

Financial performance of firms with supply chains during the Covid-19 pandemic: the roles of dynamic capability and supply chain resilience

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Abstract

Purpose: This study proposes an integrated model to explore the relationships between dynamic capability and supply chain resilience (SCRE) and their impacts on firms' financial performance with supply chains (FPwSC) during the Covid-19 pandemic.

Design/Methodology/Approach: Based on resource-based theory and knowledge-based theory, the dynamic capability is classified into resource-based dynamic capability (RBDC) and knowledge-based dynamic capability (KBDC). The study collects 158 usable survey samples from manufacturers in Taiwan and analyzes them with the structural equation model.

Findings: The results show that knowledge is power; KBDC is crucial for FPwSC, SCRE, and RBDC. In addition, SCRE mediates the relationship between KBDC and FPwSC. Finally, RBDC significantly suppresses FPwSC.

Originality: The study is the first to combine KBDC, RBDC, and SCRE into an integrated model for FPwSC. Moreover, it reveals that resilience relies on knowledge, not resources, as evidenced by SCRE being affected significantly by KBDC but not RBDC.

Practical implication: A firm with KBDC can adopt and implement strategies that exploit its internal strengths to respond to environmental opportunities, overcome internal weaknesses, and mitigate

external threats. Furthermore, a firm should fully utilize SCRE with proactive and reactive strategies. Exercising a firm's KBDC could facilitate SC collective intelligence to handle the risk of SC disruption and vice versa.

Research limitation: Future researchers could replicate this study in other industries and expand it to other countries to generalize the results.

Research Paper

Keywords: supply chain resilience; dynamic capability; resource-based view; knowledge-based view; supply chain disruption; financial performance; Covid-19

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Introduction

Since the outbreaks of Covid-19 from Wuhan in China at the end of 2019, most countries (e.g., China, Europe, Japan, US) declared various lockdown measures. The lockdown limited the movement of people, products, and raw materials, causing a sharp plunge in many business activities and forcing factories to close (Orlando *et al.*, 2022). The lockout led to a supply shortage, and prices surged. Fortune (2020) reported that 94% of the companies listed in the Fortune 1000 ranking faced supply chain (SC) disruption due to Covid-19. Many industries perceived the significant shock of the Covid-19 pandemic and the subsequent ripple effect of SC disruption. Therefore, it is crucial to understand how to mitigate the adverse effect of these disruptions and improve organizational performance through capabilities. One of the organizational capabilities that can overcome environmental volatility is the dynamic capability which refers to "a firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments and achieve new and innovative forms of competitive advantage" (Teece *et al.*, 1997, p.516). It has been extensively used to elucidate discrepancies in performance across firms (Liu *et al.*, 2013). From a long-term viewpoint, dynamic capability enables firms to align resources with the environment and extend decision options to a broader scope (Trkman *et al.*, 2015). In addition, the capability could evolve and allow firms to grow and enter new businesses by creating new products or processes (Vanpoucke *et al.*, 2014).

The dynamic theory of strategy (Porter, 1991) guides a firm to achieve competitive advantages.

In particular, the competitive advantage theory originates from the resource-based view (RBV) and extends to dynamic capability (Teece *et al.*, 1997). Furthermore, as an outgrowth of the resource-based view, the knowledge-based view (KBV) regards knowledge as “the most strategically important of the firm’s resources” (Grant, 1996, p.110). Based on these two views, the dynamic capability is of two types: *resource-based dynamic capability (RBDC)* and *knowledge-based dynamic capability (KBDC)*. The RBDC includes sensing, seizing, and transforming/reconfiguring capabilities (Teece, 2012), and the KBDC encompasses absorptive capability (Liu *et al.*, 2013), knowledge management capability (Wu and Chen, 2014), and organizational learning capability (Rojo *et al.*, 2018).

The Covid-19 pandemic has caused severe turbulence and uncertainty in the SC, which resulted in threats to the firms’ operations and sustainability. To combat the threats, a firm must have SC resilience (SCRE) to supplement dynamic capability. SCRE refers to “the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function” (Ponomarov and Holcomb, 2009, p.131). Dynamic capability generally determines a firm’s performance (Liu *et al.*, 2013). But a firm needs SCRE capability to maintain performance under SC disruption (Dolgui *et al.*, 2018; Jüttner and Maklan, 2011). Nevertheless, whether the level of SCRE is high or low depends on a firm’s capability to manage its SC network.

Many scholars have demonstrated the effect of SCRE on firms’ performance in diverse environments (e.g., Golgeci and Kuivalainen, 2020; Yu *et al.*, 2019). Specifically, SCRE was confirmed to improve risk management and market performance when firms experience high disruptions (Wong *et al.*, 2020). It also significantly impacts the response and recovery performance of post-disaster humanitarian SCs (Altay *et al.*, 2018). Moreover, some scholars have confirmed the effect of dynamic capability on firm performance under volatile circumstances. For example, Wilden *et al.* (2013) revealed that competitive intensity improves the impact of dynamic capability on a firm’s performance. In addition, Colombo *et al.* (2021) demonstrated the effect of dynamic capability on entrepreneurial performance in the ripple effect of an environmental jolt.

Regarding the relationship between firms’ dynamic capability and SCRE, we can identify the effects of absorptive ability on SC agility (Liu *et al.*, 2013) and SC flexibility (Rojo *et al.*, 2018), as well as organizational learning on SC flexibility (Rojo *et al.*, 2018). Furthermore, Kahkonen *et al.* (2021) confirmed that seizing and reconfiguring capabilities impact SCRE. In a disruptive situation, if firms with dynamic capability can bear the adversity, seek the right opportunities, and make a timely decision, the capability could determine their survivability. Furthermore, firms could decide their performance during the disruptive period if they can reconfigure their internal and external resources to entice their SC partners to achieve their common goals. During a devastating disruption, these capabilities are crucial to a firm’s financial performance with supply chains (FPwSC). Based on this discourse, we develop a novel model and propose the research questions as follows:

1. How can a firm’s dynamic capability (KBDC and RBDC) foster SCRE capability?
2. How can a firm’s dynamic capability increase (or decrease) financial performance with SCs

under disruption?

3. How can SCRE capability interact with the firm's dynamic capability to improve FPwSC?

The results reveal that knowledge is power; KBDC is more critical than RBDC in disruptive situations and significantly affects all the other constructs (i.e., RBDC, SCRE, and FPwSC). Moreover, we confirm that SCRE is a mediator and moderator between KBDC and FPwSC.

1. Literature Review and Hypotheses Development

1.1. Dynamic Capability

Dynamic capability refers to “the ability of a firm to achieve new forms of competitive advantage by renewing competencies to achieve congruence with changing business environments” (Chiang *et al.*, 2012, p.52). With dynamic capability, a firm can exploit and develop new resources (Mowery *et al.*, 1996), help shape the environment and entrepreneurship (Helfat *et al.*, 2009), and match and even induce market change (Vanpoucke *et al.*, 2014). Woldesenbet *et al.* (2011) investigated 18 small firms operating in information and communication technology, business services, and food manufacturing in the UK. Empirical results showed that the dimensions of entrepreneurial ability and the levels of dynamic capability depend on the product market and competitive dynamics. Other scholars also noted that dynamic capability's effect on performance depends on company-specific attributes (Teece *et al.*, 1997), the product market, and competitive dynamics (Woldesenbet *et al.*, 2011). Thus, the degree of heterogeneity in dynamic capability must be further discussed (Gruchmann *et al.*, 2019). For example, some scholars assume that dynamic capability is company-specific and unique (Teece *et al.*, 1997). However, others believe that dynamic capability has a few commonalities across firms despite this heterogeneity (Gruchmann *et al.*, 2019; Eisenhardt and Martin, 2000). Therefore, this study integrates the common conceptualized dimensions of dynamic capability and introduces two types of dynamic capability (RBDC and KBDC) to facilitate discussion among scholars.

1.1.1. Resource-based view and dynamic capability

The RBV suggests that competitive advantage and performance are derived from firm-specific resources and capabilities that are costly to copy by other rivals (Barney, 1991). These resources and abilities can be essential for sustainable competitive advantage and superior firm performance if they possess specific unique characteristics. Namely, they should be *valuable, rare, imperfectly imitable, and non-substitutable* (Barney 1991). RBV emphasizes gathering capital by protecting and deploying firm-specific resources to create competitive advantages (Mowery *et al.*, 1996).

The positions of a firm's assets shape the firm's processes, which explain the nature of the firm's dynamic capability (Teece *et al.*, 1997). “A dynamic capability is the firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base” (Barreto, 2010, p.271). Accordingly, Teece (2012) regarded dynamic capability as three clusters of activities and adjustments: sensing, seizing, and transforming/reconfiguring. From an economic view, sensing opportunities and threats refers to

scanning, creation, learning, and interpretive activities (Teece, 2007). The seizing process involves making timely decisions to develop new opportunities. The transforming or reconfiguring process is the continuous alignment and re-alignment of operational practices. These sub-capabilities are complementary to generate a dynamic capability only when combined and aligned (Vanpoucke *et al.*, 2014).

1.1.2. Knowledge-based view and dynamic capability

Acquiring better resources to replace the old ones and increase a firm's performance is time-consuming, costly, and counter-productive. KBV advocates that by knowing more accurately the relative productive performances of the existing heterogeneous resources, a firm can exploit these resources and achieve high performance rather than acquiring the better ones (Alchian and Demsetz, 1972). KBV considers firms as organizations that generate, integrate, and distribute knowledge (Miller 2002). The ability to create value is not based on physical or financial resources but on intangible knowledge-based capabilities. KBV suggests that intangible resources can help organizations gain competitive advantages (Attia and Eldin, 2018). Knowledge is a critical intangible resource and valuable organizational asset that is the basis of continuous development and sustainable competitive advantages. It is a vital input in a firm's manufacturing process and the primary source of value (Grant, 1996). "Knowledge is central to several quite distinct research traditions, particularly organizational learning, the management of technology, and managerial cognition. The issues with which the KBV concerns itself extend beyond the traditional concerns of strategic management, strategic choice, and competitive advantage, and address some other fundamental concerns of the theory of the firm, especially the nature of coordination within the firm" (Grant, 1996, p.110). Furthermore, knowledge-based assets can create firms' core competencies and enable them to achieve and maintain competitive success (Pemberton and Stonehouse, 2000).

We adopted the knowledge-based view and identified three categories of capability: absorptive capability (AC), knowledge management capability (KMC), and organizational learning capability (OLC). These three sub-capabilities constitute the KBDC and involve knowledge elements in organizational processes and routines. AC is defined as organizational routines and processes in the firms to acquire, assimilate, transform, and exploit knowledge to produce dynamic organizational capability (Zahra and George, 2002). KMC is an organization's ability to acquire, create, transfer, integrate, share, and apply knowledge-related resources and activities across functional boundaries to generate new knowledge (Attia and Eldin, 2018). Finally, OLC is conceptualized as the capability of an organization to process knowledge. An organization creates, acquires, transfers, and integrates knowledge and modifies its behavior to reflect the new cognitive situation and improve its performance (Jerez-Gomez *et al.*, 2005). These three sub-capabilities have coherent relationships. For example, firms often design mechanisms of knowledge applications to integrate employees' special knowledge (Grant, 1996). Furthermore, organizations have a clear division of roles and responsibilities to absorb new external knowledge from SC or others to develop mutual understanding. They build their

knowledge repository through knowledge management processes/systems and disseminate the knowledge among their departments to apply it and solve problems. Thus, the organization's members have acquired critical capacities and skills to improve their performance. Accordingly, AC, KMC, and OLC can be integrated to embody a firm's KBDC (Theriou *et al.*, 2009).

1.2. Interdependence of RBDC and KBDC

RBDC contains three sub-capabilities: sensing, seizing, and transforming capabilities (Teece, 2012). In the sensing stage, individuals' discovery and creation of opportunities require access to information and the ability to recognize, sense, and shape development. Recognizing opportunities relies partly on individuals' skills and knowledge, particularly about their needs related to existing and innovative solutions (Teece, 2007). Next, enterprises must build capabilities to proceed with vertical specialization when seizing. They must polish their AC through learning activities and skill accumulation. Finally, the transformation capability is partly rooted in supplier network development and additional investments in coordination systems for buyer-supplier relationships. The development and investments enable firms to learn from one another, co-specialize and change their internal processes when needed, and continuously improve SC processes (Vanpoucke *et al.*, 2014). In addition, such transformation processes encompass acquiring, sharing, and incorporating strategic knowledge with partners outside the firm to align and fit with business processes (Swink *et al.*, 2007). Thus, the related knowledge and capabilities are essential in the three sub-capabilities of RBDC.

Moreover, a firm's ability to integrate external knowledge is positively related to research productivity (e.g., patents) which is an intangible asset crucial to enterprises' success (Teece, 2007). Therefore, the related governance and incentive structures designed to facilitate learning and generate new knowledge become essential. Moreover, KBDC emphasizes the experience in newly created knowledge specific to the situation. As such, Eisenhardt and Martin (2000) stress that *basic learning mechanisms* in KBDC (e.g., repeated practice, codification, mistakes, and pacing of experience) can guide the evolution of RBDC in dynamic capability. Thus, we posit as follows:

H1: The firm's KBDC fosters RBDC.

1.3. Supply Chain Resilience

SCRE is "the characteristics of a well-designed supply chain network with proactive and reactive capabilities, which enables the supply chain members to reduce the probability of disruptive events (or to reduce their impact) to take the organization to a stronger and more sustainable state" (Chowdhury and Quaddus, 2017, p.188). It focuses on the system's adaptive capability to cope with temporary disruptive events (Jain *et al.*, 2017). Jüttner and Maklan (2011) identify resilience with four components: flexibility, visibility, velocity, and collaboration. They further integrated the first three components as a firm's agility. These agility components have cohesive associations; SC visibility increases SC velocity and, in turn, enhances SC flexibility (Juan *et al.*, 2022). Among these components, SC collaboration is the driver of the other three. That is, firms can adopt an SC

collaboration strategy, e.g., strategic purchasing (Ates and Memis, 2021), to build their supplier base (i.e., many suppliers), increase SC visibility, velocity, and flexibility, and address the unforeseen risk of SC disruptions. A common misconception is that a supply chain network is autonomous enough to reconfigure itself proactively and reactively. The truth is that SCRE is determined by a firm's dynamic capability. The firm must be capable of designing, constructing, and managing the SC network to improve the SCRE and combat any disruptions.

Flexibility is the capability to adapt to new, different, or changing requirements (Skipper and Hanna, 2009). SC flexibility encompasses those flexibilities that directly impact a firm's customers and are the shared responsibility of two or more functions along with an SC (Vickery *et al.*, 1999). Moreover, it has been suggested that flexibility can amount to an organic capability, which also supports sensing disruptions and, as such, relates to the event readiness dimension of SCRE (Sheffi and Rice, 2005). Jüttner and Maklan (2011) proposed that redundancy as the duplications of capacity so that operations can continue the following failure is one road to flexibility. Some scholars proposed robustness as one component of SCRE (Wieland and Wallenburg, 2013). As the suggestion by Jüttner and Maklan (2011), the main element of robustness is redundancy incorporated into flexibility. Following Moon *et al.* (2012)'s recommendation, we recognized that SC flexibility comprises four indicators: sourcing flexibility, operating system flexibility, distribution flexibility, and information systems flexibility.

Next, SC visibility is resulted from sharing useful or high-quality information (Williams *et al.*, 2013). With information and communication technologies, electronic data interchange (Barratt and Oke, 2007), and automatic identification technologies, SC's connectivity can be increased (Dubey *et al.*, 2018), thus improving information sharing and SC visibility (Dubey *et al.*, 2018). The visibility of inventory and demand is the critical component therein.

Subsequently, velocity is the speed of SC activities that are critical to sustaining competitive advantages, such as customer response speed (Chiang *et al.*, 2015), purchase decision-making speed (Kaufmann and Gaeckler, 2015), and product launch speed (Vickery *et al.*, 2015). Specifically, according to the SC operations reference (SCOR) model, SCOR processes mainly consist of materials sourcing, product making, and delivery (APICS, 2017). However, in addition to SCOR processes, SC velocity should include the speed of response to customer demand (Vickery *et al.*, 2015; Chiang *et al.*, 2015). Therefore, this study defines the SC velocity with three indicators: SC speed, purchasing decision-making speed, and customer response speed.

Finally, collaboration indicates that inter-organizational partners are willing to understand each other's viewpoints by sharing information and resources to achieve collective goals (Stank *et al.*, 2001). Collaboration among SC partners has been measured with seven components: information sharing, decision synchronization, incentive alignment, goal congruence, resource sharing, collaborative communication, and joint knowledge creation (Cao and Zhang, 2011). Among them, information sharing is essential. In this study, we adopt a shorter version of five collaborative processes from Wu *et al.* (2014): market development, collaborative communication, product/process design, process

implementation, and problem-solving.

1.4. Financial Performance with SCs under Disruption

The common phenomena in the SC disruptive situation caused by Covid-19 are supply shortages and delivery delays. FPwSC under disruption refers to the focus firm's financial performance supported by the SC in the disruption interval, from SC disruption occurring until it is solved. It means that firms with a steady financial condition could stand out and overcome the risk of disruption. Shi and Yu (2013) suggested that a firm's financial performance from SC management encompasses accounting-based and market-based measures. The former includes asset/capital utilization, profitability, cash flow, and comprehensiveness categories to define net income divided by some financial indicator (e.g., assets, equity, investment, revenue) (Hendricks and Singhal, 2005). The common scales are the return on investment and assets (ROI and ROA). The latter is an essential complement to the former. Its focus is on shareholder value, which means the financial value created for shareholders by the companies in which they invest, and the market values added. The market-based measures can manifest the firm's value, for example, the intangible assets, as they seem more objective than the accounting-based ones. Especially in a disrupted situation, manufacturing and materials costs are essential for firms. Therefore, building the FPwSC is the first step for firms in the SC to achieve sustainable competitive advantages. Wu *et al.* (2014) also suggest measuring firm performance should consider financial and non-financial aspects. In this study, we focused on the financial aspect and adapted Wu *et al.*'s (2014) financial measures of a firm's performance to measure FPwSC.

1.5. Dynamic capability and SCRE

Dynamic capability refers to strategic integration (Swink *et al.*, 2007). This integrative activity can facilitate communication, cooperation, and coordination among a firm's SC members (Vanpoucke *et al.*, 2014). A firm's integration (upstream, downstream, or externally) is partly motivated by the need to build capabilities, particularly when such capabilities are not widely spread in the industry (Teece, 2007), e.g., vertical specialization. Especially, vertical specialization must be partly a function of heterogeneity in productive capabilities along the value chain. For example, an innovative enterprise can identify and manage the bottleneck assets in the value chain from invention to market and outsource these assets to achieve scale and scope economies. Vanpoucke *et al.* (2014) adapted RBDC's three capabilities (i.e., sensing, seizing, and transforming) to measure supplier integration capability. They confirm that supplier integration capability significantly influences process flexibility, which is the first indicator (SCF1) of SC flexibility in SCRE. Furthermore, we assume that the investment and development of a firm's RBDC (e.g., vertical specialization and the management of the bottleneck assets) can facilitate the collaboration of its SC members and improve SCRE. Therefore, the following hypothesis is proposed:

H2a: The firm's RBDC improves SCRE.

KBDC is conceptualized with absorptive capability, knowledge management capability, and organizational learning capability in this study. The OLC can produce collective memory embedded in the culture and processes of organizations. The AC enables a firm to understand the culture, working habits, and technological sophistication of its SC members. Better understanding the internal capabilities of its SC members facilitates combining its members' knowledge with its own to better align with and respond to environmental changes. Moreover, AC can internalize SC partners' innovation capability and increase their knowledge overlap from the interaction with SC partners to adapt to the environmental risk (Rojo *et al.*, 2018). As such, AC is an enabler of SCRE (Golgeci and Kuivalainen, 2020).

Because KBDC always involves acquiring and transferring knowledge among internal or external members, a firm with KBDC would share the knowledge with its SC members. Therefore, their information would be transparent. The transparent information enhances their collaboration and coordination, facilitating the velocity and flexibility among the SC members. As a result, a resilient SC can be established. The principal property of resilience is the capability to learn from an unexpected event and develop better preparedness for future disruptions. This learning capability of SCRE could be strengthened by the firm's KBDC (Ponomarov and Holcomb, 2009). Thus, we hypothesize:

H2b: The firm's KBDC improves SCRE.

1.6. Dynamic Capability and FPwSC

Wilden *et al.* (2013) found that dynamic capability negatively influences sales growth and financial solvency in the general environment. The dynamic capability in their study corresponds to the RBDC in this study. "RBV encounters a boundary condition in high-velocity markets where the duration of competitive advantage is inherently unpredictable, time is central to strategy, and dynamic capabilities are themselves unstable." (Eisenhardt and Martin, 2000, p.118). Namely, in the fast-volatility markets, when an opportunity arises, making a selection is critical to seize the opportunity and manipulate resource reconfiguring. Following Teece (2007), sensing capability refers to exploring opportunities in the changing environment. It tends to involve entrepreneurial innovations and focuses on the value proposition. Thus, firms with sensing capability would invest in R&D activities. Next, seizing capability refers to making timely decisions for emerging opportunities, such as designing a business model. Its focus is value creation. Therefore, firms must cope with new products, processes, or services, invest in development and commercialization activities, and maintain and improve technological competencies and complementary assets. Finally, transforming capability is the operational capability enhanced through a firm's governance. It focuses on value fulfillment and addition. "The combination of integration sensing and seizing capabilities allows firms to determine when opportunities arise and exploit them in the short and medium term. Transformation is needed to cope with long-term changes that require strategic action." (Vanpoucke *et al.*, 2014, p.448). In this vein, the RBDC requires investment in resources and would decrease the financial performance in the

short and medium term. Therefore, we postulate as follows:

H3a: The firm's RBDC decreases FPwSC in the short and medium term.

The strategic value of dynamic capability lies in manipulating resources into value-creating strategies. Namely, the value of dynamic capability for competitive advantages depends on their ability to adjust the resource base by creating, integrating, recombining, and releasing resources. It is essential to utilize the dynamic capability to configure new resources and move into new competitive positions with a path-breaking change strategy in highly dynamic markets (Eisenhardt and Martin, 2000). KBDC relies on rapidly creating situation-specific new knowledge in these markets and less on the existing ones. Therefore, dynamic capability can help firms sense environmental uncertainties, understand market trends, and seize market opportunities. A firm with KBDC can harness new external knowledge and apply it to recognize business opportunities and avoid threats in a market.

KBDC can also facilitate formal and informal networks to transfer knowledge across different functional departments. Therefore, the firm is a cohesive entity and can learn effectively to reengineer its processes, reconfigure its assets, and improve its service and products. Accordingly, a firm with KBDC would be amenable to change and can increase performance even in the SC disruption situation. Prior research revealed that top management's investment in providing managers with training experiences to enhance their knowledge could not influence organizational performance (Huang *et al.*, 2015). In this vein, knowledge acquisition in organizations does not depend on financial investment. Instead, it depends on the corporate members' learning motivation and effectiveness. Thus, we posit as follows:

H3b: The firm's KBDC increases FPwSC.

1.7. SCRE and FPwSC

In an SC network, leading members are responsible for building resilience in their enterprises and contributing to the resilience of the whole system as long as member firms form a coherent entity and interact effectively (Golgeci and Kuivalainen, 2020). In addition, SCRE can serve as a stabilizing mechanism to provide firms with excess capacity (Wong *et al.*, 2020). Moreover, many scholars confirmed that SCRE had a significantly positive effect on SC performance (Altay *et al.*, 2018; Chowdhury and Quaddus, 2017), organizational performance (Golgeci and Kuivalainen, 2020; Yu *et al.*, 2019), and risk management and market performance (Wong *et al.*, 2020). Therefore, regardless of the severity of supply-side interruption, SCRE adds to financial success. As such, it is reasonable to posit as follows:

H4: SCRE enhances FPwSC.

1.8. The Moderating Role of SCRE

A firm needs more capacity, such as redundancy, to mitigate the effect of disruption (Wong *et al.*, 2020), recover from it, and restore to its routine or better situation under disruption. RBDC is suitable

for surviving in a changing environment by integrating and reconfiguring internal and external capabilities. However, it usually does not favor performance because it involves investing additional assets in the volatile market to achieve competitive advantages (Teece, 2007). Meanwhile, SCRE can offer flexibility to cope with customers' changing demands in the dynamic market under disruption (Juan *et al.*, 2022).

Firms with a higher level of SCRE are more likely to recover fast from unexpected disruptions and incidents while still achieving high financial performance (Yu *et al.*, 2019). The disruptive situation needs more information sharing from SC partners to reduce the impact of disruption. More information and knowledge sharing can create collective intelligence to address the adverse effect of disruption, such as the bullwhip effect caused by the long replenishment lead time (Chen *et al.*, 2000) from delivery delay in the current Covid-19 context. Also, SCRE can provide information-sharing mechanisms among SC partners (Zhang and Cao, 2018), thus enhancing KBDC with suitable approaches for increasing the FPwSC under disruption. Therefore, we postulate as follows:

H5a: SCRE mitigates the adverse effects of RBDC on FPwSC.

H5b: SCRE strengthens the positive effects of KBDC on FPwSC.

1.9. Control Variables

Consistent with previous research (Wu *et al.*, 2014), we adopt industry type, the number of employees, and annual revenue last year as the control variables of FPwSC. Therefore, based on the above hypotheses, the research model is proposed in Figure 1.

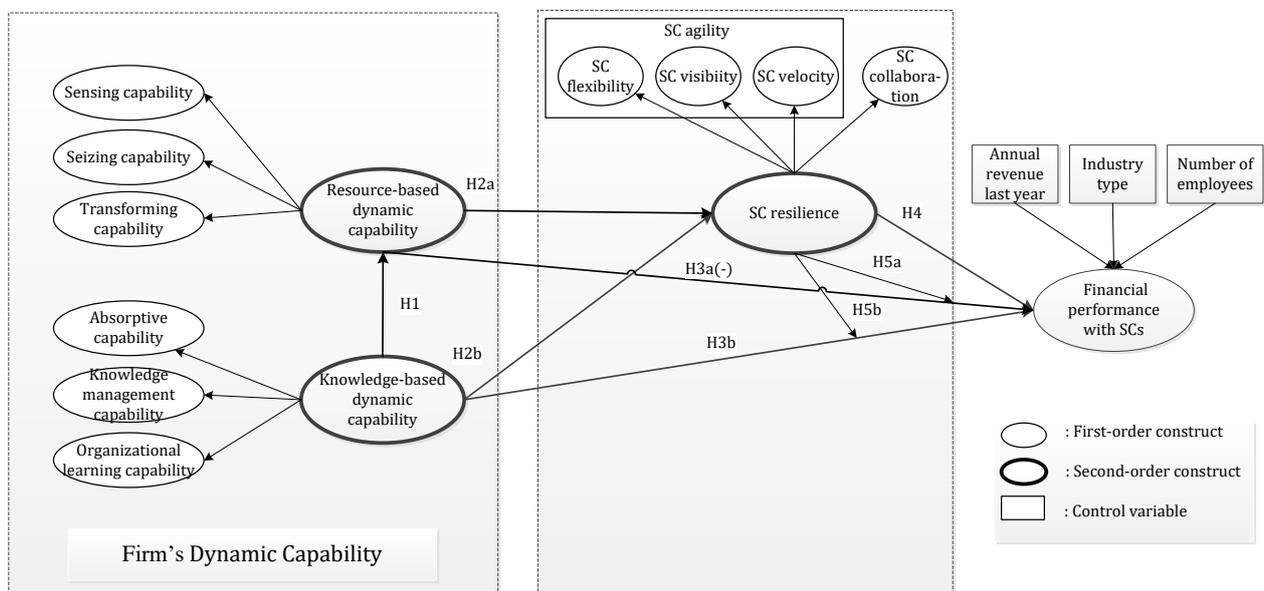


Figure 1 Research model

2. Research Design

This study collects research data through a web questionnaire and analyzes them using the SPSS AMOS software.

2.1. Subjects

The manufacturers in Taiwan were selected as the subjects of this study because SC is prevalent in this context. In the pilot test stage, an invitation email with a hyperlink web questionnaire was sent to a social media group of alumni and students from an accredited business school in Taiwan to solicit manufacturers' voluntary informants. In this group, several high-level managers in public companies from Taiwan Stock Exchange Corporation (TSEC) and over-the-counter-listed (OTC-listed) responded to this email. After three weeks, 30 qualified volunteers replied and provided their viewpoints about the questionnaire's contents.

In the formal survey phase, we searched the 2019 list of public manufacturing companies published online by the TSEC and OTC. As a result, 1325 manufacturers (among them, 698 from TSEC and 627 from OTC) were selected and emailed with a web questionnaire hyperlink to solicit volunteers. Subsequently, we sent weekly follow-up emails reminding them to reply. A total of 1125 companies received the emails, while the remaining emails to 200 companies were either rejected by their email systems for security reasons or undelivered due to the overflowing mailbox. Finally, we obtained 168 complete questionnaires after six months (from April 1 to September 30, 2021), yielding a response rate of 14.93%. Among them, 158 are usable after removing ten careless responses having the same score on all questionnaire items. We use the *semPower* package for R to perform power analyses (Jobst *et al.*, 2021). We enter two lines of comments: "(apriori <- semPower.aPriori (effect = 0.050, effect.measure = 'RMSEA', alpha = 0.05, beta = 0.20, df = 898)"; "summary (apriori)". The result showed that the required sample size is 77. As such, our sample size of 158 satisfies this requirement. Nearly 70% of the sampled companies are in the high-tech manufacturing industry. Most firms (almost 70%) are small and medium enterprises with less than 1000 employees. Almost 80% have less than 300 suppliers, and nearly 70% have more than US\$350 million in annual revenue. Over 90% of informants have bachelor's or higher degrees, and nearly 80% have over ten years of job tenure. There are more males (over 60%) than females. We surveyed the informants, who are the decision managers engaging in the strategic or operational decisions of the company. The respondents are mostly (95%) in managerial positions. Specifically, vice president and CEO are over 30%, manager nearly 35%, and vice manager 30%. The remaining eight respondents (5%) are in other managerial positions. Therefore, the respondents are prominent decision managers. According to Grant (1996), firms have the nature of coordination. In the actual situation of an organization, all managers must have the same knowledge regarding the firm's operations to involve common decision strategies. In addition, Li (1997) revealed that firms' upper-level managers have common views of their information system success factors. Their importance ratings of these factors have no significant difference. Thus, we think a manager is qualified as an informant for this study.

2.2. Tests of Biases

The potential non-response bias is tested using an independent-sample t-test. First, we conducted

the test on two objective indicators: annual revenue last year and industry type between the pretest (n=27) and formal (n=131) groups (Ates and Memis, 2021). The results indicated that mean differences for the two indicators were insignificant (p=0.449 and p=0.173, respectively); thus, the non-response bias was not a significant concern. Next, we split the sample into the earlier and later groups, each with 79 respondents, and conducted the same test between the groups for each questionnaire item. Again, the results indicated no significant discrepancy in item response between the two groups, reconfirming the insignificance of non-response bias.

In addition, common method bias could result from the measurement method when the same informants were used to assess all relationship measures (Podsakoff *et al.*, 2003). We first adapted the procedure remedies to reduce item ambiguity and maintain respondents' confidentiality (Podsakoff *et al.*, 2003). Next, we applied Harman's single-factor test (Podsakoff *et al.*, 2003) by exploratory factor analysis with an un-rotated solution that included all questionnaire items. The results indicate that five factors were extracted and accounted for 72.86 percent of the total variance. The adjusted variance explained from the first factor is 50.7, on the boundary of the threshold value (i.e., 50), so the common method bias did not a severe problem.

2.3. Research Procedure

This study follows the stages of pretest, pilot test, and survey. During the pretest, five professors with management information systems backgrounds evaluated the questionnaire's face validity, and three senior managers from manufacturers ensured proper wording, readability, and relevance. Next, in the pilot test stage, the 30 respondents' data were analyzed to confirm the measurement properties of the final items. The results showed that Cronbach's α exceeded 0.7 for all constructs, and factor loadings of all items were over 0.6, supporting the reliability and validity of the final questionnaire. Eventually, the final questionnaire containing 45 items was used to collect the data through a web survey on Taiwan's manufacturing industries.

2.4. Measurement Items

The questionnaire contains two parts. The first part is the information about firms and informants. The second part includes the items of four constructs: SCRE, KBDC, RBDC, and FPwSC, with a 7-point Likert scale (ranging from 1= strongly disagree to 7= strongly agree). SCRE, KBDC, and RBDC are second-ordered constructs. The description and the source of each scale item are shown in Table 1. In addition, the descriptive statistics and the factor loadings of the scale items are listed in Table 2.

Table 1: The descriptions and sources of questionnaire items

Constructs and Item Measures	Source
Resource-based Dynamic Capability	Lee and Rha (2016)
<i>Sensing Capability</i>	
SEN1: We can perceive demand shifts and changes in customer preference before competitors do.	

SEN2: We can feel significant potential opportunities and threats.	
SEN3: We have good observation and judgment ability.	
SEN4: We frequently interact with other partners to acquire new knowledge related to product development, process innovation, or logistics and distribution practices.	
<i>Seizing Capability</i>	
SEI1: We can quickly deal with conflicts in the strategic decision-making process.	
SEI2: We can make timely decisions to deal with environmental change under any circumstance.	
SEI3: We can reconfigure resources in time to address environmental change.	
SEI4: We can quickly decide on our technological innovation and development.+	Adapted from Teece (2007)
<i>Transforming Capability</i>	Lee and Rha (2016)
REC1: We can successfully realign or reinvent an organization in response to (or anticipation of) market change. @	
REC2: We can successfully reconfigure organizational resources to develop new productive assets.	
REC3: We can use resource recombinations to match the product-market areas better.	
REC4: We can align (or re-distribute) skills to meet the current customer's needs.	
REC5: We can effectively integrate and combine existing resources into novel combinations.	
Knowledge-based Dynamic Capability	
<i>Absorptive Capability</i>	
AC1: The organization has a clear division of roles and responsibilities to acquire, analyze, interpret, understand and utilize new external knowledge in its operations.	Adapted from García-Morales <i>et al.</i> (2007)
AC2: My firm has the necessary skills to implement newly acquired knowledge better than its rivals.	
AC3: My firm has considerable competencies in knowledge development.	
AC4: My firm can recognize new external knowledge and has the competencies to absorb, adapt and use this knowledge.	
<i>Knowledge Management Capability</i>	
KMC1: My firm can codify acquired knowledge into accessible and usable formats.	Adapted from Wu and Chen (2014)
KMC2: My firm can distribute relevant knowledge throughout the organization. @	
KMC3: My firm can integrate different sources and types of knowledge.	
KMC4: My firm can apply knowledge to solve new problems.	
<i>Organizational Learning Capability</i>	
OLC1: My firm has acquired and used much new and relevant knowledge that provided a competitive advantage over the last three years. @	Rojo <i>et al.</i> (2018)
OLC2: My firm's members have acquired critical capacities and skills that provided a competitive advantage over the last three years.	
OLC3: My firm's improvements have been influenced by new knowledge	

entering the organization over the last three years.	
OLC4: My firm is an organization that fosters learning.	
Supply Chain Resilience	
<i>Supply Chain Agility</i>	
Supply Chain Flexibility	
SCF1: Our SC can adjust manufacturing facilities and processes.	Adapted from Rojo <i>et al.</i> (2018)
SCF2: The information systems of our SC can support transportation and distribution management.	
SCF3: Our SC with multiple suppliers provides primary materials/components/products under SC disruption.#	
SCF4: Our SC has multiple transportation modes.	
Supply Chain Visibility	
VIS1: Inventory levels are visible throughout the SC.	Dubey <i>et al.</i> (2018)
VIS2: Demand levels are visible throughout the SC.	
VIS3: My firm and SC partners have frequent communications.+	Adapted from Barratt and Oke (2007)
Supply Chain Velocity	
VEL1: Our SC reacts faster to make SC decisions.	Adapted from Kaufmann and Gaeckler (2015)
VEL2: Our SC can quickly launch new products to meet customers' demands.	Vickery <i>et al.</i> (2015); Chiang <i>et al.</i> (2015)
VEL3: Our SC can quickly deliver products to customers before the due date. +	Self-developed from the concept in Kaipia (2008)
<i>Supply Chain Collaboration</i>	Wu <i>et al.</i> (2014)
COL1: My firm and SC partners collaborate in developing new markets and customer response.	
COL2: My firm and SC partners set up a communication plan for action.#	
COL3: My firm and SC partners collaborate in designing their processes or products.	
COL4: My firm and SC partners collaborate in implementing their operational activities.#	
COL5: My firm and SC partners have frequent interactions while problems occur.	
Financial Performance with Supply Chain under Disruption	
FPwSC1: Our SC can help improve the firm's return on assets under SC disruption.	Sanchez and Perez (2005)
FPwSC2: Our SC can help improve the firm's return on investment under SC disruption.	Wu <i>et al.</i> (2014)
FPwSC3: Our SC can help improve the firm's sales growth under SC disruption.	
FPwSC4: Our SC can help improve the firm's market share under SC disruption.	
FPwSC5: Our SC can help improve the firm's production and inventory costs under SC disruption.	

Note: # indicates deleted item due to lower item loading (less than 0.7), and @ signals deleted item owing to the high correlation coefficient with the items of other variables; + indicates self-developed item.

3. Analyses and Results

3.1. Measurement Model

We conducted confirmatory factor analysis with maximum likelihood estimation using SPSS AMOS 23.0 to evaluate the measurement model. Before analysis, we examined the correlations among all scale items and removed the items having high correlations with many other items to improve discriminant validity (Ronkko and Cho, 2022). The results suggested the deletion of KMC2, OLC1, and REC1. We also deleted COL2, COL4, and SCF3 because their factor loadings were lower than 0.7. Finally, 39 items of all constructs were retained for further analysis. The measurement model revealed a good fit with $\chi^2=1049.995$, degree of freedom (df)=628, $\chi^2/df=1.672$, comparative fit index (CFI)=0.937, and root mean square error of approximation (RMSEA)=0.065. Table 2 shows that Cronbach's alpha values of all constructs range from 0.858 to 0.974, meeting the criterion above the threshold value of 0.7 and supporting internal consistency reliability.

Table 2: Descriptive Statistics of the Scale

Construct and Item	Mean	Standard deviation	Item loadings	p-value
Resource-based Dynamic Capability				
<i>Sensing Capability (AVE=0.587, CR=0.850, $\alpha=0.858$)</i>				
SEN1	5.573	1.013	0.785	***
SEN2			0.757	***
SEN3			0.812	***
SEN4			0.708	***
<i>Seizing Capability (AVE=0.791, CR=0.919, $\alpha=0.915$)</i>				
SEI1	5.331	1.175	0.891	***
SEI2			0.913	***
SEI3			0.864	***
SEI4			0.779	***
<i>Transforming Capability (AVE=0.754, CR=0.924, $\alpha=0.923$)</i>				
REC2	5.356	1.138	0.865	***
REC3			0.892	***
REC4			0.831	***
REC5			0.883	***
Knowledge-based Dynamic Capability				
<i>Absorptive Capability (AVE=0.766, CR=0.929, $\alpha=0.916$)</i>				
AC1	5.236	1.171	0.813	***
AC2			0.846	***
AC3			0.896	***

AC4			0.941	***
<i>Knowledge Management Capability (AVE=0.701, CR=0.875, α=0.868)</i>				
KMC1	5.032	1.225	0.818	***
KMC3			0.891	***
KMC4			0.800	***
<i>Organizational Learning Capability (AVE=0.751, CR=0.9, α=0.895)</i>				
OLC2	5.063	1.513	0.895	***
OLC3			0.836	***
OLC5			0.867	***
Supply Chain Resilience				
<i>Supply Chain Agility</i>				
<i>Supply chain flexibility (AVE=0.690, CR=0.869, α=0.864)</i>				
SCF1	4.943	1.616	0.767	***
SCF2			0.860	***
SCF4			0.861	***
<i>Supply chain visibility (AVE=0.698, CR=0.873, α=0.889)</i>				
VIS1	4.766	1.861	0.881	***
VIS2			0.896	***
VIS3			0.717	***
<i>Supply chain velocity (AVE=0.699, CR=0.873, α=0.875)</i>				
VEL1	4.949	1.468	0.932	***
VEL2			0.868	***
VEL3			0.690	***
<i>Supply Chain Collaboration (AVE=0.549, CR=0.782, α=0.898)</i>				
COL1	4.853	1.766	0.717	***
COL3			0.614	***
COL5			0.870	***
Financial Performance with Supply Chain under Disruption (AVE=0.879, CR=0.973, α=0.974)				
FPwSC1	4.384	2.035	0.904	***
FPwSC2			0.925	***
FPwSC3			0.963	***
FPwSC4			0.966	***
FPwSC5			0.928	***
Note: *** $p < 0.001$				

Scale validation proceeds with convergent validity and discriminant validity. Table 2 shows that item loadings range from 0.614 to 0.966, and the composite reliability values of all constructs are between 0.782 and 0.973. Furthermore, all constructs' average variance extracted (AVE) values are between 0.549 and 0.879. These three criteria are all satisfactory for the threshold values and support

convergent validity.

Next, we address discriminant validity, i.e., whether two constructs are empirically distinct. As suggested by Ronkko and Cho (2022, p. 37), we present in Table 3 the latent correlation estimates on the upper triangle of the table. The latent correlation estimates of all constructs are under 0.9 except one: the correlation between KMC and AC (0.908). Among the upper limits (ULs) of all 55 correlations, 31 are below 0.8 (“no problem”); 13 are between 0.8 and 0.9 (“marginal problem”); 11 are between 0.9 and 1 (“moderate problem”). The correlations with “moderate problem” are indicated as red parenthesized numbers in Table 3. Following Ronkko and Cho’s (2022) criteria, the discriminant validity of this study has no “severe problem”.

Table 3: Discriminant validity

	Sense	Seize	Trans- form	AC	KMC	OLC	SCF	VIS	VEL	SCC	FPwSC
Sense	0.844	0.861 (0.919)	0.84 (0.91)	0.697 (0.827)	0.646 (0.779)	0.68 (0.795)	0.402 (0.589)	0.381 (0.537)	0.496 (0.652)	0.588 (0.766)	0.295 (0.471)
Seize	0.795	0.895	0.888 (0.94)	0.774 (0.863)	0.722 (0.828)	0.781 (0.863)	0.546 (0.697)	0.461 (0.621)	0.509 (0.673)	0.636 (0.772)	0.388 (0.553)
Trans- form	0.763	0.840	0.901	0.826 (0.891)	0.787 (0.875)	0.77 (0.858)	0.516 (0.678)	0.476 (0.639)	0.519 (0.669)	0.697 (0.828)	0.446 (0.608)
AC	0.659	0.738	0.779	0.895	0.908 (0.96)	0.872 (0.922)	0.597 (0.729)	0.531 (0.668)	0.597 (0.708)	0.715 (0.846)	0.529 (0.67)
KMC	0.594	0.682	0.713	0.855	0.892	0.897 (0.962)	0.604 (0.742)	0.575 (0.704)	0.635 (0.757)	0.647 (0.8)	0.594 (0.731)
OLC	0.627	0.733	0.700	0.807	0.798	0.912	0.696 (0.794)	0.67 (0.784)	0.7 (0.8)	0.818 (0.917)	0.656 (0.762)
SCF	0.374	0.513	0.469	0.548	0.538	0.627	0.888	0.748 (0.856)	0.865 (0.942)	0.882 (0.96)	0.626 (0.752)
VIS	0.618	0.448	0.468	0.524	0.526	0.640	0.725	0.904	0.88 (0.941)	0.736 (0.836)	0.606 (0.726)
VEL	0.491	0.496	0.510	0.562	0.560	0.636	0.781	0.803	0.895	0.814 (0.909)	0.608 (0.728)
SCC	0.500	0.531	0.579	0.592	0.543	0.651	0.700	0.695	0.713	0.880	0.636 (0.76)
FPwSC	0.289	0.377	0.421	0.502	0.542	0.611	0.595	0.618	0.573	0.587	0.953

Note: The diagonal numbers are the square roots of the AVEs; the lower triangle entries are the construct correlations; the upper triangle entries are the latent correlation estimates with the 95% confidence interval upper bound in parentheses.

3.2. Structural Model:

3.2.1. Endogeneity Test

Before data analysis for the structural model, it is necessary to examine whether the potential endogeneity issues exist. Endogeneity is when an independent variable correlates with a model’s structural error term (or ‘residual’) (Lu *et al.*, 2018). It may come from the effect of the independent variable on the dependent variable and the impact of all unobserved factors that correlate with the respective independent and dependent variables, making the interpretation problematic or even useless (Ketokivi and McIntosh, 2017).

We used a two-stage least-squares (2SLS) regression with two instrumental variables to examine the endogeneity of the exogenous variable, KBDC, with STATA 17.0. The instrumental variables are supplier number and annual revenue last year because supplier number and annual revenue last year could affect KBDC. We strongly believe that more suppliers could bring more helpful information to a firm, and more income could offer more incentive to share knowledge among employees.

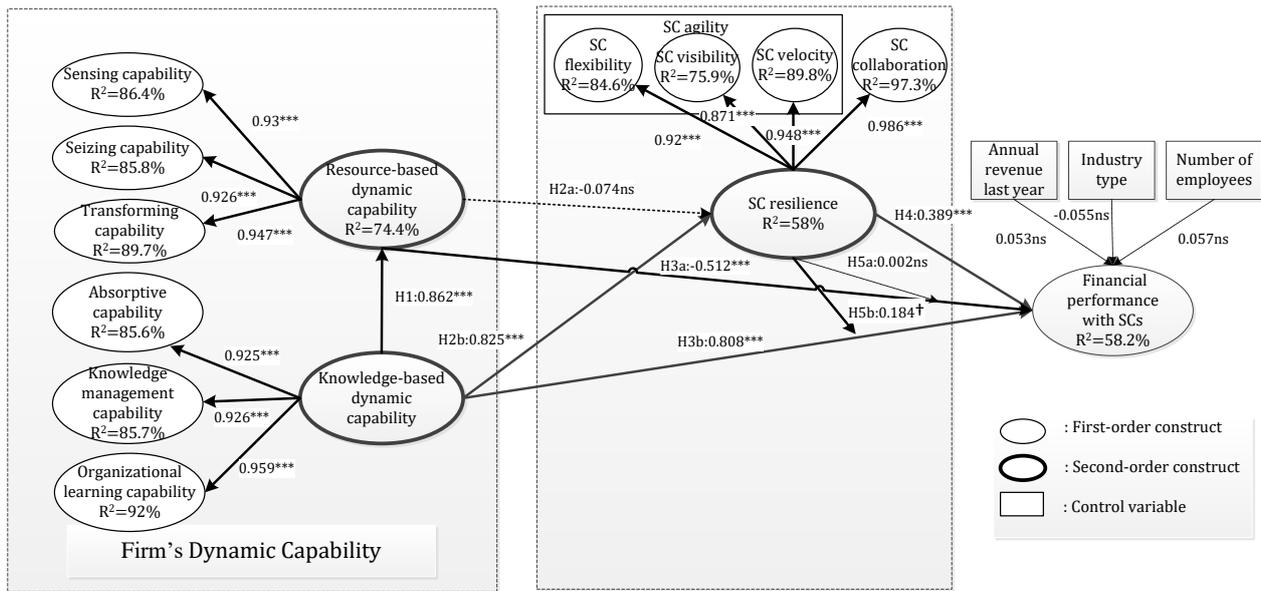
In the first stage of the 2SLS regression, KBDC was regressed on the two instrumental variables (i.e., supplier number and annual revenue last year) and two control variables (i.e., number of employees and industry type), as shown in Table 4 Model 1. Next, the instrumented KBDC was used to evaluate the relationships with RBDC, SCORE, and FPwSC. As shown in Model 2 to Model 4 in Table 4, the results indicate that all the relationships are positive, and the relationship with RBDC is significant at $p < 0.01$. Finally, the Durbin-Wu-Hausman (Wooldridge, 2010) endogeneity test was conducted to test the validity of two instrumental variables and determine if the exogenous variable is endogenous. The results show that all the $F(1,153)$ statistics of KBDC's exogenous structure are insignificant at $p > 0.1$. Therefore, the difference between the instrumented and the non-instrumented models is insignificant, indicating that the endogeneity of KBDC is not a severe problem in this study.

Table 4: 2SLS model for endogeneity test

	Model 1 First stage: KBDC	Model 2 Second stage: RBDC	Model 3 Second stage: SCORE	Model 4 Second stage: FPwSC
Industry type ^a	-0.168	-0.048	-0.058	-0.098
No. of employees ^a	0.047	0.099	0.17†	0.136
No. of suppliers ^b	0.172†	-	-	-
Annual revenue last year ^b	-0.012	-	-	-
KBDC (instrumented)	-	0.953**	0.461	0.685
R^2	4.32%	61.5%	44.3%	35.77%
Durbin-Wu-Hausman test		$\chi^2(1)=0.266$; $p=0.606$. $F(1,153)=0.258$; $p=0.612$.	$\chi^2(1)=0.270$; $p=0.603$. $F(1,153)=0.262$; $p=0.61$.	$\chi^2(1)=0.064$; $p=0.800$. $F(1,153)=0.062$; $p=0.803$.
Notes: ^a control variable; ^b instrumental variable; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$.				

3.2.2. Main Effects

The structural model demonstrates a good fit: $\chi^2=1507.815$, $df=898$, $\chi^2/df=1.679$, $CFI=0.915$, and $RMSEA=0.066$. The main effect results in Figure 2 show that KBDC significantly impacts RBDC ($\beta=0.862$), supporting H1. KBDC also significantly impacts SCORE ($\beta=0.825$) and FPwSC ($\beta=0.808$), so H2b and H3b are supported. RBDC significantly and negatively impacts FPwSC ($\beta=-0.512$), supporting H3a. Moreover, SCORE significantly and positively impacts FPwSC ($\beta=0.389$), so H4 is supported. However, RBDC insignificantly impacts SCORE ($\beta=-0.074$), thus not supporting H2a ($p > 0.10$). Finally, the three control variables: industry-type ($\beta=-0.055$), number of employees ($\beta=0.057$), and annual revenue last year ($\beta=0.053$), do not significantly affect FPwSC. The explained variances R^2 of all dependent variables (RBDC, SCORE, and FPwSC) are 74.4%, 58%, and 58.2%.



Legend: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$, ns=not significant.

Figure 2 Structural model

3.2.3. Mediating Effects

SCRE and RBDC play the mediation role in Figure 2. In the mediating effect of SCRE, the three direct effects of KBDC on SCRE, SCRE on FPwSC, and KBDC on FPwSC are all significant. Therefore, SCRE is a positive partial mediator between KBDC and FPwSC in Table 5. In the mediating effect of RBDC, the three direct effects are all significant: KBDC on RBDC, RBDC on FPwSC, and KBDC on FPwSC. Because the impact of RBDC on FPwSC is negative, RBDC is a negative partial mediator (see Table 5).

Table 5: Mediating effects

Mediating variable (M)	Independent variable (I)	Dependent variable (D)	The direct effect of (I) on (M)	The direct effect of (M) on (D)	The direct impact of (I) on (D)	Indirect effect	Mediating effect
SCRE	KBDC	FPwSC	0.825***	0.389***	0.808***	0.321** ($p < 0.01$)	Partially positive
RBDC	KBDC	FPwSC	0.862***	- 0.512***	0.808***	-0.441* ($p < 0.05$)	Partially negative

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$, ns=not significant.

3.2.4. Moderating Effects

We posit in H5a that SCRE mitigates the adverse effect of RBDC on FPwSC. The interaction

term (RBDC \times SCRE) does not significantly impact FPwSC ($\beta=0.002$ in Figure 2). It indicates that the moderating effect of SCRE does not exist in the link between RBDC and FPwSC. Therefore, H5a is not supported. Similarly, H5b posits that SCRE strengthens the impact of KBDC on FPwSC. The interaction term (KBDC \times SCRE) significantly impacts FPwSC ($\beta=0.184$) in Figure 2. It implies that the link between KBDC and FPwSC is contingent on SCRE capability. Therefore, H5b is supported. Next, we plotted the relationship between KBDC and FPwSC with high and low (one standard deviation above and below the mean) levels of SCRE. Figure 3 indicates that KBDC impacts FPwSC more when firms have a better SCRE capability.

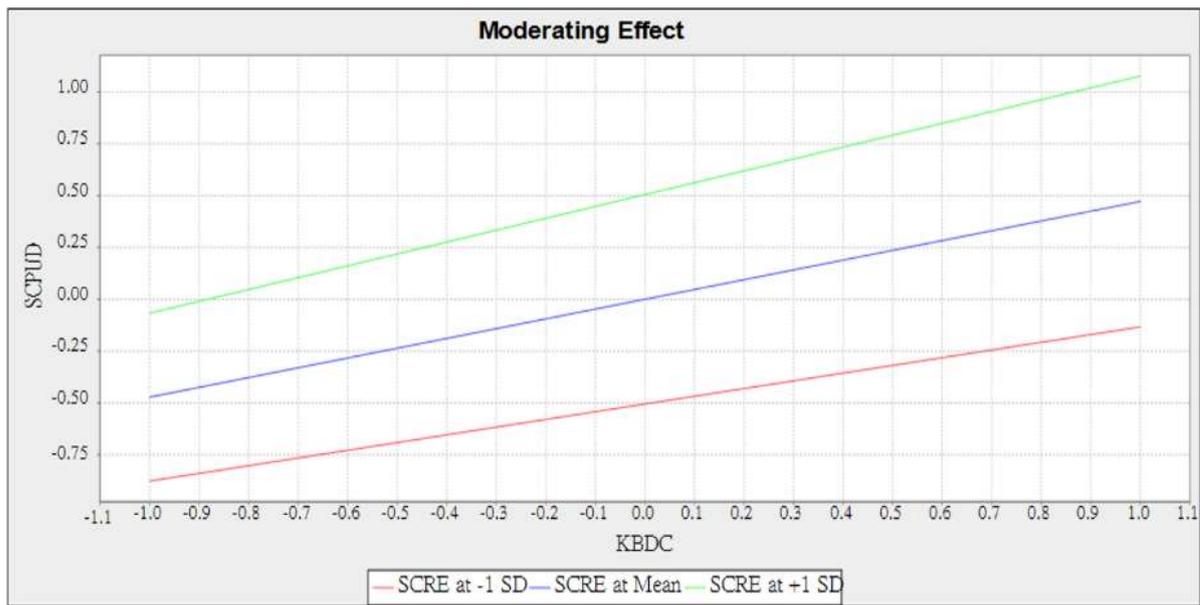


Figure 3 Moderating effect of SCRE on the relationship of KBDC with FPwSC

3.2.5. Effect Size and Predictive Validity

We examine the effect size of the significant hypothesized associations and use the squared multiple correlations (R^2) to calculate Cohen's effect size f^2 (1992) using Smart PLS 3.3.7., as shown in Table 6. The formula for Cohen's effect size is as follows:

$$f^2 = (R^2_{\text{full}} - R^2_{\text{reduced}}) / (1 - R^2_{\text{full}}),$$

where R^2_{full} is the value of R^2 from the structural model that includes all independent variables; R^2_{reduced} is the value that includes all but one particular set of independent variables.

Table 6: Effect sizes of significant hypothesized associations

Significant Association	β	f^2	Effect size #
H1: KBDC \rightarrow RBDC	0.806***	1.851	Large
H2b: KBDC \rightarrow SCRE	0.604***	0.25	Medium
H3a: RBDC \rightarrow FPwSC	-0.252*	0.043	Small
H3b: KBDC \rightarrow FPwSC	0.427**	0.1	Small
H4: SCRE \rightarrow FPwSC	0.517***	0.268	Medium

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$; # effect size of $.02 \leq f^2 < .15$ is small; $.15 \leq f^2 < .35$ is medium; and $f^2 \geq .35$ is large.

According to Cohen (1992), an effect size of $.02 \leq f^2 < .15$ is small; $.15 \leq f^2 < .35$ is medium; and $f^2 \geq .35$ is large. For FPwSC, SCRE is more important than KBDC and RBDC because the effect size of SCRE (i.e., medium) is more than KBDC and RBDC (both are small).

Next, we also test the predictive validity of the questionnaire with all independent variables (KBDC, RBDC, and SCRE) on their respective dependent variable (FPwSC) using the Blindfolding procedure of PLS 3.3.7 to obtain the Q^2 predictive relevance of FPwSC (Stone, 1974; Geisser, 1975). The result shows that the Q^2 value is 0.438 (>0.35), indicating high predictive validity.

4. Conclusions and Discussion

4.1. Conclusions

First, the SCRE is an enabler of FPwSC and a mediator between KBDC and FPwSC. The extant literature confirmed that SCRE significantly and positively impacted organizational performance (Golgeci and Kuivalainen, 2020; Yu et al., 2019). This study shows a stronger positive association between SCRE and FPwSC. A low/high FPwSC value reflects disruption's negative/positive impact on the firm performance. Today's literature is abundant on how the SC disruption damaged a firm's FPwSC. The result of this study supports that SCRE is a crucial strategy for recovering from disruption.

Second, the extant literature is abundant with research into general organizational performance. This study is distinctive for considering financial performance under pandemic disruption. Generally, corporate or firm performance encompasses financial performance (Vickery *et al.*, 2003) and non-financial performance (Wu and Chang, 2012). Financial performance refers to profitability (i.e., ROI or ROA) and market performance (e.g., market share or sales growth) (Yu *et al.*, 2019). On the other hand, non-financial performance refers to the ultimate attainment of the four balanced scorecard perspectives: financial, customer, business process, and learning & growth (Wu and Chang, 2012). In the context of SC disruption, one additional performance, risk-management performance, must be considered (Wong *et al.*, 2020). This study combines financial and risk-management concepts to measure a firm's financial performance under SC disruption.

Third, KBDC is essential to FPwSC and the antecedents of the other variables: RBDC and SCRE. Following Eisenhardt and Martin's (2000) suggestion, this study identified that KBDC is the commonality of dynamic capability across companies. It especially elucidates the vital role of knowledge in supporting a firm under SC disruption.

Fourth, SCRE depends on KBDC but not RBDC. There is only scattered and incomplete literature regarding the relationship between firms' dynamic capability and SCRE. The extant literature only found that AC affects SC agility (Liu *et al.*, 2013) and SC flexibility (Rojo *et al.*, 2018), and organizational learning impacts SC flexibility (Rojo *et al.*, 2018). This study is the first to reveal that resilience relies on knowledge, not resources, as evidenced by SCRE being affected significantly by KBDC but not RBDC.

Finally, RBDC suppresses FPwSC because RBDC requires financial investment in resources. This is evidenced by the recent stock price dive of Taiwan Semiconductor Manufacturing Co. (TSMC),

the largest chip manufacturing company in the world. Contrary to the expectation, the recent surge in demand for integrated circuits did not improve TSMC's financial performance and, thus, stock price. This surge is caused by global supply chain disruption and the recent Ukrainian War. A plausible explanation is that the investors are distressed by TSMC's plan to establish factories in the United States. They probably worry that the firm's forthcoming resource investment will weaken its future financial performance [2].

4.2. Theoretical Contributions

Our results reveal some distinctive findings and offer theoretical contributions to the existing literature. First, this study synthesized the extant streams of thought about knowledge, identified three capabilities: absorptive, knowledge management, and organizational learning capabilities, and defined them as the dynamic capability (i.e., KBDC) derived from the knowledge-based view. Second, "dynamic capability" commonly embraces the resource-based view and refers to three capabilities: sensing, seizing, and transforming/reconfiguring. In this study, we redefine it as a resource-based capability (i.e., RBDC) and develop a novel research model for future scholars to follow. Theoretically, this adaptation can explain most phenomena of dynamic capability under the SC disruption. Third, many studies focus on the performance of dynamic capability under external dynamics, but it remains unknown which dynamic capability is more critical. This study answers this question and reveals that knowledge is more important than resources in disruptive situations, as evidenced by KBDC's influence on financial performance and the RBDC. This finding confirms that KBDC is the commonality of dynamic capability across companies (Eisenhardt and Martin, 2000). Finally, the study takes a comprehensive view of dynamic capability, including organizational resource-based and knowledge-based capabilities and inter-organizational supply-chain resilience. The results reveal that all these capabilities drive a firm's financial performance and that supply-chain resilience can mediate the impact of KBDC on financial performance. These contributions are the added values and novelty of this study.

4.3. Practical Implications

This research provides several practical implications. First, knowledge is power. A firm should enhance knowledge and knowledge-based capability, which directly and positively influences financial performance. Through this capability, a firm could understand its inherent strengths and weaknesses, handle uncertainty, strengthen its resilience, and sustain its financial performance during disruption. A firm with knowledge-based capability can adopt and implement strategies that exploit its internal strengths to respond to environmental opportunities, overcome internal weaknesses, and mitigate external threats.

Second, a firm should enhance supply chain resilience to address the disruption crisis. It should fully utilize this resilience with proactive and reactive strategies (Chowdhury and Quaddus, 2017). Proactively, it should predict disruptive events, adopt appropriate strategies to avoid potential damages,

and manage the associated uncertainty. Reactively, it can handle unforeseen situations, e.g., Covid-19, with its redundant resources, flexible processes, and resilient supply chain networks.

Third, a firm should use the knowledge-based capability to improve collaboration with its supply-chain partners and strengthen its resilience to resolve disruptive problems. In particular, exercising a firm's knowledge-based capability could facilitate the collective intelligence in the supply chain network to handle the risk of disruption and vice versa.

Finally, supply-chain disruption in the Covid-19 pandemic is very complex; a firm must be flexible to reconfigure operations. Therefore, it is essential to strengthen supply-chain members' cooperation, coordination, and collaboration and agilely exercise resilience capability. For example, TSMC has finished its new fabrication factory in Arizona to manufacture its chips within the U.S. to reduce the shipment cost and meet the local customers' demand (Charlton, 2022). The evolution of supply-chain strategy today is moving from globalization to glocalization.

4.4. Limitations and Future Research

Some limitations are identified in this study. First, the insignificant effect of RBDC on SCRE calls for future researchers to examine the relationships between the sub-capabilities of RBDC on SCRE and FPwSC. The same analyses apply to KBDC. The focal firms could gain insight into how each sub-capability affects the components of SCRE and FPwSC, allowing them to formulate strategic actions against the disruption events.

Second, the roles of the informants in their major SCs are not considered in this study. A powerful focal firm has more bargaining power on the SC, while a weak focal firm has less. Future studies could collect data from these sample groups to examine the differences in the research model of this study. Both groups could formulate their business strategies and allocate resources to strengthen the linkages of dynamic capability with SCRE and FPwSC. Third, due to the polyadic constructs in this study and the single respondent for all items, there might be potential systematic bias. Future work could avoid these problems by finding the best respondents to address some or all polyadic constructs, as Flynn *et al.* (2018) suggested.

Moreover, this study uses Harman's single-factor test and discriminant validity test (Podsakof *et al.* 2003) to examine the common method bias. Future work should control for the CMV if it is significant using the marker variable techniques (Williams and McGonagle, 2016) or the unmeasured latent method construct technique (Chin *et al.*, 2012). Finally, the results only reflect the condition of the manufacturing industries in Taiwan. Therefore, future researchers could replicate this study in other local industries and expand it to other countries to generalize the results.

Note

1. https://finance.yahoo.com/chart/TSM?fr=sycsrp_catchall#eyJpbmRlcnZhbCI6ImRheSIsInBlcmlyZGljaXR5IjoxLCJ0aW11VW5pdCI6bnVsbCwiY2FuZGx1V2lkdGgiOjI0LjQ0NDQ0NDQ0NDQ0NDQ0MywiZmxpcHBIZCI6Z

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