Influence of Trust Relationships with Suppliers on Manufacturer Resilience in COVID-19 Era

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Abstract: With the frequent occurrence of emergencies such as the COVID-19 pandemic in recent years, resilience has become increasingly important for the stable and sustainable development of the manufacturing companies. Despite growing interest in supply chain resilience, less attention has been paid to manufacturer resilience and how to improve it through supplier relationship governance. Based on resource-based view (RBV) theory, trust theory and the literature on resilience, this study developed new constructs of measuring manufacturer resilience by temporal logic and sheds light on how the trust relationship with suppliers affect manufacturer resilience via the information-sharing level. The data is collected from 351 respondents who are independent directors or managers of manufacturing companies in China. This study adopted exploratory factor analysis (EFA) and structural equation modeling (SEM) to explore the dimensions of manufacturer resilience and to test the hypotheses. The results reveal that the trust relationship with suppliers has significant positive impacts on three dimensions of manufacturer resilience, that is, preparedness, responsiveness, and recovery capability. In addition, the information-sharing level partially mediates the impact of the trust relationship with suppliers on manufacturer resilience. Specifically, the information-sharing level positively affects preparedness, responsiveness, and recovery capability. Moreover, the trust relationship with suppliers facilitates the information-sharing level. Finally, the study contributes to the manufacturer resilience literature and provides useful guidance for the manufacturing enterprises in enhancing resilience quickly.

Keywords: manufacturer resilience; trust relationship with suppliers; information-sharing level; trust theory; supply chain

1. Introduction

With the emergence of national and global emergencies, such as COVID-19, as well as information technology failures and service interruptions in the supply chain [1–5], the daily operation of supply chain members and even their long-term collaboration can be largely affected [6,7]. Under the implementation of the lockdown policy to stop the spread of the COVID-19 pandemic, manufacturing firms in the supply chain are encountering unprecedented challenges [8]. Therefore, to guarantee the stability and sustainability, it is crucial for manufacturers to be resilient to supply chain disruptions during production and operations management [9–11]. Resilience is defined as companies’ capability of anticipating crises, adapting and responding quickly to threatening disruptions or vulnerabilities in the supply chain, and returning to normal or even better conditions afterward [12–15]. Existing studies mostly focus on the overall resilience of the supply chain [11]. However, manufacturing companies are the main participants in the supply chain and are distinctly different from other supply chain members, such as logistics companies [16], and the literature focusing on the resilience of manufacturing firms is still insufficient. In particular, there are even fewer relevant empirical studies [17].
Furthermore, manufacturing companies can hardly complete production tasks on their own, especially in emergencies, so the relationship with partners becomes a topic worth studying [18]. In real life, there are also frequent production interruptions caused by supply shortages. Indeed, due to the unique Chinese culture, human irrationality, and opportunism, contractual governance cannot perfectly handle all the details of business activities and coordinate between partners. Furthermore, it is difficult to avoid information asymmetry in the supply chain and opportunistic behaviors of supply chain members [19].

As an informal contract in China, relationship governance fills the gap created by imperfect contract governance [20,21]. Following the use of the resource-based view (RBV) theory for supply chain resilience enhancement practice, scholars have used relationship theory to explore the realization of resilience. Relationship governance can be effective in coordinating supply chain members to solve problems when traditional contractual governance mechanisms fail in dealing with supply chain disruptions [22–24].

Drawing on trust theory, trust is an important ingredient in supply chain relationship governance [25,26]. The trust relationship with suppliers (TRS) refers to the fact that manufacturers and suppliers trust each other not to act opportunistically [27]. Implementing trust relationships with suppliers and building interdependent and trusting partnerships will enable manufacturing companies to have an uninterrupted supply in case of emergency [28]. A trust relationship with suppliers involves individual behavior that has an impact on the operation of both the company and the supply chain [14,29]. Although the existing relationship governance literature focuses on its impact on supply chain resilience [30], the previous literature has refrained from explaining how trust can enhance manufacturer resilience. Meanwhile, some research on supplier relationship governance focuses on improving profit [31] while ignoring the potential impact of relationships with suppliers on manufacturer resilience. The inspiration for this study is to extend the concept of manufacturer resilience and explore whether a trust relationship with suppliers has a positive impact on different dimensions of manufacturer resilience.

Moreover, scholars find that trust is crucial for information sharing, which has positive effects on the capabilities of corporations [32,33]. Trust drives increased levels of information sharing at the operational level [34,35]. In addition, some scholars argue that focusing on resilience practices after a disruption puts pressure on corporate managers, which can reduce the information-sharing level [36]. In this regard, it is not clear currently whether trust can stimulate different dimensions of manufacturer resilience through information sharing between manufacturers and suppliers in emergency scenarios such as the current COVID-19 crisis. Thus, after examining the impact of a trust relationship with suppliers on the three dimensions of manufacturer resilience, the study moves on to explore the role of information-sharing level in these different pathways. To the best of the authors’ knowledge, there are few empirical studies that have linked buyer–supplier trust, information-sharing level, and manufacturer resilience dimensioned by temporal logic.

The motivation to conduct this research is to explore how trust relationships with suppliers affect manufacturer resilience in emergency event scenarios such as the COVID-19 pandemics. Specifically, this paper attempts to address the following theoretical questions: First, what is an appropriate dimensional division of manufacturer resilience? Second, is a trust relationship with suppliers positively correlated with the three dimensions of manufacturer resilience? That is, does a trust relationship with suppliers as a relationship governance approach have a positive impact at the different stages when manufacturing companies encounter crises? Third, does information-sharing level facilitate manufacturer resilience that consists of preparedness, responsiveness, and recovery capability? Finally, the study explores the mediation of information-sharing level between trust relationships with suppliers and manufacturer resilience.

The exploration of the above research questions aims to achieve the following contributions. First, scholars have developed the dimensions of resilience based on the characteristics of supply chain or different phases of the events [14,18,23,37]; however, a consensus has not been reached. To counter the research challenges, this study expands the literature
about the concept of manufacturer resilience at the corporate level based on interviews with experts from Chinese manufacturing companies. In addition, this study classifies manufacturer resilience by time dimension according to the interdisciplinary knowledge of disaster science and the supply chain resilience literature [14,38]. Second, drawing upon trust theory, we theorize and empirically examine how a trust relationship with suppliers affects manufacturer resilience in the context of Chinese companies, which complements the current literature [31,39]. Specifically, the study identifies the impact of a trust relationship with suppliers as a form of informal relationship governance on each dimension of manufacturer resilience. The purpose is to reveal the impact of trust relationships with suppliers on manufacturer resilience at different stages and furnish multidimensional insights for each activity of manufacturer resilience. Supported by previous studies, this study builds a bridge between relationship governance and manufacturer resilience in the attempt to fill the gap in the existing literature. Third, we further emphasize the role of information-sharing level, which is effective through a trust relationship with suppliers, in improving preparedness, responsiveness, and recovery capability via structural equation modeling (SEM) analysis. This study attempts to address the issue of firm stability and sustainable production by implementing an innovative model of trust relationships with suppliers and manufacturer resilience, which is a novel perspective. Based on the existing management model and supply chain structure, this paper aims to propose new managerial insights to rapidly improve manufacturer resilience in the disruptions caused by COVID-19.

This study aims to achieve the following objectives. First, this study aims to integrate the existing supply chain resilience literature and interdisciplinary knowledge to obtain appropriate manufacturer resilience dimensions, as well as the specific contents of each dimension. Second, the purpose is to reveal the impact of trust relationships with suppliers on manufacturer resilience at different stages and furnish multidimensional insights for each activity of manufacturer resilience. Furthermore, the research aims to examine the role of information-sharing level on manufacturer resilience and how it mediates between trust relationships with suppliers and different stages of resilience. Overall, the goal is to address the issues of firm stability and sustainable production by implementing an innovative model of trust relationships with suppliers and manufacturer resilience, which is a novel perspective.

The rest of this paper is organized as follows. Section 2 presents the theoretical background, research framework, and hypotheses. Section 3 presents the methodology, including the sampling procedures, measures of constructs, nonresponse bias and common method bias analysis, and exploratory factor analysis. Section 4 reports the structural equation model analysis, findings and results. Section 5 includes discussions and implications. Section 6 concludes the paper and proposes future research.

2. Literature Review and Research Hypotheses

2.1. Manufacturer Resilience

Companies’ resilience, which is reflected as the ability to uninterruptedly provide products and services to the community, is crucial during emergencies [11]. A growing number of studies by academics and policymakers show that resilience plays a key role in ensuring the survival of companies in emergencies [9]. Specifically, a company’s resilience is determined by resource planning, production capability, and the use of resources [40]. For example, before an emergency occurs, the company’s ability to rearrange internal resources to quickly respond to environmental impacts resilience [9]. In this study, we define manufacturer resilience as manufacturing companies’ capability to identify risks, increase their impacts, quickly respond to disruptions and return to normal [41].

Previous studies have classified resilience by characteristics, which encompass different characteristics of resilience, such as agility, visibility, and flexibility [18,37,42,43]. However, feature-based classification methods may overlook some of these features and fail to show the full connotations of resilience. Some scholars have also suggested that
resilience should be divided into four dimensions, that is, readiness, response, recovery and growth [14]. However, in emergency scenarios such as the COVID-19 pandemic, we argue that the growth process should be integrated into the three previous phases to facilitate rapid recovery of the enterprises. This is a theoretical gap that this study aims to fill. Manufacturer resilience is conceptualized as a second-order measurement that captures its multi-capability nature [38]. In addition, the concept of manufacturer resilience by time dimension is formed, namely, preparedness (PPA), responsiveness (RPA), and recovery capability (RCA). Those three domains are strongly correlated with each other and are co-dependent conceptually [37,42].

First, preparedness refers to a manufacturing company’s readiness to deal with risk before an emergency event such as a supply chain disruption, which includes the visibility of inventory level and demand level [44]. Research has shown that the visibility of the supply chain could enhance companies’ capability of risk forecasting [44]. Moreover, preparedness is the ability to cope with the ever-changing business environment [45], which may increase the resilience of the companies in the supply chain [46]. Preparedness plays a key role in dealing with disruptions for manufacturers in the supply chain [47]. Resilient manufacturers have preparedness by activating their potential resources in preparation for adaptation [48].

Second, responsiveness refers to the ability of a company to respond quickly to sudden disruptions in the supply chain or to environmental uncertainty, which is also related to readiness [49,50]. Responsiveness includes agility and flexibility, which represent the ability to respond quickly in emergencies and implement emergency plans. Studies have reported that responsiveness can be effective in facilitating business recovery from disruptions [15] and increase their resilience [51]. The ability to anticipate and mobilize in time for an event of disruption can reflect a company’s resilience [14].

Third, recovery capability means that companies can quickly return to normal or to an even better condition after the interruptions. Recovery capabilities are also connected with a company’s responsiveness and operational management [52]. According to the definition of resilience, resilient manufacturers can recover to the pre-disruption state after a disruption and minimize negative impacts [15,53].

2.2. Trust Relationship with Suppliers and Manufacturer Resilience

According to trust theory, trust is considered a key sociological and psychological factor in establishing a relationship [54–56]. Trust can be classified into goodwill trust, capability trust, and computational trust [57–60]. Previous research conceptualizes trust as an informal relationship governance mechanism, which limits opportunistic behaviors by sharing the same cultural values among partners and encouraging the behaviors of coordinating the interests of partners [22]. A trust relationship with suppliers is a form of relationship governance [61]. Nonetheless, they focus on exploring the influence of trust as a moderator or independent variable on operation ability or financial performance [62,63]. In this study, we assume that if a manufacturing company has a trust relationship with suppliers, this is likely to enhance its resilience. There are good theoretical reasons for them to be positively related.

Firstly, a trust relationship with suppliers can enhance a manufacturing company’s preparedness before an emergency event occurs. According to trust theory, relationship with suppliers is based on mutual trust [30,64–66]. A high level of trust in the relationship leads to consistent action by both parties, which is more efficient in making decisions and increases preparedness [34]. Norm-based trust between firms in a supply chain can reduce conflict and uncertainty [67]. Moreover, trust and good relationships enable manufacturers to obtain special treatment from suppliers in the form of better product and service support and assurance of availability, which protects against the risk of supply chain disruption in the event of supply disruption [34]. Trust has been proved as a fundamental predictor of positive performance outcomes and competitive advantage in the supply chain. Trust-
based rules as the basis for cooperation have been shown to positively influence the supply chain structures and thus the resilience of supply chain network against disruption [68,69].

Secondly, when emergencies occur, a relationship of mutual trust can improve the speed of response to emergencies, which can be represented by responsiveness. Previous studies have shown that trust is crucial for building a stable and long-term relationship as well as continuing interfirm exchange of relational assets [54,70]. For instance, when a supply chain faces disruptions and collaborates, corporations may ignore collective interests to reduce their losses. Trust, the informal relationship safeguard, becomes especially important and reinforces the value of collaboration during emergencies [71,72]. Trust between firms promotes resilience at the systemic level because it brings certain benefits to participants. Specifically, trust promotes solidarity in collaboration; thus, it positively impacts the firms’ responsiveness [73–75]. Therefore, manufacturers have a high level of trust with their suppliers, which will facilitate their timely coordination in operational processes, such as specific purchase order execution and change service support. In these concrete ways, manufacturers improve their responsiveness [34].

Thirdly, after an emergency, the trust relationship with suppliers will facilitate rapid recovery of production in manufacturing companies. Previous studies have demonstrated that trust may utilize negotiation and communication to deal with problems, which positively impacts the increase in recovery capability [22]. Interfirm trust as a long-term strategy can contribute significantly to companies’ resilience and the long-term stability of companies and their supply chains [29,76]. Moreover, trust can also convey mutual respect [77]. Informal governance such as trust not only drives manufacturer capability but also invests in future collaboration that can improve recovery capability [78]. Therefore, good partnerships between manufacturers and suppliers are essential to minimize the negative impact of supply chain disruptions, so effective coordination with trust is an important factor in improving resilience at different stages [79]. Based on the theoretical analysis above, three research hypotheses can be introduced:

Hypothesis 1a (H1a). The trust relationship with suppliers is positively related to preparedness.

Hypothesis 1b (H1b). The trust relationship with suppliers is positively related to responsiveness.

Hypothesis 1c (H1c). The trust relationship with suppliers is positively related to recovery capability.

2.3. Information-Sharing Level and Resilience

Drawing upon RBV theory, information is a kind of intangible resource that can create firms’ competitive edge [80]. Emergencies highlight the importance of speed and quality of company decisions and actions. The manufacturer–supplier trust relationship facilitates the dissemination of information between firms and guarantees the speed and quality of the availability of real-time information [81].

Initially, in the preparedness dimension of the manufacturer resilience, studies have indicated that information technology allows upstream and downstream corporations in the supply chain to effectively integrate inventory planning, demand forecasting and order scheduling, which achieves a supply–demand balance to have preparedness [82]. Information sharing between departments within the company increases the visibility and reliability of the operation which can enhance preparedness for emergencies [83].

Furthermore, high-level information technology leads to real-time sharing and integration of information [84]. Furthermore, an effective process of information technology integration may enhance corporations’ capability of coordinating with their partners to respond to changing market demands, which ensures that the suppliers accurately and quickly respond to external demands [85,86]. These are all closely related to the second component of manufacturer resilience, responsiveness. Communication with a formal schedule of regular meetings can provide a quick response to company operations, which is a form of responsiveness [87]. Information sharing based on high levels of information
technology can integrate partners’ information systems to increase their responsiveness as a form of resilience [41]. Inter-organizational operational integration contains the sharing of information resources, which can increase the responsiveness of the supply chain to disruptions [88].

Finally, information sharing between members affects the operational performance of the supply chain [89]. Scholars found that strong relationships and high information-sharing levels between supply chain companies and suppliers can contribute to their profitability and competitiveness [90,91]. In addition, information-sharing level is extremely important in the efficiency of information management, which can make supply chain members have strong resilience throughout emergencies [92]. Accurate information sharing reduces uncertainty in the external environment, which in turn increases responsiveness and recovery capabilities [63]. Sharing information among supply chain partners can help companies improve economic resilience, which is a form of recovery capability [93]. Based on the theoretical analysis above, we introduce the following hypotheses:

**Hypothesis 2a (H2a).** Information-sharing level is positively related to preparedness.

**Hypothesis 2b (H2b).** Information-sharing level is positively related to responsiveness.

**Hypothesis 2c (H2c).** Information-sharing level is positively related to recovery capability.

### 2.4. Mediating Role of Information-Sharing Level

Information-sharing level (ISL) includes information-technology level and information-exchange level [94], which are equally important [95,96]. Information technology such as big data and predictive analytics provides technical support for information exchange to accomplish timely and efficient information sharing [97]. Previous research indicates how the trust relationship could impact information-sharing level. Trust between companies also facilitates verbal and written communication and multiple forms of information sharing [98]. Furthermore, trust can significantly affect the quality of information sharing [66]. Lack of trust and communication between supply chain members will lead to potential supply chain risks [99]. Meanwhile, information technology has also increased mutual trust and deeper cooperation between companies, both of which reinforce each other [100]. The flexibility of establishing a trust relationship enhances the level of information sharing between partners [101]. On the other hand, sharing confidential and key information conveys a signal to partners that they can be trusted [64,102]. Conversely, information exchange between partners will be disturbed if lacking trust [71,103]. The lack of trust and low information-sharing level may lead to bad collaboration between manufacturers and suppliers, which further affects corporate resilience and risk tolerance [104,105]. Given these analyses, we argue that a trust relationship with suppliers could elevate the information-sharing level.

Information sharing in the supply chain is closely related to trust [106]. Moreover, studies found that information technology can help companies to improve their operational efficiency and enhance their flexibility [107]. Recent studies have increasingly emphasized that information sharing is an important factor for businesses to increase supply chain resilience and the efficacy of the relationship [14,108]. The previous studies supported that a trust relationship and information sharing can enhance supply chain resilience. Trust between companies increases supply chain resilience through information sharing [28]. However, the interactions between trust relationship with suppliers, information-sharing level, and manufacturer resilience remain unclear. This paper attempts to explore the potential mediating effect of information-sharing level between trust relationship with suppliers and the three dimensions of manufacturer resilience. Specifically, companies are highly conscious of commercial secrecy and usually keep their business strictly confidential. Many companies are afraid that a close relationship with partners may lead to the leakage of core commercial secrets [34]. As such, further investigation is needed.
A high level of trust will facilitate the sharing of confidential information between manufacturers and suppliers. Information sharing based on trust will improve supply chain visibility [44], which will allow managers to identify problems promptly and provide feedback to evaluate the partnership. Trust between companies enables partners to share resources collaboratively, thereby increasing the manufacturer resilience in different dimensions, such as proactively preventing production and operational disruptions before they occur and achieving rapid production recovery afterward [34]. Based on the preceding arguments, the following hypotheses are proposed:

**Hypothesis 3 (H3).** The trust relationship with suppliers promotes information-sharing level.

**Hypothesis 4a (H4a).** Information-sharing level has a mediating effect between the trust relationship with suppliers and preparedness.

**Hypothesis 4b (H4b).** Information-sharing level has a mediating effect between the trust relationship with suppliers and responsiveness.

**Hypothesis 4c (H4c).** Information-sharing level has a mediating effect between the trust relationship with suppliers and recovery capability.

Combing the hypotheses above, we propose the theoretical model shown in Figure 1. The model incorporates the relationships between the variables. The red lines show the direct effects of TRS on PPA, RPA and RCA; the green line shows the direct effect of TRS on ISL; the blue lines show the direct effects of ISL on PPA, RPA and RCA; and the yellow lines represent the mediating role of ISL between TRS and PPA, RPA and RCA.

**Figure 1.** Theoretical model.

**2.5. Current Research Technicals**

We found that the pandemic-related policies are relatively strict and specifically designed for a particular situation so that more empirical research is needed to understand the more recent situation of the enterprises. This will provide insights for companies to develop specific management policies in the context of the pandemic. We noticed that there are very few questionnaire studies, and there is a lack of empirical methods. In addition, previous studies focused more on the entire supply chain [1] while lacking research with manufacturing firms as the research subjects. To bridge this gap in research, this paper specifically targets manufacturing firms, which would not only enrich the literature on manufacturer resilience but also would provide better management suggestions for the firms. Moreover, the scales used in the study extend the current literature on manufacturer...
resilience measures, which requires integration of the existing literature and the adaptation of the scale in combination with interviews with company managers. Based on the theoretical and technical gaps reviewed above, we designed the current study.

3. Methodology

3.1. Study Design

We proposed the following research design. First, this study used a questionnaire as a research tool to empirically investigate Chinese manufacturing companies. We explored the dimensions of manufacturer resilience to demonstrate the usability of the scale, which could be utilized by future scholars. Second, we performed the common method bias test, which could avoid the problem of bias in this study [18,52]. In addition, we examined the reliability and validity of the questionnaire, including confirmatory factor analysis, discriminant validity testing, and model fit testing, to demonstrate that the model and questionnaire in this paper could be analyzed for the structural equation model. This was followed by structural equation modeling hypothesis testing. This paper used the bootstrap method and adopted a 5000-times sampling technique, which allowed for the distribution of the sample closer to a normal distribution and statistically significant [109]. Figure 2 illustrates the main process of the statistical analysis methods.

![Methodology Diagram](image)

**Figure 2.** The main process of statistical analysis methods.

3.2. Sampling and Data Collection

We contacted managers and independent directors in manufacturing companies in China to distribute the questionnaire from December 2021 to April 2022. We reached out with a cover letter explaining our research purpose and ensuring the confidentiality of the data. This ensures the reliability of the answers and prevents nonresponse bias. A total of 516 surveys were distributed through personal visits, emails, meetings, and online platforms. Moreover, 422 surveys were returned, and 351 were included in the final data analysis after carefully reviewing and detaching inappropriately filled surveys. The sample covered various companies across China such as Beijing, Shanghai, Tianjin, Hohhot, Chengdu, and Shenzhen. These cities had different levels of manufacturing development in China. The companies were of different types, including state-owned or state-controlled enterprises, private companies, and foreign or Sino-foreign joint ventures. Most of the companies had a size of more than 50 staff members at the time of the survey.
The sample also covered a vast set of industries, including food and beverage, metallurgical, pharmaceutical, textile and clothing, furniture, etc. Table 1 showed descriptive statistics ($n = 351$) consisting of the nature of enterprises, industry type, and enterprise size. These were generated to obtain respondents’ demographic information (see Table 1).

Table 1. Descriptive statistics.

| Description                                      | Frequencies | Percentage |
|--------------------------------------------------|-------------|------------|
| Nature of enterprises                            |             |            |
| State-Owned or State-Owned Holding               | 80          | 23%        |
| Private Enterprise                               | 228         | 65%        |
| Foreign-Owned or Sino-Foreign Joint Ventures.    | 10          | 3%         |
| Other                                            | 33          | 9%         |
| Industry type                                    |             |            |
| Food and Beverage                                | 73          | 21%        |
| Metallurgical Manufacturing and Processing/Industry of Metal Products/Mechanical and Equipment | 51 | 15% |
| Pharmaceutical/Chemical Raw Materials and Chemical Products | 62 | 18% |
| Textile and Clothing                             | 41          | 12%        |
| Wood Furniture/Paper Printing/Sports Goods       | 44          | 12%        |
| Communications Equipment, Computers and Other    | 50          | 14%        |
| Electronic Equipment                              | 30          | 9%         |
| Others                                           |             |            |
| Enterprise size (Employee Number)                |             |            |
| 1–50                                             | 25          | 7%         |
| 51–300                                           | 45          | 13%        |
| 301–2000                                         | 138         | 39%        |
| >2001                                            | 143         | 41%        |

Before the questionnaires were distributed, we visited manufacturing companies several times in order to understand the real situation of the manufacturing companies. We invited managers of the manufacturing companies and scholars from universities to check the content of the questionnaire to ensure that the questions were clear, appropriate, and understandable. We attended regular meetings of steel manufacturing companies with purchasing managers, operation supervisors, and heads of quality control departments. In addition, we conducted one-on-one interviews with managers of manufacturing companies such as food and pharmaceutical companies. We found that in current Chinese manufacturing companies, trust relationships with suppliers do affect the ability of companies facing supply disruptions. Last but not least, the questions accounting for the operational practices of manufacturing companies reflected the current state of manufacturing companies, and the contents can be used in the risk management practices of other manufacturing companies. The experts’ reviews make the scales obtained from the literature more relevant and practically meaningful.

3.3. Measures of Constructs

The core parts were based on the trust relationship with suppliers, manufacturer resilience, and information-sharing level, whereby some necessary amendments were done in the statements (see Table 2). The 7-point Likert scale was adapted to record respondents’ responses, ranging from strongly disagree to strongly agree. All the statements of questions were culturally modified for better clarity of the respondents and to avoid bias. We conducted a pretest with a small sample size of 70 respondents to test the reliability of the latent variable. The values of Cronbach’s alpha were used to examine the reliability of pre-testing because the experts recommended that such values must be higher than 0.7 for suitability [110]. All of the values for the latent variables were above the suggested threshold. There were three types of variables in the conceptual model, that is, independent variable (IV), dependent variable (DV), and mediator. The trust relationship with suppliers was adopted as IV, manufacturer resilience as DV, and information-sharing level as a...
mediator, respectively. SPSS and AMOS software packages were adopted to generate results [111–113].

Table 2. Reliability and Convergent Validity.

| Constructs and Items                                                                 | Coding | FL     |
|--------------------------------------------------------------------------------------|--------|--------|
| Trust Relationship with Suppliers (CR = 0.9101, AVE = 0.5916, \( \alpha = 0.953 \)) | TRS    | 0.783  |
| Our company trusts our suppliers to understand us when we share issues with them.      | TRS1   | 0.811  |
| We trust our suppliers to be honest and keep their promises.                          | TRS2   | 0.772  |
| We trust our suppliers to have adequate personnel and equipment.                     | TRS3   | 0.716  |
| We believe that the quality and quantity of products delivered by our suppliers meet  | TRS4   | 0.716  |
| the contract requirements.                                                           | TRS5   | 0.722  |
| We believe that our suppliers are always ready to help and support us.               | TRS6   | 0.738  |
| Suppliers will consider our interests when making decisions.                          | TRS7   | 0.788  |
| Our suppliers share our goal to pursue successful cooperation.                        |        |        |
| Information-sharing level (CR = 0.9263, AVE = 0.6423, \( \alpha = 0.961 \))         | ISL    | 0.792  |
| The company uses information technology to process information.                       | ISL1   | 0.799  |
| We can exchange information electronically with our suppliers.                        | ISL2   | 0.802  |
| We have IT system troubleshooting procedures and performance evaluations.             | ISL3   | 0.808  |
| Employees are familiar with the business processes of information systems.            | ISL4   | 0.810  |
| We are willing to provide information to our suppliers that may be helpful to them.  | ISL5   | 0.774  |
| We exchange information with our suppliers in a frequent and timely manner.          | ISL6   | 0.824  |
| We exchange accurate and complete information with our suppliers.                     | ISL7   |        |
| Preparedness (CR = 0.9157, AVE = 0.6448, \( \alpha = 0.922 \))                      | PPA    | 0.821  |
| We can pre-identify and eliminate potential risk that can be controlled.             | PPA1   | 0.802  |
| Basic safety stocks and buffer stocks can be maintained.                             | PPA2   | 0.806  |
| The inventory level is visible.                                                      | PPA3   | 0.848  |
| We have set up personnel to monitor the operation process to prevent accidents.      | PPA4   | 0.830  |
| Material preparedness and personnel training to face disruptions are in place.       | PPA5   | 0.703  |
| There are contingency plans formed based on experience to deal with the disruption.  | PPA6   |        |
| Responsiveness (CR = 0.9333, AVE = 0.6666, \( \alpha = 0.935 \))                   | RPA    | 0.834  |
| The workflow between departments can be flexibly adjusted.                           | RPA1   | 0.835  |
| Contingency plans can be quickly carried out and executed.                          | RPA2   | 0.798  |
| We can respond quickly to unforeseen emergencies and realign resources.             | RPA3   | 0.829  |
| We can keep our staff and production running steadily to meet the demand of orders.  | RPA4   | 0.810  |
| We can increase or decrease the number of suppliers reasonably.                     | RPA5   | 0.786  |
| We can detect the root cause of supply or production disruptions.                    | RPA6   | 0.822  |
| We can identify opportunities and risks arising from emergencies quickly based on the knowledge. | RPA7   |        |
| Recovery Capability (CR = 0.8897, AVE = 0.5741, \( \alpha = 0.922 \))              | RCA    | 0.801  |
| After interruptions caused by unexpected events such as epidemics, our company can return to a new normal state. | RCA1   | 0.796  |
| Interruptions can be resolved quickly.                                              | RCA2   | 0.771  |
| We will quickly restart production to respond to unexpected disruptions.             | RCA3   | 0.731  |
| Basic normal operation of departments can be maintained after an interruption.       | RCA4   | 0.739  |
| We will coordinate resources to reduce the negative impact of disruptions.           | RCA5   | 0.703  |
| We can learn from our experience and integrate resources to cope with the changing environment in the future. | RCA6   |        |

Note. TRS: trust relationship with suppliers; ISL: information-sharing level; PPA: preparedness; RPA: responsiveness; RCA: recovery capability; AVE: average variance extracted; SD: standard deviation; FL: factor loading; CR: composite reliability.

3.3.1. Trust Relationship with Suppliers

The trust relationship with suppliers was measured by the trust (before the disruption) scale designed by Bode and colleagues [72], and we reorganized the items by taking the Chinese corporate culture into account. The trust scale measured the honesty of suppliers, confidence in suppliers’ information, reliability, suppliers’ success concerns, welfare equity, and mutual benefits. It is a widely used scale and has been tested repeatedly [30,58].
The trust scale was a 5-point Likert scale with six items. Previous studies showed that Cronbach’s alpha for the credibility and the benevolence section of the scale is 0.85 and 0.74 separately [72], indicating good-to-excellent reliability.

3.3.2. Manufacturer Resilience

Manufacturer resilience was measured by three constructs, preparedness, responsiveness, and recovery capability [14]. Preparedness was measured by the items adapted from the resilience scale [15,18,42], which was a 5-point Likert scale that includes four items. The study reported that Cronbach’s alpha is 0.86, indicating good-to-excellent reliability. Responsiveness was adapted from the SCR scale which is a 7-point Likert scale that includes four items [41,114]. Recovery capability was adapted from the SCR scale [9,114,115]. The combined scale has 19 items in total.

3.3.3. Information-Sharing Level

Information-sharing level in this paper refers to the implementation, evaluation, extent, willingness, and quality of information exchange between manufacturer and suppliers [94,116]. It was measured by the information-sharing level scale with five items, and Cronbach’s alpha for the scale is 0.84.

3.4. Nonresponse Bias and Common Method Variance

We explained the purpose and importance of the study to the independent directors and experienced managers of the companies and provided them with management consulting services, which made them answer the questionnaire patiently. The questions did not involve a judgment on whether the companies were good or bad, so the respondents could self-report [117,118]. Moreover, we designed the questionnaire regarding the opinions of some managers and conducted a return visit after the questionnaire was distributed. These approaches to prevent nonresponse bias and single-source bias could be mitigated [37,119].

In addition, we examined whether there is a common method bias [18,52]. First, the Harman’s single-factor test was conducted, the model fit of the single-factor model was significantly worse, suggesting that there was no serious common method bias [117,120]. Furthermore, we compared the original model with the common method factor model as shown in Table 3. There was no significant change in the model fit for the two models, which confirmed that the common method bias was sufficiently minimal [58,111,117,121].

| Table 3. Common Method Bias Test. |
|-----------------------------------|
|                                    |
| χ^2/df   | RMSEA | SRMR | CFI | GFI | IFI | TLI |
| Original Model   | 1.509 | 0.038 | 0.041 | 0.976 | 0.892 | 0.976 | 0.974 |
| Single-Factor Model | 9.175 | 0.153 | 0.123 | 0.612 | 0.387 | 0.613 | 0.586 |
| Common Method Factor Model | 1.309 | 0.030 | 0.033 | 0.987 | 0.91 | 0.987 | 0.984 |
| Model Fit Variation | ΔRMSEA | ΔSRMR | ΔCFI | ΔGFI | ΔIFI | ΔTLI |
| Criteria | <0.05 | <0.05 | <0.1 | <0.1 | <0.1 | <0.1 |

3.5. Exploratory Factor Analysis

The research employed exploratory factor analysis (EFA). First, a conformity test was carried out to determine whether the data set was suitable for EFA. The results showed that Bartlett Test of Sphericity (BTS) was significant at the 0.001 level, and the Kaiser–Meyer–Olkin (KMO) value was 0.969, indicating the good fitness for EFA [122]. Next, we extracted the variables of the trust relationship with suppliers, information-sharing level, and manufacturer resilience using principal component analysis. As shown in the varimax rotating factor matrix performed in Table 4, the questions in the questionnaire were divided into five dimensions. The three dimensions of manufacturer resilience were preparedness,
responsiveness, and recovery capability. This indicated that these three dimensions could represent manufacturer resilience well.

Table 4. Rotating Component Matrix.

| Index | 1   | 2   | 3   | 4   | 5   |
|-------|-----|-----|-----|-----|-----|
| PPA1  | 0.782 |     |     |     |     |
| PPA2  | 0.773 |     |     |     |     |
| PPA3  | 0.784 |     |     |     |     |
| PPA4  | 0.797 |     |     |     |     |
| PPA5  | 0.789 |     |     |     |     |
| PPA6  | 0.676 |     |     |     |     |
| RPA1  | 0.820 |     |     |     |     |
| RPA2  | 0.824 |     |     |     |     |
| RPA3  | 0.790 |     |     |     |     |
| RPA4  | 0.821 |     |     |     |     |
| RPA5  | 0.801 |     |     |     |     |
| RPA6  | 0.777 |     |     |     |     |
| RPA7  | 0.825 |     |     |     |     |
| RCA1  |     | 0.599 |     |     |     |
| RCA2  |     | 0.711 |     |     |     |
| RCA3  |     | 0.663 |     |     |     |
| RCA4  |     | 0.698 |     |     |     |
| RCA5  |     | 0.687 |     |     |     |
| RCA6  |     | 0.629 |     |     |     |
| TRS1  |     | 0.788 |     |     |     |
| TRS2  |     | 0.814 |     |     |     |
| TRS3  |     | 0.777 |     |     |     |
| TRS4  |     | 0.721 |     |     |     |
| TRS5  |     | 0.778 |     |     |     |
| TRS6  |     | 0.744 |     |     |     |
| TRS7  |     | 0.794 |     |     |     |
| ISL1  | 0.788 |     |     |     |     |
| ISL2  | 0.795 |     |     |     |     |
| ISL3  | 0.799 |     |     |     |     |
| ISL4  | 0.806 |     |     |     |     |
| ISL5  | 0.802 |     |     |     |     |
| ISL6  | 0.759 |     |     |     |     |
| ISL7  | 0.822 |     |     |     |     |

3.6. Validity and Reliability

We examined the reliability and validity of the scales using composite reliability (CR), average variance extracted (AVE), factor loading (FL) (see Table 2), and discriminant validity (DVD) tool (see Table 5). Table 2 represented the values of confirmatory factor analysis that include values for FL, CR, and AVE. The values of CR assessed internal consistency in scale items [123]. Table 2 showed that the CR values of the scales are all greater than 0.7, indicating that the scales have high reliability [124]. Table 2 shows that the Cronbach’s α values of the scales are all greater than 0.7, indicating that the scales in this study have high reliability [123]. The confirmatory factor analysis was implemented to explore convergent validity using factor loading (FL) and average variance extracted (AVE) values. The values of FL and AVE should be greater than 0.5 [123,124], which was true for all scales in this study (see Table 2). Additionally, the values of means and standard deviation (SD) were also reported in Table 2.
Table 5. Correlations and Discriminate Validity.

| Construct | Mean   | SD    | TRS  | ISL  | PPA  | RPA  | RCA  |
|-----------|--------|-------|------|------|------|------|------|
| TRS       | 4.800  | 1.575 |      |      |      |      |      |
| ISL       | 4.924  | 1.668 | 0.769|      |      |      |      |
| PPA       | 3.318  | 1.340 | 0.645**| 0.801|      |      |      |
| RPA       | 5.931  | 1.058 | 0.568**| 0.579**| 0.803|      |      |
| RCA       | 4.679  | 1.002 | 0.714**| 0.439**| 0.313**| 0.816|      |

Note: All the correlations were significant at \( p < 0.01 \). Bold values in the diagonal are the square roots of average variance extracted from the constructs.

Table 5 depicted the values of DVD which can be used to find the variations among constructs. According to Deng et al. [125], the values of \( \sqrt{AVEs} \) must be higher than the values of correlations of subsequent variables, which can identify the degree of constructs’ differentiation. The Pearson correlation coefficients showed a significant relationship among trust relationship with suppliers, information-sharing level, preparedness, responsiveness, and recovery capability, which was further investigated through SEM.

Table 6 showed the results of model fit. Overall, the statistics indicated that the hypothesized model had an acceptable fit to the data. The ratio of chi-square to degrees of freedom (\( \chi^2 / df \)) was 1.638. The comparative fit index (CFI), normed fit index (NFI), and root mean square error of approximation (RMSEA) were 0.970, 0.927, and 0.043 respectively, indicating the model had a good fit to the data per the recommended criteria [126]. In addition, goodness-of-fit for the model was also examined through the standardized root mean square residual (SRMR). Hu and Bentler [126] suggested that SRMR should be lower than 0.08. The current model was considered to have accepted model fit as the SRMR was 0.059.

Table 6. Results of Model Fit.

| Index | CMIN/DF | RMSEA | CFI | RFI | IFI | NFI | PNFI | PGFI | SRMR |
|-------|---------|-------|-----|-----|-----|-----|------|------|------|
| Criteria | <3 | <0.1 | >0.9 | >0.9 | >0.9 | >0.9 | >0.5 | >0.5 | <0.08 |
| Result  | 1.638 | 0.043 | 0.970 | 0.921 | 0.970 | 0.927 | 0.857 | 0.766 | 0.059 |

4. Structural Equation Model (SEM) Analysis

The trust relationship with suppliers is not merely a key factor that affects the effectiveness of an enterprise, but it is also an essential element of manufacturer resilience. Although researchers have suggested a positive relationship between the trust relationship with suppliers and manufacturer resilience, further research is required to explore the relationship on the dimensions of manufacturer resilience as well as other factors that contribute to the relationship. The current study affirmed the positive role of TRS on PPA, RPA, and RCA, which represented different stages of manufacturer resilience. In addition, mediating effect of ISL was observed.

We implemented the structural equation model (SEM) to observe the major relationships. The main hypothesized relationships were tested using the following structural equations. First, the following equations contain the relationships between TRS on manufacturer resilience where TRS was measured using a single variable, while resilience was measured through three variables, that is, PPA, RPA, and RCA.

\[
PPA_{H1a} = \beta_{1a}TRS + \zeta_{1a}
\]

\[
RPA_{H1b} = \beta_{1b}TRS + \zeta_{1b}
\]

\[
RCA_{H1c} = \beta_{1c}TRS + \zeta_{1c}
\]

\[
PPA_{H2a} = \beta_{2a}ISL + \zeta_{2a}
\]

\[
RPA_{H2b} = \beta_{2b}ISL + \zeta_{2b}
\]
\[
\begin{align*}
\text{RCA}_{H2c} &= \beta_{2c}\text{ISL} + \zeta_{2c} \\
\text{ISL}_{H3} &= \beta_{3}\text{TRS} + \zeta_{3} \\
\text{PPA}_{H4a} &= \beta_{4a}\text{TRS} + \beta'_{4a}\text{ISL} + \zeta_{4a} \\
\text{RPA}_{H4b} &= \beta_{4b}\text{TRS} + \beta'_{4b}\text{ISL} + \zeta_{4b} \\
\text{RCA}_{H4c} &= \beta_{4c}\text{TRS} + \beta'_{4c}\text{ISL} + \zeta_{4c}
\end{align*}
\]

In addition, before making a conclusion based on the results of SEM, the mediating effect of information-sharing level (ISL) was analyzed using the bootstrap method [111]. The study examined the mediating effect of ISL on TRS and indicators of manufacturer resilience, that is, PPA, RPA, and RCA. The direct effect of each path following structural equations was examined firstly (Equations (1) – (7)). Then, the indirect/mediating effect of ISL was tested (see Equations (8) – (10)). We calculated the bias-corrected and percentile bootstrap 95% confidence interval of the indirect effect over 5000 iterations to guarantee the robustness of the method. If the interval includes 0, it suggests nonsignificant mediating effects, while an interval excludes 0 suggests a significant mediating effect [127].

The core hypotheses were assumed and analyzed through SEM (see Table 7 and Figure 3). First, it was proposed in H1a that TRS was positively correlated with PPA. The findings confirmed a positive effect ($\beta = 0.353$) between TRS and PPA at a significant level of $p < 0.001$. Therefore, H1a was supported. Second, H1b hypothesized that TRS was positively correlated with RPA. The findings asserted a positive relationship ($\beta = 0.254$) between TRS and RPA at $p < 0.001$; consequently, H1b was supported. Third, it was hypothesized in H1c that TRS was positively correlated with RCA. The findings affirmed a positive relationship ($\beta = 0.574$) between TRS and RCA at $p < 0.001$. Thus, H1c was supported. Similarly, the direct effects of ISL on PPA, RPA and RCA were all significant; the path coefficients were 0.382, 0.300, and 0.296 respectively, as shown in Figure 3, demonstrating that H2a, H2b, and H2c were supported. In addition, the results also confirmed a positive effect ($\beta = 0.676$) between TRS and ISL at $p < 0.001$; therefore, H3 was supported.

| Hypotheses | Path     | $\beta$  | SE   | $p$    | Results   |
|------------|----------|----------|------|--------|-----------|
| H1a        | TRS $\rightarrow$ PPA | 0.353    | 0.051| ***    | Supported |
| H1b        | TRS $\rightarrow$ RPA  | 0.254    | 0.046| ***    | Supported |
| H1c        | TRS $\rightarrow$ RCA  | 0.574    | 0.036| ***    | Supported |
| H2a        | ISL $\rightarrow$ PPA  | 0.382    | 0.050| ***    | Supported |
| H2b        | ISL $\rightarrow$ RPA  | 0.300    | 0.045| ***    | Supported |
| H2c        | ISL $\rightarrow$ RCA  | 0.296    | 0.032| ***    | Supported |
| H3         | TRS $\rightarrow$ ISL   | 0.676    | 0.052| ***    | Supported |

Note: *** $p < 0.001$. TRS: trust relationship with suppliers; ISL: information-sharing level; PPA: preparedness; RPA: responsiveness; RCA: recovery capability; SE: Standard error.

Three additional hypotheses were proposed and analyzed for the mediating effect. Table 8 showed the values of the additional effect of ISL; that is, ISL mediated the relationship between TRS and indicators of manufacturer resilience (PPA, RPA, RCA). The total effect and direct/indirect effect between each indicator were also summarized as follows (see Table 8); none of the intervals of the methods included 0, suggesting the significant mediating effect of ISL [127].

First, H4a proposed that ISL mediated the relationship between TRS and PPA. The findings pointed to a significant mediating effect, the bias-corrected CI ranged from 0.135 to 0.275 and the Percentile CI ranged from 0.134 to 0.274, excluding zero in the CI which suggested H4a was supported [127]. Second, H4b hypothesized that ISL mediated the relationship between TRS and RPA. The findings confirmed a significant mediating effect; consequently, H4b was supported. Similarly, it was proposed in H4c that ISL mediated
the relationship between TRS and RCA. The findings affirmed that there was a significant mediating effect, suggesting H4c was supported (see Table 8).

Figure 3. Structure Equation Model.

Table 8. Mediation Effect Results.

| Path                  | Estimate | SE  | Z     | 95% CI lower | 95% CI upper | 95% CI lower | 95% CI upper |
|-----------------------|----------|-----|-------|--------------|--------------|--------------|--------------|
| TRS -> ISL -> PPA     | Indirect | 0.202 | 0.036 | 5.611        | 0.135        | 0.134        | 0.275        |
|                       | Direct   | 0.288 | 0.051 | 5.647        | 0.195        | 0.195        | 0.393        |
|                       | Total    | 0.49  | 0.038 | 12.895       | 0.409        | 0.411        | 0.571        |
| TRS -> ISL -> RPA     | Indirect | 0.126 | 0.038 | 3.316        | 0.056        | 0.055        | 0.206        |
|                       | Direct   | 0.171 | 0.052 | 3.288        | 0.072        | 0.072        | 0.278        |
|                       | Total    | 0.297 | 0.043 | 6.907        | 0.22         | 0.217        | 0.386        |
| TRS -> ISL -> RCA     | Indirect | 0.118 | 0.035 | 3.371        | 0.057        | 0.054        | 0.193        |
|                       | Direct   | 0.358 | 0.048 | 7.458        | 0.269        | 0.269        | 0.454        |
|                       | Total    | 0.476 | 0.033 | 14.424       | 0.414        | 0.412        | 0.544        |

Note: TRS: trust relationship with suppliers; ISL: information-sharing level; PPA: preparedness; RPA: responsiveness; RCA: recovery capability; SE: Standard error; CI: Confidence interval.

5. Discussion and Implications

5.1. Discussion

Based on the analyses above, we can conclude that Chinese manufacturing companies have resilience to a certain extent. It is worth noting that their resilience differs slightly in different dimensions; specifically, manufacturer resilience can be classified as preparedness, responsiveness, and recovery capability, as shown in Table 4. To improve resilience and achieve sustainable development, companies should focus on different dimensions of resilience and clearly distinguish what capabilities they should have at different times to reduce the risk of emergencies. This division of the resilience dimension is based on the theoretical foundation of the previous literature [14,128–130], incorporating the Chinese context and interviews with leaders of Chinese manufacturing companies, and it differs slightly from the previous work.
Drawing on trust theory, the core findings were consistent with those of Doney and Cannon [64], who concluded that trust relationships with suppliers had significant impacts on resilience. Table 7 indicates that a trust relationship with suppliers significantly promotes preparedness, responsiveness, and recovery capability, especially during the recovery phase. This verifies hypotheses H1a, H1b, and H1c, which suggests that building a trust relationship with suppliers is beneficial to the resilience of manufacturing companies. This is essentially in agreement with the existing research on a single aspect, which believes that trust is a driving force for improving supply chain resilience [14,130,131]. However, this finding is slightly different from them in that we demonstrate that trust has different degrees of impact on different dimensions of manufacturer resilience. While previous articles have studied resilience in the context of supply chains [1,2,5], this paper differs in that it focuses specifically on the manufacturer segment of the supply chain. In our case, the area of study is more microscopic. Furthermore, while existing trust studies focus on the entire supply chain [59,60,69], this study focuses specifically on trust between the manufacturers and suppliers.

In addition, the trust relationship with suppliers can positively influence information-sharing level in Chinese manufacturing companies. These results are consistent with our hypotheses. This means that the more manufacturing companies and their suppliers trust each other, the more they will share information and improve their information-sharing techniques [35]. Moreover, the relationships between trust and different dimensions of resilience were shown to be mediated by information-sharing level, as shown in Table 8, which verifies hypotheses H4a, H4b, and H4c. It suggested that in the context of emergencies such as the COVID-19 pandemic, building trust and enhancing the level of information sharing between Chinese manufacturing companies and their suppliers are effective approaches of enhancing corporate resilience.

The above findings are consistent with the observations in our interviews with the manufacturing companies. For example, during our interviews with a food manufacturing company, the manager highlighted that the lockdown policy during the pandemic caused delays in the supply of raw materials from some suppliers. Only suppliers from areas that were not under lockdown could provide raw materials on time. Therefore, the manufacturer had to spend more time and look for suppliers from such areas. The manufacturer and the new suppliers built their relationship based on trust, believing that no one from the party would act opportunistically for financial gain, and they shared information about inventory, production capacity, and product quality honestly. The manufacturer trusted the supplier to provide qualified raw materials, so the manufacturer could promptly adjust production schedules and contingency plans to ensure uninterrupted production. Therefore, this study presents the actual situation of manufacturing companies in China. The strict pandemic policies and the large number of Chinese manufacturing firms make the case unique. Previous research on firm resilience has not been conducted empirically in the context of ongoing emergencies at a particular time, such as the COVID-19 pandemic in our case [9].

5.2. Contributions

While many researchers have studied the issue of supply chain resilience, this paper provides new insights concerning the trust relationship with suppliers, information-sharing level and manufacturer resilience based on the paradigm of ‘Supplier Relationship Governance—Information-sharing level—Manufacturer Resilience’. This study contributes in several ways. First, unlike previous studies that have focused broadly on supply chain resilience, this study focuses on manufacturing firms in the supply chain and innovates by dividing manufacturer resilience into three dimensions. Furthermore, the paper reveals the impact paths of a trust relationship with suppliers on the three dimensions of manufacturer resilience from three aspects. Second, our study provides evidence for the positive effects of supplier relationship governance practices on manufacturer resilience. The results further strengthen the relevance of trust theory in management practices of manufacturing.
companies. Third, the empirical research confirms the mediating mechanism driven by the resource-based view theory and trust theory, whereby the level of information sharing mediates the positive effect of trust on resilience. The data collection was supported by independent directors and managers of the manufacturing companies. The results of the study can represent the current situation of Chinese manufacturing companies during the COVID-19 pandemic. Our findings provide novel insights for our understanding of how a trust relationship with suppliers promotes manufacturer resilience and enriches the existing resilience literature. Moreover, we have made some practical suggestions to manufacturing enterprises so that our findings can potentially enhance manufacturer resilience.

5.3. Theoretical Implications

From a theoretical standpoint, our findings propose that trust relationships with suppliers might enhance manufacturer resilience, which contributes to the literature at present. First, it extends the literature by revealing how a trust relationship with suppliers improves different stages of manufacturer resilience [40]. This aims to fulfill the literature gap with empirical evidence because previous studies have refrained from closing this gap in the relationship management and manufacturer resilience literature.

Second, this study developed new constructs of measuring manufacturer resilience by temporal logic based on interviews with manufacturing companies and previous theoretical foundations. In addition, it applies interdisciplinary knowledge, combining disaster science and supply chain management to make the concept of manufacturer resilience more professional and practical [14,38]. This is valuable because previous resilience scales have mostly been derived from the supply chain literature rather than from the details of business operations and the literature from other fields.

Third, we expand the literature by explaining the mediating mechanism of the linkage between trust relationships with suppliers, information-sharing level, and manufacturer resilience, which has not been explicitly investigated. This empirical study tests the ten hypotheses presented. Thus, this study complements existing research by proposing that the trust relationship with suppliers could help firms achieve greater manufacturer resilience through information-sharing level [66].

5.4. Practical Implications

Our analytical contributions offer operational insights for the manufacturing firms to choose an appropriate relationship management method to improve the sustainable resilience of the firms and the supply chain. First, to managers of the manufacturing firms, this article points out some theoretical support for taking trust and information-sharing level factors with suppliers into account. The managers can use the relationship governance to motivate the suppliers to pay for more investment in trust relationship efforts when traditional contractual governance cannot specify all the details of cooperative operations. This approach allows manufacturers and suppliers to achieve a “Win-Win” situation.

From a managerial viewpoint, the study provides insights for manufacturing firms to improve their manufacturer resilience. First, it is crucial for enterprises to have manufacturer resilience during unexpected events. According to the results of H1a, H1b, and H1c, the findings encourage manufacturers to focus on supplier relationship governance to improve their resilience in emergency situations. Supplier management of manufacturing enterprises is advised to adopt such practices that establish trust relationships with suppliers more vigorously because relational governance can compensate for the lack of contractual governance in emergency scenarios [132–135]. This finding is important for firms in understanding and incorporating relationship management into their risk management strategies.

Second, this finding may help manufacturers to value the role of trust and information-sharing level in enhancing resilience. According to H4a, H4b and H4c, trust relationships with suppliers can improve manufacturer resilience by increasing the information-sharing level. For instance, manufacturers can assign people to supplier teams to receive real-
time feedback and facilitate collaboration. In addition, companies can establish regular formal and informal meetings to assess the status of information sharing implementation, collaboration, and proactively identify risks. The entire supply chain network consists of supply chain members such as manufacturers and suppliers, and the resilience of supply chain members is important to the supply chain as it determines the overall resilience of the supply chain [136]. Today’s supply chain environment is fraught with uncertainty, and manufacturers can improve their resilience and sustainability by incorporating these practices into their business operations. In addition, the finding that the trust relationship with suppliers influences manufacturer resilience through information-sharing level is critical for managers in developing countries. This suggests that firms need to rethink their future business models and developmental strategies by improving information technology level, enhancing the degree of information sharing, and adding big data applications.

6. Conclusions and Future Directions

This study concludes that the trust relationship with suppliers is an important safeguard for manufacturer resilience. Manufacturing companies must combine strengthening the supplier relationship with an increasing level of information sharing to improve resilience. Based on trust theory, this study concludes that a trust relationship with suppliers has a positive relationship with manufacturer resilience. Similarly, information-sharing level plays a positive mediating role in the link between the trust relationship with suppliers and different stages of manufacturer resilience. The results of this multidimensional study infer the importance of trust relationships with suppliers and information-sharing level in improving manufacturer resilience.

Furthermore, this research promotes the concept of manufacturer resilience and encourages researchers to delve into different areas, including behavioral operations and supply chain emergency management in a global context. Our findings provide scientifically sound support that manufacturers can improve their resilience of different dimensions by a trust relationship with suppliers. It is expected to provide useful guidance for the manufacturing enterprises on supplier relationship governance. Additionally, the conclusions and corresponding suggestions for enterprises not only help to enhance sustainable development but also contribute significantly to manufacturer resilience at different stages to maintain survival during the risks.

This study bears certain limitations in terms of sample size, geographical locations, and target industries where future work can be expanded. First, consider our sample of 351 managers in Chinese manufacturing corporations. Due to the specificity of corporate relationship governance in China, future studies should validate the findings and investigate their applicability with more samples employing other regions and industries to understand the applicability across the world with more theoretical support. Second, we have emphasized the trust relationship with suppliers, which was one type of relationship governance mechanism [61]. It may be useful for future research to explore the role of other approaches on the resilience of manufacturing companies, such as reciprocity [137]. In addition, the study adopted one mediation factor. This study encourages scholars to identify different types of intermediate variables and examine their effects to improve the resilience and sustainability of manufacturing companies in the future.

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