Supplier and Customer Involvement toward Firms' Competitive Advantage: The Mediating Role of New Product Development Efficiency

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Abstract: - This study investigates the extent to which supplier and customer involvement contribute to competitive advantage among garment manufacturing firms in Pakistan, particularly through New Product Development (NPD) efficiency. A quantitative approach was adopted, and responses were obtained from 297 senior managers. Partial Least Squares Structural Equation Modeling (PLS-SEM) was utilized to evaluate the empirical data. The findings indicate that both supplier and customer involvement positively influence NPD efficiency and competitive advantage. NPD efficiency also has a significant effect on competitive advantage and partially mediates these relationships. The findings emphasize that closer integration with external stakeholders during the NPD process can improve operational efficiency and strengthen the firm's market position. It further contributes to the combined effect of external integration and internal capabilities, which plays a significant role in enhancing firm performance. These implications may add value to small and medium-sized enterprises functioning in other emerging economies, such as the garment sector.

Key-Words: - Supplier involvement, Customer Involvement, New Product Development (NPD), NPD efficiency, Competitive Advantage, Garment Manufacturing firms, PLS-SEM.

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1 Introduction

Global competition has become increasingly intense, making it more difficult for firms to sustain a competitive advantage. This is due to shifting customer demands, continuous innovation, technological advancements, and, importantly, inadequate involvement of key stakeholders in development processes, [1], [2]. In developing economies, firms' ability to sustain competitive advantage largely depends on the efficiency of their development processes, [3], [4]. In this context, the adoption of digital technologies, particularly information technology, has become essential for enhancing stakeholder integration, improving decision-making, and increasing new product development (NPD) efficiency, [5].

This study focuses on garment manufacturing firms in Pakistan, a sector that significantly contributes to national exports and employment, yet has experienced a decline in global competitiveness, [6]. The decline is attributed to weak integration of suppliers and customers in new product development, inefficiencies in development activities, and limited adoption of digital technologies, [7]. Modern information systems, including digital collaboration platforms, process engineering tools, and knowledge management systems, enable firms to integrate customer requirements, supplier capabilities, and internal design knowledge into a unified new product development process. These systems improve lead time management, cost control, real-time coordination, and process automation, [8].

Firms can improve NPD efficiency and competitive advantage by involving suppliers early in the design stage and material planning, while systematically incorporating customer feedback. The use of ERP systems to track supplier inputs and CRM tools to gather real-time customer insights further enables better coordination and better cycle times. Moreover, simplifying processes and focusing on core activities to minimize delays and costs helps firms achieve first-mover advantages and strengthen their market position. These practices provide practical implications for managers and educators in organizations of different sizes, including SMEs, seeking to improve product development outcomes.

2 Problem Statement

Although supplier and customer involvement is beneficial, Pakistani garment firms have not fully utilized IT systems to enhance collaborative product development. In many cases, product development still relies on manual decision-making, slow communication channels, and poorly coordinated feedback, which limit responsiveness to changing global market trends. Moreover, limited IT infrastructure, lack of digital skills, and low investment in enterprise systems prevent firms from leveraging data analytics, cloud computing, and mobile information systems for process optimization, [9].

In contrast, prominent apparel exporters like China, Vietnam, and Bangladesh have adopted advanced digital solutions to streamline NPD, enhance speed, and better respond to market demand, [10]. Their approach includes engaging supply chain partners through collaborative digital platforms and employing big data and AI-powered design systems to leverage customer input and facilitate product co-creation, thereby improving efficiency and gaining a competitive advantage.

The role of information technology in enabling supplier and customer involvement within Pakistan's garment industry remains largely unexplored, particularly in how it contributes to gaining competitive advantage through enhanced NPD efficiency, including speed and lead time. While existing literature recognizes the importance of supplier and customer collaboration, it has yet to assess the mediating role of NPD efficiency as enhanced by digital transformation.

3 Research Objectives

The objective of the study is to fill the research gap by examining the direct effect of supplier involvement (SI) and customer involvement (CI), supported by information technology and digital tools, on the competitive advantage (CA) of garment manufacturing firms. In addition, it evaluates the direct effect of SI and CI on NPD efficiency, as well as the effect of NPD efficiency on CA. It also assesses the mediating effect of NPD efficiency, in terms of its dimensions (such as speed and lead time), to determine the effect of SI and CI on CA.

The objectives of this study are as follows:

1. To evaluate the positive effect of SI on CA in garment manufacturing firms.
2. To assess the positive effect of CI on CA in garment manufacturing firms.
3. To examine the positive effect of SI on NPD efficiency in garment manufacturing firms.
4. To evaluate the positive effect of CI on NPD efficiency in garment manufacturing firms.
5. To investigate the positive effect of NPD efficiency on CA in garment manufacturing firms.
6. To examine whether NPD efficiency mediates the relationship between SI and CA.
7. To assess whether NPD efficiency mediates the relationship between CI and CA.

4 Theoretical Background

The underpinning theory of this study is the Resource-Based View (RBV) theory, as it provides clear evidence about the relationship between the latent variables. This theory is commonly used in strategic management literature, where it explains how firms can achieve sustainable CA, [11]. The study's model adopts RBV theory as a base to empirically evaluate the influence of external resources (i.e., SI and CI) in enhancing CA via the mediating role of NPD efficiency.

RBV theory suggests that firms can achieve a sustainable CA by employing resources that are rare, valuable, unique, and non-substitutable, [12]. Suppliers and customers are considered useful external resources, and their involvement in the NPD process may greatly enhance efficiency and thus achieve CA, [13]. When suppliers provide valuable knowledge and share technologies in the early stages of the development process, it is

difficult for competitors to imitate, [14]. Similarly, customers provide valuable insights about their preferences, needs, and expectations, which help firms to develop the products as per customers' requirements and can achieve a competitive edge over their rivals, [15].

Apart from the direct effect on CA, SI and CI can enhance NPD efficiency by improving the speed and reducing lead time. The latest version of RBV suggests that firms cannot achieve CA by just adopting rare and inimitable resources, but they have to be flexible in integrating with their suppliers and customers as their strategic partners to achieve NPD efficiency, [16]. Inputs from suppliers and customers help firms develop internal capabilities and adopt lean manufacturing by reducing inefficiencies in their development processes.

Moreover, RBV also supports the idea that the internal processes of the firm, developed strategically by cross-functional teams, can be a valuable source of CA, [17]. NPD speed allows firms to be responsive and launch the product faster than their competitors, [18]. Reducing lead time helps firms develop the product quicker than their rivals by eliminating unnecessary processes in the development stage, [19].

Finally, RBV also supports the mediation of NPD efficiency between SI and CA, as well as CI and CA. SI and CI are considered essential resources, but they can only be utilized if they collaborate with firms' internal development processes. In this case, NPD efficiency is the only way in which firms can transform external integrations into competitive results, [20].

4.1 Conceptual Framework of the Study

The conceptual framework of the study, as shown in Figure 1 is as follows:

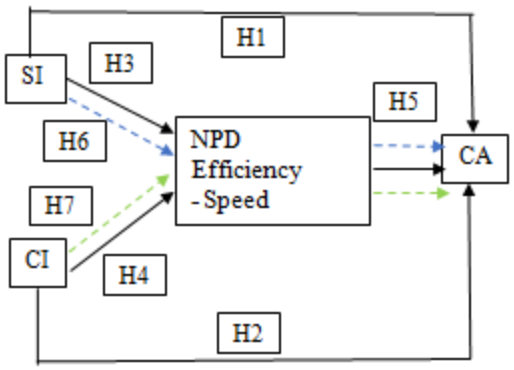

Fig. 1: Conceptual Framework

Note: Dotted lines show indirect effect, straight lines show direct effect.

Source: Created by the authors

5 Literature Review

5.1 Supplier Involvement and Competitive Advantage

According to [21], grounded in the Resource-Based View (RBV), firms can gain sustained CA through SI by improving raw material quality and reducing costs. [22] found that supplier environment factors (such as dependence, relationships, collaboration, and investment) positively affect competitive advantage in Indonesia's garment sector. Similarly, [23] reported that strategic alliances with suppliers help firms in East Java enhance competitiveness. SI supports NPD by providing external knowledge, material availability, cost efficiency, and innovative solutions, [24]. However, [25] highlighted an insignificant impact of SI on CA, resulting in reduced profitability. Therefore, the study aims to identify this gap and examine the relationship between SI and CA.

5.2 Customer Involvement and Competitive Advantage

Previous studies generally indicate that CI enhances CA. For example, [21] found a positive relationship between customer integration and CA among Indonesian manufacturers, highlighting the growing role of customers in new product design. While their study viewed customer integration as a mediator, this research positions it as a direct determinant of CA within the under-explored garment sector. Similarly, [26] confirmed its positive impact in Nigeria's apparel industry, though limited to the design phase. This study extends the scope to include sourcing, testing, and post-production. Conversely, [20] found no significant effect due to poor customer knowledge management. This study addresses these gaps in the Pakistani garment manufacturing context.

5.3 Supplier Involvement and NPD Efficiency

There is growing evidence that SI positively influences NPD efficiency, particularly regarding speed and development cost, [1], [27]. For instance, [27] found that early and extensive supplier participation enhances NPD speed by resolving technical issues early and avoiding delays. Delgado-Verde & Díez-Vial observed an indirect effect on efficiency among high-tech firms. However, [28] noted that excessive SI may hinder speed due to managerial delays. According to [29], SI in NPD reduces lead time and development cost, while the

extant literature shows conflicting views and limited impact. Therefore, this study aims to empirically test the effect of SI on NPD efficiency, given inconsistent findings, especially in the garment industry, using the RBV theory.

5.4 Customer Involvement and NPD Efficiency

According to extant literature, CI increases NPD efficiency in terms of speed. For instance, [30] found that customer participation helps firms develop and launch new products faster and speeds up the product's reach to the market. However, the authors suggest that future research is required to understand how CI helps companies strengthen their internal capabilities. This study fills this gap by examining how CI enhances speed and reduces lead time in the NPD process. On the contrary, [31] argued that customer involvement can hinder the development process through delays caused by excessive knowledge that may add challenges in the NPD process. According to [32], CI in NPD lowers lead time, whereas [33] found an adverse effect of CI on lead time. Due to these inconsistent results, this study investigates the effects of CI on NPD efficiency in terms of speed and lead time.

5.5 NPD Efficiency and Competitive Advantage

NPD efficiency is widely recognized as a key driver of CA, [34]. Studies have shown that NPD speed positively influences CA [35], while delays in product launches may lead to lower profits and market share, thus reducing CA, [35]. However, limited research has examined the specific impact of lead time on CA. While [36] suggest shorter lead times enhance performance, [37] argue that longer lead times reduce responsiveness and market competitiveness. Given this gap, the current study empirically explores how NPD efficiency, in terms of speed and lead time, contributes to CA in garment manufacturing firms.

5.6 Supplier Involvement, NPD Efficiency, and Competitive Advantage

SI is an important external resource in the NPD process that enhances CA by reducing lead time, [1]. [38] highlighted that supplier expertise helps speed up NPD, allowing firms to gain a competitive edge. [39] also linked SI to reduced lead time and emphasized its importance in achieving CA, while also suggesting the need for further empirical investigation. This study addresses that gap by investigating NPD efficiency, specifically lead time, as a mediator between SI and CA. Unlike previous research that considered NPD efficiency as an independent or dependent variable, this study considered it as a mediator. In doing so, it provides a clearer explanation of how SI leads to CA within garment manufacturing firms.

5.7 Customer Involvement, NPD Efficiency, and Competitive Advantage

CI enhances firms' CA by improving NPD efficiency. [40] found that customer engagement helps reduce lead times through proactive strategies, ensuring smooth resource flow. [30] emphasized that CI helps increase NPD speed by improving firms' ability to collect, analyze, and apply information. However, these findings are primarily from case studies lacking empirical support. This study addresses that gap by empirically examining the mediating role of NPD efficiency between CI and CA. While prior studies explored NPD efficiency as a dependent or independent variable, this research investigates its mediating role in the garment manufacturing sector. Prior studies indicate that supply chain integration and CI practices demonstrate similar patterns across emerging markets due to shared resource constraints, institutional environments, and competitive pressures. This suggests that the relationships examined in this study may extend beyond the specific context of Pakistan, particularly to small and medium-sized enterprises operating in similar emerging economy settings.

5.8 Research Hypothesis

Based on previous literature, the following are the proposed hypotheses of the present study.

H1: SI positively impacts the CA of garment manufacturing firms.

H2: CI positively impacts the CA of garment manufacturing firms.

H3: SI positively impacts the NPD efficiency of garment manufacturing firms.

H4: CI positively impacts the NPD efficiency of garment manufacturing firms.

H5: NPD efficiency positively impacts the CA of garment manufacturing firms.

H6: NPD efficiency mediates the relationship between SI and CA of garment manufacturing firms.

H7: NPD efficiency mediates the relationship between CI and CA of garment manufacturing firms.

6 Methods

This study has incorporated quantitative methods based on the positivist paradigm. The study has employed a cross-sectional design to assess the hypotheses developed based on RBV theory. The study is explanatory in nature and examines how the latent variables influence competitive advantage in garment manufacturing firms. Survey questionnaires were used in this study to collect the primary data. PLS-SEM (Partial Least Squares Structural Equation Modeling) 4.0 was used as the tool for performing inferential statistics analysis for the study.

6.1 Research Design

A causal research design is suitable for this study as it aims to examine the influence of one variable over another, [41]. This study aims to examine the direct impact of SI and CI on CA, SI and CI on NPD efficiency, and NPD efficiency on CA, as well as the indirect effect of SI and CI on CA via the mediating effect of NPD efficiency in terms of speed and lead time. Causal research is suitable for testing hypotheses and evaluating cause-and-effect relationships. Moreover, causal research helps in predicting future outcomes, which is necessary for the decision-making process, [42]. It helps companies to evaluate how extensive collaboration influences NPD efficiency and to make strategic business decisions. Based on the study's objectives, a causal research design is highly suitable for the present study.

NPD Efficiency was modeled as a reflective-reflective higher-order construct (Type I HOC) consisting of two lower-order reflective dimensions: Speed (SPD) and Lead Time (LDT), following the guidelines of [43]. The reflective-reflective specification was considered appropriate because both dimensions represent manifestations of the overall NPD efficiency construct and are conceptually interchangeable. The repeated indicators approach in SmartPLS 4 was used to estimate the higher-order construct.

6.2 Population, Sampling, and Sampling Technique

The population consists of 478 garment companies listed in the Pakistan Ready-made Garments Manufacturers and Exporters Association (PRGMEA) directory. This study employed a high-coverage purposive sampling approach using the PRGMEA directory as the sampling frame. The PRGMEA directory served as the sampling frame for the study. Questionnaires were given to all firms that were listed in the directory; however, 297 responses were collected, resulting in a response rate of 62.1%. Therefore, the study does not qualify as a census approach because the entire population was not fully covered.

The adequacy of the sample size was evaluated using the sample size guidelines, [44]. For a population of 478 firms, the minimum required sample size is 214. Since the study obtained 297 valid responses, which exceeds the minimum threshold, this confirms that the sample is sufficient for statistical analysis. In addition, the sample size meets the criteria for PLS-SEM as suggested by [43], taking into account the complexity of the structural model and the number of relationships tested.

The respondents were senior managers who were directly involved in the NPD process and served as strategic decision makers. As a result, data collected from senior managers increases the reliability of the study's findings in understanding competitive strategies in the garment sector.

6.3 Research Instruments and Data Collection

The study employed a self-administered questionnaire to gather data from the garment sector operating in Pakistan, consistent with previous research on NPD efficiency and competitive advantage, [45]. There were 478 questionnaires circulated, out of which 297 responses were gathered. The questionnaire consisted of 34 items adopted and modified from earlier studies to measure the constructs.

To verify content validity, the questionnaire was reviewed by academic experts as well as senior managers from the industry. A pilot test consisting of 32 participants was further conducted to assess reliability and revise unclear statements. All responses were measured on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), following the approach of [43] and [46]. The Cronbach's alpha values were above the threshold value of 0.7, confirming reliability. Furthermore, Inner Variance Inflation Factor (VIF) values were examined using SmartPLS 4.0 to assess multicollinearity among the predictor variables. Each item was evaluated by senior managers.

Table 1 presents the source, number of items, and measurement scale for each variable.

Table 1. Sources of Items of Constructs Used in the Study

Variables	Source	No. of Items	Scale
Competitive Advantage	Yi et al., 2021	8	1-7
Supplier Involvement	McGinnis & Vallopra, 1999	6	1-7
Customer Involvement	Feng et al., 2014	8	1-7
Speed	Lyu et al., 2022; Le & Lei, 2018	6	1-7
Lead Time	Hallgren & Oskarsdottir, 2021	6	1-7

Source: Compiled from [47], [48], [49], [50], [51], and [52]

Since the study employed a cross-sectional and self-reported survey design, common method bias (CMB) was assessed. Harman's single-factor test revealed that the first factor accounted for less than 50% of the total variance, indicating that CMB was not a serious concern. In addition, full collinearity variance inflation factor (VIF) values were assessed following [53], and all values were below the threshold of 3.3 as presented in Table 2 (Appendix), further confirming the absence of substantial common method bias.

7 Results

7.1 Analysis of Construct Reliability and Convergent Validity

Cronbach's alpha and composite reliability values were above 0.7, demonstrating acceptable construct reliability, [43]. As shown in Table 2 (Appendix), all constructs exceeded this threshold, confirming reliability. Additionally, SmartPLS 4.0 results show that each indicator had an AVE above 0.5 and factor loadings above 0.7, meeting the criteria for convergent validity, [54].

7.2 Discriminant Validity

Discriminant validity confirms that each latent variable is sufficiently different from the other variables in the model. As presented in Table 3, the square root of the AVE for every construct (diagonal values) exceeds the correlations with the remaining constructs, fulfilling the requirement of the Fornell-Larcker criterion, [55].

Table 3. Discriminant validity test based on the Fornell-Larcker criterion

Variables	CA	CI	LDT	SI	SPD
CA	**0.834**				
CI	0.714	**0.802**			
LDT	0.754	0.655	**0.798**		
SI	0.765	0.640	0.729	**0.783**	
SPD	0.773	0.715	0.671	0.660	**0.829**

Source: Author's calculation using Smart PLS-SEM 4.0 (algorithm)

In addition to the Fornell-Larcker criterion, discriminant validity was further assessed using the Heterotrait-Monotrait (HTMT) ratio, as recommended by [56]. All HTMT values were below the conservative threshold of 0.85, confirming satisfactory discriminant validity among the constructs, as shown in Table 4.

Table 4. Heterotrait-Monotrait ratio (HTMT)

Variables	CA	CI	LDT	SI	SPD
CA					
CI	0.762				
LDT	0.815	0.722			
SI	0.824	0.703	0.821		
SPD	0.829	0.779	0.746	0.727	

Source: Author's calculation using Smart PLS-SEM 4.0 (algorithm)

Before assessing the structural relationships, full collinearity variance inflation factor (VIF) values were examined following the recommendation of [53]. VIF values lower than 3.3 suggest that multicollinearity and common method bias are not present. As shown in Table 5, all VIF values were within the recommended threshold, indicating that these issues were not problematic in the study.

Table 5. Full Collinearity VIF Values

Predictor Relationships	VIF
SI -> CA	2.425
CI -> CA	2.355
SI -> NPD Efficiency	1.695
CI -> NPD Efficiency	1.695
NPD Efficiency -> CA	3.280

Source: Author's calculation using Smart PLS-SEM 4.0 (algorithm)

7.3 Assessment of the Structural Model

All outer loadings for constructs, including SI, CI, NPD efficiency (speed and lead time), and CA, were above 0.7, confirming convergent validity, as displayed in Figure 2.

Figure 2 also explains R^2 values, which indicate the model's explanatory power. SI and CI explained 69.5% of the variance in NPD efficiency, 84.9% in speed, and 82.2% in lead time. Combined, SI, CI, and NPD efficiency accounted for 74.9% of the variance in CA.

Path analysis in Figure 2 revealed positive relationships: SI → CA (0.283), CI → CA (0.152), SI → NPD efficiency (0.472), CI → NPD efficiency (0.449), and NPD efficiency → CA (0.507). NPD Efficiency also showed strong paths to its dimensions: Speed (0.921) and Lead Time (0.907).

The higher-order construct assessment confirmed that NPD Efficiency was adequately represented by its two lower-order dimensions. The paths from NPD Efficiency to Speed (0.921) and Lead Time (0.907) exceeded the recommended threshold, confirming strong reflective relationships. In addition, the correlation between SPD and LDT was positive and substantial (r = 0.671), supporting the appropriateness of the reflective-reflective higher-order construct specification. The repeated indicators approach also demonstrated satisfactory representation of the higher-order construct within the SmartPLS estimation procedure.

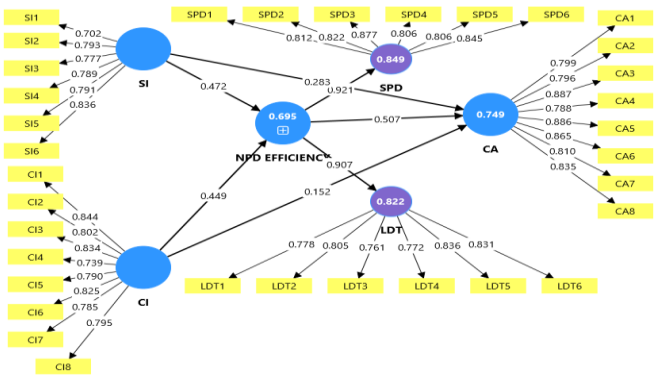

Fig. 2: Representation of the Structural Model of the Study

Source: SmartPLS-SEM 4.0

7.4 Hypotheses Test Results

This section presents the results of hypothesis testing based on data summarized in Table 6.

For a one-tailed hypothesis at a 95% confidence level, the p-value should be less than 0.05 while the t-value should be greater than 1.65, [43]. The hypothesis testing results in Table 6 confirm that all proposed relationships meet this criterion and therefore are positive and statistically significant.

Table 6. Result of the Hypothesis

Hypotheses	Relationships	Beta	T Statistics	P values	Results
	Direct Effect				
H1	SI -> CA	0.283	3.807	0.000	Supported
H2	CI -> CA	0.152	2.764	0.003	Supported
H3	SI -> NPD Efficiency	0.472	8.632	0.000	Supported
H4	CI -> NPD Efficiency	0.449	9.244	0.000	Supported
H5	NPD Efficiency -> CA	0.507	5.714	0.000	Supported
H6	SI -> NPD Efficiency -> CA	0.239	3.975	0.000	Supported
H7	CI -> NPD Efficiency -> CA	0.227	5.716	0.000	Supported

Source: Author's calculation using Smart PLS-SEM 4.0 (Bootstrapping)

For example, Supplier involvement (SI) shows a significant positive effect on competitive advantage (CA) ($\beta = 0.283$, $t = 3.807$, $p = 0.000$). Similarly, customer involvement (CI) also has a positive and significant impact on CA ($\beta = 0.152$, $t = 2.764$, $p = 0.003$). Regarding NPD efficiency, both SI ($\beta = 0.472$, $t = 8.632$, $p = 0.000$) and CI ($\beta = 0.449$, $t = 9.244$, $p = 0.000$) demonstrate strong positive effects. In addition, NPD efficiency itself significantly enhances CA ($\beta = 0.507$, $t = 5.714$, $p = 0.000$). The mediation results also confirm that NPD efficiency plays a significant mediating role in the relationship between SI and CA ($\beta = 0.239$, $t = 3.975$, $p = 0.000$) as well as between CI and CA ($\beta = 0.227$, $t = 5.716$, $p = 0.000$). Overall, the findings indicate that both SI and CI contribute to CA directly and indirectly through improved NPD efficiency.

8 Discussion

The findings of H1 and H2 indicate that supplier involvement (SI) and customer involvement (CI) positively influence competitive advantage (CA). This suggests that integrating suppliers' and customers' knowledge in the new product development (NPD) process improves decision-making and operational efficiency. Early collaboration helps identify design errors, manage lead time through efficient sourcing, and better understand market demand. Such integration of external knowledge contributes to faster NPD processes and improved competitiveness for

garment manufacturing firms. These results are also supported by the resource-based view (RBV), which explains that when external knowledge from suppliers and customers is effectively integrated into internal processes, it becomes a valuable and difficult-to-imitate resource that strengthens competitive advantage.

The results for H3 and H4 show that both SI and CI have a significant positive impact on NPD efficiency, especially by improving development speed and shortening lead time. Suppliers and customers play an important role by sharing information related to raw materials, technological changes, and market trends, which enhances coordination and planning in product development activities. For example, suppliers may provide digital fabric resources that speed up the design process, while early customer feedback helps minimize delays in product modifications. Such collaboration improves coordination and efficiency within the NPD process.

The findings of H5 indicate that NPD efficiency positively impacts CA. Efficient NPD processes allow firms to respond quickly to changing market demands, which is especially important in fast-changing industries like garment manufacturing. Firms with faster development speed and shorter lead times can launch products earlier, thereby achieving first-mover advantages. Moreover, information systems like Product Lifecycle Management (PLM) can enhance NPD efficiency and help sustain CA over time.

Finally, the results of H6 and H7 confirm that NPD efficiency mediates the relationships between SI and CA as well as between CI and CA. This indicates that the benefits of supplier and customer involvement are realized through improved NPD efficiency. Real-time information sharing through ERP and CRM enables firms to incorporate supplier and customer knowledge into product development processes. These findings support the RBV view that combining external resources with internal capabilities creates valuable, unique, hard-to-imitate competencies that enhance competitive position.

While the empirical context of this study is Pakistan, the findings are likely to be relevant for other emerging economies where firms operate under similar structural and institutional conditions. The role of supplier and customer involvement in enhancing new product development and competitive advantage may therefore extend to comparable manufacturing sectors in countries with similar economic and industrial profiles. Although this study examines larger garment firms, the findings demonstrate that stakeholder integration and internal capability leveraging can guide firms of various sizes, including SMEs, in improving competitive advantage.

9 Implications of the Study

9.1 Theoretical Implication

The present study contributes several important theoretical advancements valuable to academic researchers. First, it opens new avenues for future inquiry by integrating CI literature within the context of NPD. CI is shown to support the creation of products that meet current and future market needs; however, its impact on CA has been under-explored. This study broadens the understanding of CI as a strategic asset for gaining CA. Second, previous research on the relationship between SI and CA has found inconsistent findings. This study provides an understanding by showing both direct and indirect effects of SI on CA. Third, a major theoretical contribution is the role of NPD efficiency as a mediator between SI and CI on CA. Prior studies have focused on individual dimensions of NPD efficiency (like speed or lead time). This research integrates both components (speed and lead time) using a second-order construct. This broader approach enhances the study's novelty and provides stronger theoretical support. Finally, very few studies have examined these relationships in the garment manufacturing sector. By focusing on this industry, the study addresses an essential research gap and provides insights for a major export-oriented sector.

9.2 Practical Implication

The study offers several practical implications for SMEs in the garment manufacturing sector. It highlights the strategic importance of SI and CI in the NPD process to improve NPD efficiency and achieve CA. Small firms often face challenges such as limited resources, longer development cycle times, and operational inefficiencies. The results suggest that supplier collaboration can improve material quality, reduce lead times, and enhance production efficiency, while early CI reduces market uncertainty by better understanding customer needs and minimizes redesign costs.

For entrepreneurs, external collaborations can help make full use of supplier expertise and customer feedback while securing their internal

resources. As a result, small firms can speed up product development and improve delivery performance without investing significantly in capital infrastructure.

10 Conclusion, Limitations, and Future Research

The study concludes that SI and CI play a significant role in enhancing CA in the garment sector by improving NPD efficiency, particularly in terms of cost, development speed, and lead time. By combining external knowledge with internal capabilities, firms can strengthen innovation activities and achieve sustainable CA. The findings contribute to both theory and practice by emphasizing the importance of stakeholder integration in improving firm performance.

Despite these contributions, there are several limitations. First, the study focuses only on the garment manufacturing sector, which may reduce the generalizability of the results compared to other industries. Future research may examine the proposed model in industries such as automobiles and pharmaceuticals, as well as in different geographical contexts, such as other developing countries. Second, the study uses a quantitative research design only; future studies may benefit from qualitative or mixed-method approaches to obtain better results. Third, the study examines only limited dimensions of NPD efficiency; future research may include additional factors such as development cost and time-to-market. Fourth, CI is treated as a single latent variable; however, future research may examine its sub-dimensions, such as CI as an information source and CI as a co-developer.

Although the study is conducted in Pakistan, future research may validate the model in different contexts to examine its broader implications, particularly in similar emerging countries.

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APPENDIX

Table 2. Results Summary for Construct's Reliability and Validity

First Order Construct	Second Order Construct	Items	Loadings	Alpha	CR	AVE
SI		SI1	0.702	0.873	0.880	0.613
		SI2	0.793			
		SI3	0.777			
		SI4	0.789			
		SI5	0.791			
		SI6	0.836			
CI		CI1	0.844	0.921	0.944	0.696
		CI2	0.802			
		CI3	0.834			
		CI4	0.739			
		CI5	0.790			
		CI6	0.825			
		CI7	0.785			
		CI8	0.795			
NPD Efficiency	SPD	SPD1	0.812	0.908	0.909	0.686
		SPD2	0.822			
		SPD3	0.877			
		SPD4	0.806			
		SPD5	0.806			
		SPD6	0.845			
	LDT	LDT1	0.778	0.885	0.886	0.636
		LDT2	0.805			
		LDT3	0.761			
		LDT4	0.772			
		LDT5	0.836			
		LDT6	0.831			
CA		CA1	0.799	0.938	0.944	0.696
		CA2	0.796			
		CA3	0.887			
		CA4	0.788			
		CA5	0.886			
		CA6	0.865			
		CA7	0.810			
		CA8	0.835			

Note: AVE represents Average Variance Extracted, CR represents Composite Reliability,
Source: Author's own work using Smart PLS-SEM

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Mehdi Abbas contributed to the conceptualization of the study, literature review, questionnaire development, data collection, data analysis, interpretation of the results, manuscript writing, and revision.
- Dr. Ezanee Bin Mohamed Elias contributed to the development of the research idea, supervision, review of the manuscript, and intellectual guidance.
- Dr. Faisal Bin Zulhumadi contributed to the development of the research idea, supervision, review of the manuscript, and intellectual guidance. All authors read and approved the final version of the manuscript.

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