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The effect of high-involvement human resource management practices on supply chain resilience and operational performance

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ABSTRACT

Supply chain (SC) resilience is an increasingly important topic for practitioners and academics because it is a competitive weapon for firms to cope with SC disruptive risks. This study examines the impact of high-involvement human resource management practices on SC resilience from the ability-motivation-opportunity perspective. It also examines the relationship between the dimensions of SC resilience and operational performance. Based on data collected from 206 Chinese manufacturers, the proposed hypotheses were tested using structural equation modeling. The results indicated that employee participation played the most powerful role in improving supplier, customer, and internal resilience. Moreover, employee skills only facilitate internal and customer resilience but have no significant impact on supplier resilience. By contrast, employee incentives do not influence the dimension of SC resilience. It was also found that both internal and customer resilience have positive effects on operational performance, while supplier resilience has no significant effect. The findings contribute to literature and practice.

1. Introduction

Globalization brings opportunities for manufacturers to benefit from their global supply chain (SC) operations; however, they experience unprecedented challenges (Dubey et al., 2019; Rajaguru and Matanda, 2013). Supply chain management (SCM) is facing an increasingly complex, dynamic, and uncertain operating environment, due to trade protectionism, new technology iteration, pandemic around the world, and diversified customer demand. However, SC designs that reduce costs and improve efficiency, such as Just in Time (JIT), lean production, zero inventory, and supply base reduction, may weaken their buffer capacities to cope with unforeseen changes. As a result, SCs have become increasingly fragile and vulnerable to disruption risks, which may potentially bring huge losses to manufacturers (Hendricks and Singhal, 2010).

SC resilience has been recognized as a critical capability to effectively respond to and recover from SC disruptions and gain competitive advantage in a dynamic and turbulent business environment (Blackhurst et al., 2011; Burnard et al., 2018). Consistent with Pournader et al. (2016), SC resilience was divided into three dimensions: internal, supplier, and customer

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resilience. This division mirrors the features of the interacting relationships of SC entities and their functional differences. However, building a resilient SC is not an easy task for firms to invest extra resources and reconfigure their SCs. Previous literature mainly explored SC resilience stimulants from technical and relational perspectives while neglecting employees' role in managing SC disruptions (Appendix B for more details). The lack of employee skills during the recent pandemic poses great challenges to the recovery of the disrupted SC, such as changes in working routines, anxieties and fears among employees, and job skill shifts in remote working conditions (Butterick and Charlwood, 2021).

Human resource management (HRM) refers to a coherent set of mutually reinforcing practices aimed at shaping employees' behavior and improving their skills (Huo et al., 2015). Prior literature provides evidence that HRM practices may influence SC resilience. Blackhurst et al. (2011) suggested that employee education training, the establishment of post-disruption performance feedback, and knowledge of cost and benefit analysis are necessary conditions for building organizational resilience. Jaaron and Backhouse (2014) argue that employees with high emotional commitment are more actively involved in the recovery of SC activities. Datta (2017) found that team management increased organizational flexibility, thereby improving SC resilience. Despite their importance, these studies are either conceptual or merely explore a single aspect of HRM practices on SC resilience, providing us with opportunities for this study.

Drawing on the ability-motivation-opportunity (AMO) view, Jiang et al. (2012) summarized three sets of high-involvement HRM practices: skill-, motivation-, and opportunity-enhancing practices. In this study, we argue that different HRM practices that empower employees with skills and motivations determine whether firms can quickly respond to and recover from SC disruptions. This study follows the AMO view to operationalize HRM practices and aims to address the first research question (RQ1): *How do different bundles of high-involvement HRM practices affect different dimensions of SC resilience*?

Firms with resilient SC can recover from SC disruptions in a timely and effective manner and reduce the material shortage rate caused by disruptions (Hohenstein et al., 2015; Rezapour et al., 2017; Wieland and Wallenburg, 2013). However, SC resilience requires multiple redundancies, and firms with poor resource endowment must make a trade-off between extra investments and ensuring operational performance when SC disruptions occur (Ali et al., 2017a). Although prior studies have found that manufacturers can reap operational benefits from enhanced SC resilience, these studies have mainly considered SC resilience as a single concept (Ali et al., 2017a; Birkie et al., 2017). Insufficient attention has been paid to the multidimensional nature of SC resilience, and studies have failed to uncover the effectiveness of different dimensions of SC resilience on operational performance. Thus, this study aims to answer the second research question (RQ2)*: How do different dimensions of SC resilience affect operational performance*?

To address these research questions, this study empirically tested the relationships between high-involvement HRM practices, SC resilience, and operational performance based on 206 samples from Chinese manufacturers, contributing to the literature in two ways. First, we built an HRM-SC resilience link by incorporating the AMO view to understand how different aspects of HRM practices can play different roles in improving SC resilience. Second, this study confirms that manufacturers can reap operational benefits from SC resilience and further reveals that internal and customer resilience improve operational performance, while supplier resilience does not. Practically, it provides insights for HRM and SCM managers to better design HRM systems and adjust SC resilience initiatives holistically.

2. Literature review and hypothesis development

2.1. The AMO view of high-involvement HRM practices

Given that employees are embedded in an integrated HRM system, investigating HRM practices in isolation is insufficient. Jiang et al. (2012) adopted an AMO view to decompose integrated HRM practices into three dimensions: skill-, motivation-, and opportunity-enhancing practices. Firms can develop employees' "ability" through rigorous selection and extensive training, "motivation" by incentives and rewards, and "opportunity" through work teams and feedback (Jiang et al., 2012; Yu et al., 2017). In line with this conceptualization, this study regards employee skills, incentives, and participation as three elements of high-involvement HRM practices (Huo et al., 2015).

Although the above three practice-centered dimensions do not directly represent employees' abilities, motivations, and opportunities, we argue that these practices can effectively work through mechanisms from the AMO view. Previous SCM research applied the AMO view to explain how HRM practices contribute to SCM activities, capabilities, or performance. For example, Yu et al. (2020) suggested that green HRM practices should be developed to provide employees with ability through training, motivation through incentives, and opportunity through a conductive environment. Similarly, Singh et al. (2020) applied the AMO view to link green HRM, green innovation, and environmental performance. This study extends this research stream by using the AMO view to illustrate how the three bundles of HRM practices can be used to build SC resilience.

Specifically, employee skills are skills, knowledge, and abilities that meet specified job requirements (Pagell et al., 2010). Employee skills represent the ability dimension of the AMO view, which relies on selecting proper employees and training programs that increase their skill depth (beyond the industry-average level) and breadth (to complete multiple tasks) (Batt, 2002). Employee incentives refer to the use of appropriate ways to motivate employees to apply their knowledge and skills to specific tasks so that they can better achieve organizational goals (Ahmad and Schroeder, 2003; Chadwick and Dabu, 2009). In this manner, employee incentives represent the motivation dimension of the AMO's view that firms can set continuous goals for employees to motivate their potential. In addition, they can design reward mechanisms to identify and inspire the most

committed employees toward organizational goals (Locke and Latham, 2002). Employee participation refers to the establishment of a flat organizational structure in which employees fully express their opinions and actively participate in problem-solving and process improvement activities (Batt, 2002; Huselid, 1995). Employee participation represents the opportunity dimension of the AMO view that firms can set up teams to provide a platform for employees to maintain and develop their talents and increase their sense of participation. They can also offer responsive performance feedback information that allows employees to adjust their working modes to align with their organizational goals (Birdi et al., 2010).

2.2. SC resilience

SC resilience is defined as the SC's ability to remain alert toward changes in the environment and quickly respond to and recover from disruptions once they occur (Blackhurst et al., 2011; Burnard et al., 2018). Kamalahmadi and Parast (2016) considered SC resilience as a dynamic capability that depends on individuals' functional anticipation and preparedness for rapid changes and the application of flexible and innovative solutions to respond quickly and adapt to these changes. Such a dynamic capability can ensure an unbroken SC structure and function as well as the continuity of logistics, information, and cash flow.

Based on a tractable view, we focus on a three-tier SC (Swafford et al., 2006). A typical three-tier SC comprises a firm's direct suppliers and customers and its functions. Pournader et al. (2016) followed this three-tier SC perspective and divided SC resilience into manufacturer, supplier, and distributor resilience. In this study, it is argued that, because of the complexity of SC disruptions, it is difficult for a single firm to recover quickly and successfully without cooperating with its suppliers and customers. Each member of the SC should undertake preparation and recovery activities (Scholten and Schilder, 2015); therefore, by emphasizing resilient operations internally, in the focal firm, and externally, with its SC partners, a more nuanced investigation of the antecedents and consequences of SC resilience can be conducted.

Consistent with these views and based on major SC nodes where a potential disruption may occur, SC resilience was collapsed into internal, supplier, and customer resilience. The latter two dimensions are regarded as external resilience. Specifically, internal resilience refers to the ability of internal functions to maintain proactive alertness toward environmental changes and to quickly respond to and recover from disruptions once they occur to ensure internal continuity. Supplier resilience is embedded in the operations between the focal firm and its suppliers. It refers to the ability of joint efforts from the focal firm and its suppliers to maintain proactive alerts toward environmental changes and quickly respond to and recover from disruptions to ensure supply-side continuity. Similarly, customer resilience is nested in the operations between the focal firm and its customers. It refers to the ability of joint efforts from the focal firm and its customers to maintain proactive alerts toward environmental changes and quickly respond to and recover from disruptions to ensure demand-side continuity.

2.3. Impacts of high-involvement HRM practices on SC resilience

Human resources play an important role in SCM. The development of SC strategies, SC cooperation and coordination, and applications of technologies and tools in SCM rely heavily on employee knowledge and skills (Bendoly et al., 2006). In particular, when disruptions threaten the SC and focal firms face more dynamic and complex situations, the role of human resources becomes more prominent (Ellinger and Ellinger, 2014). For example, a fire broke out at the Meridian plant in Michigan on May 2, 2018, which was a key component supplier to Ford. Faced with a sudden SC disruption, Ford moved quickly to restore supply and production operations and thus assembled an efficient management team of employees from different business units, who arrived at the Meridian plant hours after the fire broke out to help the supplier restore production. Previous research has also shown that HRM practices can successfully shape employees' behavior and improve their job performance by improving their skills, motivating employees to fully utilize their skills and providing them with a platform to fully participate in their work (Batt, 2002; Huselid, 1995). The AMO view is employed to categorize HRM practices and consider employee skills, incentives, and participation as three elements of high-involvement HRM practices. It is posited that skill-, motivation-, and opportunity-enhanced employees can improve SC resilience. Fig. 1 illustrates the conceptual model used in this study.

Employee skills refer to the ability of firms to select competent employees and improve the depth and breadth of their skills through HRM activities such as recruitment and training (Boudreau et al., 2003; Boxall and Steeneveld, 2010). According to the AMO view, the skill-enhanced element of high-involvement HRM practices can enable firms to respond immediately to SC disruptions (Pagell et al., 2010). Firms can improve their skill-enhancing element by recruiting a high-quality workforce and developing their working skills through training. For instance, recruitment and selection activities are employed to ensure that employees are competent in maintaining psychological resilience (e.g., personality tests), which may help them cope with disruptive events. High-skilled employees can not only pre-judge SC disruptions based on their acquired experience but also quickly respond to various emergencies according to environmental requirements and use their knowledge and talents to take measures other than waiting for guidance to resume operations (Akgün and Keskin, 2014; Burnard and Bhamra, 2011). Moreover, employee training promotes employees' learning and sharing abilities to obtain more knowledge of SC risk management. They are more familiar with making rapid decisions and predominate in specific recovery processes. If employees do not possess high-level skills, they will face difficulty when encountering production discontinuity, delaying the best recovery opportunity (Riley et al., 2016; Vlajic et al., 2012).

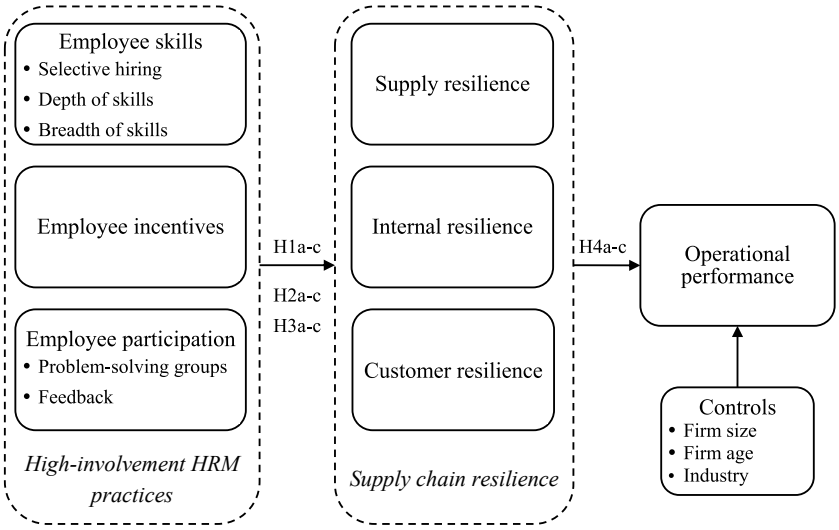

Fig. 1. Conceptual model.

Specifically, internal resilience in dealing with various emergencies depends on employee skills. Sarkis et al. (2010) argued that employees with high skill levels often have faster decision-making abilities and greater environmental adaptability, which are pivotal to improving internal resilience (Riley et al., 2016). For example, damage to facilities and equipment causes production line stagnation. If employees possess the knowledge and skills required to quickly repair damaged facilities, the production line can be restored with fewer internal breaks (Ali et al., 2017b). In addition, well-designed recruitment contributes to selecting outstanding employees for the firm. These employees can be well trained to foster a high sense of alertness and thus quickly identify potential crises and reduce the probability of internal disruptions. They also have better teamwork skills to form emergency management teams when disruptions occur. Therefore, the following hypothesis is proposed in this study:

H1a. Employee skills are positively related to internal resilience.

Employee skills can also increase external resilience. Employees with high skill levels can better communicate and coordinate with suppliers and customers to cope with SC disruptions and maintain supply and demand stability. First, training to improve employee skills gives employees more knowledge and experience in supplier and customer management (Ellinger et al., 2011). When there is a disruption upstream or downstream, employees can better understand supplier and customer needs, effectively work with them, reduce fluctuations in supply and delivery, and restore SC operations in a short time. Second, the depth and breadth of employee skills ensure that they have more crisis management knowledge and communication skills, which not only helps the focal firm establish a stable risk prevention system but also helps SC partners identify their potential risks and maintain stable operations. Third, recovery activities for SC disruption involve complex tools and measures. For example, firms use SC information systems to analyze supply and demand data fluctuations, deploy internal and external resources, and reconstruct upstream and downstream structures and processes. The successful implementation of these tools and measures depends on the skills of employees (Bendoly et al., 2006). Therefore, employees who constantly acquire new knowledge and master new skills can better maintain the continuity of upstream and downstream operations and promote their ability to recover from SC disruptions. Therefore, the following hypotheses are proposed in this study:

H1b. Employee skills are positively related to supplier resilience.

H1c. Employee skills are positively related to customer resilience.

Firms set goals for their employees and design a fair reward system to motivate them to utilize their knowledge and skills more effectively for specific tasks (Locke and Latham, 2002). In this study, it is argued that employee incentives that are oriented toward achieving organizational goals can enhance SC resilience from a "motivation-enhancing" logic. Based on the AMO view, motivation-enhancing HRM practices encourage employees to proactively seek solutions to disruptive events, thereby increasing SC resilience. Specifically, when a firm's reward system can recognize and inspire employees who have made more effort and achieved greater outcomes fairly, employees with different functions can work synergistically and efficiently to achieve organizational goals (Siemsen et al., 2008). In other words, employees cannot generate a commitment to pursue organizational interests without relatively fair incentives (Bartol and Srivastava, 2002) as they have low motivation to participate in recovery work or organize an efficient group to deal with internal disruptions. Appropriate incentives also make employees more passionate and productive (S.A. Snell and Dean, 1992). In the face of production stagnation, motivated employees actively communicate and cooperate with other functions to obtain more recognition and rewards and thus take

more active and innovative steps to facilitate internal operations. Therefore, the following hypothesis is proposed in this study:

H2a. Employee incentives are positively related to internal resilience.

Employee incentives also promote supplier and customer resilience. Maintaining supply and demand stability is a basic operational goal. Firms implement this goal in assessment and incentive systems and provide sufficient rewards for employees who can improve supplier and customer management standards. Consequently, employees recognize the importance of SCM and actively communicate with suppliers and customers to improve efficiency (Huo et al., 2015). When the SC is disturbed and the supplier or customer side cannot run smoothly, employees can spontaneously maintain relationships with suppliers and customers, strive to renew supply and final product delivery, and achieve continuous SC operations. In addition, fair incentives increase employees' organizational commitment, placing greater emphasis on the firm's overall benefits (Bartol and Srivastava, 2002). SC disruptions cause huge losses, which are not only detrimental to the realization of established goals but also threaten organizational survival. Therefore, when the upstream and downstream are disrupted, in addition to procurement and sales functions that need to actively participate in the recovery work, employees in other functions will also prioritize organizational interests and quickly take action to recover supplier and customer operations. Therefore, the following hypotheses are proposed in this study:

H2b. Employee incentives are positively related to supplier resilience.

H2c. Employee incentives are positively related to customer resilience.

By establishing problem-solving groups and providing timely performance feedback to employees, firms build a flat work platform in which employees have a strong sense of ownership and are more actively involved in various tasks (Batt, 2002; Birdi et al., 2010; Huselid, 1995). Employee participation can enhance SC resilience by providing more opportunities ("Opportunity") for employee engagement. Following the view of the AMO, opportunity-enhancing HRM practices empower employees to use their knowledge and skills to achieve goals, which is essential in disruptive SC settings because these need more contingent solutions. On the one hand, problem-solving groups provide employees with a platform for knowledge- and skill-sharing, and they have more discretion to participate in decision-making processes. When the SC is disrupted, employees immediately form an emergency management team and fully participate in the recovery work. Employees can also seek help from teammates if they are confronted with difficulties and respond collaboratively to SC disruptions (Ates and Bititci, 2011). On the other hand, firms with high employee participation usually have a more organic and flexible organizational structure that creates an open and trustworthy atmosphere. When SC disruptions occur, employees can devote more time and resources to recovering tasks beyond their daily responsibilities to achieve organizational goals (Jaaron and Backhouse, 2014).

Specifically, firms encourage employees with different internal functions to handle tasks in a problem-solving team, which improves internal resilience and problem-solving efficiency (Cantor et al., 2012). For example, when a product-quality accident leads to production stagnation, employees from different functions, such as production, procurement, sales, and R&D, compose an emergency team. This team can integrate different knowledge and experiences to systematically analyze problems, quickly find solutions to resume production, and finally improve internal resilience. In addition, performance feedback during employee participation increases their enthusiasm for work. Further, they can obtain deficiencies in their work and tap into their potential to achieve corporate goals based on performance feedback (Pfeffer, 1998). Consequently, they can correct response measures for disruptions according to real-time feedback results, which can eventually ensure the stability and continuity of internal operations. Therefore, the following hypothesis is proposed in this study:

H3a. Employee participation is positively related to internal resilience.

Employee participation can increase supplier and customer resilience. First, employees participating in teamwork fostered a cooperative culture. Cooperation is believed to be the most effective means of addressing various problems (Huo et al., 2015). Employees consciously form an emergency team with those from SC partners to fully communicate and coordinate the recovery work, which not only reduces inter-firm conflicts and costs but also improves work efficiency (Jiménez-Jiménez and Martínez-Costa, 2009). Second, employees can follow recovery feedback to identify weak links to supplier and customer operations and continuously reorient their cooperation strategy with SC partners, thereby reducing the volatility of supply and demand and enhancing supplier and customer resilience. Therefore, the following hypotheses are proposed in this study:

H3b. Employee participation is positively related to supplier resilience.

H3c. Employee participation is positively related to customer resilience.

2.4. The impact of SC resilience on operational performance

Operational performance captures how well firms perform in terms of demand response, lead time, delivery, and customer service (Flynn et al., 2010; Goodale et al., 2011). In this study, it is argued that SC resilience can improve a firm's operational performance. With internal resilience, each function becomes more sensitive to SC disruptions, and customer service is less affected because of the precautions taken in advance. In addition, resilient internal functions can react efficiently to adjust

operational processes and continue to meet customer needs promptly (Bakshi and Kleindorfer, 2009; Hohenstein et al., 2015; Sheffi and Rice, 2005). Therefore, the following hypothesis is proposed in this study:

H4a. Internal resilience is positively related to operational performance.

The focal firm and its suppliers need a certain amount of time to recover from SC disruptions, which inevitably lengthens the lead time for final product delivery. Supplier resilience means that the focal firm and its suppliers are sensitive to potential risks and prepare safety stocks in advance to minimize order losses. They can also coordinate to stabilize the raw material supply as quickly as possible, thus ensuring sufficient time to adjust the production and delivery processes. Consequently, firms with superior supplier resilience have better operational performance than their competitors (Gualandris and Kalchschmidt, 2015). Thus, the following hypothesis is proposed in this study:

H4b. Supplier resilience is positively related to operational performance.

Customer resilience enables firms to maintain continuous and stable product and service delivery, which guarantees operational performance. First, the inventory and production capacity reserved by the firm ensures that customer orders are satisfied after SC disruptions. Second, risk-sharing cooperation with customers to cope with SC disruptions can shorten recovery time, ensure time-to-market, and maintain customer satisfaction. While adjusting business processes with customers, firms can deepen their understanding of customer needs and seize opportunities to further improve customer service (Carvalho et al., 2012; Zsidisin and Wagner, 2010). Therefore, the following hypothesis is proposed in this study:

H4c. Customer resilience is positively related to operational performance.

3. Research methodology

3.1. Questionnaire design

The questionnaire was designed based on several extant instruments. First, an English version of the questionnaire was developed based on the literature review. Two researchers translated the English version into Chinese, followed by back-translation to maintain conceptual equivalence. Second, although the measures used in this study were adopted or adapted from prior literature, survey questions were modified to reduce linguistic and cultural influences, based on in-depth interviews with 18 manufacturing managers (Zhao et al., 2006); therefore, content validity was ensured through academic and practical verifications. A 7-point Likert scale was used to evaluate the respondents' perceptions of the questions, and all measures are shown in Appendix A.

Specifically, measures of internal, customer, and supplier resilience were adapted from Ambulkar et al. (2015), who developed a 4-item scale to measure internal firm resilience. We extended these measures to the SC level and asked respondents to evaluate their perceptions of how they could maintain high situational awareness, provide quick responses, cope with changes, and adapt to SC disruptions across functions and with their major suppliers and customers. Furthermore, based on a review of previous literature on SC resilience and interviews with managers, one additional item from Brandon-Jones et al. (2014) was also added and asked if they agreed that SC operations can quickly recover after disruptions. All measures were scored by the respondents, with 1 = *strongly disagree* and 7 = *strongly agree*. Definitions of resilience dimensions were also provided at the beginning of the related questions, so that the respondents could better comprehend the measures.

The measures for high-involvement HRM practices were adopted from Ahmad and Schroeder (2003) and Huo et al. (2015). Employee skills were treated as a second-order construct, reflected by selective hiring and depths, and breadth of skills. The respondents were asked to evaluate their perceptions of how their firms select employees based on work values, behavioral attitudes, and abilities of continuous improvement and teamwork; how were their employees' proficiency and skill level compared with others in the industry; and how their employees receive cross-training, perform multiple tasks, and substitute others if necessary. Further, employee incentives were measured by asking respondents how they perceived their incentive systems to identify, encourage, and reward excellent employees to achieve their objectives. Problem-solving groups and feedback systems were used as first-order constructs to reflect employee participation. The respondents were asked to evaluate their perceptions of how problems are solved and processes are improved by problem-solving groups and how work outcomes and performance are available to employees in a timely manner. All measures were scored by the respondents with 1 = *strongly disagree* and 7 = *strongly agree*.

The measures for operational performance were adapted from Goodale et al. (2011) and Flynn et al. (2010), which evaluate the level of firms' market responsiveness, lead time, delivery, and customer service, with 1 = *strongly disagree* and 7 = *strongly agree*. Firm age, industry, and firm size, were also added, measured by the total number of employees and fixed assets, as control variables, which may affect operational performance.

3.2. Data collection

Manufacturers in China were chosen as the data source for this study. First, China is the world's largest industrial country with great development in manufacturing, which provides a fertile research ground for investigating operations and SCM.

Second, owing to their SC network complexity, manufacturers are more likely to be threatened by SC disruptions than service firms. Therefore, this study selected manufacturers to explore how HRM practices influence SC resilience. Due to its vast territory and unbalanced economic development, this study selected four representative regions of China: the Pearl River Delta, Yangtze River Delta, Bohai Rim, and other regions. The other regions included the central, northeastern, and western parts of China, which, compared to developed coastal areas, have low levels of economic development (Zhao et al., 2006).

Stratified sampling method was used to select 2820 manufacturing firms from the directory provided by the National Bureau of Statistics of China, which includes various industries and regions. Phone calls were made to identify informants who had knowledge about HRM and SCM practices before mailing the questionnaires. These informants were also contacted to explain the purpose of this study and to confirm their willingness to participate in the survey, in which 812 firms agreed to participate. Questionnaires were mailed to these firms with a cover letter that explained the aim of the research. To increase the response rate, the informants were contacted a second time via phone call after 2 weeks of intermission; 298 firms returned questionnaires, of which 92 responses were deleted because of missing values. Ultimately, 206 usable responses were obtained, yielding a response rate of 25.4%. The sample size and response rate in this study are in line with those of many previous SCM studies (Autry et al., 2010; Zhou and Benton, 2007).

Table 1 summarizes the firm and respondent profiles. As shown in Table 1, respondent firms cover a wide range of industries and regions with varying firm sizes, indicating the good representativeness of the samples. Table 1 also shows that most informants are middle and top managers with a rate of 98.5%, and over half of them have been working for these positions for more than 5 years, suggesting that they are competent to answer these questions. Follow-up phone calls were also made to ensure that the informants had a good understanding of the questions related to HRM and SC resilience and confirmed that they had answered questions according to the actual practices of their firms.

4. Analyses and results

4.1. Non-response bias and common method bias

To assess non-response bias, the procedure recommended by Armstrong and Overton (1977) was followed, which compares early and late responses in terms of the number of employees and fixed assets. The *t*-test results showed no significant differences ($p > 0.05$). Second, information regarding the region, firm size, number of employees, fixed assets, and ownership was collected from the official websites of non-response firms and compared the means of these democratic variables. Similarly, the results of the *t*-test indicated no significant differences ($p > 0.05$); therefore, non-response bias was not a concern in this study.

Common method bias was examined because the data were perceptual and collected from only one informant in each firm. First, Harman's one-factor test was used to perform exploratory factor analysis (EFA) (Podsakoff et al., 2003). Seven factors appeared with eigenvalues larger than 1.0, explaining 69.63% of the total variance, and the first factor explained only

Table 1
Sample profiles.

	Percentage		Percentage
Firm profiles			
Industries		*Region*	
Metal, Mechanical & Engineering	40.8	Bohai Bay Economic Rim	35.4
Electronics & Electrical	19.4	Yangzi River Delta	24.8
Textiles & Apparel	10.2	Pearl River Delta	19.9
Chemicals & Petrochemicals	7.8	Other areas in China	19.9
Food, Beverage, Alcohol & Cigarettes	6.3		
Building Materials	4.9		
Publishing and Printing	4.4		
Rubber & Plastics	3.9		
Pharmaceutical & Medicals	2.4		
Number of employees		*Ownership*	
<100	2.0	State-owned	16.0
100–199	23.3	Privately owned	53.9
200–499	34.0	Foreign-owned	19.4
500–999	18.0	Joint venture	10.7
1000–4999	18.4	State-owned	16.0
5000 or more	4.4		
Informant profiles			
Tenure of the current position (years)		*Position*	
≤5	23.3	Top manager	22.3
6–10	39.8	Middle manager	76.2
11–15	18.9	Others	1.5
≥16	18.0		

10.93% of the total variance. Further the confirmatory factor analysis (CFA) was employed to Harman's one-factor test (Sanchez and Brock, 1996). The model fit indices were $\chi^2 = 2565.24$ with $df = 594$, RMSEA = 0.15, SRMR = 0.093, NNFI = 0.86, and CFI = 0.87. These indices were much worse and unacceptable compared with those of the measurement model. In addition, we employed an unmeasured latent method construct (ULMC) approach to further examine common method bias. Compared with the baseline measurement model, the ULMC model further aggregates all measurement indicators into another method-effect construct (Podsakoff et al., 2003). For the first-order HRM constructs with SC resilience and operational performance, the ULMC model fit indices were $\chi^2 = 789.28$, $df = 503$, RMSEA = 0.047, SRMR = 0.040, NNFI = 0.99, and CFI = 0.99 (the fit indices of the baseline model: $\chi^2 = 892.13$, $df = 549$, RMSEA = 0.052, SRMR = 0.047, NNFI = 0.98, and CFI = 0.99). For the CFA model containing only second-order HRM constructs, the fit indices were $\chi^2 = 237.30$, $df = 42$, RMSEA = 0.16, SRMR = 0.073, NNFI = 0.88, and CFI = 0.94 (the fit indices of the baseline model: $\chi^2 = 111.86$, $df = 59$, RMSEA = 0.062, SRMR = 0.046, NNFI = 0.98, and CFI = 0.99). The two ULMC model results showed no significant improvement or were even worse compared to the baseline models, further indicating that common method bias is unlikely to be problematic in this study.

4.2. Reliability and validity

The two-step method recommended by Narasimhan and Jayaram (1998) was used to examine construct reliability. First, the EFA results indicate that all items had higher loadings on the constructs that they were intended to measure, demonstrating construct unidimensionality. Second, Cronbach's alpha was calculated for each construct, and the values were greater than 0.70. The correlation coefficient of the items (those constructs with only two measures) was significant and large (Appendix A and Table 2). These results ensured construct reliability.

Further, CFA was used to assess convergent validity. First, CFA of the first-order HRM constructs with SC resilience and operational performance was conducted. The model fit indices were $\chi^2 = 892.13$, $df = 549$, RMSEA = 0.052, SRMR = 0.047, NNFI = 0.98, and CFI = 0.99, and all factor loadings were significant and greater than 0.50 (Appendix A). These results indicate convergent validity (Hu and Bentler, 1999; O'Leary-Kelly and Vokurka, 1998). We further conducted CFA of the second-order construct. The model fit indices were $\chi^2 = 111.86$, $df = 59$, RMSEA = 0.062, SRMR = 0.046, NNFI = 0.98, and CFI = 0.99. Table 2 shows the second-order factor loadings that are significant and greater than 0.50, indicating convergent validity. In addition, as shown in Appendix A and Table 2, the average variance extracted (AVE) values for all constructs were greater than 0.50, further indicating convergent validity (Koufteros et al., 2007).

Discriminant validity was assessed by comparing the square root of AVE with the correlation coefficient between the focal construct and all the other constructs. The square roots of AVE (the bold diagonal of the matrix in Table 3) were higher than their correlations, indicating discriminant validity (Fornell and Larcker, 1981).

4.3. Hypothesis test

The proposed hypotheses were tested using structural equation modeling (SEM) with the support of LISREL 8.80. The fit indices were $\chi^2 = 1179.97$, $df = 769$, RMSEA = 0.046, SRMR = 0.061, NNFI = 0.98, and CFI = 0.98, which were better than the recommended values of Hu and Bentler (1999); therefore, this model was deemed acceptable. Fig. 2 shows the significant paths with standardized coefficients. Employee skills are positively related to internal ($\beta = 0.43$, $p < 0.01$) and customer resilience ($\beta = 0.33$, $p < 0.05$) but not significantly related to supplier resilience ($\beta = 0.21$, $p > 0.1$), which supports H1a and H1c and rejects H1b. Employee incentives had no significant effect on any dimension of SC resilience; thus, H2a ($\beta = -0.09$, $p > 0.1$), H2b ($\beta = -0.15$, $p > 0.1$), and H2c ($\beta = -0.01$, $p > 0.1$) were rejected. The results also revealed that employee participation was positively and significantly related to all three dimensions of SC resilience, supporting H3a ($\beta = 0.38$, $p < 0.05$), H3b ($\beta = 0.67$, $p < 0.001$), and H3c ($\beta = 0.42$, $p < 0.05$). Internal and customer resilience were significantly and positively associated with operational performance, while supplier resilience was not, supporting H4a ($\beta = 0.46$, $p < 0.001$) and H4c ($\beta = 0.31$, $p < 0.01$) but rejecting H4b ($\beta = 0.04$, $p > 0.1$). The full model was also tested using all first-order HRM constructs, SC resilience dimensions, and operational performance; however, the full model was too complex to obtain results. It is reasonable to simplify multiple HRM practices into 3 s-order constructs: employee skills, employee incentives, and employee participation based on the AMO view. The conceptualization of HRM practices also aligns with that of Huo et al.

Table 2
Factor loadings, *t*-value, reliability, and validity of second-order constructs.

Second-order constructs	First-order constructs	Loading	*t*-value	Reliability	AVE
Employee skills	Selective hiring	0.79	8.89	0.89	0.74
	Depth of skills	0.91	10.14		
	Breadth of skills	0.87	10.49		
Employee participation	Problem-solving groups	0.82	9.11	0.57[a]	0.68
	Feedback	0.83	11.92		

Note.
[a] Correlation coefficient.

Table 3
Means, standard deviations, and correlation matrix.

Construct	1	2	3	4	5	6	7	8	9	10
1. Selective hiring	**.76**									
2. Depth of skills	.61**	**.75**								
3. Breadth of skills	.56**	.61**	**.85**							
4. Employee incentives	.57**	.60**	.59**	**.87**						
5. Problem-solving groups	.43**	.44**	.54**	.55**	**.79**					
6. Feedback	.41**	.48**	.56**	.65**	.57**	**.86**				
7. Supplier resilience	.43**	.41**	.47**	.49**	.43**	.58**	**.83**			
8. Internal resilience	.41**	.47**	.50**	.50**	.45**	.47**	.46**	**.74**		
9. Customer resilience	.37**	.44**	.49**	.51**	.42**	.52**	.63**	.50**	**.81**	
10. Operational performance	.35**	.49**	.52**	.55**	.37**	.45**	.44**	.56**	.49**	**.72**
Mean	5.60	5.44	5.29	5.27	5.19	5.17	5.15	5.24	5.36	5.58
S.D.	0.881	0.853	1.151	1.118	1.127	1.219	1.048	1.069	0.984	0.978

Note: The square roots of AVE are shown on the diagonal of the matrix in bold. $^{**}p < 0.01$. S.D.: Standard Deviation.

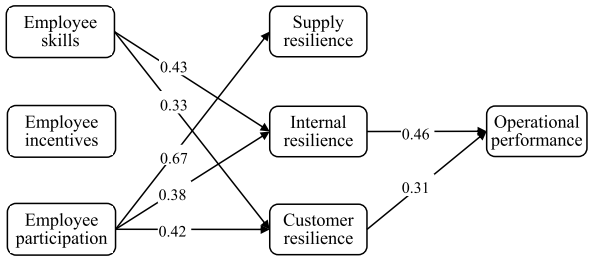

Fig. 2. Estimated structural equation model.

Table 4
Meditating effects.

Relationship	Estimate	Standard error	*Z*	*p*-value	Proportion
Skill → INR → OPF	.248	.050	4.985	.000	.388
Skill → CUR → OPF	.176	.045	3.880	.000	.275
PAR → INR → OPF	.216	.041	5.315	.000	.498
PAR → CUR → OPF	.169	.040	4.273	.000	.391

Note: Skill = Employee skills, PAR = Employee participation, INR = Internal resilience, CUR = Customer resilience, OPF = Operational performance, Proportion = Proportion of the total effect that is mediated.

(2015). Firm characteristics, such as firm age, industry, and firm size, have no significant effects on the conceptual model, which demonstrates the generality of the findings.

Based on the above direct results, the mediating effect of HRM practices and operational performance were further examined through the dimensions of SC resilience. The results in Table 4 indicate that internal and customer resilience partially mediate the relationship between employee skills, employee participation, and operational performance.

5. Discussion and implications

5.1. The relationships between HRM practices and SC resilience

This study empirically verifies the relationship between HRM practices and SC resilience, extending the research stream of the HRM-SCM interface. The results showed that different HRM practices can lead to different dimensions of SC resilience. First, employee skills improve internal and customer resilience but have no significant impact on supplier resilience. In general, these findings are consistent with those of previous studies (Ates and Bititci, 2011; Tukamuhabwa et al., 2017); for example, Blackhurst et al. (2011) argued that HRM with the goal of improving employee skills is a necessary condition for building resilient SC. Although these studies demonstrated that employee skills can promote SC resilience, they did not explore the impact of employee skills on the different dimensions of SC resilience. Employees with high-level skills, which provide equipment maintenance and customer communication abilities (Ability), can handle the stagnation of the production line speedily, maintain cooperation with core customers, and even win more customer orders, which is beneficial to internal and downstream stable operations. The finding that employee skills have no significant impact on supplier resilience

validates previous research; for instance, Gowen and Tallon (2003) argued that employee skills do not enhance all SCM practices—especially upstream activities such as integration with suppliers. Generally, suppliers are often in lower power positions, and dominant manufacturers can easily meet their demands using methods such as adjusting the order, postponing payments, and managing suppliers' inventories (Singh et al., 2011). These actions do not require employees to have skills outside of their daily work but rely on strategic planning and senior management decisions.

Second, employee incentives had a non-significant effect on any dimension of SC resilience, implying the poor role of encouragement (Motivation). Although previous literature has confirmed the important roles of employee incentives in SCM practices, such as information sharing and SC integration (Cohen et al., 2007; Mcafee et al., 2011; Osterloh&Frey, 2000), few have examined the effects of employee incentives under SC disruption conditions. Because employee incentives are largely based on employees' routinized performance, they may lose effectiveness in encouraging employees to deal with irregular disruptions. Firms usually pay more attention to the maximization of self-interest and the realization of short-term goals but ignore the interests of upstream and downstream partners (Stank et al., 2011). Thus, the employee incentive mechanism developed to achieve the firm's goals is more likely to lead to employees' short-sighted behavior, where they only focus on work within the scope of responsibility but lack the consideration of suppliers or customers (Huo et al., 2015). Establishing a resilient SC, maintaining continuous SC operations, and achieving rapid recovery after disruptions require not only the close cooperation of employees in internal functions but also require efforts to coordinate and synthesize with suppliers and customers. Therefore, employees with constrained incentives cannot meet these requirements or enhance any aspect of SC resilience.

Third, a flat work platform consisting of problem-solving groups and performance feedback enables employees to grab more opportunities (Opportunity) to participate in various tasks, which can significantly improve internal, supplier, and customer resilience. These findings are consistent with those of previous studies (Burnard and Bhamra, 2011). For instance, Datta (2017) found that employees' participation in emergency management in a team-based way increased organizational flexibility to respond to emergencies, thus enhancing SC resilience. These findings highlight the important role of employee participation in SC recovery processes. First, problem-solving groups encourage employees to make decisions and cooperate to improve their response speed after an SC disruption. Second, the real-time performance feedback system helps employees correct deviations in recovery processes, thus reducing fluctuations in logistics, information, and financial flows, which are conducive to the improvement of SC resilience.

5.2. The relationship between SC resilience and operational performance

The findings show that internal and customer resilience improve operational performance, while supplier resilience does not. Generally, SC resilience contributes to operational performance, thus validating previous findings (Behzadi et al., 2017; Carvalho et al., 2012; Li et al., 2017). Firms with excellent SC resilience can recover from SC disruptions more quickly and efficiently, reducing out-of-stock rates and improving customer service quality and satisfaction (Hohenstein et al., 2015; Rezapour et al., 2017; Wieland, 2013).

Internal resilience indicates that each function can quickly respond to SC disruptions and appropriately adjust processes and organizational structures during the recovery process to ensure that raw materials can be smoothly converted into final products, which guarantees customer value. Customer resilience shows that even in the occurrence of SC disruptions, firms can consistently stabilize products and service flows to their customers to maintain customer satisfaction. In contrast, supplier resilience can only guarantee a stable and continuous supply of raw materials and cannot directly determine final customer service (Flynn et al., 2010). In addition, firms usually retain a certain level of inventory of final products to meet unexpected needs. Even if the material supply is disrupted and requires time to recover, firms can still use these buffered inventories to serve their customers. Therefore, this study demonstrates that supplier resilience has no significant impact on operational performance.

5.3. Theoretical and practical implications

This study echoes the call of Ambulkar et al. (2015) and Samson and Kalchschmidt (2019) for more SC disruption management research to guide theory development and industrial practices. Specifically, in the context of SC disruption risk management, the antecedents and operational outcomes of SC resilience were investigated.

First, owing to the importance of human resources in theory and practice, Hohenstein et al. (2014) and Fisher et al. (2010) called for more research to explore the relationships between HRM and SCM. In response to these calls, this study pioneered the introduction of human resource elements in the field of SC risk management. Through excellent HRM practices, the focal firm can create a culture and atmosphere that prioritizes cooperation and efficiency and shapes highly skilled and highly engaged workforces (Huo et al., 2015). This study verifies the important role of human resources in improving SC resilience and highlights the irreplaceable role of employees in the recovery process from SC disruptions. It provides a new research perspective for further exploring effective SC risk management from the perspective of employees and enriches the research stream on the impact of HRM practices on SCM.

Second, this study fills the research gap left by the limited studies investigating the antecedents of SC resilience by examining the role of different elements of HRM practices through selecting and training (Ability), designing incentive mechanisms (Motivation), and providing teamwork and responsive work platform (Opportunity) (Tukamuhabwa et al., 2015).

Prior research investigated the antecedents of SC resilience from different perspectives, such as the pattern of IT use (Gu et al., 2021), intellectual capital (Mubarik et al., 2021), intelligent platforms (Shen and Sun, 2021), and digital transformation (Faruquee et al., 2021), etc., which focused on technology-related elements. This study extends this line of literature by incorporating a human-centered factor: high-involvement HRM. Specifically, this study finds that employee participation is most important for disruption recovery and can simultaneously improve internal, supplier, and customer resilience. Comparatively, the role of employee skills is relatively weak, which only improves internal and customer resilience. In contrast, when firms encounter SC disruptions, employee incentives have a limited effect and cannot improve SC resilience in any dimension. Therefore, this study distinguishes between the individual impacts of different elements of HRM practices on the dimensions of SC resilience. This study highlights the significant roles of employee participation and employee skills and provides a research basis for exploring the facilitating factors of SC resilience from HRM practices. In addition, this study also generalizes the application of the AMO view in the SC context by decomposing high-involvement HRM systems into three dimensions and empirically investigating their impacts on SC resilience.

Third, the study also reveals the impact of SC resilience on operational performance, adding empirical evidence on SC resilience-performance links. The results indicate that internal and customer resilience improves operational performance, while supplier resilience has no significant effect. Most previous research has treated SC resilience as a single-dimensional construct but neglected differences among SC entities, which leads to inconsistent findings on the relationship between SC resilience and operational performance (Ambulkar et al., 2015). To address this research gap, this study takes a holistic view of SC and divides SC resilience into three dimensions, and further examines their individual effects on operational performance. This operationalization provides directions for future research investigating SC resilience-performance mechanisms.

In addition to these theoretical contributions, this study also provides managerial insights for practitioners. First, the focal firm is expected to design appropriate HRM practices to mitigate SC disruption risk. For example, a flat working platform should be ensured for employees to fully extract opportunities, engage in recovery processes, and promote internal, supplier, and customer resilience. More specifically, firms should delegate decision-making power to problem-solving teams, encourage employees to set up cross-boundary groups to deal with various tasks, and stimulate their work enthusiasm and a sense of participation; additionally, they should provide real-time feedback based on employee performance and correct possible deviations to ensure work efficiency and task completion. Moreover, firms should attach importance to the depth and breadth of employee skills to solve stagnation in the production line and achieve consistent customer service. Therefore, in addition to selecting potential employees, firms should prioritize employee training and create an organizational atmosphere of continuous learning. These HRM actions improve employees' skills and help them deal with SC disruptions flexibly and quickly, thereby improving internal and customer resilience. Second, while supplier resilience has no significant effect, both internal and customer resilience can improve operational performance. Therefore, under disruption threats, firms should ensure the continuity of internal production and provide stable and continuous products and services to customers. It warrants that customer value is not affected, and it helps firms achieve timely product delivery and a high level of customer service. Specifically, internal functions should improve their risk-warning capabilities, adjust production and operational processes, when necessary, respond flexibly and quickly to the stagnation of production lines, and resume production as soon as possible. Firms should also reserve a portion of the finished product inventory to maintain on-time product delivery. Simultaneously, it is crucial to maintain communication and coordination with customers and adjust the corresponding service processes.

6. Conclusions and limitations

Drawing on the AMO view, this study contributes to the HRM-SCM interface by investigating the effects of HRM practices on the three dimensions of SC resilience and operational performance. Based on data collected from 206 Chinese manufacturers, it was found that different sets of HRM practices have different influences on SC resilience. Moreover, in terms of operational benefits, internal and customer resilience play vital roles, while supplier resilience has no significant effect. These findings enrich the literature and have several managerial implications.

Although this study makes both theoretical and practical contributions to literature, it has several limitations. First, the sample pool used in this study was confined to China, which may limit the generalizability and underestimate the cross-cultural influence on the HRM-SCM interface. Future studies can be designed to compare differences between countries and regions. Second, this study employed cross-sectional and self-reported data to verify the relationship between constructs, which limited its ability to reveal causal relationships. This study provides opportunities for future research to collect objective and longitudinal data to validate our findings. Third, although three sets of HRM practices are identified and incorporated from the AMO perspective, they may not capture every aspect of HRM practices. Thus, future research could examine other HRM practices for managing SC disruptions.

Declaration of competing interest

The authors declare no conflict of interest.

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Appendix A. Construct measurement, reliability, validity, factor loadings, and *t*-value

Constructs and items	Factor loading	*t*-value
Selective hiring Cronbach's alpha = 0.802; AVE = 0.58		
SH1. We use work values and behavioral attitudes as a criterion in employee selection	0.73	11.32
SH2. We select employees who can provide ideas to improve the management process	0.79	12.64
SH3. We select employees who can work well in small groups	0.77	12.15
Depth of skills Correlation coefficient = 0.571; AVE = 0.57		
DOS1. Employees at this plant have skills that are above average in this industry	0.72	11.03
DOS2. Our employees are highly skilled	0.79	12.21
Breadth of skills Cronbach's alpha = 0.893; AVE = 0.73		
BOS1. Employees receive training to perform multiple tasks	0.88	15.48
BOS2. Employees learn how to perform a variety of tasks/jobs	0.85	14.80
BOS3. Employees are cross-trained, so that they can fill in for others if necessary	0.84	14.50
Employee incentives Cronbach's alpha = 0.925; AVE = 0.76		
INC1. Our incentive system encourages us to vigorously pursue plant objectives	0.83	14.41
INC2. The incentive system at this plant is fair at rewarding people who accomplish plant objectives	0.87	15.38
INC3. Our reward system really recognizes the people who contribute the most to our plant	0.87	15.38
INC4. Our incentive system at this plant encourages us to reach plant goals	0.91	16.81
Problem-solving groups Cronbach's alpha = 0.838; AVE = 0.63		
PSG1. Our plant forms teams to solve problems	0.81	13.26
PSG2. In the past 3 years, many problems have been solved through small group sessions	0.80	12.88
PSG3. Problem-solving teams have helped improve manufacturing processes at this plant	0.78	12.46
Feedback Correlation coefficient = 0.738; AVE = 0.74		
FEB1. Information on performance is readily available to employees	0.79	12.98
FEB2. Information on productivity is readily available to employees	0.93	16.35
Internal resilience Cronbach's alpha = 0.915; AVE = 0.69		
INR1. Internal functions can maintain high situational awareness at all times	0.80	13.49
INR2. Internal functions can provide a quick response to the supply chain disruption	0.85	14.91
INR3. Internal functions can cope with changes brought by the supply chain disruption	0.85	14.86
INR4. Internal functions can adapt to the supply chain disruption easily	0.85	14.81
INR5. Internal functions can recover to normal operations speedily after the supply chain disruption	0.79	13.20
Customer resilience Cronbach's alpha = 0.859; AVE = 0.55		
CUR1. We and our main customer can maintain high situational awareness at all times	0.66	10.21
CUR2. We and our main customer can provide a quick response to the supply chain disruption	0.86	14.88
CUR3. We and our main customer can cope with changes brought by the supply chain disruption	0.79	13.00
CUR4. We and our main customer can adapt to the supply chain disruption easily	0.71	11.15
CUR5. We and our main customer can recover to normal operations speedily after the supply chain disruption	0.68	10.60
Supplier resilience Cronbach's alpha = 0.907; AVE = 0.66		
SUR1. We and our main supplier can maintain high situational awareness at all times	0.78	13.06
SUR2. We and our main supplier can provide a quick response to the supply chain disruption	0.90	16.41
SUR3. We and our main supplier can cope with changes brought by the supply chain disruption	0.83	14.33
SUR4. We and our main supplier can adapt to the supply chain disruption easily	0.78	12.92
SUR5. We and our main supplier can recover to normal operations speedily after the supply chain disruption	0.77	12.77
Operational performance Cronbach's alpha = 0.803; AVE = 0.52		
OPF1. We can quickly respond to changes in market demand	0.61	9.09
OPF2. We have an outstanding on-time delivery record to customers	0.82	13.31
OPF3. The lead time for fulfilling customers' orders is short	0.70	10.68
OPF4. We provide a high level of customer service to customers	0.74	11.60

Appendix B. Related empirical research on supply chain resilience

Citation	Theory foundation	Antecedents	Outcomes	Major findings
Johnson et al. (2013)	Social capital theory	Social capital; formative supply chain capabilities	/	Social capital could facilitate formative supply chain capabilities, thereby enhancing supply network resilience.
Brandon-Jones et al. (2014)			/	

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Citation	Theory foundation	Antecedents	Outcomes	Major findings
	Contingent resource-based view	Supply chain connectivity; supply chain information sharing		Through enhanced visibility, supply chain connectivity and information sharing could improve supply chain resilience and robustness.
Cheng and Lu (2017)	Resource-based view and trajectory perspective	Operating frontier; trajectory; absorptive capability	/	Operating frontier, trajectory, and absorptive capability could improve both proactive and reactive supply chain resilience.
Chowdhury and Quaddus (2017)	Dynamic capability theory	/	Supply chain performance	Supply chain resilience could improve supply chain performance through reducing operational vulnerability.
Chowdhury et al. (2019)	Contingent resource-based view	/	Supply chain performance	Supply chain resilience could improve supply chain performance, which was contingent on network complexity and supply chain relational practices.
Wong et al. (2020)	Organizational information processing theory	/	Risk management, market, and financial performance	Supply chain resilience could enhance risk management, market, and financial performance. These positive relationships were particularly effective when facing supply chain disruptions.
Balakrishnan and Ramanathan (2021)		Digital supply chain technologies	Supply chain performance	Digital supply chain technologies could improve supply chain performance through enhancing supply chain resilience.
Dennehy et al. (2021)	/	Big data analytics capabilities; organizational mindfulness	/	Big data analytics capabilities could enhance supply chain resilience via organizational mindfulness.
Dubey et al. (2021)	Dynamic capabilities view	Data analytic capability	Competitive advantage	Firms could attain competitive advantage by building supply chain resilience and data analytics capability, which was moderated by flexibility.
Gu et al. (2021)	Information processing theory	Patterns of IT use	Supply chain performance	Supplier and customer resilience could enhance supply chain resilience; only the explorative use of IT could improve supply chain resilience.
Kähkönen et al. (2021)	Dynamic capability view	COVID-19 upstream and downstream impact; dynamic capabilities	/	Dynamic capabilities could neutralize the negative impact of COVID-19 supply chain on supply chain resilience.
Ruel and El Baz (2021)	Dynamic capability view	Supply chain disaster readiness	Financial performance	Supply chain resilience could enhance financial performance; supply chain disaster readiness could enhance both supply chain resilience and robustness.
Um and Han (2021)	Dynamic capability view	Supply chain risks	/	Improving supply chain resilience capability could neutralize the negative impact of supply chain risks on supply chain resilience, which was contingent on supply chain mitigation strategies.
Iftikhar et al. (2022)	Dynamic capability view	Supply chain complexity; big data analytics	/	Supply chain complexity could enhance supply chain resilience, which was mediated by big data analytics.
Munir et al. (2022)	Dynamic capabilities view	Data analytic capability; anticipation; improvisation	Supply chain performance	Data analytic capabilities enabled anticipation; both anticipation and improvisation could enhance supply chain resilience, which further improved supply chain performance.
This study	Ability-motivation-opportunity view	High-involvement HRM practices	Operational performance	Internal and customer resilience improved operational performance; employee participation enhanced all supply chain resilience dimensions, while employee incentives had no influence; employee skills only improved internal and customer resilience.

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