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Reverse Logistics Practices: A Dilemma to Gain Competitive Advantage in Manufacturing Industries of Pakistan with Organization Performance as a Mediator

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Abstract: Reverse logistics is a known supply chain practice and has been proven effective in recent decades. In developing countries, these practices are already employed and considered beneficial for the business or firms. The reverse logistics concept creates value for customers and firms. Considering this, this study intends to highlight reverse logistics practices in Pakistan and examine the reverse logistics impacts on competitive advantage with the mediating role of the firm's organizational performance in Pakistan's manufacturing industries. In this study, plastic bottle manufacturing firms working in Pakistan were selected to collect the data. Hence, to collect the data from these firms, a survey technique was sought to determine the impact of reverse logistic practices on competitive advantage with the mediating role of organizational performance. A structured and adapted questionnaire was used in this regard. Organizational performance was assumed as the operational and financial performance of these firms. Data were collected using a convenience sampling technique, and the targeted population was the middle-level employees of bottle manufacturing firms. The statistical tool was adopted as the study was quantitative, and results were extracted numerically. IBM SPSS and AMOS version 24 were used as supporting statistical analysis and interpretation tools. Data analysis demonstrated that out of 219 respondents, 68 were supervisors, and others were middle managers. Statistics show that most females were supervisors, and most males were middle managers. "Confirmatory Factor Analysis (CFA)" was performed to examine the fit of the three-factor model, showing good fit indices (Chi-square/df = 2.71, CFI = 0.902, TLI = 0.896, RMSEA = 0.081), which indicates that the model fits the data well. According to the study's findings, a significant impact was examined between reverse logistics and competitive advantage, and a mediating role was confirmed between those variables. This study poses unique strengths in theoretical and practical ways and helped enrich the available literature and findings.

Keywords: reverse logistics; organizational performance; operational performance; financial performance; competitive advantage

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1. Introduction

Reverse logistics is one of the essential phases in the product life cycle. The success of advertisements and advertising campaigns is primarily determined by their effectiveness in reverse logistics. Many studies have been carried out to analyze the impact of this process on a firm's competitive advantage. A recent study mentioned reverse logistics as cleaning up and fixing returned items so they can be reused or recycled [1].

The idea of reverse logistics starts with monitoring your product's life cycle after delivery to its final destination. It includes how you can safely reprocess or dispose of it and any other information that will make your expired product more valuable to your community [2]. Reverse logistics refers to managing returns in this process and provides a starting point for value-added services [3]. Reversing this process allows companies to avoid having excess inventory on hand at any given time, which can negatively impact profitability. In addition to helping companies avoid excess inventory and maintain profitability, reverse logistics also helps organizations reduce waste by reducing the materials needed to create each product (e.g., reducing plastic packaging material). This increase in organization performance also leads to better reverse logistics practices towards competitive advantage [4].

Reverse logistics is gaining huge recognition as a key strategic element in the manufacturing sector. However, this practice is lacking in underdeveloped and developed countries. However, manufacturing companies in these countries are adopting some of them [5]. In Pakistan [1,6], where industrial growth is surging, embedding reverse logistics into business strategies is becoming increasingly crucial for a competitive advantage. The influence of organizational performance in this dynamic by playing the mediating role is particularly significant. This paper delves into the latest trends and challenges of reverse logistics within Pakistani plastic bottle manufacturing companies. It mainly focuses on how these practices intersect with organizational performance to gain a competitive advantage.

The plastic bottle industry of Pakistan is perhaps one integral part of the country's environmental and economic setup. Massively producing and consuming plastic bottle products have brought socio-economic and ecological challenges. These are essential measures; however, they have a barrier in Pakistan in the absence of affordable and durable alternatives to plastic bags and bottles, contributing the most to plastic pollution. It recently became the 128th country in the world to ban non-biodegradable plastics. Therefore, this presents a challenge in the transition to more sustainable materials, which is the use of bioplastic bottles. The government is advised to consider incorporating carbon taxes and subsidizing sustainable development to reduce plastic consumption and waste [7].

Plastic pollution, particularly from plastic bottles, significantly impacts environmental and human health in Pakistan. The country's informal solid waste management and the increasing pollution due to the growing population and industrialization exacerbate these challenges. This situation underscores the urgent need for better management practices and policy interventions to address the pollution crisis [8].

The legislative framework of the involvement of the customer in reverse logistics practices has acquired increased focus and attention on how to better the sustainability of the plastic bottle supply chain. In that regard, a study in Karachi, Pakistan, examines the importance of customer attitudes regarding the polyethylene terephthalate (PET) bottle exchange and the potential of value belief norm theory in bringing out environmentally friendly behaviors.

These findings, however, indicate that increased consumer knowledge and neutralization techniques further improve participation in reverse logistics, which could contribute to environmental sustainability [9]. Thus, the plastic bottle sector in Pakistan stands poised at an inflection point with immense environmental challenges and economic opportunities. Innovative recycling with effective management of plastic waste by following reverse logistics practices based on comprehensive legal frameworks represents one of the preconditions of achievement for this industry concerning sustainable development.

In the above context, this study examines the impact of reverse logistics on competitive advantage with the firm's organizational performance mediating role in Pakistan's manufacturing industries. This study's research question is lined below:

RQ. *Does reverse logistics impact competitive advantage with the mediating role of the firm's organizational performance in Pakistan's manufacturing industries?*

2. Rationale of this Study

Pakistan's economy, noticeable by its resource constraints and developmental needs, presents a unique background for examining the impact of reverse logistics practices. The manufacturing sector, a significant contributor to the country's GDP, is under increasing pressure to adopt sustainable and cost-effective practices to remain competitive [10,11]. In this [10] context, reverse logistics, encompassing recycling, reusing, and returning goods, emerges as a strategic approach to mitigate environmental impacts and enhance economic viability and operational efficiency [12].

The need for reverse logistics in Pakistan is further amplified by the global shift towards sustainability and the circular economy [13]. Firms in developing countries like Pakistan increasingly recognize that reverse logistics can lead to substantial cost savings, improved customer satisfaction [14], and enhanced corporate image, all of which are crucial for gaining a competitive edge in the global market [15].

This study, focusing on the impact of reverse logistics practices on the competitive advantage in Pakistan's plastic bottle manufacturing industry with organizational performance as a mediator, introduces a novel perspective in the reverse logistics research domain. The rationale is grounded in the need to understand the specific dynamics of reverse logistics in developing countries, particularly in Pakistan, where the manufacturing sector plays a crucial role in the economic landscape [16].

The innovation of this study lies in its targeted examination of the plastic bottle manufacturing sector in Pakistan, an area not extensively explored in the existing literature [10]. By contextualizing reverse logistics within this specific industry and region, this research provides valuable insights into the practices and impacts of reverse logistics in a developing country setting [17], addressing a notable gap in the literature [18]. The choice of this sector is strategic, given its significant environmental footprint [19] and potential for resource recovery through reverse logistics operations [20].

The logical foundation of this study is built upon the hypothesis that organizational performance mediates the relationship between reverse logistics and competitive advantage. This approach extends the conversation beyond the commonly analyzed operational and financial performance metrics [21], offering a holistic view of how reverse logistics practices can drive competitive advantage in manufacturing industries [22,23].

The empirical evidence gathered from middle-level employees using quantitative methods enriches the existing body of knowledge, providing a robust dataset specific to Pakistan's context [24]. This methodological rigor not only boosts the study's findings but also demonstrates the practical applicability of reverse logistics in enhancing the competitive positioning of firms in the region [25,26].

This research explores the reverse logistics practices in Pakistan's plastic bottle manufacturing industry, underscoring the critical relationship between these practices and the competitive advantage, mediated by organizational performance. This investigation is not only timely but essential, given the current economic scenario of Pakistan, characterized by its limited resources and economic challenges.

The logical premise of this study is also grounded in the theory that organizational performance acts as a crucial mediator in the relationship between reverse logistics practices and competitive advantage [11]. This perspective is supported by evidence suggesting that firms leveraging reverse logistics not only enhance their operational and financial performance [27] but also build resilience [28] against economic uncertainties prevalent in developing countries like Pakistan [29].

This study situates itself within the broader narrative of sustainable development and economic efficiency, highlighting the potential of reverse logistics as a key driver for competitive advantage in Pakistan's manufacturing sector. By integrating Pakistan's specific economic and industrial context with empirical research, this study aims to contribute meaningfully to the academic discourse and practical implementation of reverse logistics practices in emerging economies [11,12,14,20].

3. Literature Review

According to the resource advantage theory of competition, a comparative advantage for the organization comes from its competitive advantage when applied internally within an organization [30]. The given competitive approach to the effective use of resources is based on the resource advantage theory of competition. From the perspective of this theory, a company needs to identify its strengths and weaknesses to create a unique value proposition for the customers. Moreover, the company has to be in a position to find and capitalize on opportunities that prevail within the market while at the same time defending against possible threats [31].

The resource advantage theory has its roots in the work of Michael Porter, who first proposed the concept of competitive advantage in his classic book Competitive Strategy: Techniques for Analyzing Industries and Competitors. Since then, other academics and practitioners have further developed and refined the theory [32].

The concept of "core competencies" is intimately linked with the resource advantage theory. A "core competency" is a unique skill or capability crucial to a company's competitive ability. To prosper in the game, a firm must identify and leverage these competencies to carve out a unique place in the market [33]. The resource advantage theory revolves around the idea that a company's competitive edge hinges on its ability to better manage or use a resource compared to its rivals. Here, reverse logistics enters the picture as a strategic ace up the sleeve in this theory, offering a way to gain that competitive upper hand. This perspective treats an organization almost like a living entity in an evolutionary sense, capable of transferring advantages from one entity to another. In this landscape, an organization's competitive edge is all about how effectively it can control certain resources compared to its competitors. Therefore, reverse logistics is not just a process, it is a vital mechanism for creating a competitive edge [31].

According to this theory, the organization is deemed a unit of selection from one person to another. In resource advantage theory, a company's competitive advantage is based on its power of control or use and utilization of a resource better than its competitors. Resource advantage theory applies to reverse logistics to generate a competitive advantage.

Figure 1 [34] shows a generic supply chain from the forward and reverse sides. Solid and dashed lines represent the classical (forward) and reverse supply chains. Decisions regarding possible returns are made during the return evaluation stage [35], illustrating a generic closed-loop supply chain. Hence, in the above context, this study aimed to highlight the hypotheses mentioned below with support from the literature.

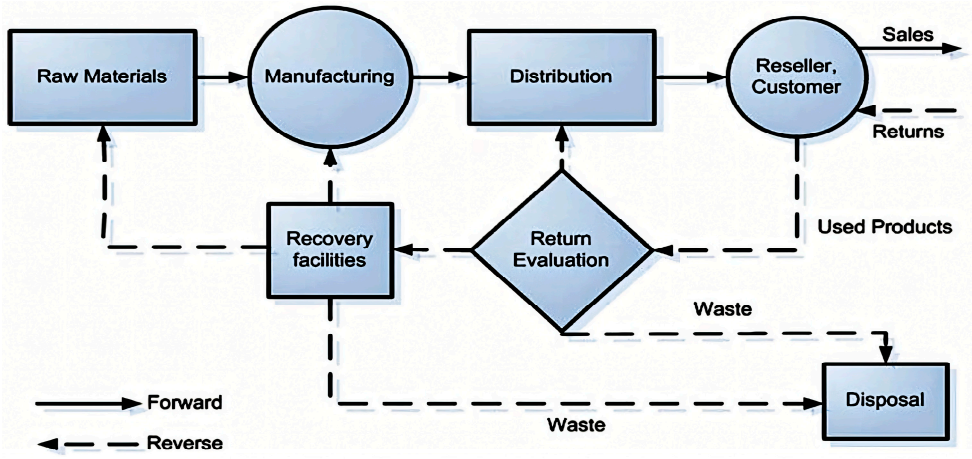

Figure 1. An encompassing form for forwarding and reversing logistics. (Source: [34]).

3.1. Reverse Logistics, Organization Performance, and Competitive Advantage

Reverse logistics is a concept that has been around for decades, but it has recently become more popular. It is important to understand reverse logistics, how it can be used in

organizations, and how it may affect performance and contribute to competitive advantage. Reverse logistics manages inventory at the end of its life cycle rather than at its beginning, which means that instead of keeping products in storage for years before they are used or discarded, reverse logistics practices allow companies to move these products through their supply chain quickly—in some cases almost as soon as they are made—and then either sell them or return them safely to the manufacturer.

A study identified the relationship between entrepreneurial strategies, management control systems, and organizational performance [36]. The study has explained that China has emerged as an economic powerhouse in recent years, ranking fourth in the world after the United States, Japan, and Germany in terms of financial strength [37]. Identifying business strategies facilitated China's rapid rise in the global economy. In this study, the researchers examined the random link between business strategies, management, and the performance control system in Chinese firms. According to the findings, non-financial components had a greater impact on performance in organizations with differentiation strategies. Still, financial management control systems greatly impacted employee performance in companies with minimal expenditure strategies. The study also suggested that if reverse logistics and supply chain processes operate well with the overall performance of workers and the whole organization, a competitive advantage over similar industries may be easily acquired [37–39].

According to [40], reverse logistic potentials have been found and confirmed in numerous sectors. Additionally, the study validated the existence of these opportunities in the lithography sector. These opportunities include the flexibility with which properties may be returned, the management of customer receivables in combination, the time it takes to process credits, the quality of reconstruction and reworking, and the timeline for doing so. While it is logical that reverse logistic potentials will boost reverse logistic performance, this is not true. Instead of improving the economic performance of the unique product market, these potentials will increase the financial performance of reverse logistic potentials [41].

A recent study in the USA discovered a direct correlation between countries with high recycling rates and high GDP, suggesting that economic growth enhances recycling efforts and organizational performance. It highlighted the need to analyze the relationship between waste generation and GDP, especially in industrialized countries that often produce waste haphazardly. The study emphasized the importance of adopting best practices from countries with high recycling rates to improve packaging waste management. Furthermore, it advocated for a unified European framework for managing packaging waste and the necessity of public education to facilitate the transition to a circular economy, thereby minimizing packaging waste [42].

In view of Pakistan, the author explored the barriers to implementing reverse logistics in Pakistan's manufacturing industry, notably organizational, financial, and technological challenges. They utilized Interpretive Structural Modeling and the MICMAC approach, underscoring the urgency for enhanced government policies and greater awareness of environmental laws. The 2021 research by Ali et al. highlighted the unrecognized competitive advantages of reverse logistics in Pakistan, suggesting that reuse and remanufacturing could be highly beneficial. Moreover, Saeed, in 2022, shed light on how reverse logistics capabilities and innovation significantly influence the supply chain performance in Pakistan's pharmaceutical sector, advocating for strategic planning and resource allocation to improve these practices. Another author, Naseem, in 2021, discussed adopting reverse logistics in Pakistan's e-commerce sector, emphasizing the need to identify and prioritize solutions to their barriers [10,43–45].

Another study showcased the Continuous Sustainability Improvement Process (CSIP) as demonstrated in the ReComp project, which focuses on recycling metalized plastic waste from the automotive industry into high-purity copper, chromium, and plastic. Initially, ReComp achieved notable environmental benefits but was not economically sustainable. However, the subsequent ReComp II significantly reduced costs and increased financial performance through modified processes. This advancement illustrated that environmentally

friendly solutions could foster better financial and sustainable performance by minimizing waste and efficiently conserving materials and energy [46].

Hypothesis 1 (H1). *There is a positive association between reverse logistics, organization performance, and competitive advantage of the firm in Pakistan's manufacturing industries.*

3.2. Reverse Logistics and Competitive Advantage

Reverse logistics is returning goods and materials to the manufacturer or supplier. Companies often incur significant costs to return defective, damaged, or unwanted products. However, reverse logistics can also create a competitive advantage [47]. By utilizing reverse logistics, companies can recover valuable resources and materials that can be used in the production process. In addition, reverse logistics can help companies save money on disposal costs and create efficiencies in the supply chain. Similarly, reverse logistics is applied to create a competitive advantage, and companies can improve their bottom line and become more successful in resource advantage theory [30].

Efficient management of logistical operations not only serves as a substantial source of competitive advantage but also increases customer satisfaction by meeting their specific requirements and expectations. As a result, reverse logistics, which focuses on activities associated with the consumption of goods, plays a vital role in lowering expenditures, and this paper explains how it works. The study [48] defined competitive advantage as a company's unique capacity to earn better returns than its rivals. To gain a competitive edge, businesses must provide differentiated value propositions via unique value chains that include trade-offs distinct from their rivals [49]. Product returns processes are designed to produce new market possibilities and provide businesses with a competitive edge by acquiring new customers and maintaining current customers. Return logistics has aided in creating a competitive advantage by impacting consumers' buying behavior in response to how product returns are handled [50].

In the last century, a researcher [51] identified several qualities necessary for a competitive advantage to be realized over time, including the value and rarity of resources, the ability to imitate resources poorly, the ability to transport resources poorly, and the inability to substitute resources. According to [52], several indices can be used to measure competitive advantage [53]. Among these characteristics are customer loyalty, waste reduction, revenue growth, market share, and brand awareness [54,55]. According to [56], a company's competitive advantage should be based on customer relationships, brand image, and reputation [49].

Hypothesis 2 (H2). *There is a positive and significant impact of reverse logistics on competitive advantage in Pakistan's manufacturing industries.*

3.3. Organizational Performance and Competitive Advantage

Organizational performance, which encompasses various aspects such as financial success, operational efficiency, employee satisfaction, and customer satisfaction, plays a pivotal role in establishing and maintaining a competitive advantage in the market. A study emphasized the role of knowledge management as a core source of competitive advantage, linking it directly with enhanced organizational performance. Effective knowledge management strategies bolster innovation, crucial for maintaining a competitive edge in dynamic markets [57].

Warren and Churchill explored using cognitive theory in knowledge construction within organizations. They argue that this approach can improve organizational performance and lead to product innovation, enhancing competitive advantage [58]. Alasfar's study investigated the impact of supply chain management and logistics on organizational performance in the tourism industry. The findings highlight these factors' significant influence on competitive advantage creation [59].

Gavalas introduced a framework for evaluating organizations' complex adaptive leadership readiness. The study suggested that adaptability, fostered by effective leadership, enhances organizational performance and provides a competitive edge [60]. Reinert and Buengeler discussed the role of diversity in improving organizational performance. They argue that a diverse workforce creates competitive advantages through improved performance [61].

Additionally, while researchers have suggested a link between operational performance and competitive advantage, it was also criticized. However, reverse logistics methods can potentially lessen customers' risk when acquiring items and offer value to the consumer experience [62–65].

Hypothesis 3 (H3). *Organizational performance positively and significantly impacts competitive advantage in Pakistan's manufacturing industries.*

3.4. Organizational Performance as a Mediator between Reverse Logistic Practices and the Competitive Advantage of Firm

Research on green supply chain practices, employee engagement, and organizational commitment has recently expanded the scope of green supply chain research. According to the study [66–70], in 2006, Haghighat proposed "essential management of supply chain and reverse logistic function, and not only recognized essential management of supply chain importance and its linked strategies as an irrefutable requirement," but also introduced the concept of reverse procedure should be conflict-free and should have efficient utilization of human force including the organizational, operational performance. Competitor advantage may be multi-dimensional and relative because corporations realize a competitive edge over their competitors via various means. Additionally, a substantial body of literature supports certain researchers' consistent use of many dimensions to evaluate competitive advantage [71–73].

A reverse logistics system can significantly contribute to achieving sustainable business results by increasing revenue, increasing recoverable and recycled goods, saving costs, considering social and environmental issues, and ensuring customer satisfaction. In addition to enhancing the company's image through effective management of costs, distribution, inventory, and environmental performance, reverse and sustainable logistics can also increase competitiveness [11,26,74–77].

In reverse logistics (RL) research, sustainability goals are often a focus due to RL's inherent pursuit of balancing economic, social, and ecological outcomes alongside operational performance that gives a competitive advantage. However, achieving these goals simultaneously can be challenging, often leading to uncertainty. This makes the relationship between sustainability and RL unclear, even though RL studies frequently emphasize sustainability objectives [75,78].

Yang et al. examined the role of a third-party reverse logistics provider (3PRLP) in enhancing the economic efficiency of electronic manufacturing companies, thereby contributing to competitive advantages. The study also highlighted that operational and economic performance in manufacturing companies plays a significant role in sustainable and reverse logistics practices and in getting a competitive advantage. Similarly, the study advocated the adoption of operational performance as a mediator to examine this role in the future. Another study article discussed how integrating corporate sustainability with environmental performance can reduce returns and reverse logistics efforts, offering a competitive edge [79,80]. A recent study also focused on the importance of green supply chain and reverse logistics in enhancing operational performance and, in turn, competitive Advantage [81].

The study conducted by Ellibeş and Akçadağ in 2023 explored the impact of green distribution practices on business performance in Kocaeli's logistics sector. It involved face-to-face interviews with 86 logistics companies. The study used regression and correlation analyses and found that green practices like alternate distribution routes and repurposing packaging significantly enhance company performance. These environmentally friendly

methods improve operational efficiency and competitiveness. The study highlights the intersection of environmental responsibility and business success in logistics [82]. A recent study from Pakistan also investigated how reverse logistics impacts the performance of firms in Karachi, Pakistan, suggesting that efficiency in reverse logistics can provide a competitive edge [83]. Another study examined the influence of sustainable supply chain management and reverse logistics on operational performance and competitive advantage in the UAE food industry and found significant results [84].

As part of SCM applications, the SCP paradigm considers the various factors on which firms make investments to form a collective structure that assists them in determining their strategy for higher performance. The study by [85] proposed that integration is the key structural characteristic that will help drive quick response strategies and improve the overall performance of supply chains in terms of operational and financial metrics. The study by [85] presented that while many indicators are discussed and raised in reverse logistics, they usually have no connection with the firm's strategy. Operational performance matters for any organization and leads toward a competitive advantage.

Hypothesis 4 (H4). *There is a mediating role of organization performance between reverse logistics and competitive advantage in Pakistan's manufacturing industries.*

4. Materials and Methods

Quantitative research was selected in this study as data were collected numerically to test the proposed hypotheses [86]. Accordingly, using statistical methods to conclude, the positivist research paradigm was chosen since quantitative research is the most suitable method of investigation for empirical research.

Moreover, considering the target population, those employees were selected in Pakistani plastic bottle manufacturing companies and worked as middle-level management. In addition, convenience sampling was used in the whole study as it was not feasible to conduct the study in all manufacturing companies. A convenience sampling strategy refers to researchers collecting market research information from a convenient pool of respondents. It is undoubtedly the most commonly used sampling technique since it is fast, straightforward, and economical [87].

The data were collected using a survey technique. Questionnaires on a "5 points Likert scale" ranging from "(1 = strongly disagree to agree 5 = strongly)" were distributed among the employees included in the targeted population on the base of convenience. However, managerial employees were included in the targeted population at the middle level. SPSS and AMOS version 24 were used as supporting tools for the statistical analysis and interpretations [88].

Similarly, few manufacturing companies were selected based on convenience and due to their working schedule and security concerns. Also, the company's employees were not always available when collecting data, so convenience sampling was the best choice. The responses from 1050 employees were collected. However, the real data were gathered from 219 out of 236 employees based on convenience sampling. The data were collected in the year 2023.

Moreover, the data were collected in several phases/periods. The first one was the Preparation Phase. In this phase, 01 month was taken to develop and test the questionnaire, ensuring it accurately measures what it is intended to measure and is understandable for respondents. This phase includes finalizing the survey design, selecting the appropriate Likert scale questions, and preparing the software tools (SPSS and AMOS version 24) for data analysis.

The second phase was the Distribution and Collection Phase, and in this phase, three months were taken to distribute the questionnaires to the targeted population and collect the responses. Analysis and Reporting Phase was another phase where 02 months were taken to analyze the data collected through the surveys using SPSS and AMOS and to compile the results into a comprehensive report.

Thus, approximately 06 months was the exact period for the entire data collection and analysis process.

4.1. Measures

A questionnaire was utilized to obtain information from the target audience, and a survey was carried out to gather information. The responses to the structured questionnaire, based on a "five-point Likert scale" ranging from "strongly disagree to agree strongly", were analysed to determine reverse logistics, organizational performance, and competitive advantage variables. The measurement scale for these variables was adapted with a few amendments from previous studies for the study variables. Measurement scale in research is the way of collecting data through questions. It helps researchers to make apparent issues that can be consistently answered through questions. These may be numerical scales (like rating a product on a scale of 1 to 5) or descriptive ones (using phrases like 'very satisfied' or 'not at all satisfied'). They help push the data into a format that fits into a manageable and analyzable pattern [89]. The existing study was taken from previous studies accordingly, i.e., Reverse Logistics Practices [90] in Table A1, Organizational Performance [91,92] in Table A3, and Competitive advantage [93] in Table A2. The overview of the questionnaire is presented in Appendix A (Tables A1–A3).

4.2. Reliability and Validity Testing Measures

Cronbach's coefficient alpha was calculated to evaluate the internal consistency and reliability of the scales. Every construct used met the acceptable criteria of Cronbach's alpha, and all of the constructs used in this study were above 0.70 [94] (see Table 1).

Table 1. Reliability and validity.

Variables	Cronbach	Construct Reliability	Convergent Validity
RLP	0.907	0.907	0.519
OP	0.929	0.903	0.523
CA	0.938	0.937	0.559

Source(s): Author.

4.3. Confirmatory Factor Analysis

In this study, the Confirmatory Factor Analysis (CFA) was performed to examine the fit of the three-factor model, revealing an optimal fit with the collected data. The assessment utilized several statistical measures: the Chi-Square to degrees of freedom ratio (χ^2/df) resulted in 2.71, indicating a good fit as it falls below the commonly accepted threshold of 3 or 5, suggesting a reasonable model-to-data congruence [95]. The Comparative Fit Index (CFI) was reported at 0.902, which exceeds the 0.90 benchmark for acceptable model fit, underscoring the model's reliability [96]. The Tucker–Lewis Index (TLI) closely approached the 0.90 threshold with a value of 0.896, indicating a near-optimal fit that might require minor adjustments for enhanced accuracy [97]. The Root Mean Square Residual (RMR) at 0.067 fell within the acceptable range, further validating the model's adequacy [98]. However, the Root Mean Square Error of Approximation (RMSEA) stood at 0.081, slightly above the preferred threshold of 0.08, signaling a need for cautious interpretation, though it remains within a tolerable range for good fit [99]. Collectively, these indices affirm a moderately high level of accuracy for the CFA model in this study, although improvements, particularly in TLI and RMSEA, could further substantiate the model's fit (Figure 2 and Table 2).

Table 2. Model fit statistics for CFA.

Chi2	DF	Chi2/df	RMR	TLI	CFI	RMSEA
374	138	2.71	0.067	0.902	0.896	0.081

Source(s): Author.

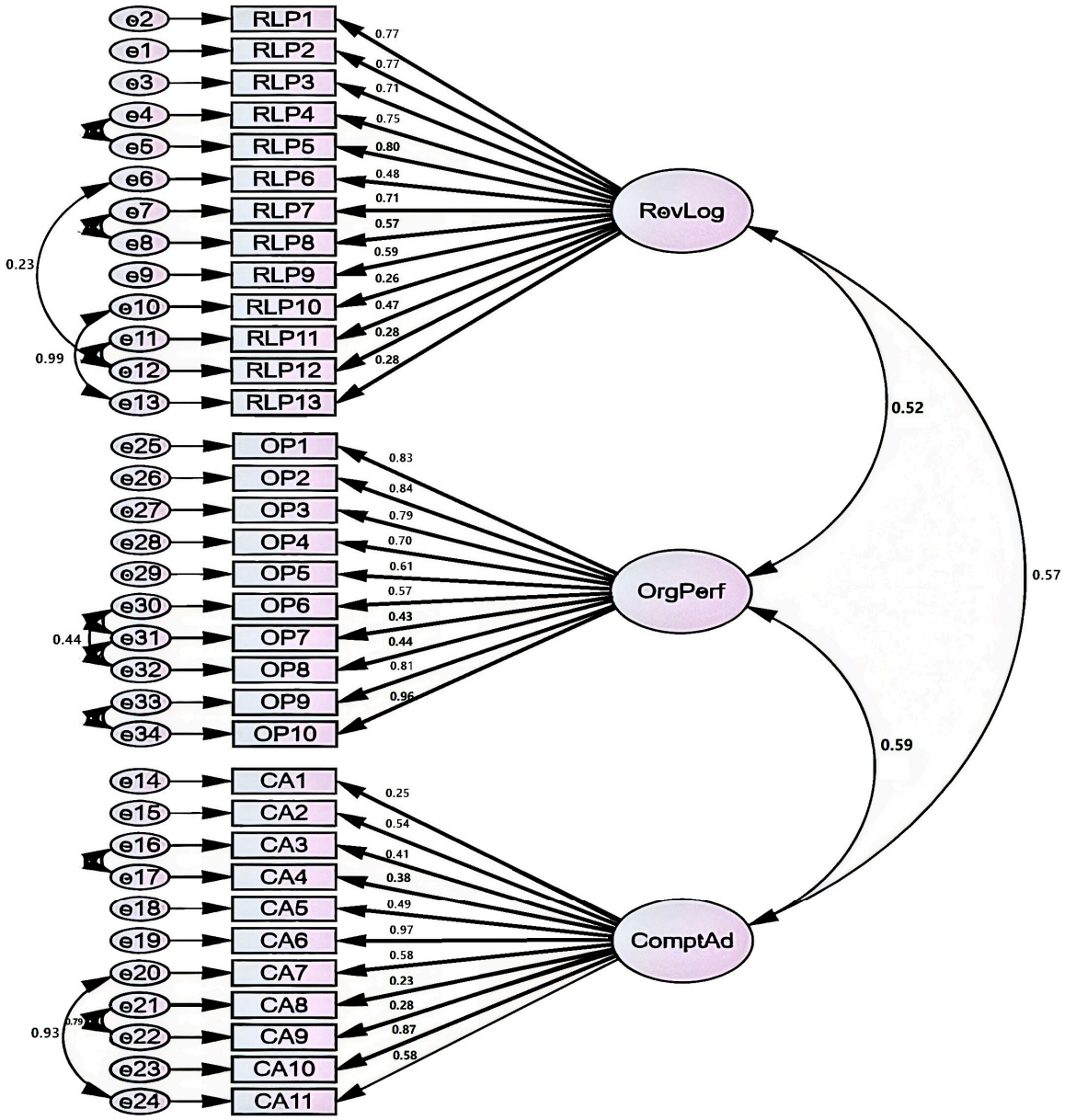

Figure 2. Confirmatory Factor Analysis.

5. Results

Among the participants, 68 were supervisors, and others were middle managers. Statistics show that most females were supervisors, and most males were middle managers.

Furthermore, as per experienced statistics, out of 219 selected received responses, 84 participants had experience of less than 5 years, 23 employees had experience between 5–14 years, 33 participants had experience of 15–20 years, and 79 had experience of less than 20 years. Overall, statistics reveal that most females were found to be less experienced than males.

The mean score and standard deviation for the observed variable of RL practices were calculated using a "Likert scale of 1 to 5, where 01 indicates strongly agree, and 5 indicates strongly disagree". All variables had a mean score that met the requirements (see Table 3).

To verify the normality assumption, the distributions of the independent variables at interval or ratio levels and the distribution of the dependent variables have been examined and found to be normally distributed [100].

Table 3. Mean, Standard Deviation, and Correlation.

	Mean	SD	RLP	OP	CA	Skewness	Kurtosis
RLP	4.27	0.54	-			−0.282/0.164	−0.453/0.327
OP	3.74	0.68	0.364	-		−0.222/0.164	−0.843/0.327
CA	4.08	0.57	0.529	0.581	-	−0.297/0.164	−0.502/0.327

Source(s): Author.

Values of the z-scores are also found within the acceptable range as observed in the different studies, i.e., skewness between −2 to +2 and kurtosis between −7 to +7 [94,101] and skewness below 3 and kurtosis below 10 [102]. Z-scores of all the variables in this study ranged between (−0.282/0.164) −1.75, (−0.222/0.164) −1.35, and (−0.297/0.164) −1.81 for skewness and between (−0.453/0.327) −1.38 (−0.843/0.327) −2.57 and (−0.502/0.327) −1.53 for kurtosis (see Table 3).

Enhancing research rigor and robustness in statistical methods and assumptions is crucial in empirical studies like the one on reverse logistics practices in Pakistani bottle manufacturing industries. This study has employed a quantitative research method, using convenience sampling to gather data from employees in fast-moving consumer goods and manufacturing firms. Applying statistical tools for analysis ensures that the results are extracted numerically, providing a solid empirical basis for the study's findings.

To ensure robustness, this study utilized SPSS and AMOS for statistical analysis. Reliability and validity testing measures, such as Cronbach's alpha, were calculated to evaluate the internal consistency of the scales used. This approach confirms the reliability of the constructs, as all Cronbach's alpha values were above the acceptable threshold of 0.70 [94]. Confirmatory Factor Analysis (CFA) was performed to examine the fit of the three-factor model, showing good fit indices (Chi-square/df = 2.71, CFI = 0.902, TLI = 0.896, RMSEA = 0.081), which indicates that the model fits the data well.

This study also ensured the normality of distributions for both independent and dependent variables, adhering to the guidelines for skewness and kurtosis ranges [94,101]. This step is vital for confirming that the statistical test assumptions are met. Moreover, correlation and regression analyses analyzed the relationship between reverse logistics, organizational performance, and competitive advantage. The significant correlations and impacts found were aligned with previous studies, adding to the credibility of the findings.

In conclusion, this study on reverse logistics practices in Pakistan's bottle manufacturing industries demonstrates a rigorous approach to statistical analysis and assumption checking. By employing robust statistical methods and ensuring the reliability and validity of the constructs, this study enhances the rigor of its research. It provides trustworthy insights into the impact of reverse logistics on competitive advantage and organizational performance.

Hypothesis Result

The first hypothesis (H1) proposed a positive association between reverse logistics, organization performance, and competitive advantage of the firm in Pakistan's manufacturing industries. Data analysis reveals a significant correlation among the prevailing study variables. Given RLP and OP are at 0.364 (r = 0.364, $p < 0.01$), RLP and CA are at 0.529 (r = 0.529, $p < 0.01$), and OP and CA are at 0.581 (r = 0.581, $p < 0.01$), this supports the first hypothesis of a significant association between reverse logistics, organization performance, and competitive advantage in Pakistan's manufacturing industries [34] (see Table 3).

The second hypothesis (H2) proposed that reverse logistics positively and significantly impacts competitive advantage in Pakistan's manufacturing industries. The data confirm H2, showing a significant impact of reverse logistics (RLP) on competitive advantage (CA) in Pakistan's manufacturing industries with the optimal variance. ($\beta = 3.87$, t = 4.351, $p < 0.000$). Results of the hypotheses are aligned with the previous studies [103] (see Table 4).

Table 4. Hypothesis significance and results.

Path	B	*T*	SE	Result
RLP → CA	0.387	4.351	0.089	Supported
OP → CA	0.510	5.758	0.089	Supported
RLP → OP → CA	0.220	4.519	0.049	Supported

Source(s): Author.

The third hypothesis (H3) proposes that organizational performance logistics positively and significantly impact competitive advantage in Pakistan's manufacturing industries. ($\beta = 0.510$, $t = 5.758$, $p < 0.001$). Results reflected the significant relationship and impact with the desired variance [104] (see Table 4).

Given the fourth hypothesis (H4), there is a mediating role of organization performance between reverse logistics and competitive advantage in Pakistan's manufacturing industries. The results also revealed that after adding a mediator, the impact of RLP on CA ($\beta = 0.387$) was significantly reduced ($\beta = 0.220$), indicating a mediation. We utilized the Sobel test [105], which showed that the path between RLP and CA was significantly mediated by OP ($z = 3.77$, $p < 0.001$). Results were in accordance with the previous studies [106]. Hence, the fourth hypothesis was also approved (See Table 4).

A review of the literature and the theoretical framework that underlies resource advantage theory and competition led to the conclusion that organization performance mediated the association between reverse logistics implementation and firms gaining competitive advantage. According to the results of this study, reverse logistics and competitive advantage are completely mediated by organizational performance. Furthermore, all hypotheses of this study are supported (see Table 5). As discussed previously, this result is consistent with the findings of other studies [104].

Table 5. Summary of all the results.

Hypothesis	Description	Correlation Coefficients	Path (β)	t-Value	SE	Result
H1	Positive association b/w RLP, OP and CA	RLP and OP: 0.364 RLP and CA: 0.529 OP and CA: 0.581	-	-		Supported
H2	Positive impact of reverse logistics on competitive advantage	-	0.387	4.351	0.89	Supported
H3	Positive impact of organizational performance on competitive advantage	-	0.510	5.758	0.89	Supported
H4	Mediating role of organization performance	-	0.220	4.519	0.49	Supported

Source(s): Author.

6. Discussion

In today's increasingly competitive global marketplaces, businesses that do not use effective supply chain management practices may realize they cannot cope with their business rivals. Numerous studies have been conducted on the influence of environmental change and excessive uncertainty on the cost of reverse logistics [107,108]. Similarly, Ref. [109] proposes that every business or organization must manage costs as cost advantage can make a competitive edge. However, managing the other operational costs cannot boost its performance if the organization does not utilize its resources. Similarly, any organization must manage not only the costs but also its supply chain practices.

Effective supply chain practices such as reverse logistics also aid in managing the resources. In this context, to manage or utilize any organization's resources, an organization must perform well. Hence, in the whole scenario, the organization acts as a mediator. This research enriched the literature to provide the association between these variables.

The findings from the presented hypotheses regarding the impact of reverse logistics (RL) on organizational performance (OP) and competitive advantage (CA) in Pakistan's manufacturing industries align with the existing literature, highlighting the intricate relationships between these variables. The authors of the study provided evidence supporting the positive correlation between reverse logistics adoption and competitive advantage through operational efficiency improvements, which echoes our findings on the significant association and impact of RL on OP and CA [110]. Similarly, Aghazadeh underscored the environmental and economic benefits derived from reverse logistics practices, thereby contributing to a firm's competitive edge, consistent with our second hypothesis' confirmation of RL's significant impact on CA [111].

The substantial relationship between OP and CA found in our study is further corroborated by [112] Banihashemi, Fei, and Chen, who discussed how reverse logistics contributes to sustainability performance across its dimensions, indicating a broader impact on competitive advantage through enhanced organizational performance [112]. As suggested by our fourth hypothesis, the mediating role of organizational performance between reverse logistics and competitive advantage finds resonance in the work of Doğru, who explored the effects of strategic orientation and reverse logistics capabilities on organizational performance, highlighting the mediation mechanism similar to our findings [113].

These studies collectively validate our research hypotheses, illustrating the critical role of reverse logistics in enhancing organizational performance and securing competitive advantage in the manufacturing sector. The consensus across studies emphasizes the strategic importance of integrating reverse logistics into operational and competitive strategy frameworks, showcasing the potential for enhanced sustainability and efficiency gains within the manufacturing industry.

Furthermore, the study results provide the foundation for future researchers to explore these variables with other phenomena to determine similar or different findings.

6.1. Implications of the Study

6.1.1. Practical Implications

Engineering and operations managers can benefit from these findings by implementing reverse logistics practices to gain a competitive advantage. As identified in this study, reverse logistics practices significantly impact firms' operational and financial performance.

By gaining insights from this study, policymakers and practitioners can also redesign their existing policies according to the dynamic world to achieve competitive advantage and operationalize their maximum efficiency for sustainability purposes. This study also enriched the notion of the previous study. It provided the implication for managers to enhance their performance and strategically incorporate sustainable and reverse logistics practices into their business.

6.1.2. Academic Implications

This research enriches the existing scholarly discussions and contributes to the academic domain. This investigation adds valuable insights to incorporate sustainable methodologies. It provides significant information on how scholars can conduct research in the related area shortly by focusing on the varied logistic practices and their impact on company performance by integrating the construct of competitive advantage that offers a deeper comprehension of the topic and bridges the gaps in the current research. This study enriches the existing literature by introducing a novel perspective into a specific regional framework. It provides a comparative valuable evaluation for future researchers interested in exploring the subject in different global regions. Overall, the investigation provided a comprehensive analysis and evaluation of sustainable practices that are diverse logistic methodologies in a critical economic sector and region and provided both practical solutions for industry professionals for leaders and a significant scholarly contribution that can pave the way for future studies in the field of sustainable supply chain management and corporate social responsibility practices literature [3].

6.2. Limitations and Future Research Options

This research reinforces the existing hypotheses and literature, but its findings might not be broadly applicable due to its unique cultural context. This study could benefit from a larger sample size and the inclusion of additional moderating and predictive variables. Different sampling methods, such as simple random sampling, could also enhance the study's generalizability. Future research might explore various phenomena and variables in different work environments.

For subsequent studies, the data set could be expanded, and the target population could be broadened from a smaller to a more diverse group to yield more statistically reliable results without relying on convenience samples. Collaborating with organizations like the Global Supply Chain Forum might increase survey response rates. A larger sample size would permit more precise statistical analysis techniques, leading to more meaningful conclusions.

The current study gathered data at a single point using a cross-sectional design. Future research could employ a longitudinal design. While this study focused on the private business sector, it is suggested that future research could explore different sectors, such as the higher education sector, which are not business or corporate.

This study supplements the present literature by conducting the research in Pakistan, and for further studies, developing and underdeveloped countries of the whole of Asia and from other continents may be targeted; as mentioned in the limitations section, this study examined the influence of reverse logistics practices; however, more developing countries may be investigated to determine the impact of these practices. Other organizations or industries may likewise be the subject of future research to elucidate this fundamental phenomenon.

7. Conclusions

The research confirms the critical role of reverse logistics in bolstering organizational performance and securing a competitive advantage in the manufacturing sector of Pakistan, aligning with and expanding upon previous studies in sustainable supply chain management. By illustrating the mediating effect of organizational performance, this study supports the hypothesis that reverse logistics practices are instrumental in enhancing firm competitiveness and contributes novel insights into the mechanisms through which these benefits are realized. This reinforces the argument for manufacturing firms, particularly in developing countries, to adopt reverse logistics as a key component of their competitive strategy, leveraging operational improvements for strategic advantage. The findings enrich the existing literature by offering a comprehensive analysis of the relationship between reverse logistics, organizational performance, and competitive advantage in a specific regional and economic context, thereby providing a valuable framework for future research and practical implementation in the field of sustainable supply chain management. Building on the contributions of [3], this research underscores the transformative potential of reverse logistics in manufacturing industries, emphasizing the mediating role of organizational performance as a novel insight into the strategic benefits of sustainable supply chain practices.

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Appendix A

Table A1. Reverse Logistics Practices (Source: [90]).

S.No.	Items	Scale				
Remanufacturing		1	2	3	4	5
(a)	Employees are trained on the importance of remanufacturing.					
(b)	The existence of a documented and communicated remanufacturing policy.					
(c)	The firm remanufactures returned cylinders through repairs, refurbishing, or parts replacement.					
(d)	The existence of a warehouse for storage of cylinders that can be remanufactured.					
Reusing						
(a)	Cylinders are reused and sent back to the market.					
(b)	Employees are trained on reuse as an environmental management strategy.					
(c)	The firm encourages customers and distributors to reuse cylinders.					
Recycling						
(a)	The firm returns used cylinders to suppliers for recycling.					
(b)	The firm returns used cylinders to suppliers for recycling.					
(c)	The existence of a documented and communicated recycling policy.					
(d)	Employees are trained on recycling as a waste management strategy.					
Repackaging						
(a)	The firm receives returned cylinders for repackaging.					
(b)	Returned cylinders are repackaged and distributed back to the customers.					
(c)	A documented and communicated repackaging policy exists.					

Table A2. Competitive Advantage (Source: [93]).

S.No.	Items	1	2	3	4	5
(a)	The company management assurance material and moral support to meet the needs and aspirations of current and future clients.					
(b)	The company's management gives staff complete freedom to complete their work.					
(c)	The company's management works on developing employee performance and improving their skills as the renewable market requires.					
(d)	The company's management seeks to know the market's characteristics to prepare strategies and tactics appropriate for any situation.					
(e)	The relationship between management and employees Features efficiency and effectiveness in completing customer orders.					
(f)	Our operations system responds rapidly to changes in product volume demanded by customers.					
(g)	Our operations system effectively expedites emergency customer orders.					
(h)	Our operations system rapidly reconfigures equipment to address demand changes.					
(i)	Our operations system rapidly reallocates people to address demand changes.					
(j)	Our operations system rapidly changes manufacturing processes to address demand changes.					
(k)	Our operations system rapidly adjusts capacity to address demand changes.					

Table A3. Organizational Performance (Source: [91,92]).

S.No.	Items	1	2	3	4	5
	(I) Operational Performance					
(a)	Increase in the amount of goods delivered on time					
(b)	Decrease in inventory levels					
(c)	Decrease in scrap rate					
(d)	Increase in product quality					
(e)	Increase in product line					
(f)	Improved capacity utilization					
	(II) Financial performance					
(g)	Improvement in general level of profitability					
(h)	Decrease in the level of production costs					
(i)	Decrease in the costs of raw materials or components					
(j)	Decrease in packaging costs					

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