil, 2014) and manage the contradictions in NPD initiatives (Lewis et al., 2002), the empirical evidence remains scant. Thus, we theorize and test the role of the combined use of participative and directive managerial activities in trade-off situations when confronting ambiguities to enable IT ambidexterity.

3 HYPOTHESES AND THE PROPOSED RESEARCH MODEL

3.1 Managerial activities and IT ambidexterity

We argue that the combined use of directive and participative managerial activities can help SMEs enable IT ambidexterity. This expectation is grounded in the theoretical arguments that indicate that managers should *"employ ambidextrous resolution strategies to ensure short-term IT contributions and continuous progress of projects."* (Gregory et al. 2015, p. 57). Similarly, prior research suggests that developing IT ambidexterity requires the provision of both expert directions and strong social support (Napier et al., 2011). IT ambidexterity requires a simultaneous focus on IT exploitation and IT exploration, which can create uncertainty, ambiguity, and complexity (Mithas and Rust, 2016). The extant literature has identified that the lack of clear role definitions, assigned responsibilities, expertise, and clarity can result in confusion, stress, and reduced commitment, leading to failures (e.g., Windeler et al., 2017). Such situations may propel SME leaders to adopt directive activities that can reduce the inherent tensions derived from role ambiguities. Directive activities (formal authority) offer collective clarity about roles and

responsibilities by providing clear instructions to the firm's employees to reach assigned milestones (Lorinkova et al., 2013). The use of formal authority for resource allocation and decision-making facilitates the motivation, management, and monitoring of individuals (Druskat and Wheeler, 2003), which encourages employees to exploit IT and accomplish goals efficiently (Somech, 2006).

The unilateral approach in exercising directive activities is said to limit creativity and to focus more on the short-term benefits of exploitation (Syed et al., 2021, Voss and Voss, 2013). Therefore, a combination of directive and participative activities can be crucial for IT ambidexterity in SMEs. To evade the trap of short-term benefits of IT exploitation for the NPD process, SME leaders must also deploy participative activities to encourage IT exploration. Participative activities encourage the collection of diverse ideas through open communication and create a common vision in team agreements, resource distribution, and decision-making (Somech, 2006; Lorinkova et al., 2013). This vision allows leaders to refine their understanding of existing IT resources and practices and the associated problems in NPD initiatives. The sense of empowerment and authority through collaborative activities enhances employees' engagement in creativity and IT learning (IT exploration) (Wagner and Newell, 2007). For example, the development of the printer business at Hewlett-Packard emerged from participative managerial activities offering autonomy to the firm's employees in experimentation (Tushman and O'Reilly, 1996), representing approximately 21% of Hewlett Packard's revenue today (Hewlett Packard Enterprise, 2019). Managers can facilitate exploration and experimentation in SMEs through participative activities that allow open dialogue, ad hoc problem-solving, discussions, and information sharing, creating a pool of diverse ideas and opinions to explore (Druskat and Wheeler, 2003; He and King, 2008). SMEs with rich informal knowledge pools can facilitate learning and sensing about new information technologies that can be deployed in the firm.

The use of directive and participative managerial activities can enable *clarity,* reducing role ambiguities among employees for efficient IT exploitation, and *creativity,* encouraging employees' engagement to facilitate IT exploration, simultaneously. Florén (2006) identifies that in successful SMEs, managers need to have conceptual, communicative, and technical skills and the ability to combine them. Managerial activities in SMEs require a variety of skills because of the constant requirement to assume different roles and may have to alter their approaches in response to new resource allocations, changes in market demand, progress by competitors on similar projects, or novel technological breakthroughs. Hence, SMEs managers can use a combination of participative

and directive managerial activities by subtly adapting the use of these activities as per the contextual requirements of IT exploitation and IT exploration. Therefore, we hypothesize:

Hypothesis 1 (H1): *There is a positive relationship between the combined use of participative and directive managerial activities and IT ambidexterity in SMEs.*

3.2 IT ambidexterity and NPD performance

SMEs have limited resources, and the simultaneous pursuit of exploring and exploiting IT resources and practices (IT ambidexterity) can be critical to enabling the performance of NPD. The capacity to harmonize the exploitation and exploration of IT resources provides operational alignment (Tai et al., 2019), operational agility (Syed et al., 2020a), and operational ambidexterity (Lee et al., 2015), which can help SMEs to improve NPD performance. More specifically, IT exploitation, with efficient use of existing IT resources, bolsters SME's operational capabilities making them more efficient and accurate, which directly improves NPD project performance (Pavlou and El Sawy, 2006). IT exploration extends the firm's reach beyond existing operational constraints (Lee et al., 2015), preparing SMEs for future challenges by expanding their technological capabilities and enabling the development of future capabilities that are critical for innovations and long-term NPD performance.

We argue that the simultaneous pursuit of IT exploitation and IT exploration enhances NPD performance by improving the richness and reach of operational and IT capabilities for SMEs. IT exploitation enables *richness* in SMEs capabilities that stem from the accurate and efficient usage of existing IT resources and practices, to improve NPD projects and business performance (Overby et al., 2006). Richness in capabilities supports coordination and knowledge flow among internal and external firm entities (Overby et al., 2006). This enables the firm's operational capabilities to be more efficient and accurate, directly improving NPD project performance, such as time to market, customer satisfaction rate, market share, and profitability of the new products (Pavlou and El Sawy, 2006). The high-quality information that is timely, accurate, and customized supports the efficient use of operational capabilities to support NPD projects in adherence to schedules, budgets, quality, and product requirements (Hoang and Rothaermel, 2010).

IT exploration can affect the *reach* of SMEs capabilities that are beyond the limits of existing IT resources and practices (Overby et al., 2006). The reach in SMEs capabilities acts as a boundary-spanning capability that helps firms foresee major technological or new product development shifts,

allowing firms to stay ahead of their competition and evade the competency trap (Syed et al., 2020, Voss and Voss, 2013). The exploration of new IT resources and practices provides future operational and strategic capabilities that help avoid stagnation (Syed et al., 2021b, Voss and Voss, 2013) and improve NPD project and business performance (Pavlou and El Sawy, 2006), thus improving long-term NPD performance.

Moreover, SMEs with the capability to simultaneously exploit and explore IT resources can be well-positioned to resolve the trade-offs underlying NPD performance. For example, NPD time efficiency, product reliability, and quality standards can be achieved through the repeated use and continuous refinement of existing technology, whereas adaptations and modifications with novel technologies and experimentation may augment new product market development, competitive positioning, and shorter lead times. Consequently, SMEs with a higher level of IT ambidexterity are expected to be better able to deliver NPD performance success and generate opportunities for business development. We thus hypothesize the following:

Hypothesis 2 (H2): *There is a positive relationship between IT ambidexterity and NPD performance in SMEs.*

3.3 The moderating role of structural configuration

Investigating how structural configuration impacts the relationship between managerial activities and IT ambidexterity in SMEs is important because organizational barriers to innovative models (such as IT ambidexterity) are particularly relevant for SMEs, as these firms generally lack structured internal knowledge sharing, acquisition, and utilization (Varis and Littunen, 2010) and the nurturing of an innovation culture to exploit novel knowledge (Terziovski, 2010). Thus, our findings to uncover the confounding effects of structural configurations may inform practitioners about how better to align their managerial practices with structural configurations.

Structural configurations are conceptualized as specific patterns of organizational arrangements for planning, resource allocation, coordination, and control (Hales and Tamangani, 1996). They represent the repetitive set of actions that provide mechanisms to govern, coordinate, manage, and control the work processes (Feldman and Pentland, 2003). Prior research has distinguished between two fundamental types of structural configurations: formal (or mechanistic) and connectedness (or organic) (Jansen et al., 2006; Kang and Snell, 2009). Formal structural configuration adheres to the centralization of control and authority, extensive task specialization

and standardization, vertical lines of communication, and strict adherence to rules and procedures. Connectedness as a structural configuration is characterized by personal linkages between people through the decentralization of control and authority, open communication, and low levels of task standardization (Jansen et al., 2006). Our expectation that a firm's structural configurations can moderate the impact of managerial activities on IT ambidexterity is based on the fact that the routines, structures, and processes required for exploitation are different from those required for exploration activities (He and Wong, 2004). While exploration flourishes in an organic configuration and loosely coupled systems that support path-breaking behavior, exploitation prospers in a mechanistic configuration and tightly coupled systems that support path-refining behavior (Kang and Snell, 2009). The structural configuration that promotes IT exploration may contradict the one required to stimulate IT exploitation (Kang and Snell, 2009).

We expect formal structural configuration can reduce the impact of managerial activities on IT ambidexterity. Formal configurations encourage well-defined routines and established practices (Kang and Snell, 2009) that may hamper managerial activities in deviating from defined expectations and behavior, curbing decisions that induce change, exploration, and innovation (Menguc and Auh, 2010). Flexibility offers significant source of competitive advantage for SMEs over large firms (Qian and Li, 2003) and allows managers to frequently take on a variety of roles, constantly adapting to the needs of the business (Diskienė et al., 2018) for simultaneous pursuit of IT exploitation and exploration. Formal structural configurations in SMEs can often impose rigid guidelines and resist rapid change. Such rigidity can restrict managerial discretion and can hinder managers from swiftly responding to new technological opportunities or challenges, thereby affecting both IT exploitation and exploration (Menguc and Auh, 2010). SMEs typically operate with limited resources and formal structures often result in well-defined departmental boundaries (Hempel et al., 2012). This can limit cross-functional interactions, which are vital for sharing knowledge and insights across domains. Managers, confined within these structures, might miss out on holistic perspectives essential for IT ambidexterity. David Espeso (Global Lead Business Strategy of Findasense, a global IT consulting company) highlighted that "*a key success factor for ambidextrous companies is learning to unlearn the old patterns of the traditional structural configuration to learn the new ones based on the collaboration and permanent value creation for the whole system, and not only for the top of the pyramid*" (Mateos, 2020, p. 2). Managers operating within strict formal structures might develop a focused vision, emphasizing only on the tasks and

KPIs defined by the structure (Menguc and Auh, 2010). This can deter them from identifying peripheral IT opportunities in fast-changing IT industry, undermining their ability to balance IT exploitation and exploration effectively. While this structural configuration might optimize some managerial tasks (Terziovski 2010), it may simultaneously impede their agility in pivoting between IT exploitation and exploration. Therefore, we expect that the impact of managerial activities on IT ambidexterity in SMEs is, to some extent, curtailed by a formal structural configuration.

Hypotheses 3a (H3a): *The firm's formal structural configuration has a moderating (undermining) effect on the relationship between managerial activities and IT ambidexterity.*

Managerial activities are argued to have a power concentration in SMEs that limits the flow of information and represent a barrier to the search for external knowledge (Marín-Idárraga and González, 2021). In this regard, connectedness may amplify the effects of managerial activities on IT ambidexterity, as it provides the *flexibility* to enable IT exploration and facilitates *continued feedback* to pursue IT exploitation. Connectedness encourages group discussions, ad hoc meetings, and social integration, which promote negotiation, compromise, and collaboration between IT and business areas (Gulati and Puranam, 2009). This IT–business collaboration allows managerial activities to share the risk and responsibility for the effective application and development of IT capabilities (such as IT ambidexterity) (Bharadwaj, 2000; Hempel et al., 2012). Organizational connectedness provides an environment of social support in which IT and business personnel can generate solutions and discuss new ideas (Gulati and Puranam, 2009; Kang and Snell, 2009). The resulting tacit knowledge presents the informational resource for managerial activities to effectively manage IT (exploration and exploitation) functionalities (Bharadwaj, 2000; Napier et al., 2011).

Connectedness is more critical to SMEs because of the scarce resource base in these firms. A high level of connectedness can foster effective resource sharing and support managerial activities in enabling IT ambidexterity. SMEs are argued to have knowledge gaps and are more sensitive to uncertainties in technological developments and exogenous shocks (Miklian and Hoelscher, 2022). Connectedness creates a system of knowledge networks that enable leaders to exchange their IT and business knowledge to foster the implementation of existing IT resources and practices and anticipate the future IT requirements of the firm. This creates an environment for managerial activities to share and learn from the experiences of organizational members supporting IT

exploitation while providing the latitude and discretion needed for IT exploration. We thus hypothesize the following:

Hypotheses 3b (H3b): *The firm's connectedness has a moderating (reinforcing) effect on the relationship between managerial activities and IT ambidexterity.*

Figure 1 presents the proposed research model.

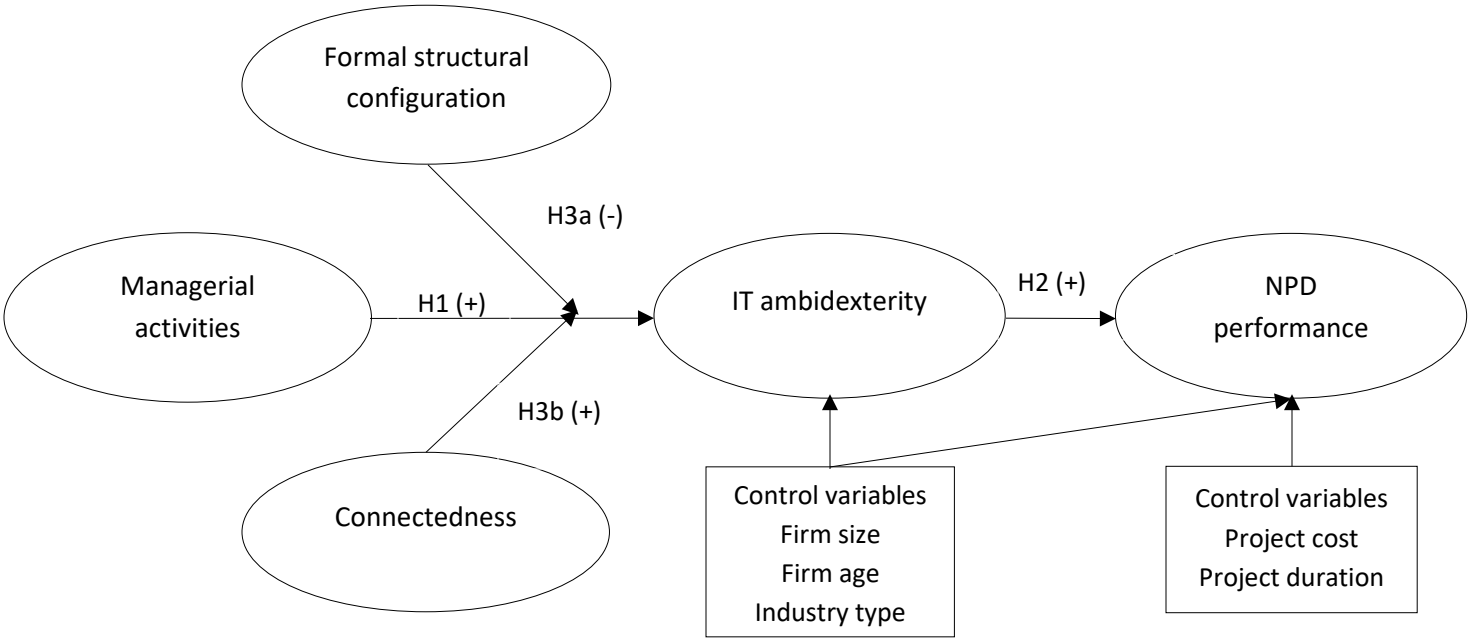


Figure 1: Hypothesized research model

4 RESEARCH METHODOLOGY

4.1 Empirical context

To test our proposed model empirically, we randomly selected 1,000 UK high-tech SMEs from the FAME database in the year 2015. The FAME database includes detailed information about 270,000 major private and public UK firms from a variety of sectors. Prior studies of high-tech SMEs in the UK that have used this database have reported good response rates to the questionnaire administration (Crick and Spence, 2005). This study focuses on the context of British high-tech SMEs. High-tech includes manufacturing and service firms in precision equipment, computers and electronics, control instruments, telecommunication, medical equipment and supplies, and optics apparatus. This context provides an appealing and critical setting to test the proposed research model for the following reasons. First, the British government has emphasized the development of

high-tech SMEs by introducing some strategic initiatives (i.e., Tech City, The Living Innovation) (Department for Business Innovation Skills, 2011). Besides, high-tech SMEs ranked ninth in the world in the 2009–13 Innovation Index (Economist Intelligence Unit, 2009). Second, SMEs account for 99.8% of all enterprises in the UK, and high-tech SMEs represent a 65.7% share of overall SME revenue (Department for Business Innovation Skills, 2011). Third, the British high-tech sector is one of the most important supply centers of high-tech products worldwide (Oke et al., 2007), and such a focus allows the spurious effects of the industry to be confounded (Stoel and Muhanna, 2009). Finally, because of the fast-paced technological changes, high-tech firms are required to develop mechanisms for NPD opportunities quickly to reap the desired benefits (Chandrasekaran et al., 2012). Given that IT ambidexterity and NPD success are more important in high-tech industries (Chandrasekaran et al., 2012; Syed et al., 2021), examining whether, and how, managerial activities enable IT ambidexterity to improve IT success in this sector potentially yields meaningful new insights.

4.2 Data collection

We adopted a survey questionnaire as the data collection instrument because secondary data were not available to evaluate the concepts under investigation. We pre-tested the clarity of the questionnaire with three senior scholars, and their feedback was used to refine the questionnaire. An external firm administered the online survey to ensure that the right respondents from the sampled firms were identified and approached. A multiple-respondent approach per firm was adopted to avoid the appearance of common method bias (Podsakoff et al., 2003). A top IT executive was targeted as the key respondent to complete the questions on IT ambidexterity. Based on prior IS research (Keil et al., 2013; Syed et al., 2021), to maximize the probability of succeeding, we asked IT executives to identify another two NPD respondents per firm. We asked the respondents (a manager and a member of the NPD project) to focus on one core NPD project[3] completed in the last 3 years to facilitate its evaluation in terms of formal structural configuration and connectedness, NPD performance, NPD project cost, NPD project duration, and managerial activities. The manager of the NPD project was the respondent targeted to complete the items on

[3] In the context of our study, core NPD project was referred to highlight the primary or most significant NPD project undertaken by the firm, which would have the most impact or significance for the firm's strategic goals and objectives. It is not based on spending level per se, but rather on the importance and strategic relevance of the project to the company.

formal structural configuration and connectedness, NPD performance, NPD project cost, and NPD project duration. A member of the core NPD project responded to the items on managerial activities. Furthermore, we checked the IP addresses to ensure that the three sections of the survey had been completed by different respondents. These survey data were collected from November 2015 until March 2016. Two reminder emails were sent to respondents who had not answered the questionnaire after the third and fifth weeks.

We received 314 questionnaires, of which 19 were removed from the dataset because they had missing values. Moreover, three questionnaires were also removed from the dataset because the respondents did not seem to be engaged, for example, giving the same value for every item. The skewness and kurtosis tests were plotted with a normal distribution curve for the remaining data to ensure that the sample was normally distributed. This data screening yielded 292 valid and complete questionnaires answered by 3 respondents per firm, representing an effective response rate of 29.2%. This sample size was deemed to be strong, especially compared to earlier IS studies using matched response data with sample sizes of 138 (Rustagi et al., 2008) and 146 (Syed et al., 2021). Data on firm size, firm age, and industry (control variables) were collected from the FAME database. Table 1 presents the key characteristics of the firms included in the sample.

Before data collection, we performed a statistical power analysis to calculate the minimum required sample size to be able to estimate the proposed model (Benitez et al., 2020). Anticipating a conservative small effect size ($f^2 = 0.08$), a desired statistical power level of 0.95, six predictors (the number of paths received by NPD performance), and a confidence level of 0.01, the minimum required sample size was 268. Our sample size was 292, which provided sufficient statistical accuracy to detect the effects of interest existing in the population (Benitez et al., 2020).

Table 1: Characteristics of firms of the sample

Characteristics		**Frequency**	**Percent**
Firm size	Small (up to 49 employees)	160	54.79
	Medium (between 50 to 249 employees)	132	45.20
Firm age	Up to 5 years	35	11.98
	Between 5 and 10 years	71	24.32
	Between 10 and 15 years	84	28.76
	More than 15 years	102	34.93
Industry	Manufacturing	167	57.19
	Service	125	42.80
NPD project cost	Up to 10,000 GBP	131	44.86
	Between 10,001 and 50,000 GBP	108	36.98
	Between 50,001 and 100,000 GBP	36	12.33

	More than 100,000 GBP	17	5.82
NPD project duration	Up to 12 months	103	35.27
	Between 13 to 24 months	148	50.68
	More than 25 months	41	14.04

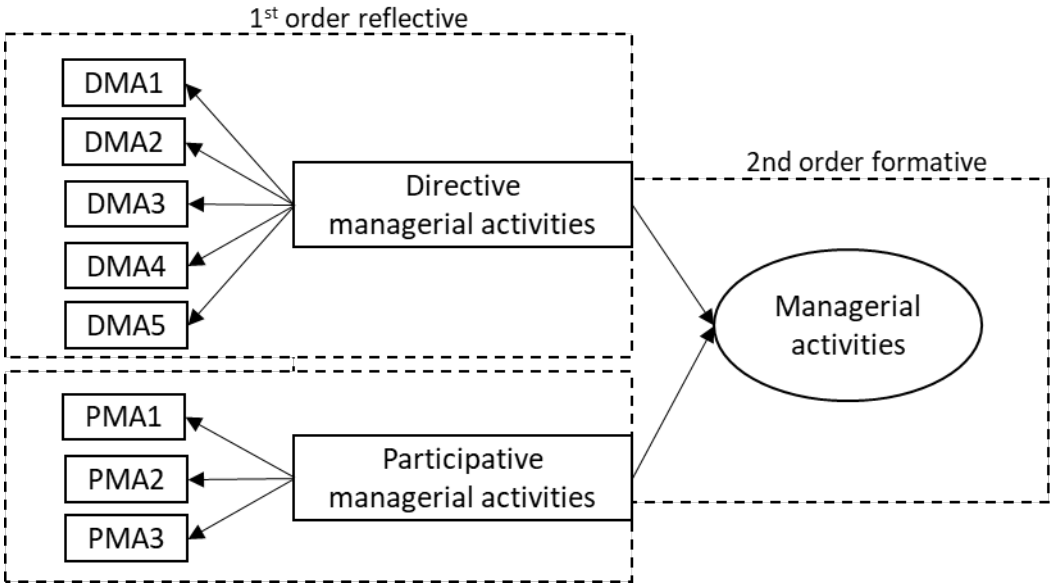
After data collection, to detect the potential effects of late-response and non-response bias, we examined the differences between early and late respondents, and respondents and non-respondents. All plausible statistical t-tests based on the demographic characteristics of the firms between these groups displayed no patterns of significant differences, indicating that late-response bias and non-response bias were not a problem in the data collection (Pavlou and El Sawy, 2006).

4.3 Measures

All the measures were adapted from existing scales in the prior literature to ensure content validity, and all measurement items were rated on five-point Likert scales with "strongly disagree" and "strongly agree" anchors.

Managerial activities: Directive and participative managerial activities were measured reflectively with five and three items, respectively. The items of directive managerial activities assess the extent to which managers provide schedules, definite standards, uniform procedures, clear instructions, and clear expectations to provide *clarity*. The items of participative managerial activities assess the extent to which managers provide feedback, suggestions, advice, and consultation to highlight the mechanism of encouraging *creativity*. All items were based on the studies by Schriesheim and Kerr (1974) and Lewis et al. (2002) and were iteratively refined for clarity and focus based on discussions with three senior IS scholars during the survey pre-test (Appendix Table A1). We proposed the combined use of participative and directive managerial activities to enable IT ambidexterity in this research, which was operationalized as a reflective–formative second-order construct. Figure 2 below shows a reflective–formative second-order operationalization.

Figure 2: Representation of reflective-formative second-order operationalization



IT ambidexterity: Aligned with the dominant operationalization of ambidexterity construct in the prior research (i.e., Gibson and Birkinshaw, 2004; Lee et al., 2015), IT ambidexterity was operationalized as a multiplicative interaction between the first-order constructs of IT exploration and IT exploitation. Some studies also modeled ambidexterity as a formative construct (i.e., Benitez et al., 2018b; Syed et al., 2020); therefore, we also considered an alternative operationalization of IT ambidexterity (i.e., as a two-dimensional second-order construct in a reflective–formative type) in our robustness analysis.

IT exploration and IT exploitation constructs were measured reflectively with five and four items, respectively. IT exploration was measured by assessing the extent to which firms encourage innovation, experimentation, the generation of new knowledge, the acquisition of new resources and practices, and the introduction of innovative ideas to highlight the focus on *reach* in IT practices and resources. The IT exploitation scale assesses the extent to which firms refine existing IT practices and resources, reuse existing IT skills, and leverage existing IT channels to highlight the focus on *richness* in IT practices and resources. The scales for IT exploitation and IT exploration were adapted based on the studies by Jansen et al. (2006) and Lee et al. (2015), and were iteratively refined for clarity and focus based on discussions with three senior IS scholars during the survey pre-test (Appendix Table A1).

Structural configuration: Formal structural configuration and connectedness were measured reflectively with three and four items, respectively. The three-item scale for formal structural configuration measures the extent to which firms' processes are characterized by rules and procedures, hierarchy, and adherence to formal procedures. Connectedness is characterized by personal linkages between people and entails the overall social relationships in the firm (Jansen et al., 2006). The three-item scale for connectedness measures the extent of opportunities for informal hall talk and accessibility to knowledge sources within organizational units. The scales for formal structural configuration and connectedness were adapted based on the studies by Jansen et al. (2006) and Hempel et al. (2012), and were iteratively refined for clarity and focus based on discussions with three senior IS scholars during the survey pre-test (Appendix Table A1).

NPD performance: We operationalized NPD performance as a reflective–formative second-order construct based on reflective first-order constructs of NPD project performance and NPD business performance. NPD project performance was assessed by adapting the scale of Wei et al. (2014), which evaluates the effectiveness of NPD project work relative to pre-defined goals for time, budget, costs, quality, and standards. NPD business performance was measured through the adoption of Pavlou and El Sawy's (2006) scale, which measures the extent to which NPD has influenced business performance relative to key competitors.

Although the self-reported measures of NPD performance are criticized for subjectivity, such measures provide an accurate estimate because archival accounting ratios are not readily available at the NPD level (Pavlou and El Sawy 2006). Following the methodological approach adopted by Pavlou and El Sawy (2006), we collected archival data at the firm level to validate self-reported NPD performance. The correlation of three accounting measures (return on assets, or ROA, return on sales, or ROS, and sales growth, or SG) were correlated with NPD measures. ROA, considered a proxy for process efficiency, measures the ratio of net operating income over average total assets. ROS, a proxy for product quality, measures the ratio of net operating income over sales. SG, which is considered an indicator of market acceptance of new products, measures the rate of change in sales. The three accounting measures were captured directly from the Bloomberg and DataStream databases and correlated highly with the subjective NPD performance ratings collected from project managers ($r = 0.44$, $p < 0.05$; $r = 0.39$, $p < 0.05$; and $r = 0.62$, $p < 0.05$), providing external validity to the latter. The strong correlations also evidence that the NPD projects in this study represent critical projects for SMEs.

4.4 Control variables

We controlled for firm size, firm age, and industry on IT ambidexterity and NPD performance These variables have traditionally been included in IS research on these variables (Lee et al., 2015; Syed et al., 2020a). Firm size was measured as the natural logarithm of the average number of full-time employees, and firm age was measured as the natural logarithm of the number of years the firm had been operating (Syed et al., 2020b). A dummy variable (0: manufacturing firm, 1: service firm) was used to control for industry effect (Benitez et al., 2018b). NPD project size can influence the firm's NPD performance, and larger NPD projects are more likely to have a higher cost and longer duration (Syed et al., 2021). Thus, we also controlled NPD performance for NPD project cost and duration.

5 EMPIRICAL ANALYSIS AND RESULTS

We empirically tested the proposed research model running a partial least squares (PLS) path model, a variance-based structural equation modeling (SEM) technique. The choice of PLS-SEM was appropriate given that our research model includes second-order constructs of a reflective–formative type and PLS-SEM provides a better estimate for composite constructs (Henseler et al., 2014; Sarstedt et al., 2016). The PLS estimate enables the empirical testing of conceptual models in both confirmatory and explanatory IS research (as in this study) through the use of an overall evaluation of the fit of the saturated and estimated models (Benitez et al., 2020a). Moreover, PLS-SEM is a well-known and commonly adopted data-analysis approach in IS (Benitez et al., 2020; Syed et al., 2021). We used the statistical software package Advanced Analysis for Composites (ADANCO) 2 Professional (Henseler and Dijkstra, 2015).

5.1 Evaluation of the measurement model

We evaluated our measurement model by following established methodological procedures (i.e., Becker et al., 2012; Hair et al., 2017). To ensure the reliability of our first-order reflective measures, we analyzed the item loadings, which were all above the recommended threshold of 0.7 (Hair et al., 2017). In construct reliability and convergent validity, Cronbach's alpha (CA), average variance extracted (AVE), and composite reliability (CR) values exceeded the suggested threshold of 0.7, 0.5, and 0.8, respectively. Appendix Table A1 presents the item loadings, CA, AVE, and CR values. Furthermore, the loadings of each construct item were greater than the cross-loadings

on other constructs (Appendix Table A3), while the square root of each first-order construct's AVE score was greater than the highest correlation with any other construct (Appendix Table A2), thus establishing discriminant validity (Fornell and Larcker, 1981). Table 2 presents the correlations among our key constructs in the structural model. In an alternate approach to assessing discriminant validity, we also examined the heterotrait–monotrait (HTMT) ratio of construct correlations, which remained below the recommended threshold of 0.9 (Appendix Table A3).

The second-order constructs of managerial activities and NPD performance were assessed following MacKenzie et al.'s (2011) guidelines for the validation of reflective–formative second-order constructs. First, the adequacy coefficient R^2_a for each second-order construct was calculated (Edwards, 2001) to check whether most of the variance in the first-order constructs was shared with their corresponding second-order construct (MacKenzie et al., 2011). R^2_a scores for managerial activities (0.55) and NPD performance (0.59) exceeded the recommended threshold of 0.5 (MacKenzie et al., 2011). Second, the weights of dimensions (Appendix Table A1) for all second-order constructs were significant (Hair et al., 2018). Finally, all variance inflation factor values (ranging from 1.613 to 3.174) were below the cut-off value of 10 (Rueda et al., 2017), indicating no issues with multicollinearity.

Finally, we performed the confirmatory composite analysis to test the adequacy and external validity of our reflective-formative second-order constructs. The confirmatory composite analysis checks the adequacy of the structure of composite measurements by comparing the empirical correlation matrix with the model-implied correlation matrix of the saturated model (Henseler et al., 2014). This comparison provides three discrepancies between the two matrixes: standardized root-mean-squared residual (SRMR), unweighted least squares (ULS) discrepancy (d_{ULS}), and the geodesic discrepancy (d_G) (Rueda et al., 2017). SRMR should be lower than 0.080, and all the HI_{95} (or HI_{99}) values should be greater than the values of the three discrepancies (Benitez et al., 2020). Table 3 presents the results of the confirmatory composite analysis for the reflective-formative second-order constructs. This analysis suggested that neither model should be rejected based on an alpha level of 0.05, since all discrepancies were below the 95% quantile of the bootstrap discrepancies, which indicates that, with a 5% probability, our structure of composite measures was correct.

Table 2: Correlation matrix

Construct	1	2	3	4	5	6	7	8	9	10
1. Managerial activities	1.00									
2. IT ambidexterity	0.44**	1.00								
3. Formal configurations	0.22**	0.14**	1.00							
4. Connectedness	0.28**	0.12**	0.09	1.00						
5. NPD performance	0.24**	0.19***	0.12*	0.06	1.00					
6. Firm size	0.40**	0.23**	0.16**	0.17*	0.09	1.00				
7. Firm age	0.06	-0.03	0.01	0.11	-0.02	0.19**	1.00			
8. Industry	-0.06	-0.08	-0.09	0.02	0.01	0.03	0.07	1.00		
9. NP project cost	0.23**	0.10*	0.11	0.24**	-0.01	0.12*	0.04	0.13*	1.00	
10. NP duration	0.06	-0.11	0.10	-0.09*	-0.05	0.29**	0.30**	-0.05	0.43**	1.00
*p < 0.05, **p < 0.01, ***p < 0.001										

Table 3: Results of the confirmatory composite analysis

Discrepancy	Second-order level		
	Value	HI_{95}	Conclusion
SRMR	0.045	0.087	Supported
d_{ULS}	1.155	3.466	Supported
d_G	4.093	6.118	Supported

5.2 Testing hypotheses

To test our research hypotheses, we created the multiplicative interaction variables (IT ambidexterity) using a two-stage approach (Fassott et al., 2016), and tested the proposed research model by performing a PLS path modeling with a bootstrapping of 4,999 subsamples. We estimated four models: the baseline model and models 1–3. The baseline model presents the relationships proposed in H1 and H2 and includes the control variables on IT ambidexterity and NPD performance. Model 1 adds to the baseline model a link between formal structural configuration and IT ambidexterity, and the interaction term between managerial activities and formal structural configuration. In model 2 we added to the baseline model a link between connectedness and IT ambidexterity, and the interaction term between managerial activities and connectedness. Model 3 accumulates all of the links added to the baseline model in models 1 and 2, to test H3a and H3b. The empirical analysis provided support for H1 and H2. We found that managerial activities enable the development of IT ambidexterity ($\beta = 0.421$, $p < 0.001$) and that IT ambidexterity improves NPD performance ($\beta = 0.334$, $p < 0.001$). Table 4 presents the results of the hypotheses testing.

We adopted the two-stage approach to estimate the interaction effects and to test H3a and H3b included in models 1–3. This approach is recommended in the case of the proposed research model, as it avoids potential multicollinearity problems (Fassott et al., 2016). This approach is

similar to the estimation of second-order constructs, as in the second stage the interaction term is estimated by multiplying the construct scores obtained in the first stage (Fassott et al., 2016; Benitez et al., 2020). The empirical analysis provided support for H3b ($\beta = 0.165^{*}$, $p < 0.05$) but not for H3a ($p > 0.10$), which highlights the supremacy of connectedness on formal structural configurations in SMEs. These results are consistent in models 1–3. As per the control variables, the effects of firm size ($\beta = 0.212^{***}$) and firm age ($\beta = 0.056^{\dagger}$) on IT ambidexterity, and NPD project cost ($\beta = -0.116^{\dagger}$) on NPD performance, were significant.

Table 4: Results of the PLS path modeling

Beta coefficient	**Baseline model**		**Model 1**		**Model 2**		**Model 3**	
Managerial activities → IT ambidexterity (H1)	0.421*** (8.545)		0.414*** (8.398)		0.417*** (8.466)		0.412*** (8.390)	
IT ambidexterity → NPD performance (H2)	0.334*** (4.789)		0.333*** (4.784)		0.344*** (4.788)		0.332*** (4.781)	
Formal structural configuration → IT ambidexterity			0.086 (1.023)				0.079 (1.016)	
Managerial activities * Formal structural configuration → IT ambidexterity (H3a)			-0.124 (-1.725)				-0.116 (-1.687)	
Connectedness → IT ambidexterity					0.119** (2.898)		0.116** (2.264)	
Managerial activities * Connectedness → IT ambidexterity (H3b)					0.165* (2.115)		0.144* (2.018)	
Firm size → IT ambidexterity (control variable)	0.212*** (3.189)		0.212*** (3.194)		0.214*** (3.196)		0.213*** (3.189)	
Firm age → IT ambidexterity (control variable)	0.056† (1.126)		0.048† (1.122)		0.064† (1.34)		0.058† (1.130)	
Industry → IT ambidexterity (control variable)	-0.028 (-0.616)		-0.028 (-0.725)		-0.020 (-0.601)		-0.025 (-0.605)	
Firm size → NPD performance (control variable)	0.031 (0.328)		0.033 (0.329)		0.031 (0.328)		0.032 (0.327)	
Firm age → NPD performance (control variable)	0.068 (0.886)		0.068 (0.886)		0.069 (0.886)		0.068 (0.886)	
Industry → NPD performance (control variable)	0.006 (0.078)		0.005 (0.078)		0.004 (0.078)		0.005 (0.078)	
NPD project cost → NPD performance (control variable)	-0.086† (-1.056)		-0.087† (-1.056)		-0.088† (-1.056)		-0.086† (-1.056)	
NPD project duration → NPD performance (control variable)	-0.085 (-1.710)		-0.084 (-1.710)		-0.085 (-1.710)		-0.085 (-1.710)	
Endogenous variable	**R^2**	**Adj. R^2**	**R^2**	**Adj. R^2**	**R^2**	**Adj. R^2**	**R^2**	**Adj. R^2**
IT ambidexterity	0.492	0.469	0.474	0.453	0.522	0.505	0.554	0.530
NPD performance	0.156	0.134	0.156	0.134	0.168	0.146	0.168	0.146

Note: t-values in parentheses. Bootstrapping 95% confidence interval bias-corrected (based on 4,999 subsamples). †p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001, one-tailed test.

The R^2 values were indicative of the explanatory power of a model. From the baseline model to model 3, the adjusted R^2 values ranged from 0.134 to 0.530, indicating moderate to strong

explanatory power (Chin, 2010). The effect size (f^2) values for the supported hypotheses ranged from 0.112 to 0.462, which indicates a medium to large effect size of our hypothesized relationships (Benitez et al., 2020). Moreover, we evaluated the overall fit for the estimated model by calculating and examining the three discrepancies previously mentioned in the confirmatory composite analysis (Henseler et al., 2014), which was crucial to test if the proposed research model was correct. The three discrepancies were below the 95% quantile of the bootstrap discrepancies, suggesting that the proposed research model was strong enough to explain and test our hypothesized relationships.

5.3 Mediation analysis

Based on Zhao et al.'s (2010) methodological approach, we performed a mediation analysis to examine the significance of the indirect effect of managerial activities on NPD performance through IT ambidexterity. To estimate this indirect effect, we added to the baseline model a direct path between managerial activities and NPD performance. This indirect effect was 0.413^{***}, and the direct effect was 0.158^{*}, giving a total effect of 0.572^{***}. This mediation analysis offers additional support to hypotheses 1 and 2.

Since connectedness moderates one of the paths in our mediation model, we tested for moderated mediation. To ascertain the moderated mediation effect, we followed the methodological suggestions of Edwards and Lambert (2007). A high connectedness group (with connected values greater than one standard deviation above the mean, n=84) and a low connectedness group (with SIC values lower than one standard deviation below the mean, n=76) were used to compare the conditional values of the entire indirect path (see also Lee et al. (2015)). The results revealed that indirect effects were statistically significant under high and low connectedness, however, the significance level was much stronger (0.44, $p<0.001$, $t=8.457$) when connectedness was high as compared to when connectedness was low (0.09, $p<0.10$, $t=1.994$). The results indicate a moderated mediation effect suggesting connectedness strengthens the mediated relationship between managerial activities and NPD performance, such that the mediation effect is stronger when connectedness is high.

5.4 Prevention and testing of common method variance

We made every possible effort to prevent the appearance of common method variance in the data collection by following the guidelines of Podsakoff et al. (2003), that is, ensuring anonymity to

respondents, informing them that there were no right or wrong answers, using multiple respondents per firm, and using randomly organized items in the questionnaire.

We checked for the appearance of potential common method variance by performing the marker variable test (Lindell and Whitney, 2001) and pairwise correlation analysis (Bagozzi et al., 1991). First, Lindell and Whitney (2001) suggested using a theoretically unrelated marker variable to adjust correlations among the key constructs. A high correlation between any of the key constructs and the marker variable would indicate the possible presence of common method variance. We used the average respondent's level of education as a marker variable, which revealed a low correlation with the dependent variables.[4] The addition of the marker variable showed that the differences between adjusted and unadjusted correlations were minimal and did not affect the significance level of the results of the empirical analysis. Second, prior research argues that high correlations between constructs ($r > 0.800$) may indicate common method variance (Queiroz et al., 2018). Our pairwise correlation matrix (Table 3) shows 0.445^{**} to be the highest correlation among the principal constructs. Finally, previous studies revealed that the presence of common method variance in data can undermine the significance level of interaction coefficients (Siemsen et al., 2010). The significant moderation effect of H3b indicated that common method variance was not a concern in our analysis.

5.5 Robustness test

Our structural model operationalized IT ambidexterity capability as the multiplicative interaction of IT exploitation and IT exploration constructs. We also validated our hypotheses using an alternate approach to operationalize IT ambidexterity as a reflective-formative second-order construct. The alternate operationalization yielded consistent results for our hypotheses. Furthermore, to facilitate the interpretation of the moderation results and gain additional insights, we prepared interaction plots to visualize the interactive effects hypothesized in H3b (see Appendix Figure A1). Consistent with H3b, the first interaction plot shows that high levels of connectedness amplify the effect of the combined use of participative and directive managerial activities on IT ambidexterity.

[4] We used the average level of education of the three respondents per firm. We also checked this analysis by using the average level of education of the first, second, and third respondent, and the results were similar. The level of education was measured by asking the respondents the level of education using the following scale: 1: no formal education, 2: high-school diploma, 3: vocational training, 4: Bachelor/Master degree, 5: professional degree, 6: doctoral education.

5.6 Post hoc analysis

To further explain the effects of managerial activities on IT ambidexterity and to understand the moderating role of configurations, we re-ran our model using first-order constructs of managerial activities. The results (Table 6) show that both directive and participative managerial activities enable IT ambidexterity. However, the enabling effect of directive managerial activities is more pronounced in high formal structural configurations (Table 6, Models 3 and 5), whereas the enabling effect of participative managerial activities is more beneficial under high connectedness (Table 6, Models 4 and 5). Table A2 in the Appendix presents the plot for significant moderation effects.

Table 6: Results for the first-order constructs of managerial activities

	IT Ambidexterity					**NPD Performance**
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Directive (DIR)		0.244**	0.246**	0.242**	0.242**	0.125*
		(0.0511)	(0.0511)	(0.0520)	(0.0526)	(0.0517)
Participative (PAR)		0.327***	0.325***	0.326***	0.325***	0.107*
		(0.0592)	(0.0588)	(0.0591)	(0.0588)	(0.0495)
Formal (FSC)			0.0908		0.0804	
			(0.0441)		(0.0427)	
DIR x FSC			0.0664*		0.0640*	
			(0.0420)		(0.0414)	
PAR x FSC			-0.106		-0.085	
			(0.0140)		(0.0132)	
Connectedness (C)				0.135**	0.136**	
				(0.0459)	(0.0464)	
DIR x C				0.0537	0.0515	
				(0.0496)	(0.0492)	
PAR x C				0.0812*	0.0758*	
				(0.0540)	(0.0535)	
IT ambidexterity						0.428***
						(0.0697)
Controls						
Firm size	0.289***	0.220***	0.222***	0.244***	0.219***	0.0636
	(0.0697)	(0.0688)	(0.0692)	(0.0690)	(0.0695)	(0.0494)
Firm age	0.0728*	0.0537	0.0540	0.0636	0.0634	0.0412*
	(0.0536)	(0.0496)	(0.0497)	(0.0494)	(0.0489)	(0.0525)
Industry	0.00309	0.00445	0.000737	0.00308	0.00683	0.00284
	(0.0231)	(0.0229)	(0.0227)	(0.0224)	(0.0230)	(0.0228)
NPD project cost						0.079**
						(0.0586)
NPD project duration						0.0435
						(0.0132)
Observations	292	292	292	292	292	292

R-squared	0.156	0.328	0.344	0.357	0.388	0.486
Adjusted R-square	0.143	0.284	0.328	0.334	0.362	0.462
F value		15.42	7.64	7.71	8.36	
Note: Standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1						

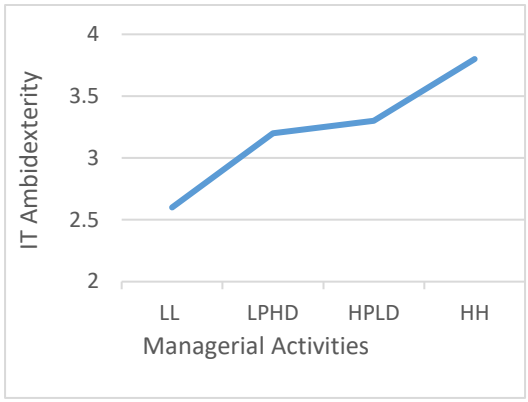
Prior studies (i.e., Cao et al., 2009) note that ambidexterity has a positive effect on performance when a firm's size exceeded 87 employees. To this end, we further analyzed our model in a split sample of small (less than 50 full-time employees) and medium-sized firms (between 49 to 250 full-time employees). Our results provide clear evidence of the strong positive influence of IT ambidexterity on NPD performance irrespective of firm size (Table 7). Moreover, the split sample results (Table 7) show that directive managerial activities have a more pronounced effect than participative managerial activities when enabling IT ambidexterity in small firms, and this effect is strengthened by formal structural configurations (Table 7, Model 2). Whereas participative managerial activities have a more dominant effect when enabling IT ambidexterity in medium firms, connectedness further strengthens participative managerial activities (Table 7, Model 5). Finally, the combined use of a participative and directive managerial activities construct shows a higher enabling effect on IT ambidexterity than either of the managerial activities alone in both small and medium-sized firms, and is further strengthened by connectedness (Table 7, Models 1 and 4).

Table 7: Split-sample analysis using first- and second-order constructs of managerial activities

	Small firms			**Medium firms**		
VARIABLES	**IT ambidexterity**		**NPD performance**	**IT ambidexterity**		**NPD performance**
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Directive (DIR)		0.268**	0.111**		0.125*	0.0657*
		(0.0553)	(0.0522)		(0.0517)	(0.0501)
Participative (PAR)		0.147**	0.0841		0.252***	0.119
		(0.0514)	(0.0179)		(0.0568)	(0.0485)
Managerial activities (MA)	0.327***			0.313***		
	(0.0596)			(0.0582)		
Formal (FSC)	0.0663	0.0781*		0.0461	0.0435	
	(0.0421)	(0.0496)		(0.0184)	(0.0132)	
DIR x FSC		0.0922*			-0.0608	
		(0.0504)			(0.0156)	
PAR x FSC		-0.161			-0.194	
		(0.0158)			(0.0164)	
MA x FSC	0.0553			0.0334		
	(0.0369)			(0.0401)		
Connectedness (C)	0.111*	0.0797		0.109*	0.107*	
	(0.580)	(0.131)		(0.580)	(0.0575)	

DIR x C		0.0503			0.0433	
		(0.0139)			(0.0461)	
PAR x C		0.0680			0.113**	
		(0.0136)			(0.0512)	
CMA x C	0.150**			0.129*		
	(0.0518)			(0.0521)		
IT ambidexterity			0.264***			0.387***
			(0.0551)			(0.0644)
Observations	160	160	160	132	132	132
R-squared	0.224	0.315	0.288	0.154	0.221	0.232
Adjusted R-square	0.202	0.296	0.265	0.137	0.206	0.214
Note: Standard errors in parentheses, *** p< 0.01, ** p < 0.05, * p < 0.1						

The sample for each of the managerial activities was categorized as low (score ≤ 2.50) and high (score > 2.50) and four combination groups were created for different levels of managerial activities as (1) low participative low directive (n=51), (2) low participative high directive (n = 74), (3) high participative low directive (n = 62), and (4) high participative high directive(n = 105). We examined and plotted the means for these combinations of participative and directive managerial activities against IT ambidexterity (Figure 3a). A similar approach was used to examine the combination groups for IT exploration and IT exploitation against NPD performance (Figure 3b) to gain further insights. We tested the comparisons among the groups using one-way ANOVA tests. Only the high–high combination groups showed significant mean differences ($p < 0.05$) from other combination groups for both IT ambidexterity and NPD performance. It is also interesting to note that the higher participative and lower directive activities showed higher IT ambidexterity mean values for SMEs than lower participative and higher directive activities. Similarly, higher IT exploitation and lower IT exploration showed a higher mean value for NPD performance than lower IT exploitation and higher IT exploration.



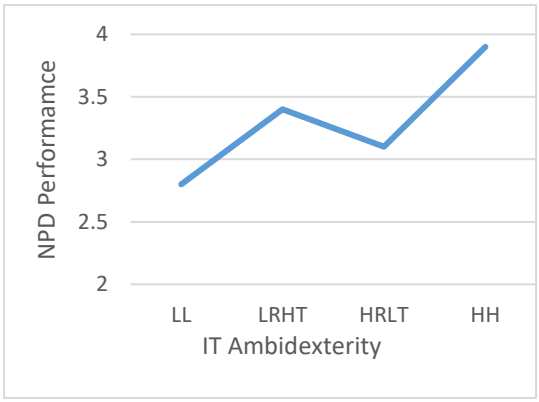


Figure 3a: Means for different combinations of participative and directive managerial activities Note: LL = low–low (n = 51), LPHD = low participative high directive (n = 74), HPLD = high participative low directive (n = 62), HH = high–high (n = 105)	**Figure 3b:** Means for different combinations of IT exploitation and exploration activities Note: LL = low–low (n = 58), LRHT = low exploration high exploitation (n = 75), HRLT = high exploration low exploitation (n = 72), HH = high–high (n = 87)

6 DISCUSSION

Our study provides empirical evidence on the role of managerial activities in enabling IT ambidexterity, as well as validating the effects of IT ambidexterity on NPD performance in SMEs. Specifically, using multiple respondents' data from 292 high-tech SMEs, we found that participative and directive managerial activities (in combination and individually) positively influence IT ambidexterity. Our post hoc findings suggest that directive managerial activities are more dominant in small firms and are supported by formal structural configurations in enabling IT ambidexterity. Participative managerial activities are more profound in medium-sized firms, and connectedness strengthens its influence in enabling IT ambidexterity. Finally, we found a positive impact of IT ambidexterity on NPD performance in both small and medium-sized high-tech firms. The results of our study contribute to the IS literature by offering support for the importance of managerial activities that effectively address digital-era management challenges in developing key IT capabilities and realizing business performance. In the following section we discuss our study's theoretical and practical implications in light of the extant research, followed by a discussion of its limitations and related avenues for future research.

6.1 Implications for Theory

Our contribution to IS research is threefold. First, considering NPD management challenges ushered in by the digital era, we contribute to validating the conceptual arguments (Gregory et al., 2015; Mithas and Rust, 2016) that IT ambidexterity ensures the strategic implementation of IT resources to achieve a business benefit. Extant research on IT ambidexterity strongly advocates its performance effects for larger firms (i.e., Lee et al., 2015; Liang et al., 2022); however, the performance implications remain less clear for SMEs. For instance, examining a sample of technology firms, Cao et al. (2009) identified that ambidexterity had a positive effect on performance when the firm size exceeded 87 employees. Similarly, Voss and Voss (2013) observed in the theater industry that smaller firms had greater difficulty managing the paradoxes and realizing the benefits of an ambidexterity capability. They speculated that resource dependency

might control threshold levels for the contingent effect of firm size on the organizational ambidexterity–performance relationship.

Our baseline model and post hoc split sample findings do not find any evidence of the firm size threshold as the boundary condition for the effect of IT ambidexterity on NPD performance. This could be because firms require substantial time and experience to develop and realize the benefits of contextual ambidexterity (Van Looy et al., 2005), suggesting that firm age can play a significant role that may overcome the firm-size threshold limitations. The average age of our sampled SMEs was 13.75 years, indicating that the firms may have developed and possessed the experience and knowledge in this extended time frame that is required to implement and benefit from IT ambidexterity. Future research can explicitly examine threshold levels for the contingent effects of firm age on the ambidexterity–performance relationship to derive theoretically and managerially interesting findings.

Second, we explain the mechanisms through which managers can enact IT ambidexterity in SMEs. Prior research has extensively argued for the importance of managerial activities in realizing ambidexterity capability; however, conceptualization and clarity about the actions of managers remain unclear. For instance, "*what is missing is a clear articulation of those specific managerial actions that facilitate the simultaneous pursuit of exploitation and exploration*" (O'Reilly and Tushman 2011, p. 8). Similarly, Turner et al. (2016, p. 200) noted that "*the literature does not fully explore the detailed actions by which managers may achieve ambidexterity.*" Resonating with, and extending, the research on the role of managerial activities, we contribute to conceptualizing and empirically testing managerial activities in SMEs as an enabling mechanism for IT ambidexterity. This study identifies that participative, directive and a combination of both managerial activities enable IT ambidexterity in SMEs. Although the managerial activities may achieve the same end, the mechanisms or ways they do this are quite different. Participative managerial activities offer a creativity opportunity by developing an NPD team member's sense of autonomy and responsibility. Directive managerial activities provide clarity with guidance regarding goals, the means of achieving these goals, performance standards, monitoring, and appropriate feedback. A key theoretical implication of these findings is to extend our understanding of the nature of mechanisms that facilitate managerial activities to enable an ambidextrous orientation for NPD performance in SMEs. This points to promising avenues for future work to explore the required skills, capabilities, and personalities to exercise effective managerial activities.

Relatedly, the notion of the combined use of two contrasting participative and directive activities by managers in terms of contextual ambidexterity (Gibson and Birkinshaw, 2004) can be beneficial, particularly to SMEs. While large firms may have the resources (i.e., multiple managers working together or in tandem) to exercise different activities to enable ambidexterity (Gregory and Keil, 2014; Montealegre et al., 2019), SMEs face the liabilities of smallness; a higher risk of failure is associated, in part, with the lack of resources and capabilities, and they are forced to reallocate resources carefully and skillfully. The conceptualization of combined use of participative and directive managerial activities in the SME context gives further credence to the theoretical arguments of Lewis et al. (2002) that in "our tough, dynamic, and demanding world, 'either/or' approaches are no longer viable" and that "today's challenges of fast change and uncertainty require 'both/and' approaches to thinking and working" (p. 547). This is particularly true for SMEs in today's digital era, where technological breakthroughs, NPD goals, and team composition are increasingly diverse and require managers to face trade-offs. As such, the concept of combined use of participative and directive managerial activities might inspire future research on exploring levels of mixing managerial activities (Figure 2) to shed light on the characteristics that differentiate effective managerial activities from those that are less effective.

Finally, the results of our study contribute novel empirical insights to the extant literature by being among the first studies to investigate the interplay between managerial activities and structural configurations in the context of SMEs. Montealegre et al. (2019) identified that throughout the evolution of digital infrastructure, organizations resolve contradictory tensions using supporting leadership and structure. Our study validates and contextualizes their findings for SMEs and specifies the explicit structural configurations that reinforce managerial activities to enable IT ambidexterity. Our post hoc analysis (Table 7) highlights the differing roles of structural configurations in supporting managerial activities when compared with small and medium-sized firms. Thus, it offers a more practical approach with feasible goals for SMEs — an approach that wraps the underlying complexity of managerial activities and structural configurations into manageable and easily understood action items rather than abstract frameworks. In this sense, our study contributes to the NPD and management literature by shedding light on the contextual factors influencing the performance of SMEs and opening an interesting avenue to explore how managers can align their managerial activities with firm structures.

6.2 Implications for practice

The theoretical development and findings of this study offer crucial lessons for IT and business executives in SMEs. First, our findings suggest that managers should consider enabling IT ambidexterity to tackle NPD challenges ushered in by the digital era. Second, managers should consider leveraging managerial activities and structural configurations to exercise exploration and exploitation of IT resources and practices to enhance NPD performance. For instance, they might initiate weekly brainstorming sessions specifically focused on innovative uses of IT in NPD or set up cross-functional teams combining IT experts with NPD teams to ensure both exploration and exploitation of IT resources are efficiently pursued. Third, managers should consider exercising a combination of both participative and directive managerial activities as the impacts of these distinct managerial activities are strengthened when used in combination. Specifically in SMEs, a combination of managerial activities may offer possibilities to manage trade-offs with limited resources. For instance, SMEs leader may combine participative strategies by hosting weekly brainstorm sessions with his team, and directive strategies by setting clear project goals. In this regard, SMEs should consider investing in training managers to develop and hone their ability to constantly adapt their managerial activities in response to the contextual requirements of different tasks and to effectively deal with the tensions arising from IT exploitation and exploration. Fourth, managers should consider implementing the right structural configurations. Specifically, in small firms (fewer than 50 full-time employees) managers can benefit from directive managerial activities and higher formal configuration, whereas in medium-sized firms (49–249 full-time employees) managers can benefit more from participative managerial activities and connectedness. However, with the combined use of participative and directive managerial activities, our findings indicate that managers might benefit from connectedness only, irrespective of firm size (i.e., small or medium). Finally, our post hoc findings suggest that managers in SMEs should consider exercising a high–high combination of participative and directive managerial activities and a high–high combination of IT exploitation and IT exploration; however, if this is not achievable, they may rely on higher participative managerial activities and IT exploitation for higher performance gains. We are confident that these lessons can help SMEs to improve NPD performance and may nurture managers to contribute to overall business value.

6.3. Limitations and future research avenues

Despite its theoretical contributions, this study has some limitations that simultaneously offer future IS research avenues. First, we contacted top executives (IT executive, NPD project manager, or operations manager) to identify two other respondents per firm to receive and complete the online questionnaire separately. This approach allowed us to find the appropriate respondents to answer each part of the questionnaire and has been used and well-accepted in prior IS research (Keil et al., 2013; Syed et al., 2021). However, this approach may suffer from a respondent selection bias. Considering the challenge of collecting survey data from multiple respondents per firm, we assume that the benefits of this approach are greater than the potential bias; therefore, future methodological IS research should investigate if our assumption is correct. Second, there might be firms with a shared NPD project leadership, and our questionnaire design was not able to capture whether firms were working with single or multiple managers on the NPD project in this study. This may have also affected the recorded responses for our managerial activities, where some projects may have more than one manager. We encourage IS scholars to examine the impact of single managers and co-leadership in exercising managerial activities and its influence on the development of IT ambidexterity and NPD performance. While the British high-tech sector is one of the most important supply centers of high-tech products worldwide (Oke et al., 2007), offering a good setting to test our model, we recognize this as a limitation in that the results of this study may only be generalized to British high-tech SMEs. Further IS research should explore how firms from other countries, sizes, and industries develop IT ambidexterity and its effects on NPD initiatives. Our findings show that the combined use of participative and directive managerial activities enable IT ambidexterity in SMEs. This presents opportunities to explore the effect of different levels of combined activities, in order to identify the effective combination of managerial activities from those that are less effective. Further research can also explore the required skills, capabilities, and behaviors for SMEs managers to exercise effective managerial activities. While our post-hoc split sample findings do not find any evidence of the firm size threshold as the boundary condition for the effect of IT ambidexterity on NPD performance in SMEs, it highlights changes in the influence of organizational structural configurations. Future research can further explore potential moderating roles of firm size and firm age on the relationship between managerial activities, IT ambidexterity, and NPD performance. This could potentially enhance the understanding of the complex relationship between these constructs in SME.

6.4 Conclusion

The performance of new product development continues to be a prime concern and a vital survival strategy for SMEs (Syed et al., 2020a). The emergence of the digital era has introduced new complexities that make NPD projects more challenging (Wiener et al., 2019). In this context, prior studies point to the importance of managerial activities (Lewis et al., 2002) and the need for an IT ambidexterity approach to tackle the NPD management challenges ushered in by the digital era (Gregory and Keil, 2014; Lewis et al., 2002). Given the above, we conceptualized the notion of combined use of participative and directive managerial activities and used matched-pair data on NPD in 292 British high-tech SMEs to analyze its role in enabling IT ambidexterity to improve NPD performance. The analysis results suggest that both the individual and combined use of participative and directive managerial activities enhance NPD performance through enabling IT ambidexterity. We clarify the confounding effect of structural configurations (formal and connectedness) on the enabling effect of managerial activities based on firm size. By offering empirical support for the effectiveness of managerial activities, our study adds novel insights to existing research on IT ambidexterity and NPD in the digital era and helps to explain the mixed findings in the context of SMEs, thereby promoting further theory development in this research area.

In conclusion, we hope that our study will inspire future research on managerial activities and combination tactics that enable managers to effectively address digital-era management challenges and help companies to create and capture value from digital transformation and innovation initiatives.

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8 APPENDIX

Table A1: Evaluation of measurement properties at first- and second-order level

Construct/item	VIF	Weight	Loading
Managerial activities (reflective formative; $R^2_a = 0.55$)	2.117		
Directive activities (CA = 0.93, CR = 0.92, AVE = 0.77)	1.613	0.578^{***}	0.843^{***}
Our leader provides schedules for the work to be done		0.171^{**}	0.774^{**}
Our leader maintains definite standards of performance		0.214^{***}	0.789^{***}
Our leader encourages the use of uniform procedures		0.184^{**}	0.821^{***}
Our leader makes his attitudes clear to the group		0.106^{*}	0.729^{***}
Our leader informs us about what is expected		0.292^{***}	0.828^{**}
Participative activities (CA = 0.89, CR = 0.89, AVE = 0.73)	2.254	0.446^{***}	0.743^{***}
Our leader asks for suggestions before taking actions		0.314^{***}	0.821^{***}
Our leader consults us when faced with project problems		0.354^{***}	0.890^{***}
Our leader advises us on our work assignments		0.439^{***}	0.905^{***}
IT ambidexterity (multiplicative)			
IT exploration (CA = 0.89, CR = 0.91, AVE = 0.72)	3.174		
Our firm pursues innovative applications of IT		0.301^{***}	0.814^{***}
Our firm experiments and develops unique IT applications		0.236^{**}	0.855^{***}
Our firm accepts demands that go beyond the existing level of information services		0.261^{***}	0.846^{***}
Our firm regularly searches and acquires new IT resources (e.g., a new generation of IT architecture, potential IT applications, and critical IT skills)		0.194^{***}	0.887^{***}
Our firm experiments with new IT management practices		0.150^{**}	0.872^{***}
IT exploitation (CA = 0.94, CR = 0.96, AVE = 0.76)	3.168		
Our firm frequently refines the existing level of IT components, such as hardware and network resources		0.239^{***}	0.820^{***}
Our firm reuses existing IT skills		0.296^{***}	0.726^{**}
Our firm leverages existing IT applications and services		0.195^{**}	0.745^{***}
Our firm continually uses existing IT services for existing clients		0.353^{***}	0.802^{***}
Formal structural configuration (CA = 0.82, CR = 0.84, AVE = 0.69)	2.980		
Written rules and procedures occupy a central place in the organizational unit		0.313^{***}	0.874^{***}
The firm adheres to a strong emphasis on getting personnel to follow formal procedures		0.296^{***}	0.709^{**}
Quality-control and cost-control procedures of operations are well documented		0.406^{**}	0.857^{***}
Connectedness (CA = 0.84, CR = 0.82, AVE = 0.71)	2.135		
In our firm there are opportunities for informal "hall talk" among employees		0.222^{***}	0.724^{**}
In this firm, employees from different departments feel comfortable calling one another when the need arises		0.410^{***}	0.810^{***}
People are quite accessible to one another		0.307^{***}	0.855^{***}
In this firm it is easy to talk with anyone you need to regardless of rank or position		0.190^{**}	0.829^{***}
NPD performance (reflective formative; $R^2_a = 0.59$)	2.553		
NPD project performance (CA = 0.92, CR = 0.91, AVE =0.68)	2.431	0.669^{***}	0.902^{***}
The deliverables of the NPD project were completed on time		0.290^{**}	0.811^{***}
The NPD project deliverables were completed within the budgeted costs		0.197^{*}	0.754^{***}
The NPD project outcomes were of high quality		0.330^{***}	0.925^{***}
The outcomes of the NPD project met the defined product requirements		0.293^{**}	0.899^{***}
NPD business performance (CA = 0.80, CR = 0.82, AVE = 0.73)	2.784	0.453^{***}	0.870^{***}
The NPD outcomes fulfilled the expectations of NPD stakeholders		0.436^{***}	0.774^{***}
The NPD time to market is shorter than our key competitors in the market		0.265^{***}	0.716^{***}

The market share of our new products is higher than the market share of the new products of our key competitors		0.246^{***}	0.846^{***}
The average profit per customer of our new products is higher than that of our key competitors		0.218^{***}	0.910^{***}
CA = Cronbach's alpha, CR = composite reliability, AVE = average variance extracted; R^2_a = adequacy coefficient. *p < 0.05, **p < 0.01, ***p < 0.001 (based on 5,000 subsamples, one-tailed test).			

Table A2. Correlations among first-order constructs

	Min	Max	Mean (S.D)	1	2	3	4	5	6	7	8
1 IT exploitation	1.00	5.00	3.63(1.42)	**0.89**							
2 IT exploration	1.00	5.00	3.58(1.36)	0.17	**0.85**						
3 Directive	1.00	5.00	2.94(1.80)	0.34	0.12	**0.88**					
4 Participative	1.00	5.00	3.11(1.64)	0.21	0.37	0.16	**0.85**				
5 Formal configurations	1.00	5.00	2.40(1.13)	0.22	0.08	0.20	0.23	**0.83**			
6 Connectedness	1.00	5.00	3.86(1.22)	0.15	0.24	0.11	0.13	0.10	**0.84**		
7 NPD project perf.	1.00	5.00	3.35(1.33)	0.38	0.11	0.23	0.25	0.14	0.06	**0.82**	
8 NPD business perf.	1.00	5.00	3.46(1.44)	0.23	0.26	0.18	0.16	0.09	0.07	0.58	**0.85**
Note. Bold values in diagonal represent square root of AVE.											

Table A3: Cross-loadings between items and first-order constructs

Indicator	DMA	PMA	IT Expt	IT Explr	FSC	C	PPF	BPF
DMA1	0.962	0.096	0.059	0.092	0.245	0.032	0.127	0.113
DMA2	0.826	0.051	0.052	0.037	0.149	0.116	0.212	0.089
DMA3	0.853	0.076	0.024	0.140	0.283	0.083	0.194	0.116
DMA4	0.856	0.123	0.185	0.158	0.305	0.021	0.024	0.245
DMA5	0.862	0.104	0.137	0.022	0.101	0.122	0.377	0.226
PMA1	0.126	0.876	0.045	0.139	0.024	0.213	0.336	0.137
PMA2	0.024	0.913	0.207	0.4142	0.2675	0.4887	0.3685	0.056
PMA3	0.135	0.872	0.281	0.4380	0.3050	0.4780	0.3406	0.236
ITExpt1	0.223	0.124	0.771	0.7999	0.5068	0.2826	0.2548	0.116
ITExpt2	0.044	0.136	0.808	0.7406	0.5236	0.2496	0.1866	0.224
ITExpt3	0.085	0.051	0.891	0.7722	0.5147	0.3159	0.2426	0.265
ITExpt4	0.190	0.383	0.909	0.8148	0.5538	0.3144	0.2865	0.202
ITExplr1	0.292	0.175	0.063	0.8315	0.5161	0.2489	0.2002	0.113
ITExplr2	0.195	0.075	0.176	0.9293	0.5088	0.3144	0.2927	0.227
ITExplr3	0.243	0.112	0.190	0.9113	0.5212	0.3262	0.2614	0.165
ITExplr4	0.064	0.240	0.096	0.9106	0.5298	0.3019	0.2790	0.078
ITExplr5	0.105	0.182	0.187	0.8803	0.5602	0.2589	0.1923	0.234
FSC1	0.134	0.294	0.157	0.5549	0.9582	0.3215	0.1338	0.114
FSC2	0.154	0.232	0.274	0.4919	0.8293	0.2800	0.1142	0.023
FSC3	0.274	0.279	0.353	0.5335	0.9201	0.2720	0.0978	0.155
C1	0.079	0.105	0.308	0.2974	0.2774	0.8286	0.2298	0.162
C2	0.056	0.049	0.302	0.3146	0.3286	0.9076	0.2285	0.232
C3	0.192	0.139	0.281	0.2679	0.2609	0.8671	0.2721	0.237
C4	0.134	0.073	0.233	0.2023	0.1271	0.7534	0.2722	0.117
NPD_PR1	0.103	0.105	0.232	0.2386	0.1830	0.2620	0.8147	0.305
NPD_PR2	0.334	0.308	0.220	0.2306	0.1133	0.1979	0.7821	0.308
NPD_PR3	0.139	0.302	0.189	0.2643	0.0921	0.2845	0.9585	0.379
NPD_PR4	0.152	0.175	0.184	0.2740	0.1219	0.2447	0.9202	0.341

NPD_BP1	0.067	0.224	0.215	0.1510	0.1794	0.1646	0.3470	0.887
NPD_BP2	0.102	0.179	0.116	0.2421	0.0577	0.1998	0.3613	0.945
NPD_BP3	0.054	0.212	0.154	0.2628	0.2020	0.0834	0.2158	0.844
NPD_BP4	0.032	0.155	0.262	0.2519	0.3817	0.0255	0.4163	0.976
DMA = directive managerial activities, PMA= participative managerial activities, ITexplt = IT exploitation, IT eplr = IT exploration, FSC = formal structural configuration, C = connectedness, PRF = project performance, and BP = business performance.								

Table A4: Heterotrait–monotrait (HTMT) ratio of correlations

	1	2	3	4	5	6
1. IT ambidexterity						
2. Directive decision-making	0.214					
3. Participative decision-making	0.292	0.173				
4. Formal configurations	0.147	0.204	0.229			
5. Connectedness	0.285	0.115	0.128	0.094		
6. NPD performance	0.191	0.252	0.234	0.127	0.063	

Figure A1: Interaction effects of managerial activities and connectedness

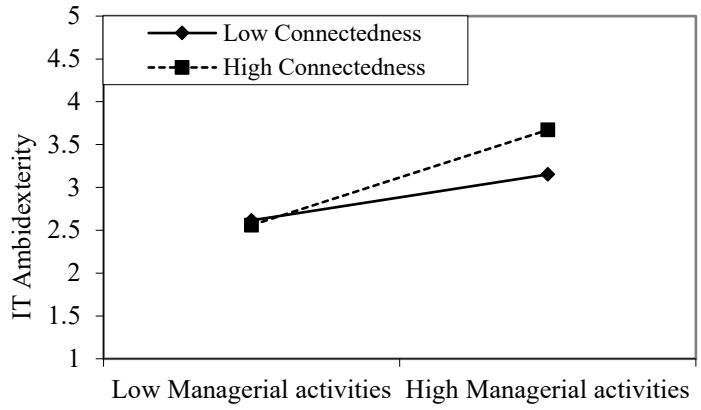

Figure A2: Moderation effects of configurations on the first-order constructs of managerial activities (Table 6)