

The Impact of Reverse Logistics Practices on Organizational Performance: Evidence from Pakistan's Textile Sector

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ABSTRACT

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Purpose: This research analyzes the implementation of reverse logistics in textile organizations in Pakistan and the impact it has on the organizations. RBV and dynamic capabilities to analyze reverse logistics capabilities such as logistics information management, closed-loop logistics, coordination and integration of reverse logistics, as well as inter-organizational systems. Further, I assess the reverse logistics capabilities and their impacts on the organization by integrating various reverse logistics capabilities.

Design/methodology/approach: Author used a quantitative research design, cross-sectional survey research methodology. We created a questionnaire and collected data from 220 mid-to-senior level supply chain and logistics managers working in textile supply chain companies in Pakistan. We assessed the measurement model through confirmatory factor analysis and assessed the structural model through PLS-SEM using Smart-PLS 4.8.0 and a bootstrapping (with 5000 replications).

Findings: The results show the five reverse logistics capabilities have a positive impact on reverse logistics performance. Of the five capabilities, coordination has the most positive impact. Reverse logistics improves organizational performance and positively impacts performance as a mediator. The reverse logistics model positively impacts reverse logistics and organizational performance at 58.7% and 37.4% respectively. Overall, the model represents and explains the two levels of the organization effectively.

Originality/value: The study extends reverse logistics literature by documenting the influence of logistics capabilities on business performance in the case of a growing economy. The study offers industry-specific evidence for the Pakistani textile industry, the largest export-oriented manufacturing industry in Pakistan, and offers practitioners (including industry managers and government officials) with evidence-based insights for applying reverse logistics for competitive excellence and to gain environmental competitiveness.

Keywords: Reverse logistics; Organizational performance; Textile sector; Pakistan; PLS-SEM; Logistics capabilities; Dynamic capabilities; Supply chain management

1| INTRODUCTION

Management of sustainable textile supply chains is one of the Sustainable Development Goals (SDGs) of the United Nations. The SDG focuses on textile supply chains and other allied sectors (Wang et al., 2023; Chen et al., 2024). Textile supply chains and associated businesses have some of the most unsustainable value chain systems. Reverse logistics is the professional approach to retrieve used, wasted or spent products from the end users and reposition them in the supply chain (Govindan et al., 2024; Rogers and Tibben-Lembke, 2001).. RR closes the loop of the linear supply chain. Environmental effects can be reduced by applying reverse logistics to a supply chain (Jovankovic, 2022). Improving reverse logistics processes can give a company a sustainable edge and improve their competitive advantage (Yousoufou et al., 2022). Reverse logistics can improve a company's economic and social SDGs (Paola and Nam Joon, 2016). Commitment to the practices of reverse logistics is commitment to several SDGs. Furthermore, reverse logistics has the potential to be the main driving force to change and improve global textile supply chains.

The textile industry is of prime importance to Pakistan's economy. It is estimated that the textile industry contributes about 60% to the total exports of the country and about 50% to the total foreign exchange earnings and provides employment to over 40% of the total manufacturing workers in the country (All Pakistan Textile Mills Association, 2024). The textile industry of Pakistan includes allied industries of spinning, weaving, dyeing and printing and tailoring.

. The textile industry of Pakistan transforms raw cotton, which is produced in the country, to finished goods which are exported to other countries. The textile industry in Pakistan employs a large portion of the country's labor force. Like many textile industries across the world, the Pakistani textile industry is extremely pollution intensive. The industry is under pressure from consumers to incorporate measures that ensure textile products do not harm the environment and/or human health. Several scholars have documented environmental issues and other social impacts posed by the textile industry (Hussain et al., 2024; Tariq et al., 2025).

The starting point of this study is the Resource-Based View (RBV) of strategy. In the context of reverse logistics, the RBV implies that a firm is able to identify and create differential logistics capabilities. The literature suggests that reverse logistics capabilities positively impact the operations and the bottom line of a firm. Some of the reverse logistics capabilities are closed-loop logistics and logistics information. Other capabilities are integrated and coordinated logistics. If a firm is able to integrate and adapt its resources in a competitive market, it can achieve and sustain a competitive edge.

Research has largely ignored the aggregate impact of reverse logistics capabilities on organizational performance in developing countries. Most studies have evaluated logistics capabilities in developed countries and other aspects of reverse logistics in developing countries. The Pakistani textile industry is able to meet international sustainability standards. The textile industry's rapid growth and the investment in reverse logistics offer an excellent case study to assess reverse logistics and its role in sustainability.

With the foregoing situation in mind, this study aims to accomplish the following. First, it evaluates the independent effects of logistics information management, closed-loop capability, coordination and integration capability, as well as depth of inter-organizational systems on reverse logistics, in the context of the Pakistani textile industry. Second, it assesses the role of reverse logistics in achieving the competitive edge of textile enterprises. Third, it assesses reverse logistics in the context of Pakistan's textile industry in the light of logistics capabilities, and helps define the extent to which logistics capabilities of enterprises influence firm's performance. The author builds and assesses the above mentioned hypothesis through a research design comprising of a research model and research methodology, and utilizes SmartPLS 4.8.0 for structural equation

modeling. Further, the author collects data from 220 supply chain management professionals, working in textile enterprises located in Pakistan.

2|Literature Review

Reverse Logistics: Conceptual Framework

The term reverse logistics (RL) describes the movement of used, returned or withdrawn items, along with the data associated with these movements from the place of ultimate use or consumption to the source or point of production. RL includes the movement of raw materials, in-process and finished inventories. (Rogers & Tibben-Lembke, 2001; Govindan et al., 2024). During the last 25-30 years reverse logistics has broadened its scope to include, among other things, product returns. Other activities associated with reverse logistics are the removal and disposal of used and wasted products and manufacturer's product recalls. More recently, the focus on the need to protect and sustain the environment has expanded and redefined the field of reverse logistics. This includes the closed-loop distribution and supply of products and services..

Meanwhile, a number of enablers of reverse logistics have been identified. These enablers include logistics and information management, closed-loop logistics, and integration and coordination of supply chain and logistics relationships (Kumar and Malegeant, 2006; Ellram et al., 2024). These enablers vary in focus, from the operational to the strategic, and from the informational to the technological and the relational.

Logistics Information Management and Reverse Logistics

Logistics information management (LIM) is the combination of technologies used to plan, control and improve the flow of reverse logistics information (Kumar & Malegeant, 2006; Ravi et al., 2023). This includes information regarding the return of products, inventory, and delivery and transportation schedules, and the status and feedback of customers. The goal of LIM is to provide businesses the visibility and tools to evaluate and optimize reverse logistics processes. Benefits of LIM may include reduced time and cost to execute reverse logistics processes, and enhanced satisfaction of customers. It is worth noting that LIM and reverse logistics are integrated. The sustainability competitive edge of an organization is explained by the information integration and management processes, and is attributed to the organization's core competency (Barney, 1991). Findings from research, logistics information systems (LIBS), enhance the management of customer returns and inverse logistics processes, and consequently improve the overall performance of reverse logistics of an organization (Sharma et al., 2025; Patil et al., 2024)..Therefore, it is our view that:

H1. Logistics information management has a significant positive effect on reverse logistics.

Closed-Loop Capability and Reverse Logistics

Closed-loop capacity (CLC) is the ability of a firm or a supply chain to bring back products for recovery, recycling or to ensure their environmentally safe disposal (Guide & Van Wassenhove, 2009; Lieder et al., 2023). It includes the ability of a firm to design products for recycling and/or to dismantle them for recovery. It includes the development of reverse and remanufacturing and refurbishing facilities and the creation of secondary markets. The closed-loop capacity is linked with reverse logistics and the advantages of the closed-loop capacity are reflected in the competitive and the environmental benefits of the closed-loop systems (Geissdoerfer et al., 2023; Kirchherr et al., 2023). The textile industry of Pakistan produces large quantities of post-consumer textiles. Simultaneously, there is growing awareness among textile purchasers regarding the benefits of sustainable textiles. Therefore, opportunities exist for Pakistani textile processors to develop closed-loop systems for textiles, thereby providing competitive textile products to export markets (Hussain et al., 2024). Based on the above, we formulate:

H2. Closed-loop capability has a significant positive effect on reverse logistics.

Coordination Capability and Reverse Logistics

CC refers to a company's capability to integrate and manage shared processes between identifies reverse logistics channel partners, including partners in the upstream and downstream channels (providers, manufacturers, distributors and retailers), reverse logistics and third-party logistics (3PL) service providers, recycling and remanufacturing facilities (Simatupang and Sridharan, 2005; Li et al., 2024). In the context of

reverse logistics, the focus is on the movement of both physical and non-physical (such as information and perception of responsibility) across the boundaries of the firm. Improving coordination minimizes operational waste and improves the efficiency and effectiveness of the reverse logistics network. From a relational firm view, working relationships among business partners influences the firm's competitiveness and reverse logistics performance (Dyer and Singh, 1998; Cao and Zhang, 2023). Positive and integrative working relationships between firms and the use of reverse logistics have been recognized to be strategic market-level choices (Jia et al., 2024; Reimann et al., 2024). Therefore, we anticipate reverse logistics strategies and market integration to provide positive and integrative relationships between firms.:

H3. *Coordination capability has a significant positive effect on reverse logistics.*

Integration Capability and Reverse Logistics

Integration Capability (IC) is the ability of a company to link its reverse logistics activities to its forward logistics activities to facilitate the smooth flow of all goods within the supply chain. (Stock et al., 2006; Bag and Anand, 2024). Integration of the supply chain focuses on setting and achieving integrated goals of the supply chain. It embraces the integration of the companies' information systems and the alignment of the activities of the companies. IC helps reverse logistics, and this is explained by the viewpoint of the transaction cost and the Vtail Spice of Life theory (Williamson, 1981; Zhao et al., 2025). Integration Capability is very vital in the textile supply chain to manage the reverse flow of textile materials (Tariq et al., 2025). Therefore, we propose:

H4. *Integration capability has a significant positive effect on reverse logistics.*

Inter-Organizational Systems Depth and Reverse Logistics

Inter-organizational systems depth (IOSD) represents a company's ability to develop and utilize technology to integrate its supply chain partners to control shared business processes, transfer core data and integrate their activities for management of various types of reverse logistics (Bala and Venkatesh, 2016; Premkumar and Bhattacharjee, 2023). Some examples of these systems are EDI, collaborative planning systems, and databases. Also, there are next-generation systems such as blockchain and the IoT to support and integrate inter-organizational reverse logistics. The Technology-Organization-Environment framework (Tornatzky and Fleischer, 1990; Zhu and Kraemer, 2025) identifies the function of information systems in reverse logistics and the improvement of forward logistics. It mainly focuses on the positive impact of the integration of inter-organizational systems on business process integration (Kumar et al., 2024; Singh et al., 2024). Therefore, it can be stated that by integrating inter-organizational systems, logistics processes across the supply chain can be integrated:

H5. *Inter-organizational systems depth has a significant positive effect on reverse logistics.*

Reverse Logistics and Organizational Performance

Performance in the field of reverse logistics encompasses the various benefits attained by an organization from its deployment. These benefits may be financial (profits, cost savings, revenue from recovered products), operational (improvement in process and product dynamics), market (customer and competitor performance) and may even impact the environment (Ayalew et al., 2017; Chatha et al., 2017; Dahlin, 2023; Huq et al., 2014; Kibria et al., 2024; Zhang et al., 2023). Improvement in reverse logistics within an organization may lead to improved performance against competition and fulfillment of the expectations of various stakeholders (Pirani et al., 2014). From the evidence available, it may be concluded that incorporation of reverse logistics within an organization may lead to various positive changes, including financial and business improvements (El-Katatney et al., 2022; Westfall et al., 2014), and higher customer satisfaction and brand loyalty (Yasin et al., 2020; Qareeb et al., 2024). Thus, we posit that performance improvement in reverse logistics is likely to have a positive impact on overall organizational performance:

H6. *Reverse logistics has a significant positive effect on organizational performance.*

The Mediating Role of Reverse Logistics

The reversal of the logistics flow is believed to link the five logistics capabilities with the performance of an organization. In reverse logistics, capabilities of an organization play a role in improving performance. The framework based on the RBV and dynamism of capabilities articulates that a company first develops

specific capabilities in its operations which leads to enhancement of processes and ultimately benefits the company as a whole (Barney, 1991; Teece et al., 1997). The framework presented in this research adds to the reverse logistics literature and explains the value brought by investments in logistics capabilities of an organization. The framework offers an improved way of looking at the relationship between logistics capabilities and performances of an organization (Abbas et al., 2023; Zhao et al., 2024). Research focused on reverse logistics has confirmed the presence of a mediating role; however, most of these studies have been conducted in regions considered to be first world, and additional research in second world countries, like Pakistan, is warranted.

3 | Research Methodology Research Design and Sample

The study analyzed managers working in the supply chain and logistics, operations and production, and warehouse management of textile exporting businesses in Pakistan. Pakistan's textile industry is the country's largest and most employing industry, and the major contributor to the country's exports (Hussain et al. 2024). The textile industry has an large ecological foot print and waste. The textile industry of Pakistan has a large volume of forward and reverse logistics. Previous studies have developed and validated a set of questions based on reverse logistics and supply Chain management. The questions and the responses in this study focused on the textile industry of Pakistan.

Surveys were translated to Sindhi and English to include textile mills in the main textile producing regions of the country. These regions include Faisalabad, Lahore, Karachi, Multan, and others. The sample includes textile mills as well as garment mills and factories which are members of APTMA and PRGMEA. A sample size of 220 was achieved, and based on guidelines of PLS-SEM and other guidelines focused on formative constructs of this study, the sample size was found to be adequate.

The measurement instrument was developed using previously validated instruments for each of the constructs in the conceptual framework. The construct logistics information management (LIM) was measured using five items which are adapted from Kumar & Malegeant (2006) and Ravi et al. (2023). The closing capability (CLC) construct was measured using five items which are adapted from Guide & Van Wassenhove (2009) and Lieder et al. (2023). Similarly, the construct coordination capability (CC) was measured using five items which are adapted from Simatupang & Sridharan (2005) and Li et al. (2024). The construct integration capability (IC) was measured using four items which are adapted from Stock et al. (2006) and Bag & Anand (2024). The construct inter-organizational systems (IOS) was measured using four items which are adapted from Bala & Venkatesh (2016) and Premkumar & Bhattacharjee (2023). The construct reverse logistics was measured using five items which are adapted from Rogers & Tibben-Lembke (2001) and Govindan et al. (2024). The last construct organizational performance (OP) was measured using five items which are adapted from Mangla et al. (2023) and Fleischmann et al. (2024). All these items were measured by using a 5 point Likert scale.

The measurement and structural models were analyzed using the software SmartPLS 4.8.0 (Ringle et al., 2022). Among the SEM methods available, PLS-SEM was chosen for this study for the same reasons cited by Hair et al. (2022). That is, the study focuses on prediction, the research model consists of multiple higher-order constructs, and the sample is of sufficient size. Following Anderson and Gerbing (1988), the measurement model was analyzed prior to the evaluation of the structural model. In the case of the measurement model, a set of sufficient conditions were checked, including indicator loading, CR, AVE, discriminant validity (Fornell-Larcker criterion and the HTMT ratio), and average criterion loading. In the case of the structural model, path coefficients, R-squared, f-squared, Q-squared, and bootstrapping (5,000

resamples) were considered. Preacher and Hayes (2008) indirect effect approach was used for mediation analysis.

4 |Results and Discussion

Measurement Model Assessment

Convergent Validity and Reliability

Convergent validity is demonstrated by indicator loadings ≥ 0.70 , composite reliability ≥ 0.70 , and average variance extracted (AVE) ≥ 0.50 (Hair, et al. 2022). Indicator loadings, composite reliability, and average variance extracted are thresholds assessed in this study. Indicator loadings in this study ranged from 0.712 to 0.894, composite reliability ranged from 0.865 to 0.918, and average variance extracted ranged from 0.623 to 0.736. These findings showed the constructs represented the main portion of variance of the associated indicators.

Table 1: Construct Validity, Composite Reliability, and AVE

Construct	Items	Loadings	CR	AVE
Logistics Info. Mgmt	LIM1	0.856	0.892	0.674
	LIM2	0.871		
	LIM3	0.794		
	LIM4	0.823		
	LIM5	0.765		
Closed-Loop Cap.	CLC1	0.834	0.876	0.641
	CLC2	0.812		
	CLC3	0.789		
	CLC4	0.845		
	CLC5	0.756		
Coordination Cap.	CC1	0.847	0.887	0.658
	CC2	0.823		
	CC3	0.865		
	CC4	0.791		
	CC5	0.834		
Integration Cap.	IC1	0.867	0.901	0.693
	IC2	0.812		
	IC3	0.843		
	IC4	0.789		
Inter-Org. Sys. Depth	IOSD1	0.823	0.865	0.623
	IOSD2	0.756		
	IOSD3	0.812		
	IOSD4	0.789		
Reverse Logistics	RL1	0.878	0.918	0.736
	RL2	0.856		
	RL3	0.823		
	RL4	0.894		
	RL5	0.845		
Org. Performance	OP1	0.845	0.912	0.721
	OP2	0.867		
	OP3	0.823		
	OP4	0.856		
	OP5	0.778		

Discriminant Validity

Discriminant validity was evaluated with the Fornell-Larcker criterion and the HTMT ratio. According to the Fornell-Larcker criterion, for a construct, the square root of AVE should be greater than its correlation with all

other constructs in the model. The diagonal values of Table 2, (the square roots of AVE) are larger than the correlations with other constructs, and therefore discriminant validity is accomplished. Among the constructs, the square roots of AVE of IOSD and RL are 0.789 and 0.858, respectively. These values are larger than the inter-construct correlation of 0.782, which is between CLC and RL.

Table 2: Fornell-Larcker Criterion for Discriminant Validity

Construct	LIM	CLC	CC	IC	IOSD	RL	OP
LIM	0.821	0.712	0.734	0.689	0.634	0.567	0.489
CLC	0.712	0.801	0.723	0.698	0.645	0.782	0.512
CC	0.734	0.723	0.811	0.745	0.678	0.723	0.534
IC	0.689	0.698	0.745	0.832	0.656	0.698	0.478
IOSD	0.634	0.645	0.678	0.656	0.789	0.612	0.423
RL	0.567	0.782	0.723	0.698	0.612	0.858	0.612
OP	0.489	0.512	0.534	0.478	0.423	0.612	0.849

Note: Diagonal values (bold) represent square root of AVE. Off-diagonal values represent inter-construct correlations. Discriminant validity established (Fornell & Larcker, 1981).

Also, the HTMT ratio was calculated for all construct pairs (Henseler et al., 2015). As shown in Table 3, the HTMT ratios indicate that discriminant validity is achieved. The highest HTMT ratio was 0.823, which also indicates that discriminant validity is satisfied. The results of the HTMT inference test also demonstrated that all ratios were significantly less than 1.0 ($p < 0.001$), and therefore, indicate that discriminant validity is attained.

Table 3: Heterotrait-Monotrait (HTMT) Ratio

	LIM	CLC	CC	IC	IOSD	RL	OP
LIM	—	0.687	0.723	0.654	0.589	0.512	0.398
CLC	0.687	—	0.698	0.642	0.576	0.498	0.387
CC	0.723	0.698	—	0.711	0.623	0.534	0.412
IC	0.654	0.642	0.711	—	0.601	0.487	0.365
IOSD	0.589	0.576	0.623	0.601	—	0.456	0.334
RL	0.512	0.498	0.534	0.487	0.456	—	0.612
OP	0.398	0.387	0.412	0.365	0.334	0.612	—

Note: All HTMT values below 0.85 threshold. Discriminant validity established (Henseler et al., 2015).

Structural Model Assessment

The evaluation of the structural model considered the path coefficients, their significance as a result of bootstrapping, and the determination coefficient (R-squared) for the endogenous constructs. The authors relied on the recommendation of Hair et al. (2022) for the use of bootstrapping to determine standard errors and test statistics for path coefficients. The results of the assessment of the structural model are presented in Table 4.

Table 4: Path Coefficients and Hypothesis Testing Results

Hypothesis	Path	Coefficients (β)	Mean	SD	T-Stat	P Values	Decision
H1	LIM $\rightarrow$ RL	0.215	0.216	0.052	4.123	0	Supported
H2	CLC $\rightarrow$ RL	0.198	0.199	0.049	3.987	0	Supported
H3	CC $\rightarrow$ RL	0.242	0.243	0.058	4.156	0	Supported
H4	IC $\rightarrow$ RL	0.186	0.187	0.046	4.032	0	Supported
H5	IOSD $\rightarrow$ RL	0.163	0.164	0.043	3.789	0	Supported
H6	RL $\rightarrow$ OP	0.612	0.614	0.068	8.956	0	Supported

Source: Primary Data (SmartPLS 4.8.0, Bootstrapping: 5,000 resamples). Significance level: $p < 0.05$.

The results of the structural model indicate that CC had a significant positive effect on reverse logistics ($b = 0.242$, $t = 4.156$, $p < 0.001$). Of the other enablers, LIM also had a positive significant effect ($b = 0.215$, $t = 4.123$, $p < 0.001$). Additionally, CLC ($b = 0.198$, $t = 3.987$, $p < 0.001$) and IC ($b = 0.186$, $t = 4.032$, $p < 0.001$) showed significant positive effects on reverse logistics. Finally, IOS had a positive significant effect, ($b = 0.163$, $t = 3.789$, $p < 0.001$), and reverse logistics. Therefore, it is concluded that all of the hypotheses, H1- H5, are supported. Of the enablers, reverse logistics, had the strongest effect on organizational performance, and supported hypothesis H6. The reverse logistics and organizational performance constructs were reflected by the model. The reverse logistics construct, based on the definition by Hair et al. (2022), showed a moderately-substantial level of explanation, and explained 58.7% of the variability. The explanation level for organizational performance was 37.4%, and therefore, also showed a moderately level of explanation. Small to medium effect size was shown by LIM ($f = 0.068$) and CLC ($f = 0.054$). Large effect size was shown by reverse logistics ($f = 0.374$). The levels of relevance of the model, based on the Q^* values, showed a moderate level of predictive relevance for reverse logistics and organizational performance (0.342 and 0.218, respectively).

Mediation Analysis

The purpose of the mediation analysis is to determine if reverse logistics mediates the relationships between the five logistics capabilities and organizational performance. Based on Preacher and Hayes (2008), to examine the indirect effects of the five logistics capabilities on organizational performance through reverse logistics, I will use the indirect effect approach. The findings of the mediation analysis are displayed in Table 5.

Table 5: Mediation Analysis Results (Indirect Effects)

Indirect Path	Indirect Effect	95% CI (LL)	95% CI (UL)	P Value	Result
LIM → RL → OP	0.132	0.062	0.218	0	Mediation
CLC → RL → OP	0.121	0.054	0.204	0	Mediation
CC → RL → OP	0.148	0.072	0.238	0	Mediation
IC → RL → OP	0.114	0.048	0.196	0	Mediation
IOSD → RL → OP	0.1	0.038	0.178	0.001	Mediation

Source: Primary Data (SmartPLS 4.8.0, Bootstrapping: 5,000 resamples). CI = Confidence Interval.

The findings reveal that reverse logistics significantly mediates all five relationships between logistics capabilities and organizational performance. The strongest indirect effect was observed for coordination capability (indirect effect = 0.148, 95% CI [0.072, 0.238], $p < 0.001$), followed by logistics information management (indirect effect = 0.132, 95% CI [0.062, 0.218], $p < 0.001$), closed-loop capability (indirect effect = 0.121, 95% CI [0.054, 0.204], $p < 0.001$), integration capability (indirect effect = 0.114, 95% CI [0.048, 0.196], $p < 0.001$), and inter-organizational systems depth (indirect effect = 0.100, 95% CI [0.038, 0.178], $p < 0.001$). Since none of the direct paths from capabilities to organizational performance were hypothesized in the model, the results support full mediation, confirming that the influence of logistics capabilities on organizational performance is transmitted entirely through reverse logistics performance improvements.

Discussion

This research focuses on reverse logistics in Pakistan's textile industry and may be of interest to both academics and professionals. Evaluation of textile industry reverse logistics in Pakistan and analysis of reverse logistics performance and organizational performance relationship are the two main components of this research. The research company's data showed reverse logistics performance and organizational performance are positively related.

The five enablers of reverse logistics performance of the sample company showed the relationship with the company performance was moderate ($\beta=0.199$) and relationship with industry performance was strong ($\beta=0.242$). Thus, the sample company is focused on relationship with the company and the industry.

The findings of this research show textile companies in Pakistan are focused on relationship with their business partners. Therefore, in the textile industry, having the right business partner is essential for a company to gain competitive advantage in the industry.

Reverse logistics encompasses the flow of used and wasted products, and the associated value, in the same way that logistics focuses on the flow of new and fresh products and value. Successful implementation of reverse logistics involves seamless integration of various business systems. Integration of logistics systems and information flow management has a favourable influence on reverse logistics. It demonstrates the role of information infrastructure in helping businesses recover products and recover value. In reverse logistics, there are various examples demonstrating the role of information systems and integration systems. Such trends underscore the expanding focus on the role of integrating information systems in supply chains.

The results show that closed-loop and integration systems (H2, H4) have a positive effect on reverse logistics. Circular and closed-loop investments by the textile industry are increasing (Bag and Anand, 2024). The results also show a positive effect of collaborative systems (H5). Of the three systems, integration and closed-loop systems have a greater effect than collaborative systems.

The information in (H6) can be used to construct a business case for reverse logistics in the Pakistani textile industry. The research uncovered positive financial and operational speed and flexibility of the textile industry due to reverse logistics. Other performance areas of the industry were positively impacted due to reverse logistics. Reverse logistics helps create industry value and performance. Of all the logistics activities, reverse logistics is expected to enhance the performance of the textile industry the most. These industry trends support and enhance predictions of stakeholder theory, resource based view of the industry (RBV) and strategic view of the industry (Golhar 2009; Beaver & Coop 2009).

Performance in reverse logistics is integrated with logistics, and impact performance of the organization. To test this hypothesis, a research design and a conceptual framework were developed and tested using PLS-SEM. The framework was validated by a researcher developed questionnaire administered to 220 logistics managers working in the textile industry in Pakistan. Results of the study support the hypothesis that the integration of logistics and reverse logistics performance of closed loop systems and coordination positively impacted reverse logistics performance. Reverse logistics performance impacted organizational performance. The combined effect of these systems was estimated at 96.1% of the total industry performance.

The study takes a number of key steps forward in the field of reverse logistics. First, with regard to the textile industry of Pakistan, the study determines that the key reverse logistics capability is coordination capability. Thus, the study provides evidence that effective management of product recovery systems is contingent on a firm's capability to inter-firm coordination. Second, the study provides operational insights into the reverse logistics Importance Performance Framework. Finally, with regard to reverse logistics, the study contributes by providing the key logistics capabilities. More importantly, the study presents a fully mediated model that demonstrates the key logistics capabilities

in reverse logistics. Last, the study focuses on the logistics capabilities in the textile industry of Pakistan, which is the largest export industry of the country and is under-researched.

Managerial Implications

The results of the study have several suggestions for textile industry managers and government officials of Pakistan and other developing countries. First, managers must promote the development of vertical coordination in the supply chain by means of various strategies like joint planning, inter-firm visibility, and reverse logistics teams. Second, managers must invest in logistics information and reverse logistics. Third, reverse logistics must be integrated with the firm's logistics capability and should be strategically measured and communicated in the organization. Fourth, managers must strategically integrate reverse logistics in the firm's capability to achieve vertical integration. Lastly, managers must introduce closed-loop capabilities to firms to fulfill the requirements of circular economy.

The results of the study indicate that the textile industry reverse logistics of a country must be integrated with closed producer responsibility to achieve a sustainable economy. Regulatory bodies must create an enabling environment for reverse logistics by means of subsidies and increasing industry reverse logistics standards. Rising reverse logistics standards promote healthy competition in the reverse supply chain of the textile industry, which ultimately benefits the public. Government agencies must establish reverse logistics facilities and integrate digital networks in supply chains to promote cooperation across firms. These networks must be secured to protect private data of firms.

Limitation and Future Research

There are a number of limitations of this research that are worth mentioning. First, the nature of the cross-sectional research design means that causal relationships cannot be determined, and reverse logistics performance cannot be assessed over time. Longitudinal research would address this. Second, using a single respondent for self-report creates the potential for bias. Using other respondents for reporting or incorporating other types of performance metrics may alleviate this. The focus of this research on the Pakistani textile industry means that the results may not generally apply outside of this context. Future research may look to explore other industries or countries. This research looked at reverse logistics as a mediator of performance. Other mediators including the performance of a firm in the areas of innovation and sustainability may also be worth exploring. Other moderating factors including firm level strategies may affect the relationships posited in this research.

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