The Impact of Digital Supply Chain Transparency on Customer Satisfaction through Trust and Service Quality in Pakistan E-commerce Industry

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HIGHLIGHTS

- The study explores how digital supply chain transparency affects customer satisfaction in Pakistan's e-commerce sector.
- Data were collected through an online survey of 386 e-commerce customers in Pakistan.
- The results show that transparent order tracking, accurate information, and clear communication improve customer satisfaction.
- Customer trust and service quality were found to partially explain the link between transparency and satisfaction.
- Service quality had a stronger mediating effect than customer trust in improving customer satisfaction.

Abstract

This study examines the effect of digital supply chain transparency on customer satisfaction in Pakistan's e-commerce industry, with trust and service quality as mediating variables. Digital technologies have changed how businesses manage operations and how customers purchase products online. However, many online consumers in Pakistan still face issues such as limited order tracking, unclear product information, delayed delivery, and weak communication. A quantitative survey design was used, and primary data were collected through an online questionnaire from consumers who had experience using e-commerce platforms such as Daraz, Amazon, Alibaba/Ali-Express, and local online stores. A total of 386 responses were collected, while 385 responses were used for regression and mediation analysis. The findings show that digital supply chain transparency has a significant positive effect on customer satisfaction. The results also indicate that transparency improves customer trust and perceived service quality. Furthermore, trust and service quality partially mediate the relationship between digital supply chain transparency and customer satisfaction, with service quality showing the stronger mediating effect. The study suggests that e-commerce companies in Pakistan should improve real-time order tracking, provide accurate product information, strengthen communication during delivery, and build reliable service systems to increase customer satisfaction and long-term loyalty.

Keywords: Digital Supply Chain Transparency; Trust; Service Quality; Customer Satisfaction; Pakistan Business Growth; E-Commerce Sector

I. Introduction

Digital technologies have changed the way businesses manage operations, communicate with customers, and deliver products and services. In supply chain management, technologies such as artificial intelligence, cloud computing, blockchain, data analytics, RFID, and the Internet of Things help firms improve information sharing, tracking, coordination, and operational efficiency [1].

The e-commerce sector in Pakistan is becoming more important because of increasing internet use, mobile connectivity, and digital payments. According to Data Reportal, Pakistan had 116 million internet users and 190 million cellular mobile connections at the beginning of 2025 [2]. The State Bank of Pakistan also reported that more than 152 million online e-commerce payments were made during Q2 FY25, with a value of PKR 192 billion, showing the growing role of digital transactions in Pakistan's online economy [3]. However, despite this growth, many online consumers still face problems related to product information, delivery reliability, order tracking, and trust in sellers.

In e-commerce, supply chain transparency means providing customers with accurate, timely, and accessible information about product availability, order status, delivery progress, and service processes. Transparency is important because online customers cannot physically inspect products or directly observe the seller's logistics process before purchase. Therefore, clear information can reduce uncertainty and improve customer confidence [4]. Recent research on Pakistan's e-commerce sector shows that logistics service quality, information quality, and product quality are important factors affecting customer satisfaction [1]. Specifically examined logistics service quality in Pakistan's e-commerce industry and found that information quality and product quality significantly influence product satisfaction.

Customer trust and service quality are also important factors in online shopping. Trust helps reduce perceived risk, while service quality improves the customer's evaluation of the shopping experience. To found that e-service quality dimensions such as website design, security/privacy, and fulfillment affect overall e-service quality and customer behavior in online shopping [5]. To investigate the relationship between e-service quality and e-trust on customer e-satisfaction and e-loyalty within the online shopping context in Pakistan [6]. These findings suggest that customer satisfaction in e-commerce depends not only on the availability of online platforms but also on the reliability, transparency, and quality of the services provided.

Although previous studies have examined e-service quality, trust, logistics, and customer satisfaction in online shopping, limited research has focused specifically on the effect of digital supply chain transparency on customer satisfaction in Pakistan's e-commerce industry. Moreover, the mediating roles of customer trust and service quality in this relationship have not been fully explored. Therefore, this study examines the impact of digital supply chain transparency on customer satisfaction in Pakistan's e-commerce industry, with customer trust and service quality as mediating variables.

I.I Statement of the Problem

Pakistan's e-commerce sector is growing day by day, but the customer is not satisfied due to its services, despite its rapid expansion. Many consumers are reporting challenges related to limited supply chain transparency, non-tracked delivery services, and weak communication systems. Confusion and lack of transparency are a decrease in confidence in online shopping platforms are frequently results of these issues. Due to these results, trust in digital marketplaces continues to be affected negatively. These problems highlight significant operational gaps within the e-commerce ecosystem.

Online consumers in Pakistan frequently faced these difficulties, such as inaccurate product descriptions, delayed shipments, and insufficient order tracking information. In Pakistan these issues reduce the overall shopping experience and create uncertainty in purchasing decisions. Poor coordination within supply chain processes further contributes to customer dissatisfaction. Additionally, customers become frustrated when sellers and service providers don't respond quickly enough. Together, these challenges undermine long-term customer relationships in the digital marketplace.

Although there has been a lot of global research on customer satisfaction in e-commerce, the Pakistani context has received relatively little empirical attention. In particular, the impact of digital supply chain transparency on customer satisfaction has not been fully investigated. Previous research frequently ignores the ways in which consumer perceptions and behavior are impacted by logistics and operations transparency. This indicates a clear research gap in the current literature. As a result, more research is required to comprehend these relationships better. In addition, the roles of trust and service quality as mediators in the connection between digital supply chain transparency and customer satisfaction have received little attention. Understanding how these variables are related is necessary for improving e-commerce performance in Pakistan. This study aims to examining the impact of digital supply chain transparency on customer satisfaction. This study also explores how trust and service quality mediate this relationship. Due to this study, it is predicted that the results will offer informative information for enhancing the e-commerce industry customer experience.

I.II Research Objectives

The main objective of this study is to examine the impact of digital supply chain transparency on customer satisfaction through trust and services quality in Pakistan's e-commerce industry. The key objectives are:

- To examine the impact of digital supply chain transparency on customer satisfaction in Pakistan's e-commerce industry.
- To analyze the relationship between digital supply chain transparency and customer trust and service quality.
- To examine the mediating role of customer trust and service quality between digital supply chain transparency and customer satisfaction.

I.III Research Questions

The study seeks to answer the following research questions:

- What does digital supply chain transparency influence on customer satisfaction in Pakistan's e-commerce industry?
- How does digital supply chain transparency affect customer trust and service quality?
- Does customer trust and service quality mediate the relationship between digital supply chain transparency and customer satisfaction?

I.IV Research Hypotheses

H1: Digital supply chain transparency has a positive influence on customer satisfaction.

H2: Digital supply chain transparency has a positively influences customer trust and service quality.

H3: Customer trust and service quality has positively effects on customer satisfaction.

H4: Customer trust and service quality mediates the relationship between digital supply chain transparency and customer satisfaction.

I.V Significance of Study

A significance of this study which is explain, why this research is important and what benefits it offers to academic community, professional practice, managerial decision making, and policy makers.

Academic Community

This study contributes to the existing body of knowledge in the fields of supply chain management, e-commerce, and consumer behavior by investigating the relationship between digital supply chain transparency and customer satisfaction. This study's findings will serve as a theoretical foundation for future researchers, those who are interested in digital transformation, online consumer behavior, and supply chain transparency in developing economies.

Professional Practice
This study provides informative information for Pakistani online retailers, supply chain managers, and e-commerce companies. Organizations can create plans to enhance order visibility, communication, and accuracy of information by determining how digital supply chain transparency affects customer satisfaction. In a highly competitive online market, the results will help companies in developing consumer trust, improving service quality, and boosting customer loyalty and retention.

Managerial Decision Making
This study is benefit for managers and decision-makers, this research emphasizes the importance of investing in digital technologies that improve supply chain visibility and transparency. The study will help managers understand how customer perceptions and satisfaction levels are impacted by transparent practices.

Policy Makers
The results of this study could help policymakers and regulatory authorities in developing guidelines and policies that's promote transparency and accountability in the e-commerce sector. Improved regulations related to consumer protection, information disclosure, and digital commerce practices can help build consumer confidence and support the sustainable growth of Pakistan e-commerce industry.

II. Literature Review

II.I Discussion the literature concept:

Digital Supply Chain Transparency in E-Commerce

Digital supply chain transparency refers to the degree to which customers and businesses are able to obtain accurate, timely, and dependable information about product origin, order handling, inventory availability, shipment movement, and delivery outcomes. In the context of e-commerce, transparency is especially important because customers are unable to physically examine products or directly monitor logistics activities before completing a purchase [7]. Supply-chain traceability (SCT), strengthened by complete and transparent information sharing, is essential for safeguarding businesses and consumers. For example, contamination in cold chain systems, including foodborne illnesses, can lead to serious short-term and long-term health effects for consumers [8]. Blockchain and other traceability technologies help enhance transparency by enabling supply chain participants to record, verify, and share information securely [9]. Prior research suggests that blockchain technology can improve supply chain management by increasing transparency, traceability, and security. It also enables easier access to product and transaction information, which enhances visibility throughout the supply chain. Existing studies further indicate that digital transparency in supply chains helps reduce information asymmetry and builds greater customer trust in online transactions [10], [11], [12].

In Pakistan's e-commerce industry, supply chain transparency is particularly important because customers often depend on product information, seller credibility, delivery updates, and return policies when deciding whether to trust an online platform [13]. When customers receive clear order tracking, accurate product details, and timely delivery communication, they are more likely to perceive the platform as reliable and professional.

Customer Trust in E-Commerce Platforms

Customer trust is one of the most important factors in e-commerce because online transactions involve uncertainty, risk, and limited physical interaction between buyers and sellers. Trust means that customers believe an online seller or platform will deliver products as promised, protect payment information, and provide reliable service [14]. Developed and validated trust measures for e-commerce and emphasized that trust is essential for online purchasing behavior [15]. Similarly found that trust plays an important role in online shopping because it reduces uncertainty and supports purchase intention [16].

In the Pakistani context, customer trust is especially important because consumers may worry about fake products, delayed delivery, payment security, and weak after-sales service. [6] found that e-service quality and e-trust significantly influence e-satisfaction and e-loyalty among online shoppers in Pakistan. This means that customers are more likely to continue using an online platform when they trust the seller and feel satisfied with the service experience.

Service Quality in Digital Commerce

Service quality in e-commerce can be understood as the way customers assess the overall performance of online services. It includes factors such as ease of website use, quick response, security, dependable delivery, accurate product fulfillment, and effective customer support. The concept of service quality is often associated with the SERVQUAL model, which evaluates quality through key dimensions including reliability, responsiveness, assurance, empathy, and tangibles [17], [18]

In online shopping, service quality covers both the digital shopping experience and the delivery process. Key aspects of e-service quality, such as website layout, data security, privacy protection, and successful order completion, strongly influence customer satisfaction, trust, and purchasing behavior online [5]. Logistics service quality in e-commerce has also been investigated, with findings indicating that information quality and product quality play key roles in influencing customer satisfaction with products [1]. These findings are highly relevant to this study because digital supply chain transparency depends on accurate information, reliable delivery, and effective communication.

In Pakistan's e-commerce sector, service quality plays a vital role because customers evaluate online platforms not only based on the products they purchase but also on factors such as delivery efficiency, order tracking, communication, return and refund procedures, and customer support. Even if the product meets expectations, poor service quality can negatively affect customer satisfaction [19].

Customer Satisfaction in E-Commerce

Customer satisfaction refers to the customer's overall evaluation of whether a product or service experience meets or exceeds expectations. In e-commerce, customer satisfaction is closely connected to expectations and disconfirmation, as online shoppers are more likely to feel satisfied when the actual shopping experience meets or goes beyond what they expected.[20].

In the e-commerce sector, customer satisfaction is influenced by various elements such as product quality, website functionality, consumer trust, reliable delivery, accurate information, and service quality. The results further show that e-satisfaction significantly contributes to improving e-loyalty among online consumers in Pakistan. Hence, online businesses should prioritize improving customer satisfaction in order to promote repeat purchases and develop lasting relationships with customers [6].

Relationship between Transparency, Trust, Service Quality, and Satisfaction

Digital supply chain transparency can improve customer satisfaction directly and indirectly. When customers receive accurate product information, real-time order tracking, and clear delivery updates, uncertainty is reduced. It may help to build customer trust, as they are more likely to view the platform as dependable and transparent. It can also enhance perceived service quality by making customers feel well-informed and supported throughout the buying process [21].

Trust and service quality can also serve as mediating factors in the relationship between digital supply chain transparency and customer satisfaction. Previous research findings to indicate that key aspects of online service quality are closely associated with the development of e-trust in online shopping [22]. Previous studies have also found that e-service quality and e-trust influence e-satisfaction and e-loyalty in Pakistan

[6]. Therefore, the existing literature suggests that transparency can enhance customer satisfaction by building stronger trust and improving how customers perceive service quality.

II.II Theoretical Framework

Signalling Theory

Signalling Theory was introduced by Spence, (1973). The theory explains how one party can reduce information asymmetry by sending credible signals to another party [23]. In e-commerce, buyers often have limited information compared to sellers regarding product quality, seller credibility, and delivery performance. In this context, digital supply chain transparency serves as an important indicator of reliability. Features such as real-time order tracking, accurate product details, verified seller information, and regular delivery updates help demonstrate that the platform is dependable and professionally operated. Researchers also note that signalling theory is relevant in situations where one party has more information than the other [24].

SERVQUAL Model

The SERVQUAL model, developed by Parasuraman, (1988), explains service quality by comparing customer expectations with actual service performance. In this study, SERVQUAL supports the role of service quality as a mediator. Customers are more likely to view an e-commerce service as high quality when the platform offers accurate information, dependable delivery, prompt responses, and transparent communication [25].

Expectation Confirmation Theory

Expectation Confirmation Theory explains that satisfaction occurs when actual service performance meets or exceeds customer expectations. In e-commerce, customers expect accurate product information, secure payment, timely delivery, and clear order tracking [26]. When digital supply chain transparency helps meet these expectations, customer satisfaction is likely to increase.

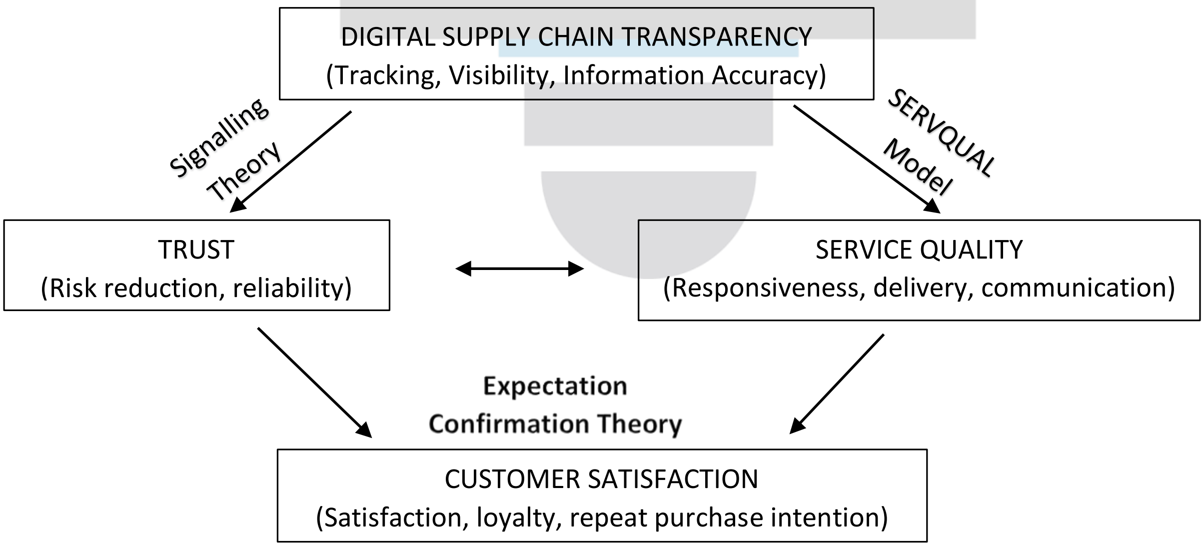

Figure 1. *Theoretical framework the relationship between digital supply chain transparency and customer satisfaction through trust, service quality*

II.III Research Gap

Prior research has explored factors such as e-service quality, customer trust, logistics service quality, and customer satisfaction in the context of online shopping. However, relatively few studies have specifically addressed digital supply chain transparency within Pakistan's e-commerce sector. Most existing research in Pakistan has primarily focused on e-service quality, e-trust, logistics performance, satisfaction, and loyalty. Therefore, the integrated relationship among digital supply chain transparency, customer trust, service quality, and customer satisfaction has not yet been sufficiently investigated within a single research framework.

To address these gaps, the current study creates an interactive framework for examining the impact of digital supply chain transparency on customer satisfaction, as well as the mediating roles of trust and service quality also providing context-specific insights relevant to Pakistan's rapidly growing e-commerce sector.

III. Methodology

III.I Research Design

This study follows a positivist research philosophy, which assumes that social phenomena can be measured objectively through observable evidence [27]. A quantitative research approach was used to collect and analyze numerical data related to digital supply chain transparency, trust, service quality, and customer satisfaction. To meet the research objectives, the study adopted a cross-sectional survey design, in which data were gathered from online consumers at one specific point in time. This design is suitable for examining current customer perceptions and experiences in Pakistan’s e-commerce sector. It also allows the researcher to test hypotheses and analyze the relationships among the study variables.

III.II Source of Data

The source of data is based on primary data, specifically responses from customers who have prior experience purchasing products and services through e-commerce platforms in Pakistan and data were collecting using a structured questionnaire.

III.III Population of Study

The population for this study consists of online shopping in Pakistan who have previously purchased products or services through e-commerce platforms. These respondents were selected because their online shopping experience makes them suitable for evaluating digital supply chain transparency, customer trust, service quality, and customer satisfaction, which are the main variables of this research. Table 3.1 presents the detailed classification of the population elements.

Table 3.1: Distribution of Population

Sr/No.	Population Element	Description
1	Target Population	Online shoppers in Pakistan
2	Geographic Area	Residence in Pakistan
3	Age Group	18 years and above
4	Platforms Considered	E-commerce websites, Daraz, Amazon & Alibaba/Ali-Express
5	Research Sector	E-commerce Industry
6	Respondent Type	Online consumers

III.IV Sample Size Determination

After reviewing and cleaning the data, 386 responses contained at least one valid answer for the main study constructs. However, for the regression and mediation analyses, 385 responses were considered complete and suitable for final analysis. A sample size of 385 respondents is appropriate for this study because the research model includes one independent variable, two mediating variables, one dependent variable, and demographic control variables. This number of responses provides enough statistical power for regression and mediation testing. It is also suitable for analysis using Stata 18, including robust regression and bootstrap mediation, as the sample is large enough to produce reliable and stable coefficient estimates.

Table 3.2: Collective Response of Sample size

Sr/No.	Description	Number
1	Rows with at least one valid construct response	386
2	Final sample used for regression/mediation	385

The analysis therefore proceeds with n = 385 as the final analytical sample.

III.V Sampling Technique

The study applied a convenience sampling method, a type of non-probability sampling, to gather data from respondents who were accessible and willing to participate. The questionnaire was shared with individuals who had experience using e-commerce platforms in Pakistan, so their responses would be relevant to the purpose of the study. In total, 386 valid responses were obtained and included in the statistical analysis.

Statistics

Data analysis was conducted using Stata 18. The data were collected through a structured questionnaire and then analyzed using several statistical techniques, including reliability analysis, descriptive statistics, correlation analysis, regression analysis, and mediation analysis. These methods were used to examine the relationships among digital supply chain transparency, customer trust, service quality, and customer satisfaction. The analysis also helped test the proposed hypotheses and understand the structural links between the study variables.

IV. Results

IV.I Data Analysis and Research Questions

Reliability Analysis

Table 4.1: Reliability Analysis Using (Cronbach's Alpha)

Scale	Items	Valid N	Cronbach alpha
DSCT	7	372	0.823
Trust	6	385	0.825
Service Quality	6	382	0.824
Customer Satisfaction	6	380	0.774

The measurement scale's reliability was determined using Cronbach's alpha. All constructs showed acceptable internal consistency, with values greater than the recommended threshold of 0.70 (Hair, 2019). DSCT ($\alpha = 0.823$), Trust ($\alpha = 0.825$), and Service Quality ($\alpha = 0.824$) demonstrated high reliability, while Customer Satisfaction ($\alpha = 0.774$) remained acceptable. These results show that the survey instrument is appropriate for further statistical analysis.

Descriptive Statistics

Table 4.2: Descriptive Statistics and Main Constructs

Variable	N	Mean	SD	Min	Max	Agree/Strongly agree %	Disagree %
DSCT	386	4.404	0.496	1.200	5.000	86.269	1.554
Trust	386	4.418	0.485	1.833	5.000	88.601	1.295
Service Quality	386	4.419	0.510	1.833	5.000	88.342	2.332
Customer Satisfaction	385	4.457	0.436	2.667	5.000	91.451	0.777

The results indicate that all variables recorded relatively high mean scores, suggesting that respondents generally expressed positive perceptions regarding digital supply chain transparency and its related outcomes. Customer Satisfaction recorded the highest mean score (M = 4.457, SD = 0.436), followed by Service Quality (M = 4.419, SD = 0.510), Trust (M = 4.418, SD = 0.485), and Transparency (M = 4.404, SD = 0.496). The mean values ranged from 4.404 to 4.457 on a five-point Likert scale, indicating a high level of agreement among respondents.

Correlation Analysis

Table 4.3: Pearson correlation analysis

Variable	DSCT	Trust	Service Quality	Customer Satisfaction
DSCT	1.00	0.779	0.784	0.726
Trust	0.779	1.00	0.783	0.734
Service Quality	0.784	0.783	1.00	0.777
Customer Satisfaction	0.726	0.734	0.777	1.00

Pearson correlation analysis revealed significant positive relationships among all constructs. Service Quality showed the strongest association with Customer Satisfaction ($r = 0.777$), followed by Trust ($r = 0.734$) and Transparency ($r = 0.726$).

Regression Analysis

Table 4.4: Coefficient Analysis: Customer Satisfaction

Predictor	Coefficient (B)	SE	Standardized B	T	P	Lower 95% CI	Upper 95% CI
Constant	1.037	0.128		8.083	<0.001	0.785	1.289
Transparency	0.184	0.047	0.207	3.918	<0.001	0.092	0.277
Trust	0.218	0.048	0.239	4.513	<0.001	0.123	0.313
Service Quality	0.372	0.046	0.430	8.076	<0.001	0.281	0.462

DSCT significantly predicts Trust ($B = 0.761$, $p < .001$) and explains 60.64% of the variance in Trust. DSCT also significantly predicts Service Quality ($B = 0.806$, $p < .001$) and explains 61.48% of the variance. In the direct model, DSCT predicts Customer Satisfaction ($B = 0.645$, $p < .001$), explaining 52.70% of satisfaction. When Trust and Service Quality are added, the model explains 65.93% of satisfaction. DSCT remains significant but its coefficient falls from 0.645 to 0.181, showing partial mediation. The DSCT alone explains 52.8% of satisfaction variance. Adding trust raises R^2 to 0.601; adding service quality raises it further to 0.660 (adjusted $R^2 = 0.657$). In the full model, all three predictors remain significant. Service quality is strongest ($\beta = 0.430$), followed by trust ($\beta = 0.239$) and transparency ($\beta = 0.207$).

RQ1: Table 4.1 and 4.2 indicate that digital supply chain transparency has a significant positive influence on customer satisfaction. A strong positive correlation **(**$r = 0.726$**)** and a significant regression coefficient ($B = 0.645$, $p < 0.001$) demonstrate that higher transparency improves customer satisfaction. Moreover, transparency explains 52.70% of the variation in customer satisfaction, confirming its substantial contribution.

RQ2: Table 4.1 and 4.2 indicate that digital supply chain transparency significantly improves both customer trust and service quality. The regression analysis shows that transparency positively predicts trust ($B = 0.761$) and service quality ($B = 0.806$), explaining 60.64% and 61.48% of their respective variances.

Mediation Analysis

Table 4.5: Mediation Path Coefficients

Path	B	Std. error	t	p-value
a1: DSCT → Trust	0.757	0.031	24.06	<0.001
a2: DSCT → Service Quality	0.803	0.033	24.33	<0.001
c: DSCT → Satisfaction	0.648	0.031	20.71	<0.001
c1: DSCT → Satisfaction	0.184	0.047	3.918	<0.001
b1: Trust → Satisfaction	0.218	0.048	4.513	<0.001
b2: Service Quality → Satisfaction	0.372	0.046	8.076	<0.001

RQ3: Table 4.5 and the Figure 4.5 show the mediation analysis that digital supply chain transparency has a direct and indirect impact on the outcome variable. The indirect effect of customer trust is 0.174 (0.762 × 0.229), whereas the indirect effect of service quality is 0.299 (0.798 × 0.375), indicating that service quality is the stronger mediator. The total indirect effect is 0.473, indicating a significant mediatory impact. When combined with the direct effect of 0.170, the total effect of transparency on the outcome variable is 0.643, indicating a strong partial mediation effect via trust and service quality.

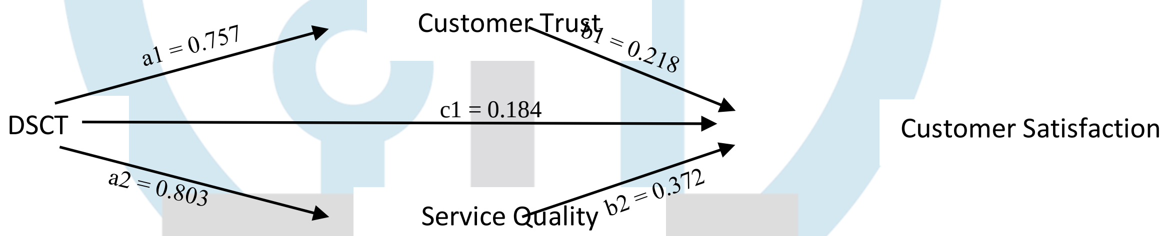

Figure 2. *Parallel mediation model with unstandardized path coefficients.*

IV.II Test of Hypotheses

H1: Digital supply chain transparency has a positive influence on customer satisfaction.

Table 4.4 shows that transparency positively predicts customer satisfaction with a regression coefficient of $B = 0.184$ ($\beta = 0.207$, $t = 3.918$, $p < 0.001$). The positive coefficient demonstrates that greater transparency in supply chain activities is associated with higher levels of customer satisfaction among consumers in Pakistan's e-commerce industry. The correlation coefficient ($r = 0.726$) shown in Table 4.3 confirms a strong positive relationship between these two variables, providing additional support for the proposed hypothesis.

H2: Digital supply chain transparency positively influences customer trust and service quality.

Table 4.5 shows that transparency has a significant positive effect on customer trust ($B = 0.757$, $t = 24.06$, $p < 0.001$) and service quality ($B = 0.803$, $t = 24.33$, $p < 0.001$). In addition, the regression results indicate that transparency explains approximately 60.64% of the variation in customer trust and 61.48% of the variation in service quality. These findings suggest that providing accurate, timely, and accessible supply chain information strengthens customer confidence while improving their evaluation of service performance.

H3: Customer trust and service quality have positive effects on customer satisfaction.

Table 4.4 shows that customer trust has a positive regression coefficient of $B = 0.218$ ($\beta = 0.239$, $t = 4.513$, $p < 0.001$), while service quality has the strongest effect with $B = 0.372$ ($\beta = 0.430$, $t = 8.076$, $p < 0.001$). Similarly, the correlation analysis in Table 4.3 reveals positive associations between customer satisfaction and trust ($r = 0.734$) as well as service quality ($r = 0.777$). These results indicate that improvements in trust and service quality significantly increase customer satisfaction, with service quality emerging as the strongest predictor in the model.

H4: Customer trust and service quality mediate the relationship between digital supply chain transparency and customer satisfaction.

Table 4.5 and Figure 4.5 Shows that the direct effect of transparency on customer satisfaction decreased from 0.648 to 0.184 after including the mediating variables, while remaining statistically significant ($p < 0.001$). The indirect effect through customer trust was 0.174, whereas the indirect effect through service quality was 0.299, resulting in a total indirect effect of 0.473. The total effect reached 0.643, confirming that transparency influences customer satisfaction both directly and indirectly. The larger indirect effect of service quality indicates that it serves as the stronger mediator, although both mediators play significant roles in strengthening the relationship.

V. Discussion:

The findings of this study confirm that digital supply chain transparency is an important factor influencing customer satisfaction in Pakistan's e-commerce industry. The statistical analysis revealed a significant positive effect of transparency on customer satisfaction ($\beta = 0.207$, $B = 0.184$, $p < 0.001$), supported by a strong correlation coefficient ($r = 0.726$), as presented in Table 4.3, Table 4.4, and Figure 3. These findings suggest that when customers receive accurate product information, real-time order tracking, and clear communication throughout the purchasing process, they are more likely to evaluate their shopping experience positively. The results are consistent with the findings, who argued that greater transparency reduces uncertainty and strengthens customers' confidence in online transactions, ultimately increasing their satisfaction [8], [20].

Figure 3. Distribution of respondents on the effect of digital supply chain transparency on customer satisfaction

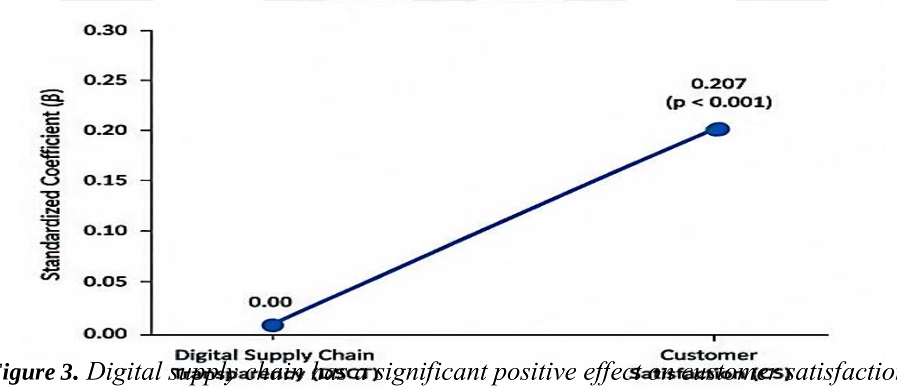

Figure 3. *Digital supply chain has significant positive effect on customer satisfaction (β = 0.207, p < 0.001)*

The study also demonstrates that digital supply chain transparency significantly improves customer trust and perceived service quality, thereby supporting the H2. Transparency showed a strong positive influence on customer trust ($B = 0.757$, $t = 24.06$, $p < 0.001$) and service quality ($B = 0.803$, $t = 24.33$, $p < 0.001$), explaining 60.64% and 61.48% of the variance, respectively. As shown in Table 4.5 and Figure 4, the effect on service quality was slightly stronger than its effect on trust, indicating that customers value operational efficiency and reliable service when evaluating online retailers. These findings support Signalling Theory, which proposes that transparent information serves as a credible signal of organisational reliability [28], and they are consistent with previous studies, who reported that transparent business practices strengthen consumer trust and improve service perceptions [29].

Figure 4. Distribution of respondents on the effect of digital supply chain transparency on customer trust and service quality

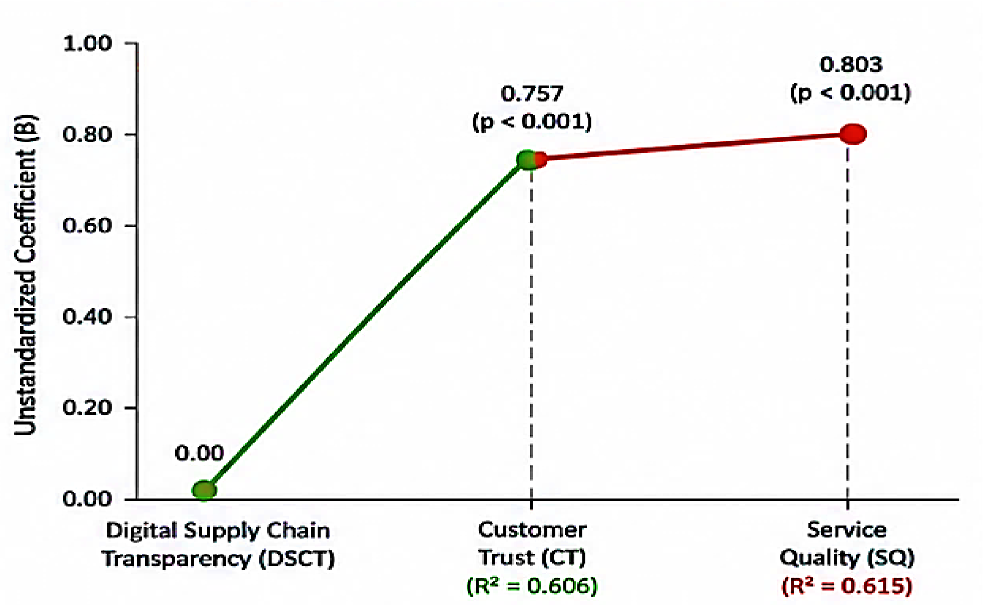

Figure 4. *Digital supply chain has a significant improves both trust (B = 0.757) and service quality (B = 0.803), with a slightly stronger effect on service quality*

The regression analysis further indicates that both customer trust and service quality have significant positive effects on customer satisfaction. Customer trust produced a positive regression coefficient (β = 0.239, B = 0.218, $p < 0.001$), whereas service quality demonstrated the strongest impact (β = 0.430, B = 0.372, $p < 0.001$). In addition, the correlation analysis reported strong relationships between customer satisfaction and trust (r = 0.734) and between customer satisfaction and service quality (r = 0.777), as illustrated in Table 4.3, Table 4.4, and Figure 5. These findings indicate that although transparency initiates positive customer perceptions, satisfaction is largely achieved when customers experience dependable delivery, responsive communication, and consistent service performance. Similar conclusions have been reported, who identified service quality as one of the most influential determinants of customer satisfaction in e-commerce

Figure 5. Distribution of respondents on the effect of customer trust and service quality on customer satisfaction

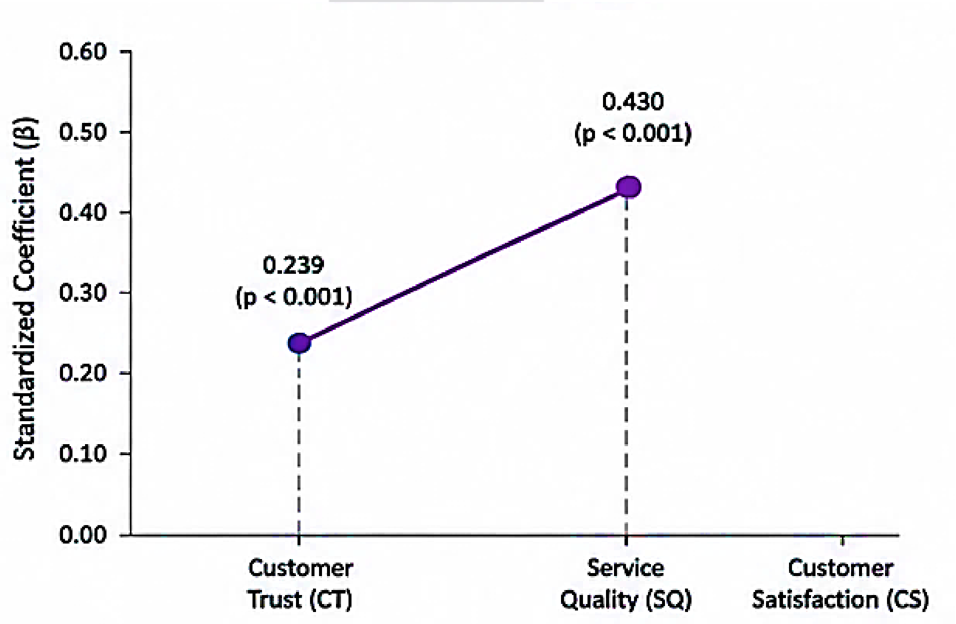

Figure 5. *Both customer trust (β = 0.239) and service quality (β = 0.430) positively influence customer satisfaction, with service quality having the stronger impact*

In the mediation analysis confirms in Table 4.5 and Figure 6, the direct effect of transparency declined from 0.648 to 0.184 after introducing the mediators, while the total indirect effect reached 0.473, including 0.174 through customer trust and 0.299 through service quality. The larger indirect effect of service quality indicates that it is the more influential mediator in this relationship. The results explains that customers become more satisfied when transparent information is supported by reliable service experiences that meet or exceed their expectations. Previous studies have shown similar results, indicating that transparency improves customer satisfaction mainly by strengthening trust and enhancing perceived service quality [9], [22].

Figure 6. Distribution of respondents on the effect of customer trust and service quality on between digital supply chain transparency and customer satisfaction

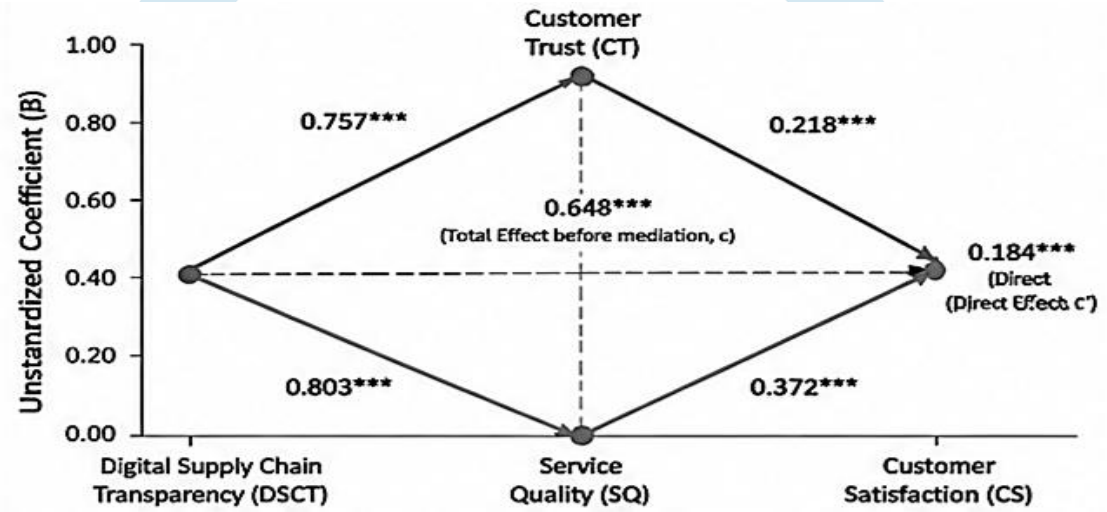

Figure 6. *Customer trust and service quality partially mediate the relationship & service quality provides the stronger mediation effect*

VI. Conclusion

This study found that digital supply chain transparency has a positive effect on customer satisfaction in Pakistan's e-commerce industry. The results show that customers are more satisfied when online platforms provide accurate product information, real-time order tracking, and clear communication during the delivery process. These transparent practices help reduce customer uncertainty and improve confidence in online shopping platforms.

The findings also show that digital supply chain transparency improves customer trust and perceived service quality. Customers are more likely to trust an e-commerce platform when they receive reliable information about their orders and delivery status. In addition, better transparency helps customers evaluate the service as more reliable and professional.

This study further confirms that customer trust and service quality partially mediate the relationship between digital supply chain transparency and customer satisfaction. Among these two mediators, service quality has the stronger effect. This means that transparency alone is not enough. E-commerce companies must also provide reliable delivery, quick communication, accurate order fulfillment, and effective customer support. Overall, the study shows that digital transparency, trust, and service quality are important for improving customer satisfaction and building long-term relationships with online customers in Pakistan.

VII. Recommendations

Based on the findings of this study, the following recommendations are suggested:

- E-commerce companies in Pakistan should improve digital supply chain transparency by providing real-time order tracking, correct product details, and regular delivery updates. This can help reduce customer uncertainty and improve satisfaction.

- Online platforms should use reliable systems to build customer trust. These may include secure payment methods, verified seller accounts, clear return and refund policies, and honest communication with customers.
- E-commerce businesses should improve service quality by focusing on fast delivery, responsive customer support, and accurate order fulfillment. These factors are important because service quality has the strongest effect on customer satisfaction in this study.
- Companies should adopt digital technologies such as AI-based tracking systems, automated logistics tools, and blockchain-based traceability where possible. These technologies can improve supply chain visibility, reduce errors, and increase customer confidence.
- Policymakers should develop stronger rules for transparency and consumer protection in Pakistan's e-commerce sector. Clear rules about product information, delivery updates, refunds, and seller accountability can help protect customers and support the growth of online business.

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