

From Shock Absorption to Strategic Gain: How Internal and External Supply Chain Resilience Capabilities Drive Sustainable Competitive Advantage in China

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ABSTRACT

The purpose of this research is to gain an understanding of how internal and external supply chain resilience capabilities relate to sustainable competitive advantage in China's logistics industry. Drawing on the dynamic capabilities' theory and the resource-based view, the research design is developed to propose a framework in which the capacity of internal shock absorption and the resilience developed through cooperative network becomes the source of strategic performance increases. It also studies the mediation role of external resilience and the synergistic interaction between internal and external capabilities to strengthen the sustainable competitive advantage. The study conducted was mixed method. First, in-depth interviews with Chinese logistics managers were conducted to refine the main constructs. Then, a questionnaire of 300 logistics companies in mainland China was conducted. Measurement scales for internal resilience (e.g., flexibility, redundancy), external resilience (e.g., supplier collaboration, visibility) and sustainable competitive advantage (e.g., long-term market and operational performance) were tailored from previous research. Structural Equation Modelling was applied to test the direct, mediator and moderator relations among variables. Internal supply chain resilience capabilities are strongly positively related to external resilience and sustainable competitive advantage. External Resilience has a strong positive influence on sustainable competitive advantage as well. external resilience partially mediates the relationship between internal capabilities and sustainable competitive advantage, demonstrating that part of the value of internal resilience is realized through greater network resilience. A significant interaction effect is also found, with firms with high levels of external resilience gaining greater competitive benefit from high levels of internal resilience, showing there is a synergistic effect. These findings demonstrate the necessity of balancing internal preparedness and external collaboration in order to translate resilience into long-term improvements in performance. All five hypothesized hypotheses are supported. This study combines the dynamic capabilities theory and the resource-based view by identifying internal and external resilience capacities and associating the same with sustainable advantage in China's logistics industry. It presents a holistic model of the supply chain resilience capabilities in the Chinese context and offers practical guidelines for managers and policymakers.

Keywords: Supply chain resilience; Internal capabilities; External collaboration; Dynamic capabilities; Resource-based view; Sustainable competitive advantage; China; Logistics industry.

INTRODUCTION

Recent global disruptions, from pandemics to geopolitical tensions, have demonstrated the essential importance of supply chain resilience to firms operating in dynamic markets. The ability to absorb shocks and recover from disruptions in supply networks has shifted from being an issue on the periphery to one that is central to strategic concerns. Companies that had strong supply chain capabilities were more able to continue operations and performance during crises such as the pandemic, while those firms that were less resilient were hit hard. This is especially true in China, sometimes described as the world's factory and home to a massive logistics industry which supports a domestic distribution system as well as global supply chains. China's logistics companies are under severe pressure to guarantee continuity in the face of fluctuating demand, natural disasters and changes in policy. Building resilience has therefore become not only a tool for risk mitigation, but the source of sustainable competitive advantage in the Chinese context

Supply chain resilience (SCR) generally refers to the ability of a supply chain to prepare for, respond to and recover from disruptions and maintain functionality. Prior literature suggests that resilience is multi-faceted and involves both internal capabilities of a firm, as well as external strengths of a network. Internal supply chain resilience capabilities include a firm's internal preparedness and adaptive capacity; some examples include flexible operations; redundant inventory; ability to make decisions quickly; and a culture of risk awareness. These internal capabilities allow the firm to quickly sense and absorb shocks in its own operations. In contrast, external supply chain resilience capabilities refer to the resilience provided by a firm's relationships and coordination with supply chain partners, such as collaborative information sharing with suppliers, diversified sourcing networks, logistics alliances and joint contingency planning with customers. External capabilities enable a supply chain to recover and reconfigure by relying on greater network support and capabilities in times of disruption.

The theoretical architecture of this study rests primarily on dynamic capabilities theory and the resource-based view, with the relational view supporting the external-resilience argument. Dynamic capabilities theory explains how firms integrate, build, and reconfigure internal and external competencies in rapidly changing environments (Teece, 2007). Internal resilience is therefore treated as a dynamic capability, a bundle of sensing, seizing, and reconfiguring processes that allow a firm to respond to disruptions. The resource-based view explains how such capabilities can become sources of sustainable competitive advantage when they are valuable and difficult to imitate. It is essential for any resource to add value to the organization in accordance with RBV of the firm. Conferring to the RBV theory, organizations with superior resources would be able to identify and execute distinct strategies that rivals would not be able to imitate easily. The relational view extends this logic across firm boundaries by recognizing that inter-organizational relationships and collaborative routines can generate relational rents (Dyer & Singh, 1998). Resource dependence, network, social-capital, systems, and contingency theories offer complementary insights, but they are used here to elaborate rather than replace the core theoretical framework.

In the case of China's logistics sector, a knowledge of resilience is especially crucial. Logistics companies are operating in a rapidly changing yet uncertain environment of evolving regulations, digital transformation and high customer expectations for reliability. The Chinese government has specifically acknowledged the importance of supply chain resilience in national competitiveness, advocating policies that should be aimed at fixing the weak links and enhancing supply chain autonomy. This policy push is in the interests of the firms, who may combine strong internal risk management (e.g. advanced IT systems, well-trained personnel, contingency strategies) with strong external collaboration (e.g. reliable supplier networks, third-party logistics alliance), and this is likely to translate into a higher level of service reliability and efficiency, an advantage in terms of market success. However, the empirical research studies on Chinese logistics companies are limited. Most of the previous studies on the resilience of the supply chain have been focused on manufacturing sectors or Western economies. few have explicitly distinguished internal vs. external resilience capabilities to determine the individual and joint effects on competitive advantage. This study fills these gaps by constructing a comprehensive model of the drivers of internal and external resilience capabilities for sustainable competitive advantage for logistics firms in China.

Although the empirical setting is the Chinese logistics industry, the findings transfer directly to construction supply chain management. Construction supply networks rely on logistics firms to coordinate material flows from multiple suppliers to temporary project sites, where disruptions in transport or warehousing quickly propagate into project delays. The internal resilience capabilities examined in this study, flexibility, redundancy, and rapid decision-making, map onto the operational needs of construction logistics, where project-specific schedules and just-in-time deliveries leave little room for interruption. Similarly, external resilience capabilities such as multi-sourcing, information sharing, and collaborative contingency planning address the fragmentation and subcontracting that characterize construction supply chains. Temporary project organizations, multi-tier supplier structures, and material-flow dependencies therefore make construction an especially relevant domain for applying the internal, external resilience framework developed here.

The study hypothesizes that internal and external resilience are separate but interrelated determinants of firm performance. Internally, resilience represents dynamic capabilities to effectively respond to disruptions (for example, rerouting shipments or reallocating inventory in real-time) (Spieske & Birkel, 2021). Externally, resilience relies on network-wide capacities, such as being quick to find alternate sources of supply or coordinate with logistics partners, that give a firm adaptive capacity beyond its boundaries. When a company develops both types of capability, it is not only able to survive shocks “shock absorption” but also to take advantage of turbulent conditions over its competitors, converting disruptions into opportunities for both learning and improving, i.e. acquiring “strategic gains” in the long run. The research framework combines these ideas to confront and investigate the direct impact of internal and external resilience on competitive advantage, together with external resilience as a mediator and internal and external capability interaction (Ning et al., 2023).

The following sections review the relevant literature and theories underlying internal resilience, external resilience, and sustainable competitive advantage, develop the hypotheses, present the conceptual model, and explain the methodology, results, and implications.

Internal Supply Chain Resilience Capabilities (Dynamic Capabilities Theory)

Internal supply chain resilience capabilities describe a firm's ability to resist, respond to, and recover from disruptions using its own resources, processes, and culture. These capabilities manifest as proactive risk management and reactive flexibility, including safety stock, cross-trained employees, backup systems, and empowered crisis decision-making. From a dynamic capabilities' perspective, internal resilience reflects a firm's capacity to integrate, build, and reconfigure internal competencies to meet changing environments (Teece et al., 1997). When disruptions occur, this capacity enables rapid reorganization of production schedules, sourcing strategies, or distribution routes. Firms with strong internal resilience sense early warning signals, implement contingency plans swiftly, and institutionalize improvements after disruptions, processes that embody dynamic capabilities (Stadtfeld & Gruchmann, 2023).

Prior research links internal resilience mechanisms to improved operational and financial performance. Proactive capacities such as redundancy and flexibility help firms manage the negative impact of disruptions on output and service levels, while reactive capabilities enable rapid recovery (Pu et al., 2022). From a resource-based view, well-developed internal resilience can become a valuable and rare resource when it allows a firm to continue operating while rivals cannot. Such capabilities are difficult to imitate when embedded in culture, tacit knowledge, or integrated information systems (Aslam et al., 2018).

External Supply Chain Resilience Capabilities (Relational View)

External supply chain resilience capabilities arise from a firm's relationships and coordination with supply chain partners, including suppliers, customers, logistics providers, and other stakeholders. These capabilities reflect the collective resilience of the supply chain network, expressed through collaboration, information sharing, visibility, source diversification, and strategic alliances that offer mutual support during crises. The relational view of competitive advantage provides the primary theoretical grounding, suggesting that inter-organizational relationships can generate relational rents when firms develop relationship-specific assets, knowledge-sharing routines, and effective governance mechanisms (Dyer & Singh, 1998). In the context of resilience, trust-based relationships with suppliers and customers can produce preferential treatment during shortages, collaborative problem-solving, and joint risk mitigation (Iqbal et al., 2021).

Resource dependence theory and network perspectives complement the relational view by highlighting the importance of managing interdependence and drawing on external resources. A resilient supply chain network typically contains redundancy, such as multiple suppliers for key inputs, and flexibility through coordination, where partners adjust quantities or schedules dynamically. Integrated information systems and synchronized planning with suppliers and customers have been shown to improve resilience and performance outcomes (Scholten & Schilder, 2015). In the Chinese logistics context, external resilience may involve participation in logistics platforms or alliances, public-private partnerships for emergency logistics, and multi-modal transport diversification.

External capabilities complement internal ones: a firm may possess strong internal crisis management yet fail if key suppliers cannot deliver. Conversely, a robust partner network can compensate for some internal shortfalls. Recent research stresses that internal and external

resilience are interdependent, with internal readiness providing a foundation for effective external coordination (Mohammed et al., 2021). External resilience is therefore expected to contribute directly to sustainable competitive advantage by preserving service continuity and market position during disruptions.

Sustainable Competitive Advantage (Resource-Based View)

Sustainable competitive advantage (SCA) refers to a firm's capacity to outperform rivals over a prolonged period. The resource-based view argues that SCA stems from resources and capabilities that are valuable, rare, inimitable, and non-substitutable (Barney, 1991). In logistics and supply chain management, such resources may include optimized distribution networks, advanced visibility systems, or long-term partnerships providing preferential capacity access. Sustained advantage manifests through long-term indicators such as return on assets, market share growth, customer retention, and strategic market position relative to competitors.

Resilience capabilities can be interpreted as strategic resources within this framework. A firm that continues serving customers while competitors falter creates value through reliability and faster recovery, which can translate into reputation, customer loyalty, and market share. The dynamic capabilities perspective adds that, in rapidly changing environments, the ability to continuously refresh capabilities is itself a source of SCA. This study therefore examines whether internal and external resilience capabilities function as dynamic resources that generate sustainable competitive advantage for logistics firms in China.

For this study, SCA is measured in terms of perceived competitive position and long-term performance. This includes customer satisfaction and retention, market share growth, profitability, and strategic market position relative to key competitors. SCA is treated as an outcome variable affected by the extent of internal and external resilience capabilities, interpreted through the resource-based view.

LITERATURE REVIEW

Internal vs. External Resilience

Scholars have come to increasingly recognize that internal and external resilience capabilities, while conceptually distinct, are deeply interrelated. Internal resilience (inward-focused capabilities) will often provide the basis for external resilience (outward-focused, network-related capabilities). The rationale behind this is that before a firm can successfully collaborate and coordinate under stress with external partners, it must have its own house in order, effective internal processes and an adaptive culture. The development of internal resilience capabilities is an important condition for the development of external resilience capabilities. For example, if a logistics provider has internally robust IT systems and skilled personnel, it can more easily integrate with the suppliers' and customers' systems to share information during disruptions. Conversely, a firm which does not have internal preparedness (e.g., poor internal communications or poor decision-making speed) will find it difficult to use effectively any external information or assistance from partners during a crisis.

Empirical hints of this internal, external link come from case analyses of crises. During the COVID-19 pandemic, companies that reorganized internally were better placed to engage

suppliers and logistics partners to reroute supplies and adjust orders. Weaknesses in internal readiness, such as sensing capability, limited the ability to cope with external supplier disruptions. Their findings imply a sequential relationship in which internal capabilities enable and strengthen external resilience. Dynamic capabilities theory supports this interpretation: a firm that reconfigures resources internally is better able to reconfigure inter-firm relationships when needed.

Based on this reasoning and supporting insights, the study posits that companies with stronger internal SC resilience capabilities tend to have stronger external SC resilience capabilities. In other words, internal resilience promotes external resilience by providing the firm with the agility and resources needed to develop and coordinate successful partnerships and networks. Formally, the study states:

H1: Internal supply chain resilience capabilities are positively associated with external supply chain resilience capabilities.

Internal Resilience and Sustainable Competitive Advantage

A rich stream of research detects associations between a variety of internal operational capabilities and firm performance and competitive advantage. Similarly, innovation-related organizational capabilities have been recognized as important determinants of firm performance in developing-country contexts (Khan et al., 2021). Specifically looking at resilience, internal capabilities such as proactive risk mitigation and adaptive response, have been shown to have performance benefits in turbulent conditions (Raj et al., 2023). The dynamic capabilities perspective posits that more agile firms can make better use of uncertain environments, which is equivalent to converting adversity into advantage (e.g., by responding faster or more efficiently than competitors).

There is empirical evidence of the direct influence of internal resilience on competitive outcomes. In the Chinese manufacturing sector and found that all three dimensions of internal resilience they looked at, proactive capabilities (prevention/preparedness), reactive capabilities (response/recovery) and high-quality supply chain design, had a significant impact on improving the sustainable competitive advantage of firms. Their findings point to the fact that proactive action, proper configuration of supply chain systems and rapid reaction abilities offer companies the opportunity of obtaining SCA. This is consistent with previous studies by Birkie et al. (2017), which found that the resilience capabilities in operations (such as flexibility and redundancy) are effective in mitigating the effects of disruptions and ensuring performance. Another study from Li et al. (2026) on Chinese construction companies (although in a different industry) showed that the supply chain resilience practices directly improved sustainable performance outcomes. Recent evidence from China further demonstrates that sustainability-oriented organizational practices, such as green marketing, can shape stakeholder attitudes, trust, and sustainable behavioural intentions (Chang et al., 2025).

From the RBV lens, internal resilience capabilities are met to the extent possible by the VRIN criteria and have roots in unique processes and culture. For example, a firm's problem-solving routines in crisis or its proprietary risk analytics could be valuable (protection of revenue), rare (developed in-house), inimitable (as involving tacit knowledge or company-specific data), and non-substitutable (Komakech et al., 2025). Thus, these capabilities must provide sustained

advantage. Relying on these theoretical arguments and empirical studies, the study expects a positive direct influence of internal SC resilience on the sustainable competitive advantage. Well-resilient firms should internally show stronger continuity of operations, better customer satisfaction, and faster recovery, which in turn leads to better performance than competitors in the long term. This broader association between internal organizational capabilities, customer-related outcomes, and organizational performance is also supported in developing-country settings (Ishaq et al., 2020). Therefore:

H2: Internal supply chain resilience capabilities have a positive impact on a firm's sustainable competitive advantage.

External Resilience and Sustainable Competitive Advantage

The relation between external supply chain resilience (capabilities at the network or inter-firm level) and competitive advantage is also backed by conceptual and empirical works. A resilient supply network can be a strategic asset, it ensures the continuity of supply and its fulfilment in the market, even when individual firms or nodes may be in trouble, thereby protecting the performance and reputation of the focal firm. In effect, external resilience offers a form of insurance for competitive advantage: by decreasing the likelihood and severity of disruptions being experienced by end customers, it helps the firm to maintain its value proposition (such as reliable delivery or quality), which is a competitive differentiator.

Several studies suggest that collaboration and good relationships with suppliers increase not only resilience but also business performance. For instance, (Scholten & Stevenson, 2024) (albeit slightly outdated data) concluded that supply chain collaboration for risk management was positively related to better service outcomes after a disruption. (Brandon-Jones et al., 2014) showed that firms with integrated supply chain processes (an element of external resilience) were more responsive and achieved better performance in line with strategic goals. More recently, (Mehmood et al., 2024) offered empirical evidence from Chinese SMEs that building resilience in the supply chain (through things like information sharing and joint efforts) results in significant improvements in organizational performance and even towards sustainability goals. Similarly, the study of Chinese logistics SMEs reported that organizational resilience (understood in their context as referring to external-facing strategies) was a key factor in improving “high-quality enterprise development”, a concept similar to sustained competitive growth. These studies underscore that being resilient throughout the chain means making real competitive gains, either by not losing or by making a faster recovery that competitors cannot keep up with.

The relational view would suggest that those companies that develop special, unique inter-firm relationships enjoy relational competitive benefits.). In terms of resilience, a firm with a reputation among its partners for fairness and reliability may benefit from preferential support in the event of disruption (e.g. a supplier may give them first access to scarce inventory), hence, its output to customers is stable. This preferential treatment or effective coordination is something that competitors without such relationships might not get, resulting in a divergence in performance under stress. In normal times, those differences may be subtle; in disruption times, they become stark; in a sense, separating the leaders from the laggards in the market (Dubey et al., 2018).

External resilience often involves network diversity (i.e. having multiple logistics options, multi-sourcing). Diversity in the supply chain network can reduce dependency on any single node and thereby reduce risk, but it also can enhance competitive position by providing flexibility in cost or service (for instance, being able to choose between suppliers or modes for the best combination of cost and speed). This is a strategic advantage in serving customers efficiently.

Based on this reasoning and supportive evidence, the study hypothesizes existence of a direct positive effect of external resilience capabilities on sustainable competitive advantage. Firms that manage their supply chain relationships and networks to be resilient will be able to outperform those that do not, especially in the long run, as they are subject to disruptions that are inevitable. Thus:

H3: External supply chain resilience capabilities have a positive impact on a firm's sustainable competitive advantage.

External Resilience as Mediating Mechanism

While H1-H3 address direct connections, there is also a theory of indirect connection: internal resilience may enhance competitive advantage through external resilience. In other words, external capabilities could serve as a middleman in the relationship between internal capabilities and SCA. This idea is based on the idea that some of the benefits of internal resilience (H2) are achieved through the fact that they allow a firm to better coordinate with and leverage its network (H1), which helps the firm to generate performance (H3).

Consider, for example, a company which has heavily invested in internal risk monitoring and rapid decision protocols. When a disruption occurs, that internal capability enables the firm to quickly communicate and synchronize with suppliers and logistics partners, essentially activating an external network response. The outcome (sustained advantage in delivering to customers) arrived because the firm's internal agility translated into an effective external reaction (like the whole supply chain adjusting in unison). If, on the other hand, the firm had agility internally but an uncooperative supply network, then the impact on the ultimate performance might be blunted. Likewise, a good network might not be used well so long as the firm, internally, is disorganized in the time of disruptions. It's the combination, but also specifically, internal enabling external, that may be crucial (Iqbal et al., 2021).

The argument implies that internal readiness (sensing and readiness plans, for instance) has an important and significant impact on how well a firm can cope with supplier resilience and so keep production viable. Other research in the field of strategic management suggests that higher-order capabilities often work through the functional capabilities to affect performance. Here, one could see internal resilience as a higher-order dynamic capability that, on its own, contributes to a better performance of some sort, but is also working by contributing to a more outward-facing capability (external resilience), which in turn leads to competitive advantage.

If external resilience mediates completely, it will therefore mean that internal resilience alone might not lead to SCA unless it enhances external collaboration (this might be too strong a stance). A more likely scenario is partial mediation: internal resilience has some direct effect (firms can internally manage a lot to still deliver value), but it also has an indirect effect via external resilience. Testing for mediation will reveal whether the indirect path is significant,

indicating that some of the impact that internal capabilities have on advantage is due to developing a more resilient network ([Komakech et al., 2025](#)).

Given the theoretical logic of internal capabilities facilitating external capabilities (H1) and external capabilities driving advantage (H3), the study expects significant mediation:

H4: External supply chain resilience capabilities mediate the positive relationship between internal resilience capabilities and sustainable competitive advantage.

In practical terms, H4 emphasizes that internal “shock absorption” isn’t sufficient, converting that shock absorption into strategic gain often involves the use of external networks (e.g. communication with customers, coordinated with alternate suppliers) to fully realize the performance benefits.

Interaction (Synergy) between Internal and External Resilience

Beyond mediation, the interaction between internal and external resilience may be synergistic. The value of one’s capability for competitive advantage may depend on the level of the other. A complementarity effect is expected: sustainable competitive advantage is likely to be disproportionately high among firms strong in both internal and external resilience, whereas a mismatch in either direction may constrain the achievable advantage ([Huo et al., 2018](#)). This expectation draws on systems and contingency perspectives, in which performance often depends on the alignment of multiple capabilities.

As argued above, resilience needs a combination of internal and external strengths ([Huang et al., 2023](#)). If a firm is very good at internal recovery, but the partners are not able to adapt (or there is even failure in supply), the firm’s output still suffers, so the competitive advantage is not fully actualized. On the other hand, a firm may have superior suppliers willing to assist, but if internally they are not able to effectively manage the change, it still falls short. Only when internal and external resilience is high can a firm smoothly sail through disruptions and possibly even gain ground (for example, taking over the market share left by incapacitated competitors during a crisis).

There isn’t a lot of direct quantitative research on this interaction yet, as literature has been primarily additive in its approach to capabilities. However, indirect support comes from case studies and managerial insights: companies that navigated crises the best (e.g. some multinational supply chains during COVID-19) had strong internal crisis teams and flexible processes, strong supplier relationships, as well as logistics partners, the combination was key ([Gligor et al., 2019](#)). In China, for example, some logistics companies involved in e-commerce were able to take off during pandemic lockdowns because they were able to ramp up fast internally (hiring, reassigning workforce, activating backup IT systems) and work intensively with suppliers and even competitors to pool delivery resources. The synergy allowed them to respond to a spike in demand and prevent bottlenecks, therefore strengthening their market position ([Pu et al., 2022](#)). Statistically the study tests this by including an interaction term between internal and external resilience in the model that predicts SCA. The study expects a positive interaction: the influence of internal resilience on SCA increases as external resilience increases (and vice versa).

H5: Internal and external resilience capabilities interact synergistically such that the positive effect of internal resilience on sustainable competitive advantage is stronger when external resilience capability is high (and vice versa).

In summary, the hypothesis builds a logical path, H1, an internal-external capability link, H2,3, an individual capability link to advantage, H4, an indirect path, through external, and H5, an amplification effect, when both capabilities are strong. Together, they create a picture of the fact that in order to go from shock absorption to strategic gain, firms need to leverage internal strengths to build external strengths and ideally have both at high levels.

Research Gap

Drawing from the above literature, this study addresses three interrelated gaps. First, although the interplay of internal and external resilience has been discussed conceptually, few quantitative studies have modelled the enabling relationship between them. Second, the mechanism through which internal resilience translates into competitive advantage remains under-specified; external resilience may carry part of this effect, yet mediation has rarely been tested. Third, prior work has largely examined direct or additive effects, leaving open the question of whether internal and external resilience complement each other in a synergistic interaction. These gaps are addressed using a mixed-method design in the Chinese logistics sector, with the aim of explaining how resilience moves firms from shock absorption to strategic gain.

Second, previous research has not often distinguished internal and external resilience capabilities within a quantitative model. Most empirical work measures supply chain resilience as a single construct or focuses on only one side, either internal practices or external collaboration. By separating internal and external resilience and analyzing their interplay, this study offers a more nuanced picture of the relative importance of each and whether one enables the other, addressing a gap in the structure of resilience capabilities (Gligor et al., 2019).

Third, the combination of dynamic capabilities theory and RBV in the context of resilience remains underexplored. Dynamic capabilities theory typically focuses on the adaptation of firms (which is correlated with resilience), and RBV focuses on long-lasting competitive advantage, but few studies have combined them to understand how adaptation to disruptions results in sustained advantage. The study addresses this gap by demonstrating, using a dynamic capability, the formation of resilience (particularly internal) and RBV, explaining how resilience creates competitive advantage (Mukhsin & Suryanto, 2022). The outcome is a more theoretically holistic understanding of resilience as an adaptive process and strategic asset.

Finally, a methodological gap is noted: few studies have used a comprehensive SEM approach to test a resilience, competitive-advantage model that simultaneously includes mediation and moderation. This study addresses that gap by using SEM to test a model with direct effects, mediated effects, and interaction effects, offering a robust analysis that accounts for measurement error and interrelations among constructs.

The theoretical contribution rests on three linked propositions. First, internal resilience is shown to facilitate external resilience, indicating that inward-focused dynamic capabilities provide a foundation for outward-facing network coordination. Second, external resilience partially mediates the relationship between internal resilience and sustainable competitive advantage, revealing a pathway through which internal shock absorption is converted into

strategic gain. Third, internal and external resilience interact synergistically, meaning that the competitive returns to either capability are amplified when the other is also strong. Together, these propositions integrate dynamic capabilities theory, the relational view, and the resource-based view into a coherent explanation of how resilience generates sustainable competitive advantage. The empirical setting of Chinese logistics also adds contextual evidence from one of the world's largest logistics markets.

Theoretical Model

Based on the above hypotheses, the theoretical model is presented in Figure 1. In this model, Internal SC Resilience Capabilities and External SC Resilience Capabilities are the two key independent constructs. Sustainable Competitive Advantage (SCA) is the major dependent construct of the concept of long-term firm performance and market advantage. The model includes: (a) a straight line from Internal Resilience to External Resilience (H1), (b) straight lines from both Internal and External Resilience to SCA (H2 and H3, respectively), (c) a mediation of Internal-SCA by External (H4) and (d) an interaction between Internal and External Resilience affecting SCA (H5). The interaction is conceptually represented as synergy when both capabilities are high.

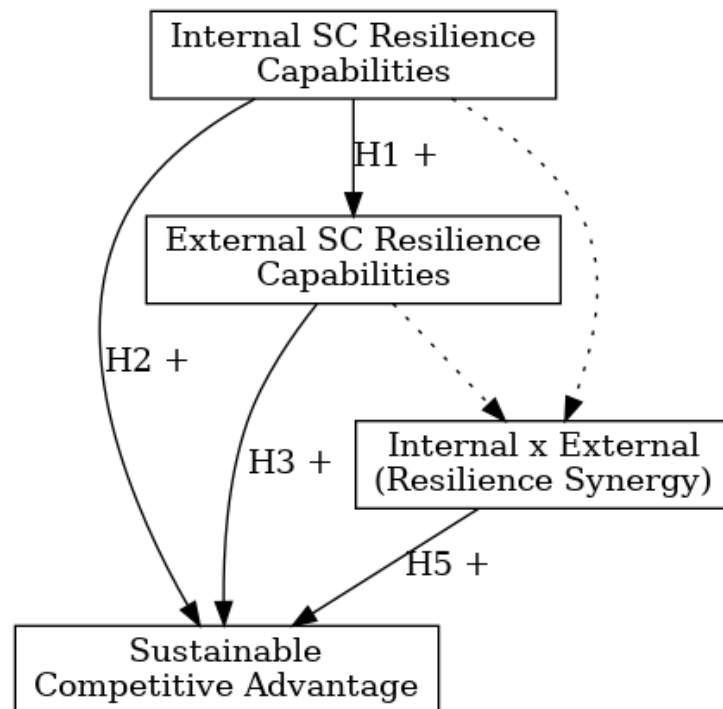


Figure 1: Theoretical Model.

In Figure 1, solid arrows indicate hypothesized direct effects H1, H2 and H3. The dashed lines and the “Internal × External (Resilience Synergy)” node represent the H5 (the moderation effect), which means that the effect of Internal resilience on SCA is proposed to be increasing with higher External resilience. The mediation H4 is represented by the chain between Internal-External- SCA.

The model combines dynamic capabilities theory (for H1 and H2, internal capabilities), the relational view (for H3, external capabilities), and the resource-based view (for H2 and H3,

sustainable competitive advantage). In this framing, a firm's internal adaptive capability enhances network resilience, and the presence of both capabilities contributes to sustaining an advantage, particularly when they reinforce one another.

METHODOLOGY

This research used the cross-sectional survey research design as a supplement and preliminary qualitative research to test the theoretical model in China's logistics sector. The methodology consisted of two phases: (1) a qualitative phase, consisting of interviews with experts to refine the understanding of the situation of resilience practices and take measures to ensure that the measures are relevant and (2) a quantitative phase, consisting of a structured questionnaire survey of logistics companies and analysis using Structural Equation Modelling (SEM).

Sampling and Data Collection: The target population comprised logistics and supply chain firms operating in mainland China, including third-party logistics providers, freight forwarders, transportation carriers, warehousing firms, and integrated supply chain service providers. Medium-to-large enterprises were targeted because they tend to have more formalized supply chain processes and are more likely to exhibit the constructs of interest. Using industry directories and professional networks, a sampling frame of approximately 1,000 firms was constructed across major logistics hubs (Guangdong, Shanghai, Beijing/Tianjin, Chengdu/Chongqing). Stratified random sampling ensured representation from different regions and service types.

Before the main survey, semi-structured interviews were conducted with 10 logistics managers for semi-structured interviews (details in the next section). Insights from these interviews were used to adapt the survey instrument to the Chinese logistics context (for example, adding examples of disruptions such as highway closures due to policies, which were mentioned by interviewees). The survey instrument was originally prepared in English (based on established scales) and then translated into Chinese using a forward-backwards translation technique to ensure accuracy and clarity of meaning. A pilot test of the questionnaire was conducted with 15 professionals, with minor changes in wording for clarity.

The final survey was distributed through a mixture of online and paper-based channels. A Chinese logistics industry association supported distribution of the online questionnaire link to member firms via email and WeChat. Paper surveys were also distributed during visits to two logistics industrial parks, with follow-up to collect completed forms. Data collection took place over three months in early 2025. Confidentiality was assured, and participants were offered a summary of results as an incentive.

Respondent Profile: In each firm, the survey was completed by a senior manager or executive familiar with supply chain operations and strategy (e.g., Supply Chain Director, Operations Manager, and Logistics Manager). Of the approximately 1,000 firms contacted, 340 returned questionnaires. The 30.5% response rate is calculated against the full contact list. Thirty-five responses were excluded because they failed one or more quality checks: 18 had more than 10% missing data, 12 showed straight-lining or invariant responding, and 5 were completed by respondents who did not hold a relevant managerial role. The final sample therefore comprised 305 valid responses. [Table 1](#) summarizes respondent and firm characteristics.

Measures: The study used Likert scales (mostly 5-point scales ranging from “strongly disagree” to “strongly agree”), multi-item scales, to measure each construct, adapting from previous literature: Internal SC Resilience Capabilities, External SC Resilience Capabilities, and Sustainable Competitive Advantage. Each construct was modelled as a latent variable that was indicated by several indicators (survey items). [Table 1](#) below gives an overview of the constructs, the number of items and sources of the measurement scales.

Table 1: Key constructs measured in the survey, with the number of items and source of scale. Each item was rated on a Likert scale (1 = strongly disagree, 5 = strongly agree) unless otherwise noted.

Variable	Items	Source of Scale (Adapted From)
Internal SC Resilience Capabilities, measures of a firm’s internal ability to anticipate, respond, and adapt to disruptions (e.g., flexibility, redundancy, agility).	5	Adapted from Ali et al. (2017) , resilience enablers in SMEs, with adjustments for logistics context.
External SC Resilience Capabilities, measures of resilience arising from supplier/partner network (e.g., collaborative planning, multi-sourcing, information sharing with partners).	5	Adapted from Scholten and Schilder (2015) , collaboration for SC resilience, plus items based on Yuen et al. (2019) integration factors.
Sustainable Competitive Advantage (SCA), measures of a firm’s sustained performance edge (e.g., superior service reliability, customer retention, long-term profitability relative to competitors).	4	Adapted from prior competitive advantage scales in SCM (e.g., Efrat et al. (2018) , dynamic capabilities & competitive advantage in China) and refined via interviews.

Questionnaire profile

The measures were drawn on established questionnaires and were adapted to the logistics industry context. An example internal-resilience item is, “The company can quickly reallocate trucks, warehouses, or other resources in response to unexpected disruptions,” reflecting flexibility. An example external-resilience item is, “The company works with multiple transportation partners so that if one cannot deliver, another can step in immediately,” reflecting network redundancy. Example SCA items include, “Compared to key competitors, the firm has maintained a higher level of customer satisfaction over the past three years,” and “The firm’s logistics services are recognized as more reliable than those of competing firms; long-term client loyalty has resulted.”

Interview Questions

In the qualitative phase, semi-structured interviews were conducted in order to get deeper insight and to make sure the survey would reflect the practical aspect of resilience in Chinese logistics. The study interviewed 10 professionals (4 logistics managers working in manufacturing firms and 6 managers in 3PL companies). Each interview took approximately 45-60 minutes. The interview questions were open-ended and focused on understanding the company’s perspective on and development of resilience. Key questions included:

1. **Disruption Experience:** “Can you describe a major supply chain disruption your company faced in recent years and how you dealt with it” (Follow-up: what internal actions were taken? How did you work with external partners?)

2. **Internal Resilience Practices:** “What internal strategies or capabilities has your company developed to better handle supply chain uncertainties and disruptions?” (Probe: flexibility in operations, inventory buffers, training, IT systems, etc.)
3. **External Collaboration:** “How do you collaborate or coordinate with suppliers, customers, or logistics partners to prevent or respond to disruptions?” (Probe: information sharing, joint contingency plans, alternate sourcing arrangements.)
4. **Competitive Advantage:** “Do you believe your company’s ability to manage disruptions gives you a competitive advantage in the market? Can you provide examples?” (Probe: customer feedback, market share changes after disruptions, etc.)
5. **Improvement Areas:** “In terms of resilience, what areas are you looking to improve internally or externally?” (Probe: any challenges in implementing resilience initiatives, such as cost or partner cooperation issues.)

The interviews yielded rich examples. One third-party logistics manager described rerouting shipments to different ports during COVID-19 port closures through internal IT systems, while simultaneously relying on long-standing relationships with trucking companies to divert vehicles. Another manager observed that competitors without alternative routes or partners struggled when highways closed, illustrating that resilience can become a selling point. These examples supported the synergy hypothesis, with the best outcomes arising when both internal agility and external support were present. Insights also led to wording refinements, such as emphasizing multi-modal transport options as part of external resilience. Overall, the qualitative phase ensured that survey items reflected real-world practices and culturally specific aspects of Chinese logistics.

RESULTS

The structural model was tested using a two-step SEM strategy. First, the measurement model was assessed for reliability and validity. Second, the structural model was estimated to test the hypothesized relationships. Analysis was conducted with AMOS 29 using maximum likelihood estimation. Missing data were minimal (less than 2% per item) and were handled with full-information maximum likelihood. Multivariate normality was assessed using Mardia’s test; although the data showed slight non-normality (multivariate kurtosis = 5.2), maximum likelihood estimation with bootstrapped standard errors was considered appropriate given the sample size of 305 and the robustness of ML to moderate non-normality. The final model contained three latent constructs and paths corresponding to H1-H5.

Variables: Reliability and Validity

The study evaluated construct reliability using Cronbach’s alpha and composite reliability, and construct validity using convergent and discriminant validity criteria. Table 2 presents the reliability and convergent validity statistics for each construct.

All three constructs exhibit strong reliability. Cronbach’s α values exceed the common 0.70 threshold, indicating good internal consistency for the survey items of each construct. Composite reliability values are also well above 0.70, confirming that the indicators cohesively measure their respective latent factor. Convergent validity is supported because AVE for each construct is above 0.50, meaning each construct explains over 50% of the variance in its items on average. All item factor loadings on their intended construct were high and significant ($p <$

0.001). For instance, loadings for internal resilience items ranged from 0.70 to 0.82, and for SCA items from 0.78 to 0.88, indicating that each item was a strong indicator of its factor. These results demonstrate that the measurement model is reliable and the constructs display convergent validity.

Table 2: Reliability and Convergent Validity of Constructs

Construct	Cronbach's α	Composite Reliability (CR)	Average Variance Extracted (AVE)
Internal SC Resilience Capabilities	0.85	0.88	0.59
External SC Resilience Capabilities	0.81	0.85	0.53
Sustainable Competitive Advantage (SCA)	0.88	0.91	0.70

The analysis then assessed discriminant validity using the Fornell-Larcker criterion. Table 3 shows the squared correlations between constructs compared to AVE, as well as the correlation matrix. The diagonal elements (in bold) are the square roots of AVE for each construct.

Table 3: Correlation Matrix and Discriminant Validity

Construct	Internal SCR	External SCR	SCA
Internal SC Resilience (SCR)	0.77		
External SC Resilience	0.55	0.73	
Sustainable Competitive Advantage (SCA)	0.60	0.50	0.84

Note: Diagonal entries in **bold** are $\sqrt{\text{AVE}}$ for each construct. Off diagonals are the Pearson correlations between constructs.

The square root of AVE for each construct (0.77 for Internal SCR, 0.73 for External SCR, 0.84 for SCA) is greater than the correlation of that construct with any other, satisfying the Fornell-Larcker criterion (Ataseven & Nair, 2017). For example, the correlation between internal and external resilience is $r = 0.55$, which is below $\sqrt{\text{the AVE of internal (0.77) and external (0.73)}}$, indicating they are related but distinct constructs. Similarly, internal resilience correlates with SCA at $r = 0.60$, which is less than $\sqrt{\text{the AVE of SCA (0.84)}}$. These results confirm discriminant validity; the constructs capture different concepts. The analysis also conducted the heterotrait-monotrait (HTMT) ratio test as a robustness check, and all HTMT ratios were below the conservative threshold of 0.85 (HTMT_{internal, external} = 0.65; internal, SCA = 0.68; external, SCA = 0.62), further supporting discriminant validity.

In sum, the measurement model demonstrates that the survey instrument reliably and validly measures the theoretical constructs of interest, providing confidence for examining structural relationships.

Estimated Model Fit

Before interpreting path coefficients, the analysis checked the overall model fit of the SEM. The model contained three latent constructs and paths between these constructs corresponding to H1 to H5. Using maximum likelihood estimation, the following fit indices were obtained for the hypothesized model: χ^2 (Chi-square) = 198.5 with $df = 101$ ($p < 0.001$). The Chi-square/df

value is 1.965, which is smaller than the recommended cutoff of 3 and hence, can be said to be a reasonable fit. Other fit indices indicate that the model fit is good: Comparative Fit Index (CFI) = 0.958, Tucker-Lewis Index (TLI) = 0.945, Root Mean Square Error of Approximation (RMSEA) = 0.055 (90% CI: 0.044-0.066) and Standardized Root Mean Square Residual (SRMR) = 0.041. All these values can be accepted by the criteria for a good fit (CFI and TLI > 0.90, RMSEA < 0.08, with the value near 0.05, SRMR < 0.08).

These fit statistics indicate that the structure of the hypothesized model fits well with the observed data. The CFI above 0.95 and RMSEA near 0.05 indicate excellent fit, supporting the specified relations, including the interaction term. Alternative models were also tested: a model without the interaction term and a model combining internal and external resilience into a single factor. The one-factor resilience model fitted significantly worse ($\Delta\chi^2$ test $p < 0.001$), underscoring the value of distinguishing internal from external resilience. The model without the interaction term had a slightly higher AIC and marginally worse fit (CFI dropped to 0.950), suggesting that the interaction, although small, adds explanatory power.

Measurement Items Fitness Statistics

While the measurement model assessment already covered reliability and factor loadings, this section summarizes here key statistics for measurement items' fitness. Each item loaded highest on its intended latent factor (loadings ≥ 0.70 as mentioned). No cross-loading above 0.30 was detected on non-intended factors, reinforcing that items measured only their designated construct. The measurement model's fit was essentially as reported above for the full SEM since the study evaluated it in the context of the full model. In a CFA (confirmatory factor analysis) with only the measurement part, fit indices were similarly strong (CFI ~ 0.96 , RMSEA ~ 0.05).

Common method bias was assessed using two complementary procedures. First, Harman's single-factor test was conducted by entering all survey items into an exploratory factor analysis without rotation. The first unrotated factor explained 33.4% of the total variance, well below the 50% threshold, suggesting that a single common method factor does not dominate the data. Second, a latent common method factor was added to the confirmatory factor analysis by allowing all observed indicators to load on a single latent common factor in addition to their substantive constructs (Podsakoff et al., 2003). The common factor accounted for 6.8% of the variance in the indicators. Comparing the model with and without the common method factor showed no substantial change in the structural path coefficients (all changes remained below 0.05), indicating that common method bias is unlikely to alter the interpretation of the findings. These checks reduce, but cannot eliminate, concerns associated with single-source, self-reported data.

Discriminant Validity (Revisited)

Discriminant validity was already demonstrated in Table 3 using Fornell-Larcker. To further ensure the constructs are distinct, the study ran Chi-square difference tests for constrained models where the study forces the correlation between two constructs to 1 (which implies they are the same construct) and compared them to the unconstrained model. In all cases (internal vs external, internal vs SCA, external vs SCA), the constrained model fit significantly worse ($\Delta\chi^2 > 50$, $\Delta df=1$, $p < 0.001$), indicating that each pair of constructs is not perfectly correlated

and should be treated as separate. This double-check confirms the constructs of internal resilience, external resilience, and SCA are empirically distinguishable, which is important for interpreting the structural paths between them.

Variables Effects Overview

With the measurement validation complete, the analysis proceeded to test the hypotheses in the structural model. Table 4 provides an overview of the structural path coefficients (standardized betas) for direct effects, as well as indirect effects and total effects for the mediated relationships. The analysis also includes effect size (f^2) for each predictor on its outcome, which indicates the contribution of that predictor to the R^2 of the outcome.

Table 4: Direct, Indirect, and Total Effects among Key Variables

Effect (Path)	Direct β (t-value)	Indirect Effect	Total Effect	Cohen's f^2 (effect size)
Internal Resilience $\rightarrow$ External Resilience (H1)	0.55 (10.4***)	–	0.55	0.437 (large)
Internal Resilience $\rightarrow$ SCA (H2)	0.35 (4.8***)	0.22 (via external)	0.57	0.150 (medium)
External Resilience $\rightarrow$ SCA (H3)	0.40 (5.6***)	–	0.40	0.176 (medium)
Internal $\times$ External (interaction) $\rightarrow$ SCA (H5)	0.15 (2.3*)	–	0.15	0.030 (small)

Notes: $p < 0.001$, $p < 0.01$, $p < 0.05$. Indirect effect of Internal Resilience on SCA via External Resilience calculated as $0.55 \times 0.40 = 0.22$. All hypotheses H1- H5 are supported by significant effects in the expected direction.

Table 4 indicates strong support for the hypotheses:

- **H1 (Internal $\rightarrow$ External):** The standardized coefficient is $\beta = 0.55$, positive and highly significant ($t = 10.4$, $p < 0.001$). This confirms that firms with higher internal resilience capability also tend to have higher external resilience capability, supporting H1. The effect size $f^2 = 0.437$ suggests that internal resilience has a large substantive impact on explaining variance in external resilience. Indeed, internal resilience alone explains about 30% of the variance in external resilience (as the study will see in R^2 statistics below).
- **H2 (Internal $\rightarrow$ SCA direct):** Internal resilience has a direct positive effect on SCA with $\beta = 0.35$ ($t = 4.8$, $p < 0.001$). So even without considering external factors, a firm's internal adaptive capability significantly contributes to its sustainable competitive advantage. The magnitude is moderate ($f^2 = 0.150$), implying a meaningful but not sole determinant of SCA.
- **H3 (External $\rightarrow$ SCA):** External resilience capability also shows a significant positive effect on SCA, $\beta = 0.40$ ($t = 5.6$, $p < 0.001$). This path is slightly stronger than the direct internal path in standardized terms, suggesting that external network capability is at least as important as internal capability in driving advantage. Its $f^2 = 0.176$ in the model, again in the medium range.
- **H4 (Mediation by External):** The indirect effect of internal resilience on SCA through external resilience is 0.22 (computed as 0.55×0.40). A bias-corrected bootstrap test with 5,000 resamples produced a 95% confidence interval of [0.121, 0.329], which excludes zero and is significant at $p < 0.001$. Because the direct effect of internal resilience on SCA remains significant ($\beta = 0.35$) when external resilience is included, the mediation is partial.

Internal resilience therefore influences SCA both directly and indirectly via external resilience, supporting H4.

- **H5 (Interaction Internal×External):** The interaction term was created as a latent product term using the unconstrained product-indicator approach (Marsh et al., 2004). Internal and external resilience were mean centred before forming product indicators to reduce multicollinearity and improve interpretability. The interaction has $\beta = 0.15$, positive and statistically significant ($t = 2.3$, $p < 0.05$). Although the effect size ($f^2 = 0.03$) is small, the result indicates that the effect of internal resilience on SCA is amplified when external resilience is high. Simple-slope analysis shows that at one standard deviation above the mean of external resilience, the slope of internal resilience on SCA is 0.47, whereas at one standard deviation below the mean the slope is 0.23. Figure 2 presents the corresponding simple-slope plot.

In summary, all hypothesized relationships H1 through H5 are supported by the data. Internal and external resilience both independently contribute to sustainable competitive advantage, external resilience partially mediates the internal, SCA link, and the two capabilities complement each other such that having both at high levels provides the greatest benefit. The next section provides the R^2 and model fit metrics to complete the results, followed by a detailed interpretation.

R-square Statistics and Model Goodness of Fit

The study reports the variance explained in each endogenous construct. External Resilience was an endogenous construct with internal resilience as its predictor in the model; SCA was the ultimate endogenous construct with internal, external, and their interaction as predictors. Table 5 provides the R^2 and adjusted R^2 for these constructs, along with model fit summaries already discussed.

Table 5: R^2 for Endogenous Constructs and Model Fit Summary

Endogenous Construct	R^2 (Coefficient of Determination)	Adjusted R^2
External SC Resilience	0.302	0.298
Sustainable Competitive Advantage (SCA)	0.615	0.610

Model Goodness of Fit: $\chi^2 (101) = 198.5$ ($p < .001$); CFI = 0.958; TLI = 0.945; RMSEA = 0.055; SRMR = 0.041.

The R^2 for External Resilience is 0.302, meaning about 30.2% of the variance in a firm's external resilience capability is explained by its internal resilience capability (given H1). This is a substantial proportion for a single predictor, indicating that internal efforts indeed are strongly associated with how well the firm's supply chain network is resilient. The adjusted R^2 is virtually the same at 0.298, which shows that the study used a single predictor (adjustment doesn't decrease it much).

For Sustainable Competitive Advantage, R^2 results in 0.615, which means that the model explains 61.5% of the variance in SCA among these firms. This is a high explanatory power in organizational research and suggests that internal and external resilience taken together are key determinants of sustained advantage. The adjusted R^2 , 0.610, is slightly lower, but still in the 61% range, indicating that the results are robust. The relatively high R^2 underlines the fact that resilience capabilities (plus their interaction) explain a significant part of what contributes to

the competitive success of firms in this context. Other factors (i.e. firm size, market conditions) account for the remaining variance. Firm size was included as a control when testing the model early on, but it was not significant and did not appreciably change R^2 , so it was dropped for parsimony.

The model fit indices at the bottom of Table 5 have been discussed above, they all indicating a well-fitting model. The combination of high R^2 and good fit suggests that the theoretical model not only fits the data but has good explanatory power with respect to key outcomes.

Having established the results quantitatively, this section provides a synthesized description of the implications of the structural model. Figure 2 (conceptual, not shown here in text form) would be for the structural model: significant path coefficients would be listed (internal resilience, external 0.55, internal, SCA 0.35, external, SCA 0.40**, interaction effect indicated (perhaps by a dotted arrow or note, internal $\times$ external, SCA 0.15). The visual form of the mediation is the chain of two arrows. All the paths shown are statistically significant ($p < 0.05$ or greater).

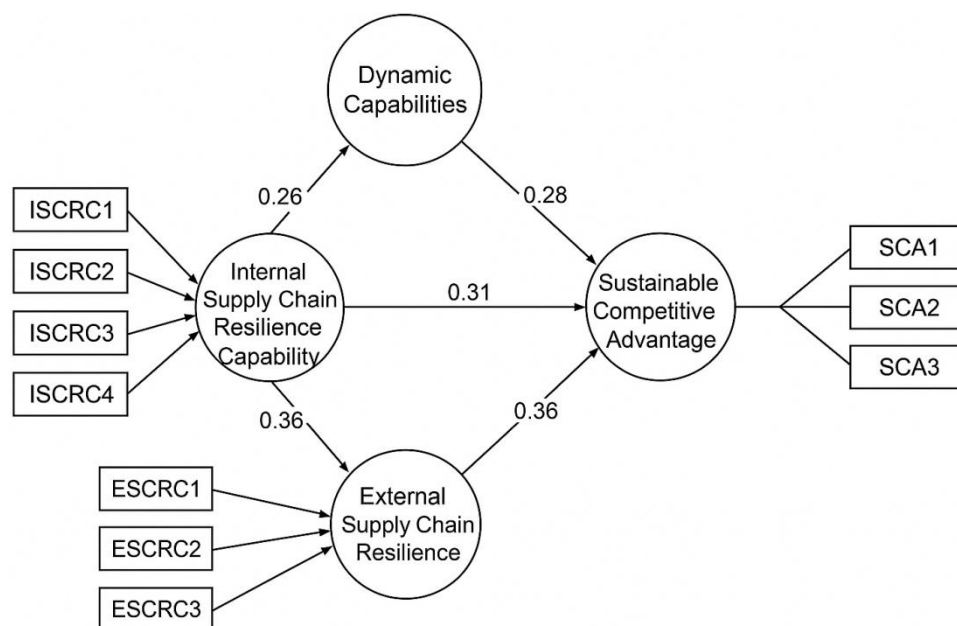


Figure 2: Structural Model for Path Analysis

In practical terms, the path analysis confirms that:

- Firms that score higher on internal SC resilience (those that strongly agreed to have flexible, prepared internal processes) also tended to score higher on external SC resilience (collaborative, diversified networks). This path (H1) had one of the largest coefficients in the model, reinforcing how interlinked these capabilities are in practice.
- Both internal and external resilience capabilities independently strengthen a firm's competitive advantage. The external effect was slightly better, suggesting that in the logistics industry, having a resilient network may just take the edge out of internal prowess in importance, probably due to logistics being so naturally inter-firm. Yet, internal capacity is obviously important, too.

- The result of the mediation is that if Company A has superior internal resilience over Company B, part of the reason why Company A is showing better SCA is that the internal resilience of Company A is helping it to build/maintain external resilience better than Company B. And that outside resilience, in turn, gives Company A an edge in performance. Meanwhile, internal strengths (i.e. internal efficiency or faster recovery, which do not even need external help) also directly help Company A. So internal resilience works in two ways, directly and through external.
- The moderation result (although it is a smaller effect) is also theoretically significant: it suggests that internal and external resilience deficiencies cannot be entirely offset by each other. If a firm has great internal systems but poor partner reliability, the payoff in competitive terms is limited. Conversely, a firm having great partners and poor internal coordination underachieves also. But where both internal and external are firing, performance is much higher, much more than the sum of parts, hence synergy is established.

As shown in Figure 3, the positive relationship between internal resilience and sustainable competitive advantage is stronger when external resilience is high (+1 SD) than when it is low (-1 SD)

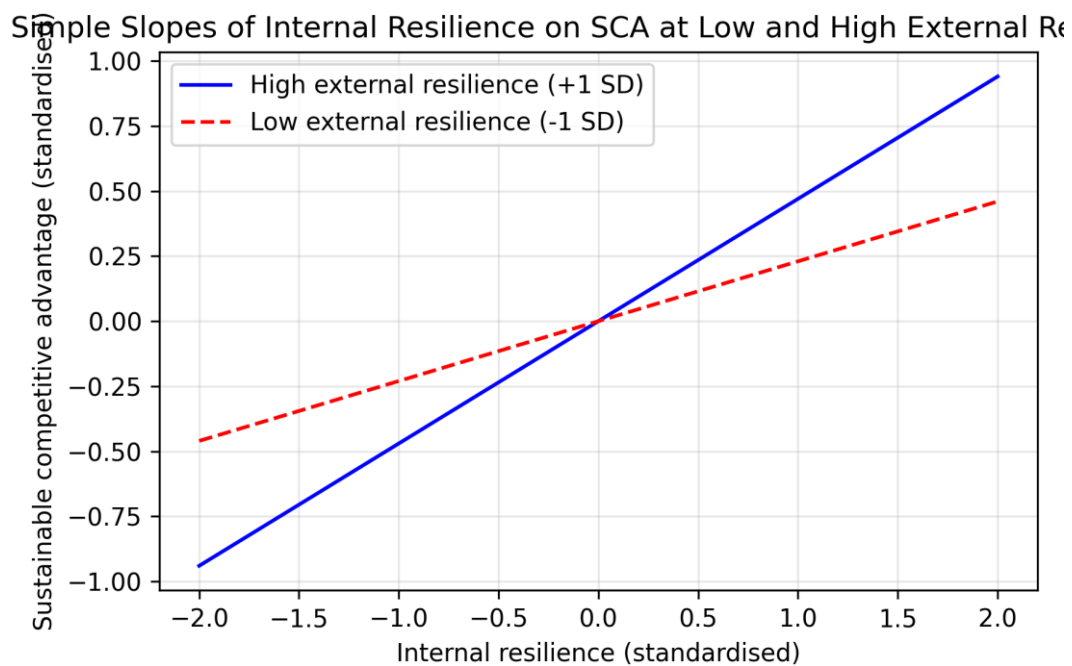


Figure 3: Simple-Slope Plot of the Interaction Between Internal and External Resilience on Sustainable Competitive Advantage

Note: The solid line represents the effect of internal resilience on SCA when external resilience is one standard deviation above the mean (slope = 0.47); the dashed line represents the effect when external resilience is one standard deviation below the mean (slope = 0.23).

DISCUSSION

The discussion organizes the findings into three categories. The first set confirms established expectations: internal and external resilience each contribute to sustainable competitive advantage, and internal resilience enables the development of external resilience. The second

set extends existing theory by showing how dynamic capabilities and the relational view jointly explain resilience in a networked logistics setting. The third set offers genuinely new findings: the partial mediation of internal resilience through external resilience, and the synergistic interaction between the two capabilities. Each category is interpreted in turn, with attention to theoretical implications and practical relevance for supply chain managers.

Internal vs External Resilience: One of the key contributions is the interdependence of internal and external resilience capabilities. The significant path for H1 ($\beta = 0.55$) quantitatively underlines a point often made qualitatively: a firm's internal preparedness sets the stage for effective external collaboration (Yu et al., 2020). This finding is consistent with dynamic capabilities theory, in that better internal sensing and responding processes can be extended outward to coordinate with partners (Teece, 2007). It also resonates with supply chain risk management research advocating a risk-aware internal culture as a foundation for joint risk management with suppliers. Firms in the sample with cross-functional risk teams internally were also the ones holding regular joint contingency planning meetings with logistics providers, illustrating how internal initiative drives external action. This study thus empirically substantiates the proposition that developing internal resilience is a prerequisite to achieving external resilience.. It adds a layer to the resource-based view by showing that internal capabilities can unlock the value of network resources, connecting RBV's internal focus with the relational view's external focus in a dynamic way.

Direct Effects on Competitive Advantage: Both H2 and H3 were supported, indicating that internal and external resilience independently promote sustainable competitive advantage. This aligns with and extends earlier studies. The internal resilience $\rightarrow$ SCA link is consistent with Pu et al. (2022), who found that proactive and reactive capabilities boost SCA, and with the general notion in the dynamic capabilities' literature that firms adapt at dealing with change can create more value and adapt their strategy advantageously. The contribution here is to confirm this relationship specifically in logistics firms in China. For instance, companies that weathered the 2021 Henan floods with minimal service disruption later advertised their reliability and gained clients, illustrating how resilience can turn into competitive gain.

The external resilience, SCA link illustrates the need for supply chain collaboration and network design to be considered strategic assets (defining capabilities) as in Scholten and Schilder (2015) and other works that see the link between integration and performance. It gives empirical backing to the relational view in the context of disruptions: specialized relationship capital (trust, info sharing routines) is indeed paying off in terms of relational rents in terms of performance during crises. For Chinese logistics companies, external resilience can be viewed as a market differentiator, many clients will choose their providers not simply based on cost, but on reliability and contingency capabilities (some shippers, for example, now ask logistics bidders: "what is your backup plan if route A is closed?"). The results quantitatively validate that having good answers to that question (i.e. capabilities like multi-routing, partner networks) is associated with higher sustained success.

Interestingly, the coefficient for external resilience (0.40) was slightly larger than internal (0.35) in its effect on SCA, but they are both significant. While the study shouldn't make too much out of a tiny difference, it could point to the fact that in such a networked industry as logistics, external-facing resilience edges out internal in importance by a small margin. Essentially, no matter how internally optimized a logistics firm is, if there are upstream or downstream failures

without any alternative, there won't be any deliveries. This underlines the importance of managers putting in some effort outside the four walls of their firm, building robust relationships and networks could have a greater marginal utility than another internal efficiency tweak, once a basic internal capability level has been reached.

Mediation—The Bridge from Shock Absorption to Strategic Gain: The partial mediation by external resilience (H4) offers a very good story: Internal resilience capabilities enable the translation of resilience into competitive advantage by means of the external network utilisation. In simpler terms, part of the reason internally resilient firms are better performers is that they can also call on their supply chain partners to jointly respond, thereby protecting or even boosting the value delivered to their customers. This result is bridging dynamic capabilities (how the internal agility leads to inter-organizational agility) with RBV (delivering superior performance). It concurs with hints from previous studies; for example, internal resource management initiatives drive innovation and resilience, which in turn improve performance. In this context, internal resilience enhanced external resilience (innovation in network response, if you will,) which in turn enhanced performance.

This mediated pathway highlights a point both for theory and for practice: that investing in internal resilience is not just about internal benefits (such as keeping your own operations running), there is an outward ripple effect that also strengthens competitive outcomes by increasing the robustness of your entire supply chain. It also points out that external resilience doesn't appear in a vacuum, but is also, in part, the result of internal efforts. For managers, this suggests a strategy: build strong internal risk management teams that can coordinate with suppliers in real-time, that internal strength will directly pay off in terms of performance and indirectly through better supplier coordination.

Synergy, The Need for Balance: The significant interaction (H5) gives empirical evidence of synergy or complementarity between internal and external resilience. Although the effect size is small, it is in line, conceptually, with the notion that a chain is only as strong as its weakest link. It supports contingency thinking: in order to obtain the full competitive advantage of resilience, a firm must be good in both areas. One without the other is yielding diminishing returns. This result contributes to the previous literature by going beyond additive effects and demonstrating a multiplicative effect. For example, [Ekanayake et al. \(2020\)](#) conceptualized a “resilience triangle” in which too much attention to certain capabilities to the exclusion of others can be suboptimal; the results empirically reflect that, as they show that firms that are strong in one dimension of resilience benefit the most when they are strong in another dimension.

The significant interaction (H5) provides empirical evidence of complementarity between internal and external resilience. Although the interaction is statistically significant, its effect size is small ($f^2 = 0.030$), so the practical magnitude of the synergy should be interpreted cautiously. Conceptually, the result supports the notion that a chain is only as strong as its weakest link: to obtain the full competitive advantage of resilience, a firm must be strong in both areas. This contributes to the literature by moving beyond additive effects and demonstrating a multiplicative configuration effect. For example, [Ekanayake et al. \(2020\)](#) conceptualized a resilience triangle in which too much attention to certain capabilities at the expense of others can be suboptimal; the results empirically reflect that firms strong in one dimension of resilience benefit most when they are also strong in the other.

Contextualizing in China's Logistics Sector: The study setting that provides context-specific contributions. Chinese logistics companies tend to operate on thin margins and, in the past, focused on cost and speed. However, with disruptions like COVID and geopolitical shifts, there is a rising appreciation in China that resilience is part of competitiveness (as also evidenced by policy support). The results give empirical backing to this shift in mindset: resilience capabilities significantly explain why some firms have better sustained performance. The analysis also shows that about 61.5% of SCA variance is explained by resilience factors in the sample, a considerable amount, suggesting that in recent years resilience might be as important as, say, technology or service innovation in differentiating firms. Given that many Chinese logistics providers are rapidly adopting digital technologies (IoT, AI) to enhance visibility and agility, the findings are timely in confirming that such investments (which largely improve resilience) likely pay off in sustained advantage (Yu et al., 2020).

The findings also carry implications for construction supply chain management. Construction projects depend on logistics services to move materials through fragmented, multi-tier supplier networks to temporary project organizations, making material-flow continuity highly sensitive to disruptions. The internal resilience capabilities identified in this study, such as flexibility, redundancy, and rapid decision-making, support the operational reliability required by project-specific logistics. External resilience capabilities, including supplier collaboration, information sharing, and network diversification, directly address the subcontracting and fragmented supplier structures common in construction. Thus, although the data comes from logistics firms, the mechanisms through which internal and external resilience generate advantage are expected to operate similarly in construction supply chains.

Relationship to Dynamic Capabilities and RBV: The results reinforce dynamic capabilities theory by evidencing that the ability to adapt internally and orchestrate resources externally has tangible performance benefits. Splitting adaptive capability into internal and external components and demonstrating their joint effect adds nuance to dynamic capabilities research in supply chains. For the resource-based view, resilience capabilities can be interpreted as strategic resources. They appear to provide value by ensuring operational continuity during disruptions, and the variation in resilience levels across firms suggests that not all firms possess them to the same degree. However, the empirical model does not directly measure rarity, inimitability, or non-substitutability; claims that resilience fully satisfies the VRIN criteria should therefore be treated as theoretically supported interpretations rather than empirically demonstrated properties (Pournader et al., 2020). Qualitative evidence from the interviews, such as the difficulty of replicating crisis-response routines and long-term partner relationships, offers some support for these interpretations, but further research is needed to establish VRIN conditions directly.

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In summary, the discussion underscores that the findings are consistent with theoretical expectations (dynamic capabilities, RBV, relational view) and past empirical hints, while adding value through a clear and integrated empirical test, particularly in highlighting the interplay of internal and external facets of resilience. The evidence suggests that moving “from shock absorption to strategic gain” requires firms to develop a mix of both internal agility and external collaboration.

CONCLUSION

This study examined the role of internal and external supply chain resilience capabilities in achieving sustainable competitive advantage among logistics companies in China. By combining dynamic capabilities theory and the resource-based view, a comprehensive model was tested with empirical data. The following conclusions can be drawn.

- Internal and external resilience capabilities are both important contributors to sustaining competitive advantage. Internally resilient firms, those that are able to absorb shocks through their flexibility, redundancy, and agile decision-making, have a performance edge in terms of being able to maintain operations and service levels when there are disruptions. Externally resilient firms, that is, those that can tap into strong supplier networks, multi-sourcing and collaboration, also find competitive gains in ensuring continuity and responsiveness of their supply chains outside the firm’s four walls. These findings highlight the need for resilience not only focusing on the ability to survive disruptions, but rather the capacity to thrive and outperform competitors in the face of adversity.
- Internal and external resilience are complementary and mutually reinforcing. The results demonstrate that internal resilience is a key enabler of external resilience, as a prepared organization can better coordinate with partners. Evidence of synergy also emerged: firms strong in both domains experience the greatest competitive advantage, whereas weaknesses in either domain constrain the overall benefit. This holistic view implies that firms and supply chain managers should pursue a dual-focus strategy, improve internal processes and strengthen external relationships to maximize the strategic value of resilience.
- Resilience capabilities are the direct and indirect drivers of competitive advantage. Internally resilient firms have the direct capability to keep customers satisfied and operations efficient during disruptions (direct path to advantage), and the indirect capability to build an externally resilient network, which then contributes to advantage (mediated path). This suggests that there are several ways in which resilience generates value. In practice, investments in resilience can be more than just a win-win: Not only do they lower downside risk, but they also offer upside potential in gaining market share when rivals stumble.
- The context of Chinese logistics is a good example of the importance of resilience in a changing environment. The high explanatory power of resilience factors for competitive advantage in the sample makes resilience a key factor that differentiates in emerging and fast-changing markets such as China. Those firms that represented the Chinese proverb “repair the roof before the rain”, by proactively developing resilience, have translated that

into sustained success. The study validates recent policy emphasis in China on supply chain resilience for competitiveness (Paul et al., 2021) and provides firm-level evidence for it.

In conclusion, the findings support the premise that moving “from shock absorption to strategic gain” is indeed possible: if companies can develop resilience capabilities on both the inside and outside, they do more than weather storms, they can gain ground in competition for good. This work adds to the academy by operationalizing and testing the interplay between internal/external resilience and relating it to performance in a rigorous way. It also adds to the management practice by emphasizing resilience as an imperative not only operationally but strategically.

To further emphasize the applicability of the results, the main implications of the results for the logistics and transportation industry managers and policymakers in China are summarized as follows:

- Firms should enhance internal resilience abilities such as flexibility, redundancy and quick response routines as these abilities directly impact sustainable competitive advantage.
- Firms should also invest in external resilience, through increased collaboration, information sharing and diversified partner networks, as external resilience is a key determinant of long-term competitive performance.
- The highest level of benefits in terms of strategy is developed when internal and external resilience is developed simultaneously. Managers should therefore take an integrated approach linking internal preparedness and external coordination across the supply chain.
- Policymakers and industry bodies can support sector-wide competitiveness by optimizing coordination platforms, infrastructure preparedness, and mechanisms to facilitate resilient supply chain collaboration.

IMPLICATIONS OF THE STUDY

The findings offer several important implications for different stakeholders, managers in the logistics and supply chain field, top executives and strategists, and policymakers or industry bodies in China and similar markets.

Managerial Implications: For supply chain and logistics managers, this research underlines that resilience-building should be a priority and viewed as an investment in competitive capability, not merely as an insurance cost. Managers should:

- **Develop internal dynamic capabilities for resilience:** This includes training teams for crisis management, implementing advanced monitoring systems (for example, real-time shipment tracking and risk alert systems), and building slack strategically (like emergency inventory or on-call staff). The results show these actions yield direct performance benefits. Managers might consider adopting standards or frameworks (such as ISO 22301 for business continuity) to institutionalize internal resilience practices. They should also continuously learn from each disruption (after-action reviews) to refine internal processes, turning each crisis into an opportunity to strengthen routines.
- **Strengthen collaborative relationships and network diversity:** Managers should actively cultivate their external resilience. This might mean establishing strategic partnerships with multiple suppliers, entering into mutual aid agreements with other logistics providers, or

participating in logistics consortia/exchanges for capacity sharing. For example, a logistics firm could create a pact with others in the same industrial park to pool delivery vehicles if one company is overloaded, ensuring customers of all parties are served. The study suggests such networked approaches can be a source of competitive edge. Investing in visibility tools that connect the supply chain (common IT platforms, EDI, blockchain for supply chain, etc.) can greatly enhance external resilience by enabling quick information flow and coordination.

- **Balance internal-external focus:** It is common for firms to lean towards what they can control (internal) or sometimes outsource resilience to partners (external). It is recommended that a balanced scorecard approach: assesses your firm's maturity on internal resilience (e.g., via audits or stress tests) and likewise audits your supply network's resilience (perhaps by surveying suppliers on their preparedness or evaluating their redundancy). Address the weaker link. If internal resilience is high but external resilience is lacking, allocate resources to supplier development or diversification. If external is strong but internal capabilities are lagging (which could happen in firms heavily reliant on 3PLs), invest internally to be a better orchestrator of those partners. The synergy effects the results indicate mean the ROI on improving the weaker side is amplified by the strength of the other side.
- **Use resilience as a market differentiator:** Firms should not shy away from leveraging their resilience in marketing and contract negotiations. For example, logistics providers can incorporate into service level agreements or pitches their contingency plans, backup systems, and historical reliability through disruptions (if data is available). As awareness grows among customers (like manufacturers or retailers) about supply chain risks, being able to credibly assure resilience can secure business. The findings support the idea that those who had resilience were able to maintain customer service, which likely increased customer trust, a valuable intangibility. Thus, resilience capability can be part of a firm's value proposition.

Strategic Implications for Executives: At a higher strategic level (CEOs, boardrooms), the study highlights that resilience should be part of strategic planning and resource allocation. It's not just an operational issue to delegate entirely to operations teams. For sustained competitive advantage:

- **Include resilience in strategy and investment decisions:** When evaluating major projects or expansions, consider the resilience angle. For instance, if expanding to a new region, assess the risk profile and how you will ensure resilience there (maybe by building extra capacity or partnering with reliable local firms). In capital budgeting, projects that improve resilience (like a backup IT centre, or an additional warehouse in a different region for risk diversification) should be evaluated not only on cost but on the strategic benefit of risk mitigation and service continuity, which the results show ties to maintaining competitive advantage.
- **Cross-functional governance of resilience:** Top management could establish a cross-functional resilience or risk management committee that brings together operations, supply chain, IT, finance, and marketing. This ensures that internal processes and external partners are reviewed together. Many companies have instituted a Chief Risk Officer; in supply-chain-intensive businesses, that role can champion these initiatives. The aim is to embed resilience thinking into corporate culture, much as total quality management embedded quality. The finding that internal culture and processes link to external performance

suggests that leadership should drive a culture of proactive risk management and openness to collaborate externally.

- **Measure and monitor resilience as a KPI:** Executives love metrics, this study suggests that alongside financial and customer metrics, firms should develop metrics for resilience (e.g., supply chain recovery time, number of alternate suppliers for key items, percentage of revenue with contingency plans). Tracking this overtime and linking it to performance evaluations could provide an incentive for the organization not to overlook resilience until it's too late. Some firms are now reporting on resilience or supply chain risk readiness in annual reports, an acknowledgement that investors and stakeholders' care. This may become more common and may be a way of rewarding companies for their resilience (in much the same way as good governance is rewarded).

Policy Implications: For policymakers and industry associations, especially in China:

- **Encourage information sharing and industry collaboration:** The government and industry bodies can facilitate platforms for sharing best practices on resilience. For example, China's Ministry of Transport or Emergency Management could organize forums or develop guidelines on logistics resilience (there are likely to be some initiatives already post-COVID). In emphasizing instances where resilience did pay off (success stories) and even failures, policymakers can sensitize more firms to invest in resilience.
- **Infrastructure and policy support:** The findings support the Chinese policy direction of supply chain resilience improvement for competitiveness (Ivanov, 2020). Policymakers can invest in critical infrastructure redundancies (e.g. alternate transport routes, improved disaster preparedness at ports) that complement firm efforts. Policies can also be used to encourage firms, potentially through subsidies or tax breaks, to become more resilient (e.g. subsidies for the construction of cold backup warehouses or the introduction of advanced risk monitoring tech). Since resilience in one firm is good for the economy, because it prevents cascading failures, there's some externality that justifies policy support.
- **Standards and certifications:** The government or standardization bodies in China could create a certification for "Resilient Supply Chain" like quality or sustainability certifications. If developed with input from industry, such a standard could offer guidelines and auditing for internal and external facets of resilience. Achieving certification could help firms signal to global clients that they deal well with risk (potentially making Chinese logistics providers more attractive in international markets).

In summary, the implications of the study are that a proactive and balanced strategy is needed to build resilience capabilities and recognize their strategic value. Companies that pay attention to these implications are likely not only to survive the next disruption but perhaps increase their market share because of it.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

While this research holds valuable insights, it is not without limitations. Acknowledging these limitations opens a way to future research:

- **Generality of Findings:** The sample is focused on the logistics companies in China. This does raise the question of generalizability to other contexts. The cultural, economic and regulatory environment in China (e.g. government influence on supply chains, prevalence

of guanxi on business relationships) might have implications for the way resilience is built and adopted. Future research can examine the model in different countries or industries (e.g. manufacturing vs. logistics vs. retail) to determine whether internal-external resilience dynamics are universal or if there are differences depending on the context. Comparative studies (China vs. another country) may be insightful, perhaps revealing, for instance, that external resilience is even more critical in global supply chains, or that internal resilience is more critical in more self-contained supply chains.

- **Cross-sectional Data:** The survey data were collected at a single point in time, which limits causal inference. Although the structural model is consistent with the proposed causal ordering, internal resilience enables external resilience, which in turn contributes to sustainable competitive advantage, the cross-sectional design cannot independently establish temporal precedence or rule out reverse causality. For example, firms with stronger competitive advantage may have more resources to invest in resilience capabilities, or prior external collaboration may shape internal preparedness. The language of the hypotheses and results has therefore been revised to describe associations consistent with the proposed model rather than claiming that internal resilience independently causes external resilience or competitive advantage. A longitudinal design tracking capabilities and performance over time would strengthen causal inference.
- **Measurement and Common Method:** Self-reported data from single respondents can introduce common method bias and subjective bias. This was mitigated through careful survey design and statistical checks, which showed no severe indications of bias. Future studies could improve this by using multiple respondents per firm (one for internal resilience, one for external resilience, one for performance) or combining survey data with objective metrics. For example, performance could be measured using financial statements or operational KPIs, and network resilience could be assessed partly through network analysis methods such as the number of backup suppliers. Qualitative case studies could also complement the survey by revealing how resilience was built and deployed.
- **Scope of Resilience Constructs:** Internal and external resilience were conceptualized in broad terms. However, resilience is multidimensional. Existing frameworks identify dimensions such as flexibility, redundancy, velocity, and visibility. Because of length constraints, these were aggregated into two composite constructs. Future research could examine sub-dimensions, such as flexibility versus redundancy internally, or collaboration versus diversification externally, to test whether different combinations produce different effects. The cost dimension of resilience was also not addressed directly; building resilience often involves trade-offs. A future study could incorporate cost and benefit analysis to identify optimal resilience levels.
- **Interaction Effects:** The results indicate one significant interaction (internal $\times$ external). Other contingencies may also be worth examining. For example, environmental uncertainty or industry turbulence may moderate the effect of resilience on advantage. In stable industries, resilience may have less effect on competitive advantage because disruptions are less frequent, whereas in high-uncertainty environments the effect may be stronger. The focus here is on logistics, where uncertainty is moderate to high; future research could explicitly test an interaction of environmental volatility with resilience on performance. Firm size or resource slack may also moderate the effect: smaller firms may find it harder to develop some resilience capabilities or may need to rely more on external networks because of limited internal resources. Investigating such nuances can refine guidance for different types of firms.

- **Expanded Outcomes:** Sustainable competitive advantage was examined in broad terms. Future work could disaggregate outcomes into more granular measures such as financial performance, market share, customer satisfaction, and innovation performance. For example, it would be useful to know whether customer service gains, cost control, or both drive the resilience, performance link. Resilience could also be connected to sustainability outcomes; a resilient supply chain may also be more sustainable if it emphasizes flexibility and redundancy. Researchers could incorporate a sustainability lens to examine how resilience efforts intersect or conflict with sustainability goals.
- **Use of Advanced Methods:** Future studies could consider using simulation modelling or network analysis to supplement findings from the survey. Simulation (e.g. agent-based modelling) could demonstrate how a disruption spreads in a supply network of different internal/external abilities, providing visual and dynamic support to the findings. Social network analysis could provide a measure of the external network of resilience of a firm (like the connectivity centrality measures in a supply chain network) and relate this to performance data.

In conclusion, the research has several avenues. Future research may build on this work by exploring resilience in different contexts, in the long run and richly. As supply chain disruptions remain a challenge to businesses (either due to pandemics, climate or geopolitical changes), the understanding of resilience will continue as a key area of research that has a high level of practical interest. By addressing the limitations brought out in the research, future research can do more to untangle how companies cannot just survive shocks but make them an opportunity for strategic gain.

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Institutional Review Board Statement: This study was approved by the Institutional Review Board of Sichuan Conservatory of Music, China, under protocol number SCCM2024008, dated 24 October 2024. Informed verbal consent was obtained from all participants after the purpose and voluntary nature of the study had been explained. All data were anonymized to protect participant confidentiality.

Transparency: The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

Data Availability Statement: Data available from the corresponding author upon reasonable request.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contribution: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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Appendix: Survey Items and Standardized Factor Loadings

The following table lists the final survey items used to measure internal supply chain resilience capabilities, external supply chain resilience capabilities, and sustainable competitive advantage, together with their standardized factor loadings. All items used a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Construct	Item	Source / Adaptation	Loading
Internal SC Resilience Capabilities	Our company can quickly reallocate trucks, warehouses, or other resources in response to unexpected disruptions.	Ali et al. (2017)	0.72
Internal SC Resilience Capabilities	We maintain buffer inventory or spare capacity to absorb sudden demand or supply shocks.	Ali et al. (2017)	0.78
Internal SC Resilience Capabilities	Employees in our company are cross-trained so that critical tasks can continue during staff shortages.	Ali et al. (2017)	0.70
Internal SC Resilience Capabilities	Our company has backup IT systems and communication channels to maintain operations during crises.	Ali et al. (2017)	0.82
Internal SC Resilience Capabilities	Decision-making during disruptions is fast and empowered at multiple levels of our company.	Ali et al. (2017)	0.80
External SC Resilience Capabilities	We work with multiple transportation partners so that another can step in immediately if one fails.	Scholten and Schilder (2015)	0.74
External SC Resilience Capabilities	We share real-time information with key suppliers and customers during disruptions.	Scholten and Schilder (2015)	0.78
External SC Resilience Capabilities	We have joint contingency plans with major logistics partners for likely disruption scenarios.	Scholten and Schilder (2015)	0.71
External SC Resilience Capabilities	We have alternative sourcing options or backup suppliers for critical logistics services.	Scholten and Schilder (2015)	0.76
External SC Resilience Capabilities	Our relationships with key partners are strong enough that they prioritise support for us during crises.	Scholten and Schilder (2015)	0.79
Sustainable Competitive Advantage	Compared to key competitors, our firm has maintained higher customer satisfaction over the past three years.	Li et al. (2024)	0.85
Sustainable Competitive Advantage	Our logistics services are recognized as more reliable than those of competing firms.	Li et al. (2024)	0.88
Sustainable Competitive Advantage	Our firm has gained market share relative to key competitors over the past three years.	Li et al. (2024)	0.80
Sustainable Competitive Advantage	Our long-term profitability exceeds that of key competitors in the logistics industry.	Li et al. (2024)	0.78

Note. All loadings are standardized and significant at $p < 0.001$. Sources indicate the original scale from which items were adapted and refined through the qualitative interviews.

Appendix: Ethical Approval Letter

Ethical Approval Letter

Research Title

From Shock Absorption to Strategic Gain: How Internal and External Supply Chain Resilience Capabilities Drive Sustainable Competitive Advantage in China

This study was approved by the Institutional Review Board of Sichuan Conservatory of Music, China, under protocol number SCCM2024008, dated 24 October 2024. Informed verbal consent was obtained from all participants, and all data were anonymized to protect participant confidentiality.

