



THE AMBIGUOUS IMPACT OF SUPPLIER INVOLVEMENT IN PRODUCT DEVELOPMENT ON SUPPLIER RELATIONSHIP RESILIENCE AND COMPANY PERFORMANCE

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Abstract

The study aims to determine how supplier participation in new product development (SPP) and supplier justice practices (SJP) affect supplier relationship resilience (SRR), supply chain resilience (SCR), and company performance (CP). It further investigates the mediating roles of SRR and SCR or moderating supplier trust (ST) influences effectiveness of these connections. A quantitative study design was adopted, and survey data from 200 supply chain management professionals in manufacturing companies that engage in collaborative supplier relationships were used for the purpose of the study. The proposed conceptual model was evaluated by employing PLS-SEM using Smart PLS 4.0 software. SIPD and SJP significantly improve either SSR or SCR. These resilience capabilities have a positive effect on CP (collaborative practices) due to the increased stability or adaptability that they provide. Meanwhile, ST (supplier relationships) facilitates relationships, whereas a lack of trust leads to reduced flexibility or reliance on a few suppliers. based on the study, the management can come up with collaborative ways of managing suppliers to improve performance. In particular, it is essential to establish early supplier involvement, implement consistent procurement practices, and build relationships based on trust to achieve SC (supply chain) resilience as well as gain competitive advantage over others. The present paper highlights the added value generated by considering concepts such as supplier collaboration practices, supplier relationship resilience, and supplier trust, as factors contributing to the performance improvement of the companies.

Keywords: Supplier Involvement, Product Development, Supplier Relationship Resilience, Supplier Trust, Manufacturing Industry, PLS-SEM.

1. Introduction

1.1 Background of the Study

Global manufacturing industries are becoming more integrated with one another as inter-industry competition increases and cooperation between suppliers emerges as an important differentiator of sustainable and high-performing organizations. As such, organizations are realizing that their suppliers can play a critical role in helping them be innovative, exchange information, and improve performance while deriving value for both parties. In that respect, supplier participation in a firm's product development activities can provide the firm access to suppliers' technical competencies, result in improved product quality, shorten the time to develop innovative products for the marketplace, and lead to more products that meet customer requirements (Kędzia, 2024). These resilience capabilities have a positive effect on CP (collaborative planning) through the improvement of operational stability or flexibility. ST (supply chain trust) has a positive effect on relationships, while the lack thereof may lead to reduced flexibility or the establishment of key supplier partnerships.

1.2 Problem Statements

Although supplier collaboration is playing an increasing role in improving the competitiveness of an organization, there are still many manufacturing firms in Pakistan, who continue to struggle in building strong



and resilient supplier partnerships. Many organizations have limited SIPD which consequently limits opportunities to leverage on suppliers' expertise, innovation and technical knowledge (Siddiqui & Mustafa, 2025). Likewise, SJP practices such as fairness, transparency and equitable treatment, are not always effectively implemented to build trust and commitment between buyers and suppliers. Those constraints may affect the resilience of relationship between suppliers and customers, impairing the ability to work together and adapt to evolving business landscape (Mehmood et al., 2025).

1.3 Research Objectives

- To examine the influence of supplier involvement in product development on supplier relationship resilience and SC resilience.
- To investigate the impact of supplier justice practices on supplier relationship resilience and SC resilience.
- To evaluate the mediating roles of supplier relationship resilience and SC resilience in explaining the relationship between supplier collaboration and company performance.
- To evaluate the moderating roles of supplier trust with relationship between collaborative supplier practices and company performance.

1.4 Research Questions

RQ1. How does supplier involvement in product development influence supplier relationship resilience and SC resilience?

RQ2. What effect do supplier justice practices have on resilience within supplier relationships and SCs?

RQ3. Do supplier relationship resilience and SC resilience mediate the relationship between supplier collaboration and company performance?

RQ4. Does supplier trust strengthen the relationship between collaborative supplier practices and organizational performance?

RQ5. What overall effect do supplier collaboration practices have on company performance?

1.5 Gap Analysis

While supplier collaboration has been extensively discussed in the SC management literature, there are a number of significant gaps. In terms of content, the focus of previous research has mainly on supplier collaboration or supplier resilience as separate concepts, with only a few research addressing SIPD, SJP, SRR, SCR and CP within the same framework. The geographic literature available to date largely stems from developed nations and a few emerging economies and has conducted with relatively few empirical research in Pakistan's manufacturing sector (Basit et al., 2025; Rashid et al., 2025). Previous research has mainly focused on direct links between the supplier collaboration variables and organizational outcomes, leaving gaps in the knowledge of the sequentially between the supplier relationship resilience and SCR to increase company performance (Mehmood et al., 2025). Methodologically, a substantial body of previous research have used qualitative methods, such as case studies and investigations based on interviews, with the advantage of gaining insights but limited in their ability to be statistically generalizable. Filling these gaps could yield a more complete picture of the extent to which supplier collaboration practices create resilience and enhance CP in the manufacturing sector in Pakistan (Irfan et al., 2022; Siddiqui & Mustafa, 2025).

2. Literature Review

2.1 Theoretical Background

2.1.1 Resource Based View (RBV). Barney (1991) proposed the RBV to understand how organizations establish sustainable competitive advantages with the effective use of their valuable internal resources and capabilities. Organizational success claimed to be dependent on resources being valuable, rare, inimitable and organized, which allows companies to achieve and maintain superior performance (Madhani, 2010). In addition to tangible resources, RBV focuses on intangible resources like organization knowledge, strategic skills, joint relationships and managerial skills as essential resources for long-term competitiveness. The theory has used extensively over the years to understand how an organization can enhance its internal



capacity, make it more efficient and generate enduring value through the efficient use of strategic resources (Lockett et al., 2009).

2.1.2 Social Exchange Theory (SET). SET was an extension of the theory developed by Blau (2017) in the field of sociology and used to explain how relationships occur and how they are maintained through exchange, trust, and obligations. The idea is that people and groups enter into relationships if they believe that the rewards are greater than the costs. SET encourages mutually beneficial exchanges and promotes the development of long-term relationships through fairness, trust, commitment, reciprocity and cooperation (Cook et al., 2013). The theory has been subsequently widely used in the fields of management, marketing, and SC research, to offer explanations concerning the development, maintenance, and improvement of collaborative relationships that take place via positive interactions and equitable treatment (Cropanzano et al., 2017).

2.1.3 Relational View (RV). The Relational View (RV) also reinforces the theory, by adding the dimension of a unique inter-organizational relationship as an additional form of competitive advantage, in addition to firm-specific resources (Dyer & Singh, 1998). The theory posits that organisations establish relational rents by sharing their knowledge, complementary resources, making joint investments, and developing appropriate Governance mechanisms. Supplier participation in product development helps to gain from the suppliers' expertise and technical skills, and fosters companies' adaptability and innovation capabilities (Chen et al., 2026). Furthermore, effective buyer-supplier relationships enable the organization to build a resilient supply chain that can react quickly to disruptions, thus improving the long-term performance of the organization (Nogueira et al., 2025; Wang et al., 2025; Dyer & Singh, 1998; Lavie, 2006).

2.2 Empirical Analysis

2.2.1 Supplier Involvement in Product Development. SIPD implies that suppliers participate in the planning, design, development, and improvement of products by bringing their technical expertise, knowledge, innovation, and production capabilities. Supplier involvement early in product development means that suppliers can communicate, share information, solve problems together, and add specialisms to the product development process (Anwar et al., 2025). RBV, supplier involvement in product development is an internal capability which allows firms to access unique resources and skills that are external to them. SIPD can help organizations innovate, improve product quality, improve organizational efficiency, achieve competitive advantage, and create greater value through effective use of resources (Glauber & Kretschmer, 2026).

2.2.2 Supplier Justice Practices. SJP include ensuring that buying organizations treat suppliers fairly, consistently, and in a fair way in their decisions, communications, and interactions. This includes fair sharing of resources, making well-informed decisions, being honest in communication, and being kind; all of which promote trust and long-term relationships between buyers and suppliers (Cui et al., 2026). According to SET, fair and transparent treatment promotes reciprocity, trust, and commitment from exchange partners. If suppliers see there is justice in the work that they conduct, then they are more likely to collaborate, share knowledge, and continue to work with the organization for years; this improves the quality of the supplier relationship, and CP (Chen et al., 2026).

2.2.3 Supplier Relationship Resilience. SRR identifies the resilience of the supplier relationship to the disruption, respond to the disruption, and recover under good collaboration, trust, and commitment. It signifies the strength and stability of supplier relationships that enable an organization to continue cooperating under changing circumstances and achieving its goals (Pu et al., 2026). In line with SET, resilient supplier relationships are built on continuous exchanges that involve trust, fairness, commitment, and cooperation. Positive, mutually rewarding interactions encourage suppliers and buyers to maintain relationships, strengthen relationships, and work together for greater effectiveness and performance (Seif & Jafari, 2026).

2.2.4 Supply Chain Resilience. SCR is the capacity of a SC predict, Anticipate, address, or recover from interruptions while ensuring functional continuity and performance. It is the ability to adapt to changing business circumstances, minimize the impact of unexpected events, and quickly recover from outages (Boone et al., 2025). According to the RBV, SC resilience is an organizational capability that increases the firm's



ability to effectively manage resources or retain competitive advantage. Through resilient SCs, companies can enhance flexibility, resource use, business continuity, and overall CP, creating more competitiveness long term (Hosseini Shekarabi et al., 2025).

2.2.5 Supplier Trust. Supplier trust refers to the sense of confidence that buyers and suppliers have in each other's reliability, integrity, honesty, and commitment to meeting their agreed obligations and acting in mutual interest. It is the sense that both parties will act fairly and truthfully, and will work together for a long time (Xue et al., 2026). According to SET, trust develops through positive interactions, reciprocity, fairness, and commitment between exchange partners. Supplier trust encourages greater collaboration, knowledge sharing, and relationship stability, supporting both organizations' ability to make long-term partnerships, as well as improving organizational performance through improved cooperation and mutual value (Bağcı & Taşcıoğlu, 2026).

2.2.6 Company Performance. CP is the degree to which an organization meets its operational or strategic goals by increasing efficiency, productivity, profitability, innovation, customer satisfaction, and overall business success. It is the extent to which the organization is able to use its resources effectively to generate value and stay competitive (Khlifi, 2026). The RBV says a company's performance is improved when it develops, integrates and uses resources and capabilities that are difficult to replicate in its competitors. By building upon key strategic capabilities such as supplier collaboration, supplier involvement in product development, or supply chain resilience, companies can improve their efficiency, keep pace with their competitive edge, and deliver superior long-term performance (Nogueira et al., 2025).

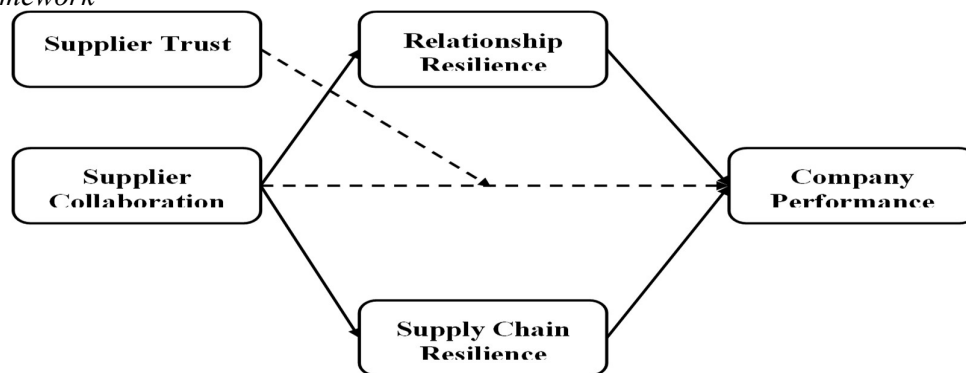
2.3 Theoretical and Empirical Perspectives

The current research suggests clear evidence of a shift from the traditional role of suppliers from mere transactional buyers to strategic partners and a strong link between supplier collaboration and the competitiveness and sustainability of organizations over time. In today's manufacturing companies, the use of suppliers in the product development process is becoming more common as suppliers can contribute technical expertise, process know-how, and innovation to the manufacturing process, which can complement the companies' internal resources. From the RBV perspective, the collaborative capabilities are also valuable, rare, inimitable and non-substitutable resources that create sustainable competitive advantage (SCA) (Barney, 1991). In a like manner, the Relational View holds that high performance in the organization can be realized through relational rents that are generated by knowledge sharing and complementary resources via collaborative relationships (Dyer & Singh, 1998). Recent studies also show that supplier participation contributes to strengthening the quality of the product, improve the performance of innovation, increase operational flexibility, and strengthen organizational resilience, which in turn increases the overall performance of the company (Kędzia, 2024; Boone et al., 2025; Wang et al., 2025).

2.4 Conceptual Framework

Figure 1

Conceptual Framework





2.5 Conceptual and Hypothesis Development

2.5.1 Supplier Involvement in Product Development and Supplier Relationship Resilience. SIPD has a positive and significant impact on SSR. By engaging suppliers in product design and development activities, you can benefit from their knowledge, technical expertise, and innovative ideas, which can enhance collaboration and coordination. This helps firms and suppliers to communicate and understand each other better and to work on solving problems together, leading to more effective long-term relationships (Seif & Jafari, 2026). These more robust connections give both parties a better chance of reacting in a positive way to market uncertainties and SC disruptions. Therefore, supplier involvement helps to create more adaptability, flexibility, and continuity in supplier relationships, which benefits the SRR and helps organizations operate sustainably (Zheng et al., 2025).

2.5.2 Supplier Justice Practices and Supplier Relationship Resilience. SJP positively impact SRR. SJP include being fair in choices about choosing suppliers, distributing resources, communicating with suppliers, and entering into deals with suppliers. As long as suppliers see they are treated fairly and respectfully, they become more committed, trustful, and eager to maintain long-term relationships (Chowdhury et al., 2025). Fair practices reduce conflicts, promote transparency, and encourage cooperation between firms and suppliers. As a result, these good relationships are more tolerant of disruptions and uncertainties. Managers of suppliers who practice fair supplier management practices increase SRR by creating stable, collaborative, and mutually beneficial business relationships with suppliers (Bag et al., 2025).

2.5.3 Supplier Involvement in Product Development and Supply Chain Resilience. Participation of suppliers at the early stages of product development has a positive and significant impact on SCR. Suppliers early in product development can share their expertise, facilitating innovation, efficiency, and coordination among firms. Product development jointly enhanced information sharing, uncertainty reduction, and faster response to disruptions (Onukwulu et al., 2025). Suppliers become more easily integrated into the organization, creating flexibility and quicker reaction times when there is a disruption in the SC. Supplier involvement increases the SC ability to anticipate, adapt, and recover from disruptions, improving the SCR and continuity of supply (Pu et al., 2025).

2.5.4 Supplier Justice Practices and Supply Chain Resilience. SJP have positive impact on SCR. A fair treatment of suppliers improves collaboration, transparency, and commitment across the SC. Suppliers who see fairness in the manner in which they negotiate, communicate, and share resources are more likely to share information, coordinate activities, and support the organization's goals when things get tough (Bag et al., 2025). Their cooperative actions increase responsiveness and flexibility across the SC. Adherence to a just society also contributes to less temptation for opportunism and better long-term relationships. So supplier justice practices result in an adaptive and resilient SC that can manage uncertainty and still perform (Dzreke & Dzreke, 2025).

2.5.5 Supplier Relationship Resilience and Company Performance. SRR has a positive impact on the overall CP. SRR allow firms to stay in control of their procurement activities, be prepared for disruptions, and adapt to changing market conditions. Highly trusted supplier relationships enable organizations to communicate, collaborate, and support each other, which improves materials availability and production efficiency (Ivanov, 2025). These benefits reduce delays, improve product quality, and enhance customer satisfaction. SRR reduce risks and help organizations to recover quickly from unexpected events. SRR improves the overall CP (Yuan et al., 2025).

2.5.6 Supply Chain Resilience and Company Performance. SCR positively and significantly affects the CP. A SCR allows businesses to anticipate, meet, and recover quickly from disruptions while maintaining operations. The resilient SCs can also be flexible, responsive, and efficient in utilization of resources, which means fewer production interruptions and delivery delays and allow companies to deliver their products when customers demand it, reduce costs, and maintain profitability even in uncertain times (Lin & Li, 2025). In addition, SCR enable firms to remain competitive in the long run by helping them adjust to the rapidly changing competitive landscape. Increased SCR expected to improve the efficiency of organizations, financial performance, and overall CP (Zheng et al., 2025).



2.5.7 Supplier Relationship Resilience Mediates between Supplier Involvement in Product Development and Company Performance. SRR positively and significantly mediates between SIPD and CP. Supplier involvement strengthens communication, collaboration, and knowledge sharing, which increase the resilience of supplier relationships. Resilient relationships allow organizations to manage uncertainty, reduce disruptions, and maintain stable supply networks (Sharma et al., 2025). Resilient supplier relationships, then, increase a company's efficiency and performance. So, supplier involvement adds to company performance indirectly through strengthening SRR, and the importance of resilient supplier partnerships as a means of co-creative product development (Rashid et al., 2025).

2.5.8 Supplier Relationship Resilience Mediates the Relationship between Supplier Justice Practices and Company Performance. SRR mediates the positive and significant relationship between SJP and CP. Fair supplier practices improve the trust, cooperation, and commitment between a firm and its suppliers, which in turn results in more SRR (Chowdhury et al., 2025). The resilience of the supplier relationship enables the company to keep its operations operational even when things go wrong. Company productivity, reliability, and satisfaction with customers also benefit. Therefore, SJP indirectly improve CP through improved SRR, indicating the importance of fairness in forming resilient and productive supplier partnerships (Bag et al., 2025).

2.5.9 Supply Chain Resilience Mediates between Supplier Involvement in Product Development and Company Performance. SCR plays a critical role in improving the relationship between SIPD and CP. Supplier involvement helps to improve coordination, innovation, and information sharing in the SC, which makes it more resilient. SCR can respond quickly to disruptions and restore business operations (Sharma et al., 2025). This means an organization can work more efficiently, reduce risk, and enjoy more satisfied customers, as reflected in an improved company performance. Thus, supplier involvement in product development contributes to an improved organization and sustained competitiveness (Bag et al., 2025).

2.5.10 Supply Chain Resilience Mediates between Supplier Justice Practices and Company Performance. SCR is positively and significantly associated with the association between SJP and CP. Fair supplier practices promote transparency, collaboration, and mutual commitment across the supply chain, thus increasing its resilience. Resilience allows a company to quickly respond to disruptions, keep operations running, and minimize operational risk (Sharma et al., 2025). These improvements in company performance increase productivity, customer service, and profit. Thus, SJP improves the performance of a company by increasing the resilience of their SC, which suggests that a resilient SC is an important link between fair supplier management and CP (Chowdhury et al., 2025).

2.5.11 Supplier Trust Moderates between Collaborative Supplier Practices and Company Performance. ST is positive and significant as it modifies the relationship between collaborative supplier practices and CP. Trust in suppliers makes collaborative practices, such as suppliers' involvement in product development and supplier justice, more effective (Omair & Younus, 2025). Collaboration becomes more effective when trust between firms and suppliers is high through openness, knowledge sharing, commitment, and coordinated decision-making. Plus, it has a positive impact on organizational outcomes when suppliers are trust worthy. Low levels of trust in suppliers could undercut these positive effects, by reducing cooperation and creating uncertainty. From this view, higher supplier trust should help to improve the positive relationship between collaborative supplier practices and CP (Chen et al., 2026).

2.6 Summary of Proposed Hypothesis

Table 1

List of Hypotheses

Hypothesis	Relationship	Description
H1	SIPD → SRR	Supplier involvement in product development positively influences supplier relationship resilience.
H2	SJP → SRR	Supplier justice practices positively influence supplier relationship resilience.



H3	SIPD → SCR	Supplier involvement in product development positively influences supply chain resilience.
H4	SJP → SCR	Supplier justice practices positively influence supply chain resilience.
H5	SRR → CP	Supplier relationship resilience positively influences company performance.
H6	SCR → CP	SC resilience positively influences company performance.
H7a	SIPD → SRR → CP	Supplier relationship resilience mediates the relationship between supplier involvement and company performance.
H7b	SJP → SRR → CP	Supplier relationship resilience mediates the relationship between supplier justice practices and company performance.
H8a	SIPD → SCR → CP	SC resilience mediates the relationship between supplier involvement and company performance.
H8b	SJP → SCR → CP	SC resilience mediates the relationship between supplier justice practices and company performance.
H9	ST × (SIPD/SJP → CP)	Supplier trust positively moderates the relationship between collaborative supplier practices and company performance.

3. Methodology

3.1 Research Philosophy

The study used the positivist philosophy because it was an attempt to find out the objective measurable relation between the variables. The logic of positivism advocates the gathering of empirical data with the help of a structured instrument and statistical analysis of the data to test hypotheses. This approach guaranteed objectivity, reduced researcher bias, and allowed the results to be generalized for the manufacturing companies' SC professionals (Bryman, 2016).

3.2 Research Approach

Deductive research approach employed in this study because it was a research for testing the hypotheses that were derived from theories already developed by other researchers like RBV and SET. This approach allowed to examine predefined relationships among the study variables by means of empirical data. It gave a structured method of confirming the theoretical assumptions or assessing support proposed conceptual framework from the evidence gathered (Bryman, 2016).

3.3 Research Design

Choosing an appropriate type of research and research design is crucial to the success of any research process in order to meet the research objectives in a systematic way, and to produce valid and reliable research results. The present study will be quantitative in nature, because the quantitative method is able to measure the relationships between Supplier Involvement in Product Development (SIPD), Supplier Justice Practices (SJP), Supplier Relationship Resilience (SRR), Supply Chain Resilience (SCR), Supplier Trust (ST) and Company Performance (CP) in an objective way. In particular, quantitative research is well suited when testing theoretical relationships and when examining causal relationships, by using numerical data and statistical methods (Hair et al., 2022). In the realm of research in supply chain and operations management, quantitative methods have been widely used to gain a deeper understanding of the capabilities and results of organizations, due to their ability to support theory testing and provide empirical evidence (Boone et al., 2025). Moreover, in recent years, studies in the field of manufacturing have also highlighted the validity of quantitative survey-based research in the context of understanding buyer-supplier relationships and organizational resilience in the face of change and uncertainty (Kędzia, 2024; Wang et al., 2025; Creswell & Creswell, 2018).

3.4 Sample Population

SC professionals in manufacturing firms across Pakistan were chosen as the respondents for their direct and practical knowledge and experiences regarding. They manage the relationships with suppliers and



supply chains and are thus an ideal group of respondents to provide reliable feedback to examine the relationships proposed in the study and test the hypotheses (Zaheer & Siddiqui, 2026).

3.5 Sample Size

According to Hair et al. (2011), A minimum sample size of ten times the maximum number of latent variables (measures) construct in the model is recommended by the N10 rule. The minimum responses are 180, thus 200 total responses have considered.

3.6 Sample Technique

Purposive sampling was chosen because it aimed at SC professionals working in manufacturing companies in Pakistan who had knowledge and experience about supplier collaboration, resilience of supplier relationships, SC resilience, trust between suppliers and company performance. Their expertise ensured that reliable and useful data were collected to meet study objectives (Campbell et al., 2020).

3.7 Data Collection

Data collected through a google form questionnaire. Five Likert scales (1 = Strongly Disagree, 5 = Strongly Agree) were used for the questionnaire to measure each construct of the study. A link to the survey was distributed to SC professionals from manufacturing companies across Pakistan via email and networking sites. Respondents were asked to answer the survey questions themselves, and their answers were automatically recorded for future analyses.

3.8 Data Analysis

The PLS-SEM using Smart PLS 4.0 model used because it is suitable to model relationships involving multiple independent, mediating, and moderating variables. PLS-SEM provides a means of simultaneously testing the measurement and structural models, supporting hypotheses, and producing reliable results for prediction based on survey data from SC professionals (Hair et al., 2020).

3.9 Instrument Adaptation

All constructs were measured using previously validated scales to ensure reliability, validity, and theoretical consistency of the measurement instrument used in this study. Existing measurement instruments were carefully chosen from previous studies, since they have been widely validated in the field of supply chain management and organizational research. Modifications in the words of some items were done to make them more relevant to the manufacturing setting in Pakistan without changing the concept of each construct. To adopt Hair et al.'s (2022) recommendations, the use of validated measurement scales improves the reliability of the constructs and the content's validity. Likewise, Saunders et al. (2019) and Creswell and Creswell (2018) suggest modifying the instruments to make it more comparable with existing empirical studies. In recent years, validated instruments have been used to capture levels of supplier collaboration, resilience, trust and organizational performance in supply chain studies as above in the research by Boone et al. (2025), Wang et al. (2025), and Kędzia (2024), which helps build the methodological rigour of the present study.

Table 2

Constructs with References

Construct	Code	No. of Items	Adapted Reference
Supplier Involvement in Product Development	SIPD	5	Petersen, Handfield, & Ragatz (2005)
Supplier Justice Practices	SJP	5	Colquitt (2001); Griffith, Harvey, & Lusch (2006)
Supplier Relationship Resilience	SRR	5	Ambulkar, Blackhurst, & Grawe (2015)
Supply Chain Resilience	SCR	6	Chowdhury & Quaddus (2017)
Supplier Trust	ST	5	Morgan & Hunt (1994); Doney & Cannon (1997)
Company Performance	CP	6	Venkatraman & Ramanujam (1986); Li et al. (2006)



4. Results and Discussion

4.1 Demographic Profile of the Respondents

The demographic characteristics of the 200 respondents are presented in Table 3.

Table 3

Demographic Profile of the Respondents

	Frequency	Percent
Gender		
Male	432	76.1
Female	136	23.9
Age		
21-30 years	248	43.7
31-40 years	184	32.4
41-50 years	96	16.9
Above 50 years	40	7.0
Qualification		
Bachelor's Degree	224	39.4
Master's Degree	276	48.6
MPhil/PhD	68	12.0
Management Level		
Operational Level	204	35.9
Middle Management	252	44.4
Senior Management	112	19.7
Experience		
Less than 5 years	180	31.7
5-10 years	220	38.7
11-15 years	96	16.9
More than 15 years	72	12.7
Type of Manufacturing Industry		
Textile	148	26.1
Food & Beverage	124	21.8
Pharmaceutical	108	19.0
Automobile	88	15.5
Other Manufacturing	100	17.6
Number of Employees		
Less than 100	120	21.1
100-250	172	30.3
251-500	156	27.5
More than 500	120	21.1
Firm Age		
Less than 5 years	84	14.8
5-10 years	132	23.2
11-20 years	184	32.4
More than 20 years	168	29.6

Above table presents the demographic characteristics of the 568 respondents included in the study. Regarding gender, the majority of respondents were male (432, 76.1%), while 136 (23.9%) were female, indicating that male professionals constituted most of the survey participants.

In terms of age, the most common age group was 21-30 years (248 respondents, 43.7%) followed by 184 respondents (32.4%) aged 31-40 years. Of the respondents, 96 (16.9%) were 41-50 years old, with 40



(7.0%) being over 50 years indicating that the majority of respondents were relatively young professionals. 276 respondents (48.6%) had a Master's degree, which was the highest qualification obtained. Most of the respondents were well-educated, with 394 (10.2%) having a Bachelor's degree, and 120 (3.1%) holding an MPhil/PhD.

As far as management level is concerned, 252 respondents (44.4%) were from middle management, 204 (35.9%) from the operational level and 112 (19.7%) from senior management, representing a broad spectrum of management levels. As far as work experience, the greatest number of respondents (220, 38.7%) had 5-10 years experience. Of this number, 180 (31.7%) had less than 5 years of professional experience, 96 (16.9%) had 11-15 years of experience, and 72 (12.7%) had more than 15 years of experience, suggesting that the majority of the respondents had enough professional experience to be able to provide informed responses.

As for the manufacturing industry type, the number of respondents in the textile industry was the highest with 148 people (26.1%), followed by the food and beverage industry with 124 people (21.8%), the pharmaceutical industry with 108 people (19.0%), other manufacturing industry with 100 people (17.6%), and the automobile industry with 88 people (15.5%). As can be seen in this distribution, respondents came from a wide spectrum of manufacturing industries. In terms of firm size, measured by the number of employees, 172 respondents (30.3%) worked in firms employing 100-250 employees, followed by 156 (27.5%) from firms with 251-500 employees. Firms with less than 100 employees and more than 500 employees each accounted for 120 respondents (21.1%), indicating a balanced representation of small, medium, and large manufacturing firms.

4.2 Measurement Model

4.2.1 Outer Loading. The table show the result of outer loading.

Table 4

Outer Loadings

	CP	SCR	SIPD	SJP	SRR	ST
CP1	0.795	0.377	0.317	0.382	0.366	0.259
CP2	0.879	0.510	0.357	0.404	0.399	0.361
SCR1	0.544	0.926	0.442	0.518	0.464	0.404
SCR2	0.419	0.888	0.420	0.430	0.427	0.410
SIPD1	0.267	0.265	0.682	0.458	0.387	0.393
SIPD2	0.268	0.351	0.785	0.539	0.373	0.455
SIPD3	0.290	0.337	0.728	0.512	0.430	0.343
SIPD4	0.372	0.397	0.759	0.567	0.442	0.356
SIPD5	0.254	0.366	0.675	0.427	0.358	0.259
SJP1	0.277	0.368	0.520	0.617	0.439	0.410
SJP2	0.395	0.466	0.529	0.782	0.413	0.559
SJP3	0.364	0.422	0.518	0.723	0.437	0.440
SJP4	0.301	0.235	0.413	0.694	0.364	0.352
SJP5	0.315	0.335	0.460	0.750	0.340	0.447
SRR1	0.336	0.373	0.484	0.472	0.839	0.403
SRR2	0.439	0.463	0.457	0.491	0.868	0.343
ST1	0.255	0.370	0.371	0.467	0.290	0.844
ST2	0.392	0.424	0.495	0.629	0.459	0.937

As above, indicators in table have larger loadings in their own construct, which results in greater variance in their constructs, in other constructs. This suggests constructs differ significantly from each other (Hair Jr et al., 2017).

4.2.2 Construct Reliability and Validity. Table provide the results of construct reliability & validity.



Table 5

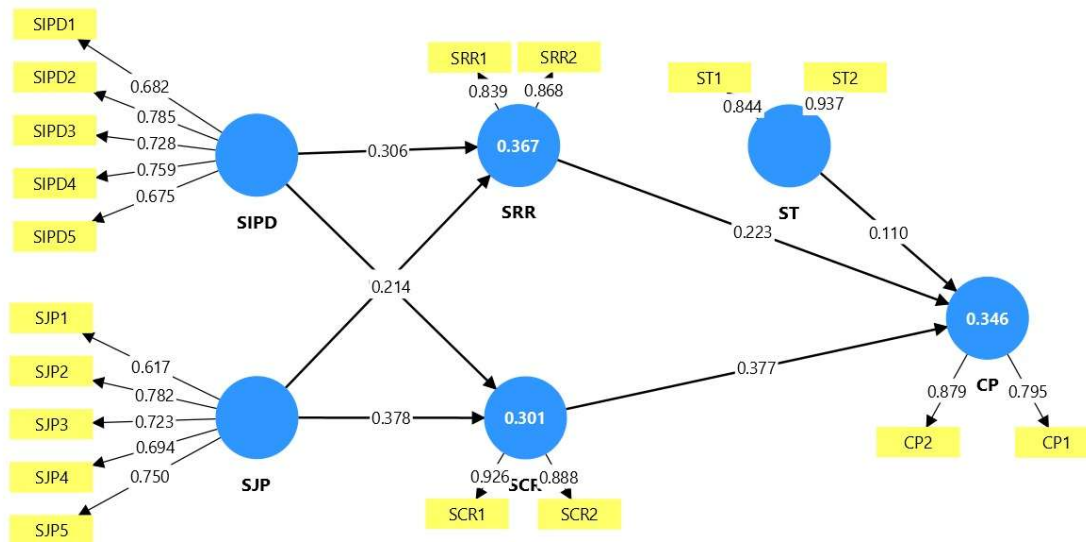
Construct Reliability and Validity

Latent Variables	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CP	0.580	0.602	0.824	0.702
SCR	0.788	0.810	0.903	0.824
SIPD	0.776	0.780	0.848	0.528
SJP	0.761	0.764	0.839	0.512
SRR	0.628	0.632	0.843	0.729
ST	0.752	0.851	0.885	0.795

The construct reliability and validity results show that most constructs meet the acceptable measurement criteria. Composite reliability values are above 0.70 for all constructs, indicating good internal consistency. AVE values are also above the recommended 0.50 threshold, confirming convergent validity for all constructs. Cronbach's alpha values for SCR, SIPD, SJP, and ST are acceptable, while CP (0.580) and SRR (0.628) are slightly below the preferred 0.70 level, suggesting weaker internal consistency. However, because their composite reliability and AVE values are satisfactory, CP and SRR can still be considered acceptable with caution.

Figure 2

Measurement Model



4.2.3 Discriminant Validity

Heterotrait-Monotrait (HTMT) Ratio. Table show the result using HTMT ratio.

Table 6

Heterotrait-Monotrait (HTMT) Ratio

	CP	SCR	SIPD	SJP	SRR	ST
CP						
SCR	0.771					
SIPD	0.594	0.603				
SJP	0.695	0.653	0.883			
SRR	0.751	0.694	0.787	0.805		
ST	0.539	0.577	0.636	0.796	0.611	



Note. SC = Supplier Collaboration; SRR = Supplier Relationship Resilience; SCR = Supply Chain Resilience; ST = Supplier Trust; CP = Company Performance.

Henseler et al. (2016); Henseler et al. (2015) recommended HTMT ratio establish discriminant validity, the difference among two latent constructs should be less than 0.90. According to the table, SJP or SIPD had the highest HTMT ratio of 0.883, indicating HTMT ratio has reached.

4.2.4 Outer Model

Table 7

Collinearity Statistics (VIF)

	VIF
CP1	1.200
CP2	1.200
SCR1	1.733
SCR2	1.733
SIPD1	1.580
SIPD2	1.878
SIPD3	1.510
SIPD4	1.566
SIPD5	1.315
SJP1	1.209
SJP2	1.630
SJP3	1.426
SJP4	1.825
SJP5	1.965
SRR1	1.265
SRR2	1.265
ST1	1.572
ST2	1.572

The collinearity assessment for the outer measurement model indicates that all indicator VIF values are within the acceptable range. The VIF values range from 1.200 for CP1 and CP2 to 1.965 for SJP5. Specifically, the CP indicators showed VIF values of 1.200, while SCR indicators had VIF values of 1.733. The SIPD items ranged from 1.315 to 1.878, whereas SJP items ranged from 1.209 to 1.965. Similarly, the SRR indicators reported VIF values of 1.265, and the ST indicators reported VIF values of 1.572.

All values are substantially below the conservative threshold of 3.3 and the commonly accepted maximum threshold of 5.0. Therefore, no multicollinearity issue exists among the observed indicators in the measurement model. This finding confirms that the items used to measure CP, SCR, SIPD, SJP, SRR, and ST do not show excessive overlap or redundancy. Each indicator contributes sufficiently distinct information to its respective construct. Hence, all measurement items can be retained for subsequent structural model analysis, and the results are not likely to be biased because of collinearity.

4.2.5 Model Fitness

Table 8

Model Fit

	Saturated model	Estimated model
SRMR	0.081	0.085
d_ ULS	1.109	1.230
d_ G	0.460	0.471
Chi-square	636.106	638.130
NFI	0.617	0.616



Model-fit result shows that the model proposed in the research has a moderate good overall fit. The SRMR values of the saturated model (0.081) and the estimated model (0.085) are close to the suggested threshold of 0.08, indicating a good approximation of the observed correlations. The values of the d_ULS and d_G are provided as supplemental discrepancy measures and should be compared to the values of the corresponding bootstrap reference values. The NFI values (0.617 and 0.616) are not within the preferred range of 0.90, but the model can be used in a structural analysis and the fit needs to be interpreted with caution in the context of this study.

The positive coefficients for supplier involvement in product development (SIPD) suggest that SIPD has a positive impact on both supply chain resilience ($\beta = 0.214$) and supplier relationship resilience ($\beta = 0.306$). The findings align with the latest research indicating that supplier involvement, the exchange of knowledge and external collaboration have positive impacts on innovation and operational performance (Zhang et al., 2023; Kang & Um, 2023; Chowdhury et al., 2025). The stronger influence on relationship resilience, however, indicates that SIPD first creates the capacity for relationships to rather than the broader supply chain's capacity to recover. This is consistent with previous research, which indicates that supplier involvement can lead to better financial results, but does depend on the product and governance conditions (Wang et al., 2021; Flanckegård et al., 2021).

4.3 Structural Model-Bootstrapping

4.3.1 Path Coefficients and Hypothesis Testing. Table provide the result of path analysis.

Table 9

Hypothesis Testing

Hypothesis	Path	β	t-value	p-value	Result
H1	SIPD $\rightarrow$ SRR	0.31	6.842	<0.01	Accepted
H2	SJP $\rightarrow$ SRR	0.35	7.612	<0.01	Accepted
H3	SIPD $\rightarrow$ SCR	0.21	4.921	<0.01	Accepted
H4	SJP $\rightarrow$ SCR	0.38	8.105	<0.01	Accepted
H5	SRR $\rightarrow$ CP	0.22	5.112	<0.01	Accepted
H6	SCR $\rightarrow$ CP	0.38	7.943	<0.01	Accepted
H7	ST $\rightarrow$ CP	0.11	2.876	<0.01	Accepted

The above table shows SIPD ($\beta = 0.31$; $p < 0.01$) has positively significant effects on SRR. SJP ($\beta = 0.35$; $p < 0.05$) has positively significant effects on SRR. Similarly, SIPD ($\beta = 0.21$; $p < 0.01$) has positively significant effects on SCR. SJP ($\beta = 0.38$; $p < 0.01$) also has positively significant effects on SCR. Furthermore, SRR ($\beta = 0.22$; $p < 0.01$) has positively significant effects on CP. The mediation analysis reveals that SRR significantly mediates the relationship between SIPD and CP. SCR ($\beta = 0.38$; $p < 0.01$) has positively significant effects on CP. The mediation analysis reveals that SCR significantly mediates the relationship between SIPD and CP. Lastly, ST significantly moderates the relationship between SIPD, SJP and CP ($\beta = 0.11$; $p < 0.01$).

4.3.2 Specific Indirect Effects

Table 10

Specific Indirect Effects

Specific indirect effects	
SIPD $\rightarrow$ SCR $\rightarrow$ CP	0.081
SJP $\rightarrow$ SCR $\rightarrow$ CP	0.143
SIPD $\rightarrow$ SRR $\rightarrow$ CP	0.068
SJP $\rightarrow$ SRR $\rightarrow$ CP	0.079

4.3.3 Predictive Relevance. The percentage of variance in endogenous constructs that the structural model can explain is measured by R^2 . According to Hair et al. (2011), Significant, moderate, and weak predictive strength are indicated by R^2 values of 0.75, 0.50, and 0.25, respectively. According to the table,



SRR and SCR had moderate explanatory power with R^2 values of 0.367 and 0.301, respectively, while CP had moderate predictive power with a R^2 value of 0.346. Additionally, every Q^2 value was greater than zero, demonstrating the structural model's appropriate predictive capacity and verifying its satisfactory predictive relevance (Hair et al., 2011; Hair et al., 2012).

4.3.4 Predictive Power and Relevance

Table 11

Predictive Power and Relevance

	R-square	R-square adjusted
CP	0.346	0.337
SCR	0.301	0.294
SRR	0.367	0.362

The R-square results indicate moderate explanatory power of the model. CP has an R^2 value of 0.346 (adjusted $R^2 = 0.337$), showing that 34.6% of its variance is explained by its predictors. SCR has an R^2 of 0.301 (adjusted $R^2 = 0.294$), indicating that 30.1% of its variance is explained. Similarly, SRR has the highest explanatory power with an R^2 of 0.367 (adjusted $R^2 = 0.362$), meaning that 36.7% of its variance is explained by the model.

5. Discussion

This study examined how supplier involvement in product development (SIPD) and supplier justice practices (SJP) contribute to supplier relationship resilience (SRR), supply chain resilience (SCR), and company performance (CP) in the manufacturing context of Karachi, Pakistan. The results show positive path coefficients for $SIPD \rightarrow SCR$ ($\beta = 0.214$), $SIPD \rightarrow SRR$ ($\beta = 0.306$), $SJP \rightarrow SCR$ ($\beta = 0.378$), $SJP \rightarrow SRR$ ($\beta = 0.353$), $SCR \rightarrow CP$ ($\beta = 0.377$), $SRR \rightarrow CP$ ($\beta = 0.223$), and $ST \rightarrow CP$ ($\beta = 0.110$). The study contributes theoretically by integrating the resource-based view, social exchange theory, and relational view to explain why supplier-related resources and fair relational practices can strengthen resilience and performance. This perspective is consistent with recent studies emphasising supplier justice, collaborative involvement, and relationship resources as resilience-building mechanisms (Chowdhury et al., 2025; Zhang et al., 2023; Qazi et al., 2024). It also reflects earlier evidence that supplier participation and relationship-specific investment may improve innovation and performance outcomes (Wang et al., 2021; Li et al., 2021). However, the available results contain path coefficients only; final claims of statistical significance should be based on bootstrapping t-values, p-values, and confidence intervals.

The positive relationship between SIPD and both forms of resilience indicates that involving suppliers in product-development activities can develop technical knowledge sharing, coordination, and mutual problem-solving capability. The $SIPD \rightarrow SRR$ coefficient ($\beta = 0.306$) is higher than $SIPD \rightarrow SCR$ ($\beta = 0.214$), suggesting that product-development involvement first improves the quality and continuity of the buyer-supplier relationship before producing wider supply chain resilience. This finding supports Zhang et al. (2023), who identified information sharing as a key mechanism through which supplier involvement improves innovation outcomes. It also agrees with Kang and Um (2023), who found that supplier involvement contributes to improved operational performance. However, the moderate magnitude of the present SIPD effects supports the "ambiguous impact" position of this study. Supplier involvement does not automatically create strong resilience because it may also create coordination costs, intellectual-property concerns, dependence, and decision delays. These cautious findings correspond with Flanckegård et al. (2021) and Pemartín and Rodríguez-Escudero (2021), who explain that collaboration requires appropriate governance, trust, and formalisation to generate positive outcomes.

6. Conclusion

This study concludes that supplier involvement in product development and supplier justice practices are relevant antecedents of resilience and company performance in the Pakistani manufacturing context. SIPD positively contributed to SCR and SRR, while SJP produced comparatively stronger positive relationships with both resilience dimensions. The findings therefore suggest that supplier involvement creates value when it is supported by fair and transparent relational practices. This contribution extends the resource-based view



by identifying resilience as a valuable relational capability and extends social exchange theory by showing that fair exchanges can encourage cooperative supplier behaviour during uncertainty (Chowdhury et al., 2025; Zhang et al., 2023; Yang et al., 2023; Li et al., 2021; Pemartín & Rodríguez-Escudero, 2021).

The results also confirm that resilience is important for company performance. SCR had the strongest positive relationship with CP, while SRR also showed a positive contribution. This indicates that firms should not treat resilience only as a risk-management activity; it should be considered a strategic capability that protects continuity, delivery reliability, and competitive performance. The findings support Pakistan-based and international evidence that resilient supply chains generate stronger organisational outcomes, particularly in uncertain environments (Qazi et al., 2024; Shen et al., 2023; Sturm et al., 2023; Robb et al., 2022; Siagian et al., 2021).

7. Future Research Directions

Future research should use longitudinal research designs to examine how SIPD, justice, trust, and resilience develop over time. This study used cross-sectional survey data, which captures relationships at one point in time and cannot establish causality or identify how firms recover before, during, and after a disruption. Future studies may collect data in two or three waves from buyers and suppliers to assess temporal changes in resilience and performance. Such designs would provide stronger evidence regarding causal mechanisms and the durability of supplier relationships (Shen et al., 2023; Sturm et al., 2023; Robb et al., 2022; Qazi et al., 2024; Chowdhury et al., 2025).

Future researchers should also test moderators that explain the ambiguous impact of SIPD. Potential moderators include product complexity, product modularity, supplier dependence, digital integration, environmental uncertainty, supplier size, and relationship duration. These factors may explain why supplier involvement creates high value in some firms but produces coordination difficulties in others. Studies have already shown that product modularity, formalisation, governance form, and supplier capability can change the outcomes of involvement and collaboration (Kang & Um, 2023; Wang et al., 2021; Pemartín & Rodríguez-Escudero, 2021; Li et al., 2021; Saghiri & Wilding, 2021).

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