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How can firms unlock successful implementation of digitalisation? Firm-level evidence from manufacturing companies

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Abstract

Although starting the process of digitalisation is not difficult for many global companies, successful implementation of digitalisation is much more elusive. Our study thus addresses the following research question: How can companies manage and sustain the positive outcomes of digitalisation, particularly in a volatile environment? We developed a new framework based on dynamics capability theory. Through an

investigation of 203 Chinese manufacturing companies that have achieved varying degrees of digitalisation, we found that two primary types of strategic flexibility—resource and coordination flexibility—fully mediated the positive relationship between digitalisation and firm performance. Moreover, market turbulence enhanced the positive mediation effects of strategic flexibility (i.e. resource and coordination flexibility) on the digitalisation–performance relationship. This result suggests that when a company faces a highly uncertain market environment but seeks to maintain the performance boost resulting from digitalisation, it needs to place increased emphasis on the flexibility with which it manages and updates its resource portfolios. Our proposed moderated-mediation mechanisms contribute to strategic IS research on digitalisation by elucidating how companies can manage and sustain successful digitalisation outcomes. Our findings also provide insights managers can use to unlock successful implementation of digitalisation.

Keywords: digitalisation; resource flexibility; coordination flexibility; market turbulence; performance

1. Introduction

In response to the disruption of various industries by digital technologies, many companies have embarked on the process of digitalisation (Wessel et al., 2021). A recent global survey showed that 70% of respondent companies had developed or were in the process of developing a plan for going digital (Wachsman, 2018). *Digitalisation* is an organisation's use of digital technologies to gather data, improve information exchange, strengthen collaboration and enable related business improvements (Fabian et al., 2023; Grover et al., 2022). Although companies that have lead implementing digitalisation have achieved higher returns than their peers (MIT, 2013), managing and sustaining the positive outcomes of digitalisation is a serious challenge. McKinsey (2018) reported that in some digitally savvy industries, such as high tech, media and telecommunications, the success rates of digitalisation did not exceed 26% and that in less savvy industries, the success rates were even lower—between 4% and 11%. Failure in digitalisation directly results in billions of dollars of waste (Tabrizi et al., 2019), and it may result in a rapid loss of market share to competitors (Morgan, 2019). Therefore, academics and practitioners must develop a better understanding of how to manage and sustain the positive outcomes of digitalisation (Vial, 2019).

Studies have investigated the relationship between digitalisation and performance from various theoretical perspectives, such as dynamic capabilities (Soluk & Kammerlander, 2021), the resource-based view (Eller et al., 2020), knowledge management (Li et al., 2022c) and servitisation (Abou-foul et al., 2021). In this research stream, *dynamic capabilities theory* (DCT) is the most prevalent theoretical approach. Compared with other theories, DCT has more relevance to business contexts in the digital era, which are marked by high degrees of turbulence and volatility (Mikalef et al., 2021b). Although studies based on DCT have advanced the knowledge of the relationship between digitalisation and performance, they have examined digitalisation primarily at the level of a specific digital technology, especially big data analytics (Mikalef et al., 2021b) and AI (Abou-foul et al., 2021). However, because companies typically deploy multiple digital technologies rather than relying on just one (Li et al., 2022b), discussing digitalisation only at the level of a specific digital technology offers few insights into how companies can implement an effective digital strategy at the organisational level. A survey of businesses of all sizes in North America

and Western Europe found that the most common barrier to digital success was CEOs who lacked a clear plan for achieving digitalisation (Morgan, 2019).

Although several leading studies have used DCT to explain digitalisation at the organisational level, these studies have either focused on the direct effects of digitalisation on firm performance without using empirical data to establish that DCT is the main mechanism of this relationship (Li, 2022) or conceptualised and operationalised the microfoundations of DCT but failed to disclose whether and why digitalisation increases firm performance in some circumstances but decreases it in others (Li et al., 2022a). These DCT research gaps also point to academic and managerial dilemmas. Academically, DCT may not fully explain why some studies have found that digitalisation has a positive effect on firm performance (Abou-foul, Ruiz-Alba, & Soares, 2021) but others have found that the effect is negative (Pettit, Croxton, & Fiksel, 2019). Managerially, DCT may help companies recognise the value of digitalisation but fail to inform them about where to begin, leaving them behind the competition. According to an investigation of more than 700 digital decision-makers, many companies fear they will begin losing market share in less than a year if they do not go digital (Morgan, 2019). Because neither practice nor the literature has provided a widely applicable solution for how to succeed in digitalisation, our study raises the following research question: *From the perspective of DCT, how can companies manage and sustain the positive outcomes of digitalisation?*

To unlock the black box through which digitalisation affects firm performance, we consider strategic flexibility. We do so because *strategic flexibility*, which is an organisation's ability to dynamically manage and update its resource portfolios in a proactive or reactive manner to adapt to a changing environment (Wei et al., 2014), is the embodiment of a company's dynamic capabilities at the organisational level (Brozovic, 2018). Studies have identified two primary types of strategic flexibility. The first is *resource flexibility*, which is a company's ability to repurpose its resources, enabling the pursuit of alternative strategies in response to shifts in the competitive landscape (Li et al., 2017). The second type is *coordination flexibility*, which is the ability of a company to develop new resource combinations by arranging and organising the functions and interests of different units (Zhou & Wu, 2010). We address our research

question by investigating the relationships among digitalisation, the two primary types of strategic flexibility and firm performance.

The primary purpose of developing dynamic capabilities is to adapt to rapidly changing business environments (Helfat et al., 2009). *Market turbulence*, that is, frequent and unpredictable changes in customer needs and product preferences (Mangus et al., 2020), is likely a key environmental influence on an organisation's ability to manage and sustain digitalisation, because market turbulence is related to the uncertainty and risk inherent in business operations (Wang et al., 2015). Companies operating in highly volatile markets are more likely to rely on digitalisation to optimise their resource portfolios or create new ones; it is only by doing so that they can quickly respond to changing customer preferences and market demands and ultimately improve firm performance (Li, 2022). If research on the effect of digitalisation on firm performance ignores the role of market turbulence, it may fail to develop a thorough understanding of why digitalisation improves firm performance in some circumstances but weakens it in others. We consider market turbulence on the basis of strategic flexibility to provide a more comprehensive answer to the research question.

We focus on China's manufacturing industry because China is dedicated to accelerating the digitalisation of its manufacturing industry and, like other countries, is facing the dilemma in which some firms have successfully made this transition while others are still struggling with it (Li et al., 2022a; Ye et al., 2022). We survey and analyse 203 Chinese manufacturing companies that have achieved varying degrees of digitalisation. We find that resource and coordination flexibility—the two main types of strategic flexibility—fully mediate the positive relationship between digitalisation and firm performance. We also offer novel insights into how market turbulence moderates the mediation effects of resource and coordination flexibility on the relationship between digitalisation and firm performance. Our results show that the positive mediation effects of resource and coordination flexibility become stronger when market turbulence is high. If this result holds more widely, it suggests that companies that maintain the performance boost resulting from digitalisation can do so because they manage and update their resource portfolios with

a high degree of flexibility.

We make two theoretical contributions to strategic IS research on digitalisation. *First*, although prior studies have employed DCT to explain the relationship between digitalisation and performance (Bahrami & Shokouhyar, 2022; Mikalef et al., 2021a), they have typically been conducted at the level of a specific digital technology rather than at the organisational level. The studies that have used DCT to analyse digitalisation at the organisational level have failed either to consider dynamic capabilities as major variables in the model or to clarify how and why digitalisation boosts firm performance in certain cases but harms it in others (Li et al., 2022a; Zeng et al., 2022). In this paper, we examine dynamic capabilities in terms of two types of strategic flexibility and outline the possible mediation mechanisms, thereby extending the microfoundations of DCT in digital contexts and confirming its applicability.

Second, because the evidence on the digitalisation–performance relationship includes both positive (Abou-foul, Ruiz-Alba, & Soares, 2021) and negative (Pettit, Croxton, & Fiksel, 2019) results, existing studies have explained this inconsistency primarily in terms of nonlinear relationships (Kohtamäki et al., 2020; Li, 2022). Unlike these studies, ours considers strategic flexibility and market turbulence in the digital context, and it offers novel insights into the moderation mechanisms through which market turbulence enhances the positive mediation effect of strategic flexibility on the link between digitalisation and firm performance. These findings not only provide a new theoretical explanation for the complex effects of digitalisation but also enrich the current knowledge about how to manage and sustain the positive outcomes of digitalisation.

2. Literature Review

2.1. Digitalisation

Extant research has identified digitalisation as an organisation's use of digital technologies to enable business improvements, such as gathering data, improving information exchange and strengthening collaboration (Abou-foul et al., 2021). Because AI, big data analytics, cloud computing and the Internet of Things (IoT) are the digital technologies most widely used to implement digitalisation in a range of sectors (Papadopoulos et al., 2022) and especially in manufacturing companies (Li et al., 2022c), studies have

investigated the outcomes of digitalisation primarily at the level of one of these technologies (Lehrer et al., 2018). For example, using a unique set of panel data from 814 companies representing the period 2008–2014, Müller et al. (2018) revealed that big data analytics can help companies improve their productivity by 3%–7% on average. Based on a systematic literature review, Borges et al. (2021) summarised four major business values that facilitate the adoption of AI: supporting the decision to adopt it, increasing customer and employee engagement, achieving automation and developing new products and services.

Considering that companies deploy multiple digital technologies instead of relying on just one (Li et al., 2022b), some studies have discussed the outcome of digitalisation at the organisational level. For example, using survey data from 193 small and medium-sized enterprises in Austria, Eller et al. (2020) found that IT, employee skills and digital strategy are the three major drivers of digitalisation and, more importantly, that digitalisation significantly and positively influences financial performance. Based on in-depth interviews of managers in the food industry in Greece, Annosi et al. (2021) reported that digitalisation in food supply chains can prevent food waste and improve business performance. Li et al. (2022a) analysed a sample of 165 Chinese manufacturing companies and suggested that even during the COVID-19 pandemic, companies with advanced digitalisation capabilities typically exhibited stronger market-capitalising and operational-adjustment agility (which resulted in better performance) than those with weak digitalisation capabilities.

Although most studies of digitalisation have found that it has a positive influence on performance, a few studies have found that it has a negative influence. For example, Pettit et al. (2019) argued that the use of digital technologies may increase cybersecurity risks, making businesses more vulnerable and ultimately resulting in poor performance. Ralston and Blackhurst (2020) claimed that when digitalisation enables companies to replace employees with machines, companies may lose their abilities to adjust existing processes in response to disruptions. To explain the discrepancy between positive and negative findings, some studies have moved from linear to nonlinear relationships (Li, 2022). For instance, by integrating positive and negative findings, Kohtamäki et al. (2020) posited that the relationship between digitalisation

and performance is characterised by an inverted-U shape and that this relationship is moderated by *servitisation* (i.e. the tendency of a company to provide value-added services to its customers). They concluded that a company can realise the positive effects of digital technologies on firm performance when it achieves a certain level of servitisation and that the outcomes of digitalisation may otherwise be negative. However, most of the literature has lacked this level of nuance. Because verifying nonlinear processes is relatively difficult, most extant studies have analysed the direct nonlinear effect of digitalisation on firm performance without using empirical data to explicitly establish that such a nonlinear relationship is caused by the processes claimed by the authors (Li, 2022).

Many companies recognise the business value of digitalisation but struggle with the process of implementing it or remain unsure about how to begin that process. Therefore, additional research on achieving successful implementation digitalisation—namely, on the ways in which companies can effectively manage and sustain the positive outcomes of digitalisation—is needed. Our study addresses this opportunity.

2.2. Strategic Flexibility

A company's resources typically consist of the tangible and intangible firm-owned assets, such as knowledge of technology, skilled personnel, capital and machinery (Wernerfelt, 1984). DCT posits that heterogeneity of resources is the main source of competitive advantage and that to achieve this heterogeneity, companies need to effectively integrate, build and reconfigure their resource portfolios (Adner & Helfat, 2003; Sirmon et al., 2011). As a concept derived from DCT, *strategic flexibility* is typically understood as the ability of a company to flexibly manage and update its resource portfolios to adapt to a changing environment (Chen et al., 2017; Johnson et al., 2003; Li et al., 2017; Wei et al., 2014).

Existing research has contrasted various definitions of strategic flexibility and compared strategic flexibility with similar concepts. Based on a detailed review of 146 articles and eight book chapters that examined strategic flexibility, Brozovic (2018) explained that the definition of strategic flexibility typically involves three dimensions: (1) a *reactive dimension*, that is, a definition of how an organisation responds to changes in the business environment in a timely and appropriate way; (2) a *proactive dimension*, that is, a

definition of how an organisation responds proactively to changes in the business environment or leads the change; and (3) an *intentional dimension*, that is, a definition of how an organisation takes offensive and defensive measures. Because most studies have strongly emphasised the responsiveness of strategic flexibility (Brozovic, 2018; Wei et al., 2014) and because it is increasingly crucial for companies to respond proactively to increases in market risks (Knemeyer et al., 2009), we define *strategic flexibility* as the ability of an organisation to manage and update its resource portfolios in a proactive or reactive manner to adapt to a changing environment. Notably, *agility*, which is a company's ability to sense environmental change and respond readily to both the opportunities and threats occasioned by the change (Pinsonneault & Choi, 2022), is very similar to strategic flexibility. Nonetheless, strategic flexibility differs from agility in two respects. First, strategic flexibility involves only strategic issues, whereas agility involves both strategic and operational issues (Overby et al., 2006). Second, agility builds on and extends strategic flexibility, because agility pertains to the entire organisation's capacity to sense and respond to changes in the business environment and thus encompasses both proactive and reactive responses (Overby et al., 2006).

Research has examined the role of strategic flexibility in a variety of contexts (Bock et al., 2012; Yuan et al., 2010). For example, based on a sample of 195 Indian companies, Nadkarni and Herrmann (2010) revealed that strategic flexibility is a key mediator of the relationship between CEO personality and firm performance. Using data from 148 Chinese companies, Chen et al. (2017) showed that IT-enabled core competencies help companies achieve superior performance by enhancing strategic flexibility. Through an analysis of 282 Italian companies, Miroshnychenko et al. (2021) demonstrated that strategic flexibility mediates the relationship between a company's absorptive capacity and its business-model innovation.

Although previous research has advanced the understanding of the role of strategic flexibility, few studies have examined phenomena associated with digitalisation from a strategic-flexibility perspective. Although Chen et al. (2017) revealed that strategic flexibility mediates the relationship between IT and firm performance, they conceptualised strategic flexibility as a holistic construct and did not account for the disparities among its subdimensions, which may have limited the study's comprehension of the mediating

role of strategic flexibility. Herhausen et al. (2021) warned that although strategic flexibility may be attractive to organisations as a potential avenue for growth, that they may be paralysed in their attempts to implement it when faced with the new challenges of digitalisation. In the context of digitalisation, it is critical to examine the effect of strategic flexibility on firm performance. Digitalisation provides the tools that enable companies to flexibly manage and update their resource portfolios (Mandviwalla & Flanagan, 2021). To better understand the digitalisation phenomenon, we comprehensively investigate the relationships among digitalisation, the two primary types of strategic flexibility and firm performance.

2.3. Market Turbulence

Market turbulence is the degree to which the environment a firm operates in is characterised by change and uncertainty (Dess & Beard, 1984), and such turbulence often results in frequent and unpredictable changes in customer needs and product preferences (Mangus et al., 2020). According to *contingency theory*, an organisation's success may depend less on the strategy itself than on how well that strategy fits the environmental factors that give rise to opportunities, constraints and risks for the organisation (Van de Ven & Drazin, 1984). Because market turbulence is related to a company's environmental conditions, previous research has primarily examined its moderating role in distinct contexts to determine the degree to which a company's strategies fit the environment (Van de Ven & Drazin, 1984). For example, using survey data from 154 high-tech manufacturing companies in Taiwan, Tsai and Yang (2013) found that under high levels of market turbulence, the positive relationship between firm innovativeness and business performance is stronger than that under low levels of market turbulence. By analysing 235 Chinese companies, Wang et al. (2015) showed that market turbulence positively moderates the relationship between innovation capability and external-collaboration effectiveness and between information capability and external collaboration effectiveness. Using a sample of 518 Chinese companies, Zhou et al. (2019) found that when market turbulence is low, the indirect effect of marketing agility on financial performance is stronger.

Because market turbulence can also be associated with a company's external pressures (Qiu et al., 2020), several studies have used institutional theory to investigate the direct effect of market turbulence on a company's behaviours. For example, De Clercq et al. (2018) collected data from a sample of Ontario

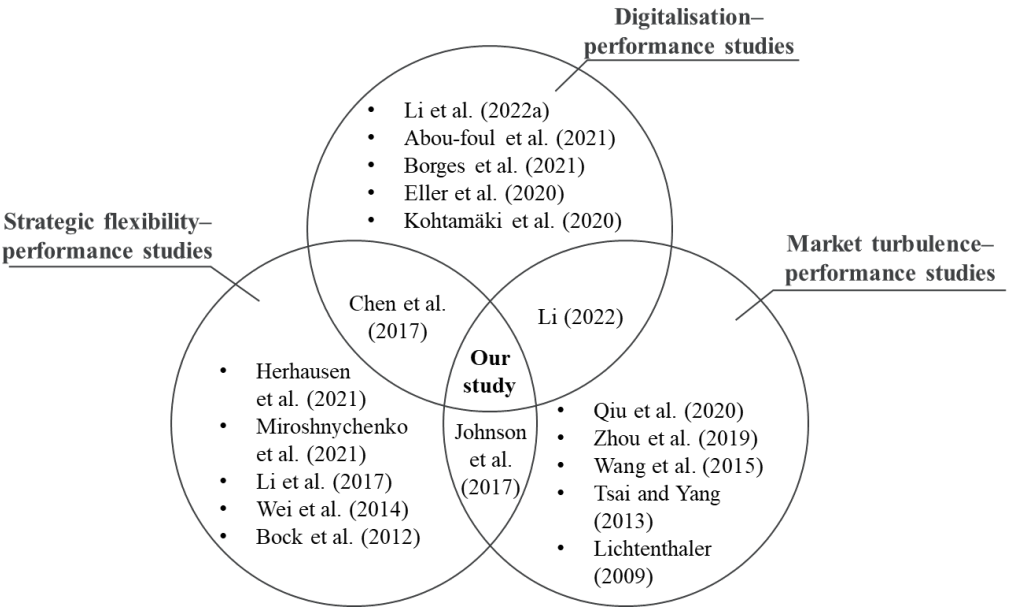
restaurants and found that market turbulence can increase sustainable firm behaviours through *network embeddedness* (i.e. the degree to which a company has close, informal ties with its network partners). Using panel data from 472 listed Chinese firms representing the period 2006–2017, Qiu et al. (2020) revealed that green-product innovation rather than green-process innovation is the primary route through which market turbulence affects financial performance.

Although studies have found that market turbulence has a direct effect and moderating effect on firm performance in distinct contexts, we propose that in the context of digitalisation, market turbulence plays a stronger moderating role. First, regardless of whether market turbulence is viewed as an environmental condition or institutional pressure, it is a given factor of the company's environment—not a choice or a result of certain behaviours. Second, the digital era is characterised by a highly volatile market environment, and DCT suggests that to adapt to this environment, companies need to develop dynamic capabilities by integrating, building and reconfiguring their resource portfolios (Helfat et al., 2009). Considering that adaptability mainly reflects the correspondence between a company's strategies and its environment, we suggest that it is more appropriate to understand the influence of market turbulence on firm digitalisation from a contingency perspective than from an institutional perspective.

To our knowledge, only Li (2022) has discussed the moderating role of market turbulence in the context of digitalisation. Li (2022) surveyed 223 Chinese companies and found that when market turbulence is high, increases in digital transformation are linked to better economic performance but worse environmental performance. Despite Li's contributions, his study focused primarily on the direct effect of digital transformation on performance and did not clearly explain how market turbulence influences the mechanisms behind such an association. We build on Li's work by adding how market turbulence moderates the mediating role of strategic flexibility in the digitalisation–performance association.

Summarising the current digitalisation literature, **Figure 1** presents a Venn diagram that highlights the position of our study in the overall literature. Our study lies at the intersection of three major research streams: digitalisation, strategic flexibility and market turbulence. The figure illustrates both our differential

Figure 1. The position of our study in the digitalisation research literature.

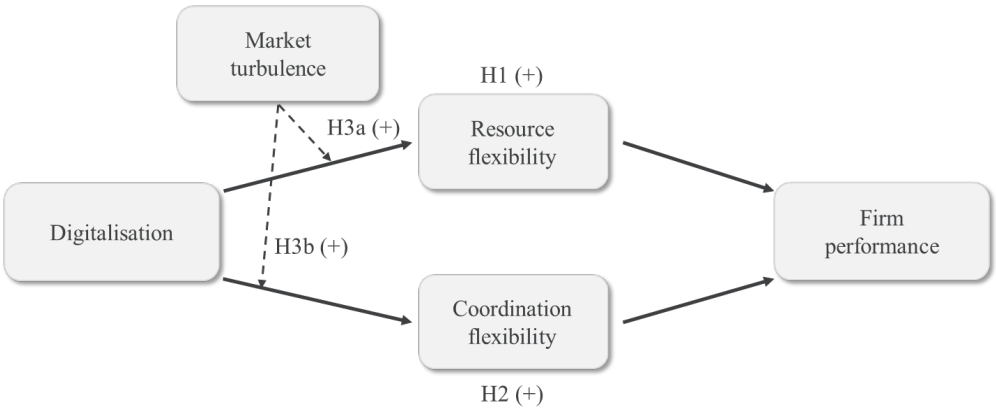


and incremental contributions to the literature.

3. Hypothesis Development

Our study's aim is to better understand the mechanisms underlying the relationship between digitalisation and firm performance from the perspective of dynamic capabilities (Helfat et al., 2009). **Figure 2** summarises our theorisation in operational model form, in which all the predicted relationships are either mediators or moderators; that is, market turbulence acts as a positive moderator, and resource and coordination flexibility—the two main types of strategic flexibility—act as positive mediators. DCT suggests that companies can handle changes in the environment by integrating, building and reconfiguring their resource portfolios (Helfat et al., 2009). This means that when digitalisation is properly applied to the appropriate business processes to help companies update their capabilities, it may progressively foster the company's development, creating excess returns or increased value (Herhausen et al., 2021; Li et al., 2022a). Hence, we propose that strategic flexibility mediates the digitalisation–performance relationship. The concept of market turbulence embodies the degree of volatility and uncertainty in a firm's market milieu (Mangus et al., 2020). Moreover, the primary reason for companies to develop dynamic capabilities is to adapt to their environmental circumstances (Helfat et al., 2009). This necessitates achieving a correspondence between their strategies and the prevailing environment. Given these factors, we propose

Figure 2. Our proposed moderation–mediation theoretical model.



Note: H1 and H2 predict mediation of the relationship between digitalisation and firm performance, with resource flexibility and coordination flexibility as the respective mediators; H3a and H3b predict positive moderation of the same mediation relationships by market turbulence.

that market turbulence can serve as a key moderating influence on the mediating effect of strategic flexibility. The unpredictable nature of a turbulent market can directly influence how strategic flexibility contributes to the company's adaptability and eventual success.

3.1. The Mediating Role of Strategic Flexibility

Studies have suggested that strategic flexibility takes two forms. The first is *resource flexibility*, which is the ability of a company to pliably reallocate resources to pursue alternative courses of action in response to changes in its competitive setting (Li et al., 2017). The COVID-19 pandemic occasioned many instances of resource flexibility: automakers quickly repurposed their production lines to produce masks, perfume manufacturers began to produce hand sanitiser instead of perfume and automobile manufacturers even started producing sophisticated medical ventilators (Betti & Heinzmann, 2020; Brem et al., 2021). The second form of strategic flexibility is *coordination flexibility*, which is the ability of a company to create new resource combinations by harmoniously organising and overseeing the functions and interests of different units (Zhou & Wu, 2010). A recent example of coordination flexibility occurred at Sinopec. To address the challenges of the COVID-19 pandemic, Sinopec flexibly coordinated with the fresh food retailer Freshipo to launch a new service that provided contactless delivery of fresh food to customers through its extensive network of gas stations (Wang et al., 2020). Moreover, studies of IT use have found that IT-enabled core competencies boost the establishment of strategic flexibility, which further improves firm

performance (Chen et al., 2017). Following this logic, we assume that the use of digital technologies is not only the starting point of digitalisation but also an optimisation of existing IT use (Ivanov et al., 2019). In this section, we focus on how the two types of strategic flexibility explain the relationship between digitalisation and firm performance.

From a resource-flexibility perspective, studies have claimed that if a company wants to redesign its resource portfolios, it first needs to sense, understand and carefully respond to unexpected changes in the environment (Ambulkar et al., 2015; Ojha et al., 2014). Digitalisation requires manufacturing companies to embrace the IoT and widely deploy sensors, processors and actuators in their supply chain networks to actively collect economic information related to operations and the operating environment (Schniederjans & Hales, 2016). We propose that these IoT-related forms of digitalisation help companies access customer, supplier and market data in a seamless and consistent manner, which in turn enables them to sense and understand environmental changes. Digital value creation is also the major value proposition of digitalisation (Baiyere et al., 2020). Big data is characterised by volume, velocity, variety and veracity (Guha & Kumar, 2018), and AI can help companies extract insights from massive amounts of data (Choi et al., 2018). Hence, we propose that digitalisation based on big data analytics and AI helps companies optimise key resources and processes (Abou-Foul et al., 2023), which can in turn guide their resource reconfiguration.

Furthermore, prior research has asserted that resource flexibility is critical for companies' survival and growth in turbulent environments (Chen et al., 2017). By breaking down existing operation routines, resource flexibility can enhance product customisation, delivery and customer experience, all of which help companies adapt to changes in the environment and ultimately sustain or improve performance (Anand & Ward, 2004; Anand et al., 2010). Summarising our logic and evidence, we posit that enhancing resource flexibility is the catalyst that enables digitalisation to enhance firm performance. Such a catalyst is necessary because the data companies acquire through digitalisation has limited use in the absence of a transformative process. By transforming the acquired data into valuable insights to continuously guide their

reorganisation of existing resources, companies can adapt to the changing environment and obtain sustained performance improvements. Morgan (2019) demonstrated that when a company constantly optimises its existing resource portfolio through digitalisation to improve customer experience, its economic returns can increase by 20%–50%. Hence, we predict:

H1. Resource flexibility positively mediates the relationship between digitalisation and firm performance.

From a coordination-flexibility perspective, studies have claimed that if a company wants to find new applications for current resource portfolios, it first needs to improve the ability of different units to collaborate (Wei et al., 2014). Because the use of digital technologies can make unit boundaries more flexible, digitalisation helps companies strengthen coordination among business units (Conboy et al., 2020; Waizenegger et al., 2020). Ge et al. (2023) showed that even in the face of the COVID-19 pandemic, the work-from-home capability could ensure that all departments continue to function with seamless communication and collaboration. Such continuity is inseparable from the cloud-based digitalisation of companies because it can enable employees to access data from anywhere (Krancher et al., 2018). Prior studies have contended that maintaining flexible product strategies is another prerequisite for creating new resource portfolios (Sanchez, 1995). The incorporation of digital technologies, particularly 3D printing, into the production process to achieve process digitalisation has the potential to drastically reduce switching costs and enable flexible product manufacturing (Beltagui et al., 2020). Brem et al. (2021) revealed that during the COVID-19 crisis, digital manufacturing technologies helped several automobile companies (e.g. Tesla, Ford, General Motors) swiftly transform their production processes into processes for manufacturing critical medical supplies.

Research has also shown that coordination flexibility allows companies to incorporate newly acquired external knowledge into their current knowledge—facilitating the development of new products, services and processes, the emergence of new business models, the entry into new markets and, ultimately, the maintenance or improvement of performance (Nadkarni & Herrmann, 2010). According to the rationale outlined above, we assume that digitalisation positively influences firm performance by enabling more

coordination flexibility. Crucially, digitalisation may not affect performance directly, because although digitalisation provides companies with opportunities to identify and enter new markets (Zangiacomi et al., 2020), these opportunities can be transformed into actual economic benefits only if companies constantly create new resource combinations (i.e. develop new products, services and processes) that match new customer needs. Companies can successfully pull off such constant creation only if they have high levels of coordination flexibility. Hence, we propose:

H2. Coordination flexibility positively mediates the relationship between digitalisation and firm performance.

3.2. The Moderating Role of Market Turbulence

Because every firm is embedded in its surroundings and a company's strategy should fit its market conditions (Wang et al., 2015), we now address the effect of market turbulence on the digitalisation–performance relationship. First, a high degree of market turbulence entails a high degree of uncertainty and risk, which typically increases the need for information (Wang et al., 2015). From a resource-flexibility perspective, to achieve a fit between strategy and environment, companies may need to increase their reliance on digital technologies, especially big data analytics and AI, to better understand their customers and gain more insights into the market (Mikalef et al., 2021a; Warner & Wäger, 2019). Only by engaging in such digitalisation activities can companies build flexible resource portfolios, thereby making timely responses to their customers and achieving a sustainable competitive advantage. A global survey of more than 700 digital decision-makers in markets with intense competition found that 55% of companies that perform poorly in implementing digitalisation believe that failing to update their resource portfolios will cause them to start losing market share in less than a year (Progress, 2016). From a coordination-flexibility perspective, the insights gained from the use of digital technologies (e.g., big data analytics, AI, and the Internet of Things) can help companies break down information silos, facilitate coordination among business units and departments, and help employees understand changes in the environment (Ye et al., 2022), thereby promoting a better fit between a company's digital strategy and its environment. Such a fit is extraordinarily important under high levels of market turbulence. A recent report revealed that when

market competition becomes more intense, Chinese companies that effectively leverage digitalisation to facilitate alignment across functions generate nearly 17% more revenue from digital investments than companies that fail to do so (Accenture, 2020).

Second, market turbulence is often associated with intense market competition and technological advancements (Wang et al., 2015), and intense market competition and technology advancements shorten the cycles of product development (Li, 2022). To achieve a fit between their digital strategy and this change in product development, companies must constantly maintain a high degree of resource flexibility on the basis of digitalisation. McKinsey (2020) conducted a global survey among 899 senior managers and found that the acceleration of digital or digitally enhanced offerings shows a seven-year increase on average; in Asia, the leap is even greater, at 10 years. Importantly, many of the respondents attributed such leaps to their organisations' realignment of current resource portfolios to update their product focus rather than to dramatic, rapidly achieved breakthroughs in product development (McKinsey, 2020). This evidence indicates that under high levels of market turbulence, the positive influence of digitalisation on resource flexibility and downstream performance improvements should be stronger than it is that under low levels of market turbulence. Moreover, due to increased market rivalry and technological improvements, to match such a trend, all the departments in a company must collaborate more closely than in the past, thereby involving coordination flexibility. Based on a global survey of 1,500 executives in industrial sectors, Accenture (2020) found that nearly 7.7% of the increase in digitalisation-related costs could be attributed to competition between internal departments and that such internal competition may occasion conflicts between departments, giving rise to situations in which some departments win the internal competition while the company as a whole falls behind external competitors. Hence, under high levels of market turbulence, companies must improve their coordination flexibility to reduce internal competition between departments, thus maintaining the positive outcomes of digitalisation.

In summary, we predict that in the face of shifting market conditions and consumer demands, to achieve a fit between strategy and environment, companies rely more on digitalisation to improve their resource

and coordination flexibility, thereby resulting performance improvements. Hence, we propose:

H3a. Market turbulence enhances the positive mediation effect of resource flexibility on the relationship between digitalisation and firm performance.

H3b. Market turbulence enhances the positive mediation effect of coordination flexibility on the relationship between digitalisation and firm performance.

4. Research Design

4.1. Data Collection

China is the world's central manufacturing engine and its second-largest economy. Because digital technologies have disrupted most industries, Chinese firms face the critical and difficult challenge of determining how to employ digital technologies to update traditional industries (Zhou et al., 2020). Notably, Chinese firms that fail to sustain the positive outcomes of digitalisation face intensified cost and labour pressures from other developing countries (Li, 2020). The Chinese government's efforts to promote digitalisation through laws and financial aid have helped China's digital economy become the second largest in the world, behind only that of the United States (Ma, 2022). Because China has a large and diverse manufacturing sector with a rich history of digital adoption and because the findings from China can provide guidance for other regions, particularly developing countries, our survey focused on Chinese manufacturing companies.

Before formally launching our study, we invited three scholars from the field of digital operations management to refine our questionnaire for content validity. For further refinement, we then recruited 30 MBA students with expertise in digital operations to participate in a pilot of our questionnaire. Next, we collaborated with a survey company whose private database contained over 30,000 Chinese companies. The survey was conducted in the third quarter of 2021. In the first round, the survey company randomly contacted 1,000 Chinese companies from its private database to inquire about their use of digital technologies. According to previous studies, big data analytics, the IoT, AI and cloud computing are the four digital technologies most frequently adopted by Chinese companies (Li, 2022; Li et al., 2022b). We eliminated companies that did not adopt any of these digital technologies, resulting in a sample of 515 usable companies. In the second round, the survey company contacted these 515 companies by email,

including a cover letter that stated the objectives of the study and its potential contributions to the respondent companies. To mitigate the potential for problems related to common method bias, each company representative was asked to provide two informants. One informant response was assigned to top executives, who replied to questions that focused on digitalisation, market turbulence, resource flexibility and coordination flexibility. Another informant response was assigned to financial or market managers, who were asked to answer related questions on firm performance. The responses of different informants from the same company were matched according to the focal variables. A total of 315 companies responded to the emails, resulting in 203 acceptable responses and a recovery rate of 39.42%.

Table 1 summarises the profiles of the respondent companies. The sum of the percentages of the four most frequently adopted digital technologies was greater than 100%, suggesting that many respondent companies adopted different combinations of digital technologies in their digitalisation process, such as big data analytics combined with cloud computing, big data analytics combined with AI, or big data analytics combined with the IoT.

4.2. Nonresponse Bias

We used three methods to check for nonresponse bias. Because the survey company provided us with basic information for all 515 companies, we first performed a paired *t* test to examine whether the companies that did not reply differed from the companies that did in terms of staff counts; we observed no significant differences ($p > 0.05$). We then compared the means of years in operation between the early (25%) and late (25%) response groups, and the results of a paired *t* test revealed that these groups had similarities ($p > 0.05$). Finally, motivated by the work of Dubey et al. (2021), we required the survey company to contact 30 individuals from the nonresponse group again. These individuals were randomly chosen and instructed to answer one item for each of the constructs. The paired *t* test of group means indicated no significant difference between the response and nonresponse groups for any question ($p > 0.05$). In short, nonresponse bias was not a concern in our study (af Wåhlberg & Poom, 2015).

4.3. Measures

All the items in this study were adapted from established measures from digitalisation and organisational

Table 1. Sample Characteristics (n = 203)

	Frequency	Percentage
Firm age (years established)		
<10 years	22	13.30%
10–19 years	83	42.86%
20–29 years	67	33.00%
>30 years	20	10.84%
Firm size (number of employees)		
<100	15	8.37%
100–199	22	11.33%
200–499	50	27.09%
500–999	46	23.15%
1000–4999	47	23.65%
>5000	12	6.40%
Ownership		
State-owned	34	17.73%
Collectively owned	10	5.91%
Privately owned	134	68.97%
Foreign	14	7.39%
Industrial types		
Automobile	11	6.40%
Chemical	18	8.37%
Electronics	37	19.21%
Food	15	8.87%
Machinery	52	26.11%
Pharmaceutical	14	7.88%
Steel	15	8.37%
Textile	19	9.85%
Others	11	4.93%
Adoption of digital technologies		
AI	124	61.08%
Big data analytics	173	85.71%
Cloud computing	139	68.47%
IoT	141	69.46%

research. First, from Nasiri et al. (2020), we adapted four items related to transformation to measure *digitalisation*, that is, the extent to which a company captured and used digitality in its operations (Abou-foul et al., 2021; Bharadwaj et al., 2007). To measure *market turbulence*, we then adapted three items from Mangus et al. (2020), all of which revealed the degree of instability and uncertainty within a company's markets. Next, we considered two types of strategic flexibility—*resource* and *coordination flexibility*. For this purpose, we adapted eight items from Wei et al. (2014); we used the four items related to a company's ability to reconfigure existing resources to measure resource flexibility and the four items related to a company's ability to create new resource combinations to measure coordination flexibility. To measure *firm performance*, we adapted four items from Vickery et al. (2003) that reflected a company's growth in sales, profit, return on investment and return on sales, respectively. All the items were measured on a 7-point

Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Appendix A **Table A.1** summarises the details of the items. Finally, we operationalised firm age, firm size, ownership and industrial types as major control variables.

5. Data Analysis

5.1. Measurement Properties of Constructs

We first performed a confirmatory factor analysis to assess construct reliability and validity (Li et al., 2019), yielding the following measurement model fit indices: χ^2 = 197.815, df = 142, χ^2/df = 1.393, incremental fit index (IFI) = 0.971, comparative fit index (CFI) = 0.970 and root mean square error of approximation (RMSEA) = 0.044. Because the χ^2/df and RMSEA were less than 3 and 0.08, respectively, and because both the IFI and CFI were above 0.9, our model fit the data well (Wang et al., 2016). We then assessed convergent validity, reliability and discriminant validity. The standardised factor loadings of each item ranged 0.694–0.874, each with a p value less than 0.001, suggesting good convergent validity (Fornell & Larcker, 1981). Moreover, as **Table A.1** shows, the average variance extracted (AVE) values of all the constructs were greater than 0.5, demonstrating acceptable convergent validity (Podsakoff et al., 2003). Given that we demonstrated strong convergent and discriminant validity, we concluded that our constructs had satisfactory reliability because the composite reliability and Cronbach's alpha values of each construct exceeded the threshold value of 0.7 (Nunnally et al., 1978) (see Table A1). Finally, as presented in **Table 2**, the square roots of the AVEs of each construct were much larger than their correlations with other constructs, thus supporting discriminant validity (Podsakoff et al., 2003). Overall, this study's measures had sufficient reliability and validity.

5.2. Common Method Bias

Following Li et al. (2019), we first conducted a Harmon's single-factor test. To do so, we performed a confirmatory factor analysis by loading all the items onto a single factor and found that the model fit indices were poor (χ^2 = 846.657, df = 152, χ^2/df = 5.570, IFI = 0.633, CFI = 0.629 and RMSEA = 0.150). We then used the marker-variable technique (Lindell & Whitney, 2001), employing the shoe size of one of the informants as a marker variable. As **Table 2** indicates, the correlations between the marker variable and

Table 2. Correlation Matrix and Discriminant Validity

Variable	Mean	Standard deviation	1	2	3	4	5
1. Digitalisation	5.785	0.774	**.754**				
2. Market turbulence	5.685	0.848	.358**	**.800**			
3. Resource flexibility	4.693	1.173	.355**	.319**	**.796**		
4. Coordination flexibility	4.664	0.862	.439**	.441**	.508**	**.766**	
5. Firm performance	5.504	0.820	.401**	.404**	.480**	.593**	**.740**
6. Marker variable	n/a	n/a	.090	.058	.027	-.061	.078

Note: ** = *p*-values < 0.01; the square roots of the AVEs appear bolded and on the diagonal.

other variables were nonsignificant ($p > 0.05$). Moreover, the relevant correlations of variables did not become statistically nonsignificant after we controlled for common method bias. Based on these results, we concluded that common method bias was not a major threat to our data.

5.3. Hypothesis Testing

Before formally testing the hypotheses, we performed a multicollinearity check. The variance inflation factors for the focal constructs in each of the models were well below the recommended value of 10 (Akter et al., 2016; Neter et al., 1990). Hence, multicollinearity was not a serious threat to our data analysis. Moreover, the process macro embedded in SPSS 23.0 offers several advantages, including one-step analysis of mediation effects, automatic processing of bootstrap and Sobel tests of mediation effects and the ability to process moderated-mediation-effects models with controlled variables (Hayes, 2013). Thus, we primarily used the *process* macro to test our hypotheses. We first calculated the mean of all the items within each construct to obtain an overall score, an approach consistent with the methodology used by Song and Di Benedetto (2008). We set digitalisation as the independent variable; resource and coordination flexibility as mediating variables; market turbulence as the moderating variable; firm performance as the dependent variable; and firm age, firm size, ownership and industrial type as control variables to run the *process* routines. Finally, by setting 5,000 bootstrap resamples and generating 95% bootstrap confidence intervals, we ran Models 4 (mediation analysis) and 7 (moderated-mediation analysis) of the *process* routines. **Table 3**, **Table 4** and **Table 5** summarise the results.

Table 3 presents the estimated results of the (moderated) mediation analysis based on the logic of stepwise regression. Models 1, 4 and 7 represented the basic model, which included only control variables. Models 2 and 5 revealed that digitalisation had a significant positive relationship with resource flexibility

(β = 0.479, $p < 0.001$) and coordination flexibility (β = 0.507, $p < 0.001$). Moreover, in the absence of any presumed mediators (see Model 8), digitalisation had a significant positive relationship with firm performance (β = 0.390, $p < 0.001$). However, in the presence of the presumed mediators (see Model 9), this positive relationship became nonsignificant (β = 0.126, $p > 0.05$), whereas resource flexibility (β = 0.134, $p < 0.01$) and coordination flexibility (β = 0.395, $p < 0.001$) had significant positive relationships with firm performance. These results thus indicated a full mediation effect. Further, Models 3 and 6 showed the moderation effect of market turbulence. Both interaction terms indicated that it had a significant positive influence on resource flexibility (β = 0.251, $p < 0.05$) and coordination flexibility (β = 0.249, $p < 0.001$).

Table 4 and **Table 5** elaborate on the results of the mediation analysis based on the bootstrap approach. Specifically, if the lower and upper bounds of the 95% bootstrap confidence interval excluded zero, then the path coefficient was statistically significant, and vice versa. As **Table 4** shows, whereas the direct path of digitalisation was nonsignificant, both of its indirect paths were significant. These results provided a second demonstration of the full mediation effect. Moreover, according to the results of **Table 5**, the mediation effects of resource and coordination flexibility became larger with an increase in market turbulence. Finally, the indices of the two moderated-mediation analyses were 0.034 and 0.098, and their 95% bootstrap confidence intervals were [0.001, 0.095] and [0.001, 0.228], respectively. Thus, these results confirmed the presence of significant moderated mediation effects.

Based on these findings, we concluded that each of our hypotheses was supported. Resource flexibility fully and positively mediated the relationship between digitalisation and firm performance (H1 supported). Coordination flexibility fully and positively mediated the relationship between digitalisation and firm performance (H2 supported). Market turbulence acted as a positive moderator of the positive mediation effect of resource flexibility on the relationship between digitalisation and firm performance (H3a supported). Finally, market turbulence acted as a positive moderator of the positive mediation effect of coordination flexibility on the relationship between digitalisation and firm performance (H3b supported).

Table 3. Estimated Results

	Resource flexibility			Coordination flexibility			Firm performance		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Constant	5.019***	2.421**	9.112***	4.038***	1.285*	7.754***	5.176***	3.057***	2.226***
Control variables									
Firm age	-.011	-.009	-.004	-.010	-.008	-.002	-.023**	-.021**	-.017**
Firm size	.110	.053	.044	.122*	.061	.050	.138**	.091	.060
State owned	.151	.141	.074	.435	.424	.355	.165	.156	-.030
Privately owned	-.437	-.357	-.328	.141	.225	.261	-.192	-.126	-.168
Foreign	-.305	-.201	-.394	.317	.427	.244	.175	.260	.118
Machinery	-.384	-.489	-.520	-.091	-.202	-.226	.186	.101	.246
Electronics	-.111	-.194	-.183	.166	.078	.093	.331	.263	.258
Pharmaceutical	-.590	-.560	-.608	.020	.051	.024	.091	.115	.170
Steel	.061	.118	.017	.295	.355	.255	.423	.469	.314
Food	-.602	-.528	-.605	.205	.284	.206	.129	.189	.148
Chemical	-.198	-.184	-.282	.021	.037	-.074	.231	.243	.253
Textile	-.342	-.323	-.414	.173	.194	.093	.268	.284	.251
Automobile	-.976	-.638	-.757	-.352	.007	-.118	-.158	.119	.201
Independent variable									
Digitalisation		.479***	-1.008		.507***	-0.987		.390***	.126
Mediators									
Resource flexibility									.134**
Coordination flexibility									.395***
Moderating variables									
Market turbulence	n/a	n/a	-1.128	n/a	n/a	-1.071**	n/a	n/a	n/a
DIG × MT	n/a	n/a	.251*	n/a	n/a	.249***	n/a	n/a	n/a
Degrees of freedom	13, 189	14, 188	16, 186	13, 189	14, 188	16, 186	13, 189	14, 188	16, 186
R^2	.104	.190	.245	.073	.250	.375	0.125	0.241	.451
F-value	1.692	3.141***	3.781***	1.146	4.483***	6.968***	2.080*	4.272***	9.549***

Note: *** = $p < 0.001$; ** = $p < 0.01$; * = $p < 0.05$; DIG = digitalisation; MT = market turbulence.

Table 4. Mediation Effects of Strategic Flexibility

Paths	Effect	BootSE	BootLLCI	BootULCI
Digitalisation → Firm performance	.126	.070	-.011	.264
Digitalisation → Resource flexibility → Firm performance	.064	.029	.017	.129
Digitalisation → Coordination flexibility → Firm performance	.200	.060	.072	.314

Note: BootSE = BootLLCI = bootstrapped lower confidence level; BootULCI = bootstrapped upper confidence level; bootstrapped standard error.

Table 5. Conditional Indirect Effects of Digitalisation on Firm Performance

Paths	MT values	Effect	BootSE	BootLLCI	BootULCI
Digitalisation → Resource flexibility → Firm performance	5.000	.033	.022	-.005	.082
	5.667	.056	.028	.012	.119
	6.333	.078	.040	.017	.170
Digitalisation → Coordination flexibility → Firm performance	5.000	.102	.044	.015	.189
	5.667	.168	.055	.061	.278
	6.333	.233	.086	.075	.412

Note: BootSE = BootLLCI = bootstrapped lower confidence level; BootULCI = bootstrapped upper confidence level; bootstrapped standard error; MT values = values for market turbulence, which are in the 16th, 50th and 84th percentiles.

5.4. Endogeneity Statements

Because we used a nonexperimental design, endogeneity was a concern. We therefore controlled potential endogeneity in two ways. *First*, common method bias is one of the primary sources of measurement error, which may foster endogeneity (Wang et al., 2016). We gathered data from different informants to reduce the potential for common method bias, which mitigated the potential threat of endogeneity caused by measurement error. *Second*, because endogeneity is related to the trajectory of causality, we must theoretically support the trajectory of causality. We argue that digitalisation influences strategic flexibility and downstream performance improvements, that is, that the relationship's trajectory is from digitalisation to firm performance. Some recent digitalisation studies, including Abou-foul et al. (2021) and Nasiri et al. (2020), have confirmed similar trajectories.

6. Discussion

Global companies have become increasingly data driven, and efforts to achieve digitalisation are now integral components of organisational transformation. However, these efforts are not based on one-off decisions; maintaining the success of a digitalisation initiative requires continual investment and buy-in. In fact, as with earlier IT initiatives—such as the rushed implementations of first-generation enterprise resource planning—most digitalisation initiatives fail, and those that are successful are difficult to maintain. Thus, determining how to manage and sustain the positive outcomes of digitalisation has emerged as a

significant challenge for scholars and practitioners (Eller et al., 2020; Holmström et al., 2019).

Chinese manufacturing is a compelling context in which to study digitalisation, because it plays an important role in global supply chains and because China's manufacturing industry is focused on accelerating digitalisation (Ye et al., 2022). This context also presents challenges for digitalisation research, because global supply chains involving manufacturing involve a lot of market turbulence that needs to be addressed with digitalisation, so that these efforts can positively influence firm performance (Li, 2022). Thus, from the perspective of dynamic capability, our study explains the mechanisms underlying the relationship between digitalisation and firm performance under high levels of market turbulence (Wernerfelt, 1984). We explain how market turbulence influences the digitalisation–performance relationship through strategic flexibility. We do so through an empirical study of 203 Chinese manufacturing firms that have achieved varying degrees of digitalisation.

6.1. Key Results

Based on our study's motivation and its theoretical foundation, this section summarises our two most important findings. *First*, in line with much of the extant literature, we confirm the positive relationship between digitalisation and firm performance (Abou-foul et al., 2021; Mak & Max Shen, 2021; Škare & Soriano, 2021; Zangiacomi et al., 2020). However, we also uniquely demonstrate that the positive relationship between digitalisation and business performance is fully mediated by resource flexibility and coordination flexibility. This finding indicates that it may be misguided to examine digitalisation without considering the mediation effects of resource and coordination flexibility on business performance. Chinese manufacturers can attain superior performance only when digitalisation improves their ability to reorganise existing resource combinations and create new ones.

Although our findings are context specific, we expand primarily on Zeng et al. (2022) and partially on Mikalef et al. (2019). Zeng et al. (2022) used panel data from A-share listed companies in China representing the period 2012–2019 and found a direct relationship between digitalisation and firm performance. Zeng et al. (2022) used the resource-based view and DCT to explain how digitalisation influences firm performance; however, they did not consider variables related to the theoretical lenses they

claimed to use in their model. We confirm this mediation mechanism from the perspective of dynamic capabilities at the strategic level, namely strategic flexibility. Mikalef et al. (2019) investigated 175 Greek companies and found that dynamic capabilities fully mediated the positive relationship between big-data-analytics capabilities and innovation capabilities; we find that dynamic capabilities also act as a mediator between digitalisation and firm performance. Some possible explanations are that on one hand, digitalisation begins with the application of digital technologies (Fabian et al., 2023). Because big data analytics is the most frequently adopted digital technology (Li et al., 2022b), building big-data-analytics capabilities is likely an important aspect of digitalisation for many companies. On the other hand, many studies have indicated that innovation capabilities are one of the most influential factors of a company's growth and renewal (Hanelt et al., 2021).

Second, we uniquely demonstrate that the positive mediation effects of strategic flexibility (both resource and coordination flexibility) on the digitalisation–performance relationship are enhanced under high levels of market turbulence. Such a result is a given of the global supply chains in which Chinese manufacturers participate because every market or industry has a natural range of market turbulence and thus the need for flexibility. Moreover, this conclusion expands previous studies' findings regarding organisational innovation. In particular, Wang et al. (2015) investigated 235 Chinese companies and found that in highly turbulent markets, collaboration success depends heavily on innovation capability; in addition, they found that market turbulence positively moderates the relationship between information capability and collaboration effectiveness. They attributed the positive moderating effect of market turbulence to the following reasons on one hand, market turbulence may shorten the cycles of technological innovation and product development; on the other, for improved decision-making, managers need more information. In this paper, we demonstrate that companies with a higher degree of digitalisation can better sense, understand and carefully respond to market changes, thereby providing support for the argument that market turbulence shortens the cycles of technological innovation and product development. We also suggest that the insights brought about by digitalisation may break down information silos within companies and facilitate

coordination among business units and departments, thereby responding to the arguments of Wang et al. (2015)'s work.

6.2. Theoretical Implications

We make two contributions to the strategic IS research on digitalisation. *First*, to explain the relationship between digitalisation and firm performance, prior research has mainly used DCT (Li et al., 2022a; Yang & Yee, 2022) because this theory reflects contemporary corporate environments, which are characterised by high levels of turbulence and volatility (Helfat et al., 2009; Li, 2022). Although several studies have used DCT, most of these studies have considered digitalisation primarily at the level of a specific digital technology, especially big data analytics (Mikalef et al., 2021b) and AI (Abou-Foul et al., 2023). Because companies typically deploy multiple digital technologies rather than relying on just one, additional studies of digitalisation at the organisational level are needed. Although several leading studies have used DCT to analyse digitalisation at the organisational level, they have focused on the direct effects of digitalisation on firm performance (Zeng et al., 2022) and have not clarified whether and why digitalisation can strengthen firm performance in some circumstances but weaken it in others (Li et al., 2022a). Such gaps raise concerns about the incomplete understanding of how companies should develop their dynamic capabilities in a different way. Our study specifies dynamic capabilities through the lens of strategic flexibility and outlines the possible mediation mechanisms, thereby extending and enriching existing knowledge of DCT in digital contexts (Mikalef et al., 2021b).

Second, we provide a new theoretical explanation for the complex effects of digitalisation. The explanations for this phenomenon offered by existing research are based primarily on the perspective of digital technology as an investment or resource (Kohtamäki et al., 2020). However, like other IT investments, digitalisation is not a silver bullet to improving performance; in fact, digitalisation projects may undermine firm performance (Pettit, Croxton, & Fiksel, 2019). Moreover, although investing in new digital technologies is critical for business success, the sheer newness of a given digital technology does not mean it is ideal for a company's development (Kohtamäki et al., 2020). Blindly investing in new digital technologies undoubtedly increases the budget burden of companies. Although previous studies have

provided some valuable insights into the complex effects of digitalisation, digitalisation depends not only on investing in new digital technologies but also, and more importantly, on how companies develop corresponding abilities to adapt to changes in their business environments (Li, 2022). Accordingly, to show how a company can bring its strategy into alignment with its business environment, a more in-depth assessment of digitalisation should consider external factors. Our study reveals how strategic flexibility and market turbulence jointly influence the positive effect of digitalisation on firm performance, thus enriching the current knowledge of the complex effects of digitalisation.

6.3. Managerial Implications

Our findings provide several insights that can help managers sustain the positive outcomes of digitalisation for their companies, especially in the face of shifting market conditions and consumer demands. *First*, to thrive in the digital age, a company must use digitalisation to improve its ability to restructure its existing resources. A classic negative example is the case of Digital Equipment Corporation (DEC), a former market leader in the computing industry and a direct competitor of IBM that was annihilated by the digital revolution (Barron, 2021). Because DEC was unable to anticipate future market shifts and respond appropriately and rapidly, many observers blamed its failure on the inflexibility of its resources. In the digital age, data-driven growth is replacing technology-driven growth (Gerow et al., 2015). Hence, to properly fulfil shifting market expectations, companies must increase their flexibility by digitally altering their resources. Because data has become one of the most important factors of a company's production (Lehrer et al., 2018), to optimise the allocation of existing resources, companies must monitor the utilisation of different resources by storing, managing and using data effectively (Soluk & Kammerlander, 2021).

Second, companies should leverage the affordances of several digital technologies to facilitate coordination among their business units, encourage the development of new business processes across divisions and foster a culture of collaboration (Tabrizi et al., 2019). These efforts are important because interdepartmental competition may result in overinvestment in digital projects. More precisely, interdepartmental competition is a major cause of rising costs and the difficulty of sustaining the positive outcomes of digitalisation (Accenture, 2020). Hence, to improve coordination flexibility and resulting

performance through digitalisation, companies should plan the strategy of each stage in detail, fully discuss it with relevant department leaders and communicate it widely to all participants (Elbanna & Newman, 2022). During its digitalisation process, Zhenhua Port Machinery Company Limited (ZPMC), the world's largest manufacturer of port machinery and heavy equipment, faced the challenge of dealing with many departments and many standardised projects (Accenture, 2020). Accordingly, ZPMC established a standardisation committee to focus on the overall goal of digitalisation, to strongly control the data architecture and application architecture and to deploy a cloud-based infrastructure to promote cross-department, cross-business and cross-system coordination, all of which ultimately contributed to the success of its digitalisation initiative (Accenture, 2020).

6.4. Limitations and Future Research

Our study's limitations indicate opportunities for future research. *First*, our study focuses on digitalisation, which is an organisation's use of digital technologies to gather data, improve information exchange, strengthen collaboration and enable related business improvements (Li et al., 2022c; Mak & Max Shen, 2021; Papadopoulos et al., 2022; Ritter & Pedersen, 2020). However, many global companies view digitalisation not as the final strategic stage but as a necessary first step towards a riskier and more strategic digital transformation. They do so because *digital transformation* involves deep structural change, a new organisational identity and new value propositions (Baiyere et al., 2020; Chanias et al., 2019; Vial, 2019; Wessel et al., 2021)—all of which are deeper, more longitudinal and even riskier. Organisations that lack basic experience with digitalisation and at least some success in implementing it would likely suffer colossal failure if they attempted to jump directly to digital transformation. However, it is not entirely clear how organizations can move longitudinally from successful digitalization implementation experiences to the necessary organizational learning, capabilities, and resources—in the face of market turbulence—to enable successful digital transformation. Filling this important research gap will require substantial longitudinal research.

Second, our findings are based primarily on manufacturing companies in China with asset-heavy operations. Accordingly, examining the proposed framework in the context of other industries, especially

service companies, may improve our study's generalisability. The investment requirements for digital technology equipment in manufacturing companies necessitate higher and more complex levels of technology-specific fixed capital investment than they do in more service-oriented industries; thus, in the latter, the return on investment may take longer to appear because of the lower fixed-asset turnover involved. Likewise, the risks of investing in the wrong fixed assets are high, especially considering the rapidity of technological development. Some of the more extreme examples are found in the manufacturing of semiconductors, cars, car batteries, aircraft, rockets, military hardware, and solar panels, in which technology-infused capital investments can be in the billions of USD. For these reasons, China's fixed-asset investment is massive (over 7.99 trillion USD), and the country's manufacturing sector has placed a strong emphasis on increasing investment in fixed high-tech assets (Yue, 2021). In light of these developments, although our study considers market turbulence, companies face changes not only in customer preferences but also in technological development (Calantone et al., 2003). Hence, future studies could examine other external factors, especially the turbulence of technological development (Li et al., 2022d).

Third, we examine only Chinese companies, thus limiting the global generalisability of our results. Cross-cultural considerations would be an interesting direction for future research. For example, scholars could compare the differences between Chinese and US manufacturing companies in terms of the effects of digitalisation on firm performance. One of the key issues is that although virtually all manufacturers in the world deal with market turbulence, differences in how they deal with it emerge that need to be considered in terms of national cultural traditions, labour availability, contract enforcement, organisation culture, social identity, management style, conflict resolution and government regulations, among other issues. These issues become more complex in the context of joint ventures and supply chains that include partners from different world regions (Li et al., 1999; Reus & Rottig, 2009; Salk & Shenkar, 2001).

7. Conclusion

To gain a deeper comprehension of the many phenomena associated with digitalisation, we construct a dynamic capabilities-oriented moderated-mediation model. Using survey data from 203 Chinese manufacturing enterprises, we present strategies for managing and sustaining the positive impacts of digital

transformation. Our research outcomes are poised to guide manufacturing businesses towards prosperity in the digital era.

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Appendix A. Methodology Support

Table A.1. Measurement items

Constructs (Source)	Constructs and items	Factor loadings	Reliability and validity
Digitalisation	In our company, we digitalize everything that can be digitized.	0.739	CR = 0.840
Adapted from Nasiri et	In our company, we achieve information exchange with digitality.	0.787	AVE = 0.568
al. (2020) based on	In our company, we create stronger networking between the different business processes with	0.765	α = 0.832
(Abou-foul et al., 2021;	digital technologies.		
Bharadwaj et al., 2007)	In our company, we collect massive volumes of data from different sources.	0.722	
Market turbulence	Customers in our markets are very receptive to new product ideas.	0.804	CR = 0.842
(Mangus et al., 2020)	In our markets, customers' preferences change relatively fast.	0.768	AVE = 0.640
	New customers tend to have product-related needs that are different from those of existing customers.	0.827	α = 0.842
Resource flexibility	There are a large range of alternative uses to which our major resources can be applied.	0.732	CR = 0.872
(Wei et al., 2014)	The difficulty of switching from one use of our major resources to an alternative use is low.	0.719	AVE = 0.633
	The time required to switch to alternative resource use is short.	0.845	α = 0.868
	The major resources can be allocated to develop, manufacture, and deliver a diverse line of products.	0.874	
Coordination flexibility	We often collaborate with each other to find a new use for internal resources.	0.777	CR = 0.850
(Wei et al., 2014)	We often find new resources through communication between units.	0.748	AVE = 0.586
	We often find new resources and/or new combinations of existing resources.	0.768	α = 0.848
	We often find new resources and/or new combinations of external resources.	0.769	
Firm performance	My organization's growth in sales is better compared to major competitors.	0.694	CR = 0.829
(Vickery et al., 2003)	My organization's growth in profit is better compared to major competitors.	0.759	AVE = 0.548
	My organization's growth in return on investment is better compared to major competitors.	0.738	α = 0.826
	My organization's growth in return on sales is better compared to major competitors.	0.767	

Note: α = Cronbach's alpha; AVE = average of the variance extracted; CR = composite reliability.