

DELIVERY SERVICE QUALITY ASSESSMENT OF CROSS-BORDER E-COMMERCE BETWEEN CHINA AND UZBEKISTAN

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ABSTRACT

Cross-border e-commerce (CBEC) has become a major driver of global digital trade. Within the Belt and Road Initiative, the China–Uzbekistan trade corridor has emerged as an important route connecting East Asia and Central Asia. However, the success of CBEC in this corridor depends heavily on the quality of delivery services. Despite the growing importance of Central Asian markets, empirical evidence on delivery service quality in CBEC remains limited, particularly from the combined perspectives of customers and logistics employees. This study examined the development of CBEC and delivery services between China and Uzbekistan. Grounded in the SERVQUAL framework, the study assessed five service quality dimensions: reliability, responsiveness, assurance, empathy, and tangibility. A cross-sectional quantitative design was employed using survey data collected from 189 respondents, comprising 67 logistics employees and 122 customers. The Analytic Hierarchy Process (AHP) was used to determine the relative importance of service quality dimensions, while Fuzzy Comprehensive Evaluation (FCE) was applied to assess overall service performance. The findings revealed that reliability was the most important service quality dimension, followed by assurance and responsiveness. Reliability also achieved the highest performance scores among both customers and employees, whereas empathy consistently recorded the weakest performance. The overall customer and employee satisfaction scores were 3.57 and 3.70, respectively, indicating satisfactory but improvable service quality. Both stakeholder groups highlighted challenges related to service accessibility and stress-free delivery experiences. This study extends SERVQUAL research to the underexplored China–Uzbekistan CBEC corridor, integrates customer and employee perspectives in logistics service quality assessment, and demonstrates the applicability of combining AHP and FCE in evaluating CBEC delivery performance. The findings suggest that logistics providers should strengthen delivery reliability, real-time tracking, customs coordination, and customer communication, while policymakers should enhance trade facilitation and logistics infrastructure.

Keywords: Cross-border e-commerce, delivery service quality, SERVQUAL, China–Uzbekistan corridor; customer satisfaction.

1. INTRODUCTION

The rapid advancement of digital technologies, internet connectivity, and global logistics networks has fundamentally transformed international trade, making cross-border e-commerce (CBEC) one of the fastest-growing segments of the global digital economy (Liu et al., 2023; Zha et al., 2022). Unlike traditional international trade channels, CBEC enables consumers and businesses to engage directly in international transactions through digital platforms, reducing geographical barriers and expanding market access. As a result, CBEC has become a critical driver of global economic integration, facilitating the movement of goods, services, and

information across national borders with unprecedented speed and efficiency (UNCTAD, 2024).

The global CBEC market has experienced remarkable growth over the past decade. According to Statista, the global cross-border e-commerce market was valued at approximately US\$785 billion in 2021 and is projected to exceed US\$7.9 trillion by 2030 (Koen, 2023). Similarly, the World Trade Organization (WTO) has highlighted the increasing contribution of digital trade and e-commerce to global economic development, particularly in emerging markets where digitalization is reshaping traditional trade patterns (WTO, 2024). China has emerged as the world's largest e-commerce market and a leading force in CBEC development. Official statistics indicate that China's cross-border e-commerce trade volume increased by 10.8% in 2023 and continued to grow by 9.6% during the first quarter of 2024, reaching approximately 577.6 billion yuan (Xinhua, 2024). This expansion has been supported by technological innovation, government policy initiatives, and investments in international logistics infrastructure.

In recent years, trade and economic cooperation between China and Uzbekistan have deepened significantly under the framework of the Belt and Road Initiative (BRI). Uzbekistan occupies a strategic position in Central Asia, serving as an important gateway connecting East Asia, Europe, and the Middle East. Bilateral trade between China and Uzbekistan has expanded considerably, with China becoming one of Uzbekistan's largest trading partners. According to the Government of Uzbekistan and China's customs statistics, bilateral trade exceeded US\$14 billion in 2024, reflecting growing economic interdependence and increasing demand for cross-border commercial activities (Asian Development Bank, 2024; Ministry of Investment, Industry and Trade of Uzbekistan, 2024).

The rapid expansion of trade relations has been accompanied by increasing adoption of e-commerce platforms by consumers and businesses in Uzbekistan. Improvements in internet penetration, mobile payment systems, digital infrastructure, and logistics networks have encouraged greater participation in online international shopping, particularly from Chinese e-commerce platforms such as Alibaba Group, AliExpress, and Temu. Consequently, delivery service performance has become a critical determinant of customer satisfaction and business success in the China–Uzbekistan CBEC ecosystem (Gulc, 2021). While digital platforms facilitate online transactions, the ultimate success of CBEC depends heavily on the efficiency and quality of logistics and delivery services (Do et al., 2023). Delivery service quality encompasses multiple dimensions, including timeliness, reliability, responsiveness, order accuracy, information transparency, shipment security, and customer support (Parasuraman et al., 1988; Blut et al., 2018). In cross-border settings, these dimensions become even more important because goods must travel through complex international logistics networks involving transportation providers, customs authorities, freight forwarders, warehousing facilities, and last-mile delivery operators (Chen et al., 2020).

The China–Uzbekistan corridor presents unique logistical challenges that may influence delivery service quality. Unlike coastal economies with direct access to maritime trade routes, Uzbekistan is a landlocked country that relies heavily on multimodal transportation systems, including rail, road, and air freight networks. Cross-border shipments often encounter customs clearance delays, regulatory complexities, infrastructure constraints, documentation requirements, and coordination challenges among multiple logistics stakeholders (ADB, 2024). These challenges may increase delivery lead times, shipping costs, and service uncertainties, ultimately affecting consumer perceptions and purchasing behavior.

Existing studies have consistently demonstrated that logistics service quality significantly

influences customer satisfaction, repurchase intention, trust, and loyalty in e-commerce environments (Giuffrida et al., 2020; Blut et al., 2018; Ding & Zhao, 2021; Vakulenko et al., 2019). However, most CBEC logistics research has focused on developed markets or major international trade corridors involving China, Europe, and North America (Fisher et al., 2019; Ding & Zhao, 2021). Comparatively limited attention has been given to emerging Central Asian economies such as Uzbekistan, despite their growing importance within global supply chains and the Belt and Road Initiative. Furthermore, empirical evidence regarding how delivery service quality dimensions influence cross-border e-commerce performance from both consumer and employee perspectives remains scarce.

Against this backdrop, assessing delivery service quality within the China–Uzbekistan CBEC context is both timely and important. Understanding the strengths and weaknesses of current delivery services can provide valuable insights for logistics providers, e-commerce platforms, policymakers, and international trade stakeholders seeking to enhance operational efficiency and customer experience. This research assesses delivery service quality in cross-border e-commerce operations between China and Uzbekistan using the SERVQUAL framework. Specifically, the study aims to identify key factors influencing delivery service quality, evaluate the performance of delivery service providers, and propose practical measures to improve logistics service performance within the China–Uzbekistan CBEC ecosystem. The study addresses the following objectives:

1. To examine the development of cross-border e-commerce and delivery services between China and Uzbekistan.
2. To identify the factors influencing delivery service quality from the perspectives of consumers and employees.
3. To evaluate the performance of delivery service providers involved in China–Uzbekistan cross-border e-commerce.

2. LITERATURE REVIEW

2.1 Cross-Border E-Commerce Development in China and Uzbekistan

China has emerged as the global leader in cross-border e-commerce, supported by extensive manufacturing capabilities, advanced digital infrastructure, and strong governmental support for digital trade initiatives. The country's CBEC ecosystem has evolved into a highly integrated network that combines e-commerce platforms, financial technologies, logistics providers, and customs facilitation mechanisms. Major Chinese platforms such as Alibaba, AliExpress, JD.com, and Pinduoduo have significantly expanded international market access for Chinese firms while simultaneously attracting global consumers seeking affordable and diverse products (Wang et al., 2020).

A major catalyst for China's CBEC expansion has been the implementation of the Belt and Road Initiative (BRI) and the associated Digital Silk Road strategy. These initiatives have strengthened economic connectivity through investments in transportation infrastructure, digital technologies, customs cooperation, and trade facilitation mechanisms (Yu et al., 2020). The Digital Silk Road has promoted cross-border digital trade by supporting e-commerce development, telecommunications infrastructure, and logistics integration across participating countries (Giuffrida et al., 2020; Do et al., 2023). As a result, CBEC has become an important instrument for deepening economic cooperation between China and emerging markets.

Among Central Asian economies, Uzbekistan occupies a strategically important position within the BRI framework. Situated at the heart of Central Asia, Uzbekistan serves as a key

transit corridor connecting East Asia, Europe, and the Middle East. Trade relations between China and Uzbekistan have expanded significantly over the past decade, driven by infrastructure investments, transportation connectivity projects, and increasing commercial cooperation. The growth of CBEC activities between the two countries reflects broader efforts to enhance regional economic integration through digital trade channels.

The development of e-commerce in Uzbekistan has accelerated in recent years due to increasing internet penetration, smartphone adoption, and government initiatives aimed at digital transformation. The country has implemented reforms designed to modernize its digital economy, promote electronic payments, and encourage entrepreneurship within the online marketplace sector. These developments have created favorable conditions for the expansion of CBEC activities and increased consumer participation in international online shopping.

Nevertheless, significant structural challenges continue to affect the efficiency of CBEC operations in Uzbekistan. Unlike coastal economies with direct maritime access, Uzbekistan is a doubly landlocked country, requiring international shipments to transit through multiple countries before reaching final destinations. This geographical characteristic substantially increases transportation complexity, customs interactions, transit times, and logistics costs. Consequently, delivery service quality becomes a particularly critical determinant of customer satisfaction within the China–Uzbekistan CBEC corridor.

2.2 The progress of delivery service for CBEC

The delivery service of the cross-border e-commerce (CBEC) companies starts from the product pick-up from the shop or retailer stall where the items were ordered from, the carrier centre before shipping or transportation and final delivery to the customer. As illustrated in Figure 1, steps are from order and pick up till the final delivery to the consumers. The activities are described below;

Pick-up Stage: This is the first stage of the CBEC delivery process. It starts from the time the consumers have ordered (selected and completed payment) from the e-commerce application for instance Alibaba or Taobao online trade platform. Some of the risks associated with the activities at the pick-up stage include; handover omission, inconsistency with product pick, poor network coverage, product acceptance error, etc.

Package and processing: At this stage, the shipper assigns shipping and client details, and packages the product to meet cross-border handling requirements. Besides, the product is given a destination address label, or receiver location, inspecting items, packaging, and sorting items based on type or size. The products are packaged based on the fragility and type of products. The study expects the following risks to occur at the processing and package stage; error in sorting goods, delays in processing, diligent handling, loss of package and others.

Transportation stage: At this stage, the product is moved from carrier to the customer's doorstep. The transportation channel could be air cargo or sea cargo. The speed of the transport time depends on the type of carrier services, route type, speed of the package and meeting cross-border regulations in a timely manner. At this point, the following occurrences can affect the smooth transportation delivery services; delays in transportation, lack of due diligence, product missing, unknown routing, carrier accident and others.

The last stage of the CBEC process is the destination delivery services. This is when the products have arrived at the destination country (Uzbekistan), and the carrier needs to send or arrange for the client to pick up the product. In this period, several challenges can impede product transmission such as delivery address error, inflexible pick-up time, unexpected

charges, damage to package upon delivery, poor handling services, etc.

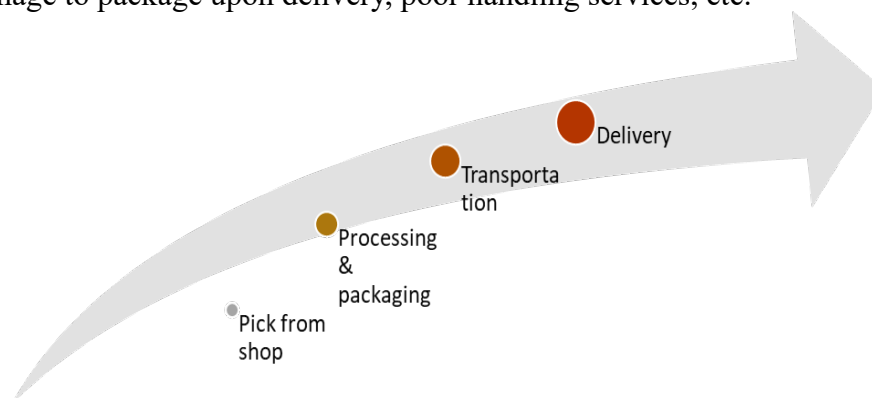


Figure 1 Cross-border delivery process

2.3 Delivery Service Quality in Cross-Border E-Commerce

Cross-border electronic commerce (CBEC) has emerged as one of the most transformative developments in international trade, fundamentally altering how firms access foreign markets and how consumers acquire products across national boundaries. Unlike traditional international trade, which is often constrained by complex intermediary networks, CBEC leverages digital platforms, electronic payment systems, and integrated logistics networks to facilitate direct transactions between geographically dispersed buyers and sellers (Li & Guo, 2019). The increasing digitalization of trade has enabled firms of varying sizes to participate in global markets, thereby reducing entry barriers and expanding international market opportunities. The rapid expansion of CBEC reflects broader shifts in the global economy toward digital trade and platform-based business models. Early forms of e-commerce were largely domestic and characterized by limited international transactions. However, advancements in internet technologies, digital payment infrastructures, cloud computing, and logistics management systems have facilitated the evolution of global online marketplaces capable of serving consumers across multiple jurisdictions (Gulc, 2021).

Zhu et al. (2023) examined cross-border electronic commerce's new path using articles from 2000 to 2021. The systematic review concluded that an increase in the operational efficiency of delivery services is an essential factor in promoting the adoption of CBEC. Do et al. (2023) investigated the effects of logistics service quality and price fairness on customer repurchase intention in CBEC. Using the structural equation model (SEM), they established that customer satisfaction is positively related to service quality (personnel quality), technical service quality (timeliness) and price quality (price fairness). Ho and Chaung (2023) studied the critical quality attributes for business-to-business cross-border electronic commerce platforms. The study revealed 15-dimensional quality attributes including payment safety, payment convenience, clear refund policy, transparency of delivery, reliability of delivery, safety of logistics delivery, information transparency, information security, information privacy, simplicity of return processes, consumer dispute mechanics, effectiveness of return and exchange, customer complaint services, and simplified search function.

Scholars increasingly conceptualize delivery service quality as a multidimensional construct encompassing operational efficiency, information transparency, responsiveness, reliability, security, and customer support (Miao et al., 2019; Do et al., 2022). This perspective extends

beyond traditional logistics performance indicators such as delivery speed and cost. Contemporary consumers expect real-time tracking information, proactive communication, secure handling of goods, flexible delivery options, and effective resolution of service disruptions. Consequently, logistics providers are required to balance operational efficiency with customer-oriented service delivery. The literature demonstrates that delivery service quality significantly influences consumer satisfaction and behavioral intentions. Han and Kim (2019) observed that dissatisfaction with delivery performance remains one of the most common causes of negative customer evaluations in CBEC transactions. Similarly, studies examining online consumer behavior consistently identify delivery reliability and information transparency as key predictors of repurchase intentions and customer loyalty (Mou et al., 2020). These findings suggest that logistics performance has evolved from a supporting operational function into a strategic marketing resource.

An important debate within the literature concerns whether delivery speed alone determines customer satisfaction. Earlier studies frequently emphasized rapid delivery as the primary indicator of service quality (Mou et al., 2020). However, recent evidence suggests that consumers increasingly value predictability and transparency over speed alone. Customers may tolerate longer delivery periods if they receive accurate information regarding shipment status and expected arrival times. This shift reflects broader changes in consumer expectations associated with digital commerce environments. The significance of delivery service quality becomes even more pronounced in emerging markets characterized by logistical constraints. In landlocked countries such as Uzbekistan, customers often face extended delivery periods, customs delays, and limited last-mile delivery infrastructure. Under such conditions, reliability and communication may become more important than speed itself. Therefore, assessing delivery service quality within the China–Uzbekistan CBEC corridor requires consideration of contextual factors that distinguish Central Asian logistics environments from those of more developed e-commerce markets.

Moreover, Han and Kim (2023) explored ways of improving the service quality of cross-border e-commerce. They used the latent Dirichlet allocation model and 14 service quality issues that consumers are concerned about in CBEC. The results showed that consumers paid more attention to the service quality of delivery service, customs efficiency and tariff, shopping experience, and others. Zha et al (2022) researched on the use of bonded warehouse or direct-mail, logistics mode choice in a cross-border e-commerce supply chain with platform information sharing. They focused on CBEC firms and their platforms. The study discovered that transparent information sharing is beneficial to both the platform, delivery firms and overseas suppliers. Li and Guo (2019) used the SERQUAL mode to assess the cross-border e-commerce service quality based on the definition of traditional service quality and cross-border e-commerce. The study employed used 250 questionnaires and found that delivery firms have to provide high-quality customer service, while also protecting the legitimate rights and interests of consumers. Casado et al. (2018), concluded that the facet of consumer satisfaction stimulates the extreme activation of ambiguity, penalty, distrust, and disappointment may be indicative of a high level of negativity during the evaluation of products from the perspective of the consumers. Li et al. (2019) reported that cross-border e-commerce had been shaped by many factors including language-related trade costs, parcel delivery, exchange rates, and online payment systems.

Giuffrida et al. (2020) studied cross-border business to consumer e-commerce in China.

They categorized the consumers' service variables into company-related (cost and product), market-related (platform, demand), and external (quality check, regulations) levels. In terms of cross-border e-commerce, they stressed the logistics-related services as a key to solving many other satisfaction variables which include cost factors, demand, and regulations. Song et al (2019) used text mining and fuzzy rule-based reasoning methods to assess cross-border e-commerce commodity risk and quality of delivery. They identified two quality issues namely inherent (when a commodity violates specific safety regulations) and historical inefficiencies (signifying how often and seriously the commodities with features like the one being considered to have violated the regulations).

2.3 SERVQUAL Model

Cross-border e-commerce service quality is based on the definition of traditional service quality (Li and Guo, 2019). The idea of service quality (S.Q.) was supported by the SERVQUAL model proposed by Parasuraman and colleagues in 1993. It is the most common instrument for measuring service quality. S.Q. Parasuraman et al. (1993) defined S.Q as the perceived quality of service provided by distinctive organizational units, or the people working in these, to other units or employees within the organization. Service quality is paramount in every organization or channel. Lack of it may lead to dismissal, denied promotions, etc. Nowadays, organizations look for quality service among all their partners. Fisher et al. (2019) demonstrated the financial impact of improved service quality and customer satisfaction as well as customers' sensitivities to both positive and negative service quality variability. This accounts for reasons there have been a series of service quality research in almost all fields of academic studies. Ma et al. (2021) asserted that apart from the cost, and time indices of e-commerce, service quality is also regarded as an important optimization objective. Shan et al. (2021) also carried out a CIT analysis on e-services to avoid failures in commerce delivery services, they suggested that when the business delivery service is lower than the customer's expectation or a customer's request fails to be realized, service failures take place.

Recent studies in the direction of multidimensional service quality have revealed that there is no homogeneity of service quality scales in previous studies. However, researchers focused on several measures to include efficiency, system availability, fulfilment, privacy or security, reliability, responsiveness, functionality or design, assurance, ease of use, information quality, appearance, loyalty or e-loyalty, perceived value, satisfaction, and trust (Nguyen et al., 2019; Shan et al. 2021; Mou et al., 2020; Kim et al., 2017). Nevertheless, other scales emerge in a particular e-service context. These observed variables are reflected as "general" or "special" scales in assessing traditional service quality (Ladhari (2019). The SQ scale in Table 1 tends to depend on the service industries involved. Even within the same industry, the scales still rely on the user's type of service. According to theoretical reviews, there are six consistent e-SQ scale concepts as follows: reliability, security, responsiveness, information quality, ease of use, and website design (Mou et al., 2020).

Table 1 Measures of CBEC service quality

Service quality	Definitions	Sample
Reliability	It is the ability of the enterprise to accurately fulfil the service commitment. For B2C cross-border e-commerce enterprises, whether the quality meets the promise, and whether the information is true can be used as a measure of the reliability of the consumer	CBEC deals with orders as required CBEC is trustworthy Service delivery meets expectations
Responsiveness	The ability of the buyer, retailer, third-party logistics and platform administrative support to interact and settle	There is a timely response to service

	disputes. The return speed or whether the dispute can be handled in time under CBEC.	Feedbacks communicated	timely
Assurance	staff is trustworthy with a good reputation, customers have a good experience during the transaction, staff is polite and patient, and staff can get support from the company, providing better service	Buyers get support and better service Higher likelihood of getting a refund Good return policy	
Empathy	The retailer and the platform of CBEC understand the customers' demands, and the interests of customers have the highest priority	The company can provide personalized services specifically and the staff can give individual care	
Tangibility	Ability to feel and sense that the CBEC is genuine, third-party logistic real as well.	There are modern delivery facilities.	

3. METHODOLOGY

3.1 Research Design

This study adopted a cross-sectional quantitative research design to evaluate delivery service quality within the cross-border e-commerce (CBEC) corridor between China and Uzbekistan. The quantitative approach was deemed appropriate because the study seeks to systematically assess perceptions of delivery service quality among key stakeholders and generate empirical evidence capable of informing managerial and policy decisions. Cross-sectional surveys have been widely employed in logistics and service quality research because they facilitate the collection of standardized data from multiple respondents at a single point in time, enabling comparisons across organizations and stakeholder groups. The study was grounded in the SERVQUAL framework, which conceptualizes service quality as a multidimensional construct comprising reliability, assurance, responsiveness, empathy, and tangibility. Given the increasing importance of logistics performance in cross-border e-commerce ecosystems, SERVQUAL provides a robust theoretical lens through which service quality can be evaluated across diverse delivery service providers.

3.2 Study Context and Participants

The study focused on cross-border e-commerce delivery services operating between China and Uzbekistan, one of the emerging trade corridors strengthened through China's Belt and Road Initiative and Uzbekistan's growing digital economy. The rapid expansion of online retail transactions between the two countries has increased the strategic importance of efficient logistics, timely delivery, shipment visibility, and customer-oriented service provision. Consequently, evaluating delivery service quality within this corridor provides valuable insights into the operational effectiveness of logistics providers and the experiences of both organizational stakeholders and consumers.

The target population comprised two key stakeholder groups involved in cross-border e-commerce delivery activities: employees of logistics service providers and customers who had previously utilized cross-border delivery services between China and Uzbekistan. Five major logistics firms actively participating in the China–Uzbekistan delivery corridor were selected for investigation. The study anonymized the firm names for ethical grounds. A purposive sampling strategy was employed to identify employees possessing substantial knowledge of organizational delivery operations. Respondents included operations managers, logistics coordinators, human resource managers, customer service officers, accountants, and other experienced personnel directly involved in service delivery processes. Such respondents were considered information-rich cases capable of providing reliable evaluations of delivery service performance. In addition,

customers who had utilized cross-border delivery services within the previous twelve months were recruited to provide user-based assessments of service quality. This dual-perspective approach enhances the comprehensiveness of service quality evaluation by integrating both provider and customer viewpoints. A total of 189 valid responses were obtained, comprising 67 employee responses and 122 customer responses. The inclusion of multiple stakeholder groups minimizes single-source bias and strengthens the validity of the findings through methodological triangulation.

3.3 Measurement Instrument

The study measured delivery service quality using a structured questionnaire adapted from the SERVQUAL model and prior logistics and e-commerce delivery service studies (Shan et al., 2021; Kim et al., 2017; Kiba-Janiak et al., 2021; Do et al., 2023; Ma et al., 2021). All items were assessed on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). **Reliability** was measured using seven items assessing the consistency and dependability of delivery services. Sample items included *"Delivery services are timely"* and *"Orders are delivered accurately without loss or damage."* The scale was adapted from Shan et al. (2021), Kim et al. (2017), and Do et al. (2023). **Assurance** was measured using seven items evaluating customers' confidence in the service provider. Sample items included *"The delivery company has a good brand reputation"* and *"Transactions are secure."* The items were adapted from Shan et al. (2021) and Kiba-Janiak et al. (2021). **Responsiveness** was measured using five items assessing the promptness and effectiveness of service delivery. Example items included *"Order processing is efficient and fast"* and *"Reported problems are addressed promptly."* The scale was adapted from Shan et al. (2021) and Do et al. (2023). **Empathy** was measured using five items capturing the extent to which service providers offer personalized and customer-oriented services. Sample items included *"The company offers convenient delivery schedules and payment options"* and *"Products are handled with utmost care during delivery."* These items were adapted from Shan et al. (2021) and Do et al. (2023). **Tangibility** was measured using six items reflecting the physical and technological resources supporting delivery operations. Sample items included *"The company has modern delivery facilities"* and *"Modern shipment tracking technologies are available."* The scale was adapted from Shan et al. (2021), Ma et al. (2021), and Do et al. (2023).

3.4 Data Collection Procedure

Data collection was conducted using an online survey platform. Prior to the main survey, the questionnaire underwent expert review and pilot testing to ensure content validity, clarity, and contextual appropriateness. Academic experts in logistics management and international trade evaluated the relevance and comprehensiveness of the measurement items. A pilot study involving a small group of respondents representative of the target population was subsequently conducted. Before survey administration, formal authorization was obtained from participating organizations. The questionnaire was distributed electronically through organizational contacts, email networks, and customer databases provided by participating logistics firms. Online data collection was selected due to its efficiency, cost-effectiveness, and ability to reach geographically dispersed respondents involved in international trade activities. Several measures were implemented to enhance data quality. First, responses were collected anonymously to encourage honest participation. Second, duplicate submissions were restricted through system controls. Third, all questionnaire items were configured as mandatory to minimize missing data. Finally, respondents

were informed that participation was voluntary and that all information would be treated confidentially and used solely for academic purposes.

4. RESULTS

4.1 Respondents' Profile: Firm Employees

Table 2 depicts the 67 valid responses from employees of five cross-border e-commerce logistics firms operating within the China–Uzbekistan trade corridor. The sample was predominantly male (65.7%) and the majority of respondents possessed a bachelor's degree (56.7%), followed by postgraduate qualifications (26.9%). Concerning job positions, marketers and sales personnel constituted the largest group (38.8%), followed by administrative staff (19.4%), operational personnel (17.9%), warehouse managers (13.4%), and accountants (10.4%). The diversity of positions represented in the sample enhanced the comprehensiveness of organizational perspectives captured in the study.

Table 2 Firm employees' biodata

Items	Frequency	Percent
Gender		
Male	44	65.70%
Female	23	34.30%
Age of respondents		
Below 20 years	1	1.50%
20-30 years	40	59.70%
31-40 years	17	25.40%
41-50 years	8	11.90%
51-60 years	1	1.50%
Educational Qualification		
Certificate/diploma	11	16.40%
Bachelor degree	38	56.70%
Postgraduate degree	18	26.90%
Years working in your organization		
Below 5 years	35	52.20%
6-10 years	19	28.40%
11-15 years	9	13.40%
16-20 years	3	4.50%
Over 20 years	1	1.50%
Current position/rank		
Marketer or Salesperson	26	38.80%
Accountant	7	10.40%
Warehouse manager	9	13.40%
Operational personnel	12	17.90%
Administration	13	19.40%

4.2 Respondents Profile: Consumers

Table 3 is the consumer sample, with 122 respondents who had utilized cross-border e-commerce delivery services between China and Uzbekistan. Male consumers represented 60.7% of the sample, while females accounted for 39.3%. The majority of respondents were within the economically active age groups, with 41.8% aged between 20 and 30 years and 30.3% aged between 31 and 40 years. The findings further revealed a relatively high level of educational attainment among consumers.

Table 3. Consumers biodata

Items	Frequency	Percent
Gender		
Male	74	60.70%
Female	48	39.30%
Age of respondents		
Below 20 years	8	6.60%
20-30 years	51	41.80%
31-40 years	37	30.30%
41-50 years	22	18.00%
51-60 years	4	3.30%
Educational Qualification		
Diploma	26	21.30%
Bachelor degree	51	41.80%
Postgraduate degree	39	32.00%
No formal education	6	4.90%

4.3 Data Analysis Procedure

Prior to analysis, the responses were screened for completeness, consistency, and potential entry errors using Microsoft Excel. The cleaned dataset was subsequently exported to IBM SPSS Statistics for descriptive analysis and preliminary data processing. To determine the relative importance of each service quality dimension, the Analytic Hierarchy Process (AHP) was employed. Mean scores obtained from employee assessments were used to construct pairwise comparison matrices and calculate the weights of the five SERVQUAL dimensions. The weights were subsequently normalized to ensure comparability and to establish the relative contribution of each criterion to overall delivery service quality performance. Thereafter, the weights of individual sub-indicators under each SERVQUAL dimension were computed using the same procedure. Finally, the Fuzzy Comprehensive Evaluation (FCE) method was applied to integrate the weighted SERVQUAL criteria and consumer evaluation data, enabling a comprehensive assessment of delivery service quality across the selected CBEC logistics firms.

The arithmetic mean was computed by simply adding up all the observations and dividing by the total number of observations. Where; x_i means the weight of the criterion, and the value x_i ranges from 1~5, 1 means not very important, 2 = not important. 3 = normal or neutral important, 4 = important and 5 = very important.

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n} \dots \dots \dots (4.1)$$

The study computed the weight of each SERVQUAL measure of the delivery Firm performance as follows; e.g. Reliability

$$\text{Very important} = 5 * (11 + 6 + 7 + 10 + 8) = 5 * 42 = 210$$

$$\text{Important} = 4 * (2 + 6 + 5 + 2 + 5) = 4 * 20 = 80$$

$$\text{Neutral} = 3 * (0 + 1 + 1 + 1 + 1) = 3 * 4 = 12$$

$$\text{Not important} = 2 * (0 + 0 + 0 + 0 + 0) = 2 * 0 = 0$$

$$\text{Not very important} = 1 * (0 + 1 + 0 + 0 + 0) = 1 * 1 = 1$$

$$\text{Total score} = (210 + 80 + 12 + 0 + 1) = 303$$

$$\text{Average level} = 303/67 = 4.522$$

Using a similar procedure, the researcher computed the average level of each indicator.

For responsiveness: *Average level* = 4.403

For assurance: *Average level* = 4.463

For empathy: *Average level* = 4.179

For tangibility: *Average level* = 4.254

Then we select the method of normalization to determine the weight. For the weight of reliability is calculated.

$Weight = 4.522 / (4.522 + 4.403 + 4.463 + 4.179 + 4.254) = 0.2072$. Using a similar procedure, the researcher computed the weight of each indicator.

Table 4. Importance of evaluation indicators for delivery services

Indicators	Total scores	Average level	Weight
Reliability	303	4.522	0.2072
Responsiveness	295	4.403	0.2018
Assurance	299	4.463	0.2045
Empathy	280	4.179	0.1915
Tangibility	285	4.254	0.1949

4.4 The Evaluation of the Delivery Service Quality

Table 5 presents customers' perceptions of cross-border e-commerce delivery service quality. Overall, the mean scores ranged from 3.27 to 3.76, indicating a moderately positive assessment of service performance. Within the reliability dimension, customers expressed relatively favorable opinions regarding correct contract documentation ($M = 3.67$) and transparent procedures ($M = 3.66$), suggesting confidence in the administrative aspects of service delivery. Under assurance, transaction security ($M = 3.76$) and staff professionalism ($M = 3.71$) received the highest ratings, highlighting the importance of trust and competence in customer evaluations. For empathy, convenient branch locations and pick-up points ($M = 3.75$) and careful product handling ($M = 3.73$) were highly valued. However, the delivery process being stress- and worry-free recorded the lowest mean score ($M = 3.27$), while 24/7 service availability ($M = 3.33$) was also rated comparatively lower. These findings suggest that although customers generally perceive delivery services positively, improvements are needed in operational convenience and customer experience.

Table 5. The descriptive statistics of customers' opinions CBEC delivery qualities

Questions		Min	Max	Sum	Mean
Reliability	Delivery services are timely	1.00	5.00	411.00	3.37
	Delivery services are accurately	1.00	5.00	424.00	3.48
	Lack of damage during delivery	1.00	5.00	438.00	3.59
	Lack of loss during delivery	1.00	5.00	434.00	3.56
	Compliance and completeness of the order	1.00	5.00	438.00	3.59
	Correct contract documentation	1.00	5.00	448.00	3.67
	Transparent procedures, documents and standards of service	1.00	5.00	446.00	3.66
Assurance	Good brand reputation	1.00	5.00	447.00	3.66
	There is a convenient return process for product	1.00	5.00	417.00	3.42
	There is a convenient refund process for payment	1.00	5.00	439.00	3.60
	Effective compensation mechanism	1.00	5.00	430.00	3.52
	The service system is convenient to access to ask for help	1.00	5.00	438.00	3.59
	The staff is polite, professional and patient	1.00	5.00	453.00	3.71
	Transactions security	1.00	5.00	459.00	3.76

Responsiveness	Delivery services 24/7	1.00	5.00	406.00	3.33
	Efficient and fast order processing	1.00	5.00	418.00	3.43
	Efficient handling of returns	1.00	5.00	416.00	3.41
	Simplicity and easy to reach dispute mechanisms	1.00	5.00	429.00	3.52
	Responsiveness to reported problems	1.00	5.00	443.00	3.63
Empathy	Offering a convenient time of service, date and method of payment	1.00	5.00	445.00	3.65
	Flexibility in the choice or change of date and place of delivery	2.00	5.00	440.00	3.61
	Convenient location of branches and drop-off/pick-up points, convenient working hours	2.00	5.00	457.00	3.75
	Delivery process is stress and worry free	1.00	5.00	399.00	3.27
	Products are handled with utmost good care	2.00	5.00	455.00	3.73
Tangibility	Expanded and well-equipped operational network	1.00	5.00	426.00	3.49
	There are modern delivery facilities	1.00	5.00	440.00	3.61
	Modern and functional ICT technologies (applications for shipment monitoring and tracking, mobile applications)	1.00	5.00	439.00	3.60
	The package is professional and standard.	1.00	5.00	443.00	3.63
	Accurate and clear information on the terms of service	1.00	5.00	448.00	3.67
	The staff has neat wearing with code	1.00	5.00	443.00	3.63
Valid N		122			

Table 6 presents employees' assessment of delivery service quality across the selected CBEC firms. The mean scores ranged from 3.21 to 4.06, indicating generally favorable evaluations of organizational performance. The assurance dimension received particularly strong ratings, with good brand reputation ($M = 4.06$) and transaction security ($M = 3.94$) emerging as key strengths. Similarly, transparent procedures and service standards ($M = 3.97$) and correct contract documentation ($M = 3.96$) recorded high scores under reliability, reflecting confidence in internal operational processes. Within empathy, employees rated careful handling of products highly ($M = 3.93$), suggesting a strong commitment to service quality. Conversely, delivery services operating 24/7 received the lowest rating ($M = 3.21$), while the perception that the delivery process is stress- and worry-free also scored relatively low ($M = 3.31$). Overall, employees perceived the firms as performing well in reliability, assurance, and tangibility, but acknowledged challenges related to service accessibility and customer convenience.

Table 6. The descriptive statistics of staff opinions

Questions		Min	Max	Sum	Mean
Reliability	Delivery services are timely	1.00	5.00	235.00	3.5075
	Delivery services are accurately	1.00	5.00	246.00	3.6716
	Lack of damage during delivery	1.00	5.00	242.00	3.6119
	Lack of loss during delivery	1.00	5.00	241.00	3.5970
	Compliance and completeness of the order	1.00	5.00	258.00	3.8507
	Correct contract documentation	1.00	5.00	265.00	3.9552
	Transparent procedures, documents and standards of service	1.00	5.00	266.00	3.9701
Assurance	Good brand reputation	1.00	5.00	272.00	4.0597
	There is a convenient return process for product	1.00	5.00	247.00	3.6866
	There is a convenient refund process for payment	1.00	5.00	238.00	3.5522
	Effective compensation mechanism	1.00	5.00	242.00	3.6119
	The service system is convenient to access to ask for help	1.00	5.00	252.00	3.7612
	The staff is polite, professional and patient	1.00	5.00	255.00	3.8060

Responsiveness	Transactions security	1.00	5.00	264.00	3.9403
	Delivery services 24/7	1.00	5.00	215.00	3.2090
	Efficient and fast order processing	1.00	5.00	249.00	3.7164
	Efficient handling of returns	1.00	5.00	245.00	3.6567
	Simplicity and easy to reach dispute mechanisms	1.00	5.00	247.00	3.6866
	Responsiveness to reported problems	1.00	5.00	251.00	3.7463
Empathy	Offering a convenient time of service, date and method of payment	1.00	5.00	245.00	3.6567
	Flexibility in the choice or change of date and place of delivery	1.00	5.00	243.00	3.6269
	Convenient location of branches and drop-off/pick-up points, convenient working hours	1.00	5.00	255.00	3.8060
	Delivery process is stress and worry free	1.00	5.00	222.00	3.3134
	Products are handled with utmost good care	1.00	5.00	263.00	3.9254
	Expanded and well-equipped operational network	1.00	5.00	251.00	3.7463
Tangibility	There are modern delivery facilities	1.00	5.00	247.00	3.6866
	Modern and functional ICT technologies (applications for shipment monitoring and tracking, mobile applications)	1.00	5.00	257.00	3.8358
	The package is professional and standard.	1.00	5.00	249.00	3.7164
	Accurate and clear information on the terms of service	1.00	5.00	249.00	3.7164
	The staff has neat wearing with code	1.00	5.00	247.00	3.6866
	Valid N	67			

4.5 Customers Satisfaction with Delivery Service Quality

Then the study combines the opinions of staff and customers to calculate the performance of delivery service. We assume that all the sub-indicators have the same importance for the main indicator. We calculate the average level of each main indicator. For example:

For reliability: $0.2072 * [(3.37 + 3.48 + 3.59 + 3.56 + 3.59 + 3.67 + 3.66)/6] = 3.56$

Using a similar procedure, the researcher computed the level of each main indicator. Then drawing on the concept of the Fuzzy model the study multiplied the weight of staff and opinion from customer perception to calculate the level of service quality.

Table 7 presents the overall customer evaluation of delivery service quality based on the weighted SERVQUAL dimensions. The results indicate an overall performance score of 3.57, suggesting that customers were generally satisfied with the quality of cross-border e-commerce delivery services. Among the five dimensions, reliability recorded the highest weighted performance score (0.7376), highlighting customers' positive perceptions regarding delivery accuracy, timeliness, and order fulfillment. Responsiveness (0.7285) and assurance (0.7076) also demonstrated relatively strong performance, indicating that customers viewed service providers as responsive and trustworthy.

Table 7. Customers' satisfaction level

Indicators	Weight	Total scores	Performance
Reliability	0.2072	3.56	0.7376
Responsiveness	0.2018	3.61	0.7285
Assurance	0.2045	3.46	0.7076
Empathy	0.1915	3.60	0.6894
Tangibility	0.1949	3.61	0.7036
			3.5667

4.6 Employees' Satisfaction of Delivery Service Quality

Table 8 reports on employees' assessment of overall delivery service quality. The findings reveal an overall performance score of 3.70, indicating that employees generally perceived their organizations as providing high-quality delivery services. Reliability emerged as the strongest dimension, recording the highest weighted score (0.7749), followed closely by responsiveness (0.7608), suggesting confidence in operational efficiency and service consistency. Assurance also received a favorable evaluation (0.7362), reflecting employees' belief in the firms' credibility, security, and professional service delivery. Tangibility recorded a weighted score of 0.7270, indicating positive perceptions of logistics infrastructure and technological resources. Similar to the customer assessment, empathy received the lowest score (0.7028), although it remained above the acceptable threshold.

Table 8. Staff satisfaction level

Indicators	Weight	Total scores	Performance
Reliability	0.2072	3.74	0.7749
Responsiveness	0.2018	3.77	0.7608
Assurance	0.2045	3.60	0.7362
Empathy	0.1915	3.67	0.7028
Tangibility	0.1949	3.73	0.7270
			3.7017

5. DISCUSSION AND CONCLUSION

5.1 Discussion of Results

This study sought to identify the key dimensions influencing delivery service quality in the China–Uzbekistan cross-border e-commerce (CBEC) corridor. The AHP results revealed that reliability emerged as the most important service quality dimension, followed by assurance and responsiveness. This finding suggests that stakeholders in the China–Uzbekistan CBEC ecosystem place greater emphasis on the ability of logistics providers to deliver orders accurately, securely, and consistently than on purely physical or technological attributes. The dominance of reliability is consistent with the argument of Parasuraman et al. (1988) and Shan et al. (2021), who identified reliable service fulfillment as the foundation of perceived service quality. In cross-border environments characterized by customs procedures, multimodal transportation, and longer delivery distances, consumers are often more concerned about whether products arrive correctly and safely than whether delivery is exceptionally fast. This finding further supports Mou et al. (2020), who argued that predictability and fulfillment reliability increasingly outweigh speed as determinants of customer satisfaction in e-commerce logistics. The high importance attached to assurance reflects the growing significance of trust and risk reduction in international digital trade. Since CBEC transactions involve payment security, product uncertainty, and geographical separation between buyers and sellers, customers rely heavily on secure transactions, reputable logistics providers, and transparent procedures. This finding aligns with Ho and Chuang (2023), who identified payment security, delivery transparency, and effective customer support as critical quality attributes in cross-border e-commerce platforms.

Customers' Perceptions of Delivery Service Quality

The findings indicate that customers generally perceived delivery service quality positively, although performance levels remained moderate rather than exceptional. Among the service attributes, transaction security, staff professionalism, product care, and convenient pick-up locations received the highest ratings. These results suggest that customers value service attributes that reduce uncertainty and facilitate the practical completion of cross-border transactions. The

strong evaluation of transaction security supports previous findings by Do et al. (2023) and Ho and Chuang (2023), who found that secure payment systems significantly enhance customer confidence and repurchase intentions in CBEC environments. The positive assessment of staff professionalism also reinforces the argument that service quality extends beyond logistics operations to include interpersonal interactions and customer support experiences. Interestingly, customers rated the availability of 24-hour delivery services and stress-free delivery experiences relatively lower. This suggests that although consumers appreciate the overall service quality, operational challenges continue to affect the customer experience. Given Uzbekistan's landlocked geographical position and dependence on multimodal transport networks, these findings are unsurprising. As highlighted by the Asian Development Bank (2024), customs delays, transit complexities, and infrastructure constraints remain persistent challenges within Central Asian logistics systems. Therefore, customer dissatisfaction appears to stem less from product handling or security concerns and more from process-related uncertainties throughout the delivery journey.

Employees' Perceptions of Delivery Service Quality

Employees reported consistently higher evaluations of delivery service quality than customers across all SERVQUAL dimensions. In particular, brand reputation, transaction security, transparent procedures, and product handling received strong ratings. These findings indicate that employees perceive internal operational systems to be functioning effectively and believe that their organizations provide high-quality logistics services. The divergence between employee and customer evaluations is theoretically important. While employees tend to evaluate performance based on internal processes and organizational standards, customers evaluate service quality based on actual service experiences and outcomes. Similar perception gaps have been observed in service quality studies where organizations often overestimate the quality delivered relative to customer experiences (Blut et al., 2018). The findings therefore suggest the existence of a service perception gap within the China–Uzbekistan CBEC logistics environment. Notably, employees also acknowledged weaknesses in continuous service availability and stress-free delivery processes. The fact that both employees and customers identified these areas as weaker aspects of service delivery increases confidence in the validity of the findings and indicates genuine operational challenges rather than isolated customer dissatisfaction.

Overall Performance of Delivery Service Providers

The fuzzy comprehensive evaluation results revealed an overall customer satisfaction score of 3.57 and an employee satisfaction score of 3.70. These scores indicate that delivery service providers operating within the China–Uzbekistan corridor are performing satisfactorily but have not yet achieved excellence in service quality. Reliability emerged as the strongest performance dimension in both stakeholder groups, confirming its central role in cross-border logistics success. This finding supports the argument of Li and Guo (2019) that reliability remains the most critical determinant of service quality in CBEC settings because it directly affects trust, customer retention, and transaction success. Conversely, empathy consistently recorded the lowest performance scores among both customers and employees. While firms appear to perform adequately in operational and technical dimensions, they are less successful in providing personalized and customer-centered services. This finding extends previous research by Giuffrida et al. (2020), who argued that logistics performance alone is insufficient for long-term competitiveness and must be complemented by customer-oriented service strategies. In emerging CBEC markets, where service failures and uncertainties are more frequent, empathy may become an increasingly important

differentiator among competing logistics providers.

5.2 Conclusion

This study assessed delivery service quality in the China–Uzbekistan cross-border e-commerce corridor using the SERVQUAL framework integrated with the Analytic Hierarchy Process and Fuzzy Comprehensive Evaluation methods. The findings demonstrate that reliability, assurance, and responsiveness are the most influential dimensions shaping delivery service quality perceptions. Both customers and employees generally viewed the performance of delivery service providers positively, although customer evaluations were consistently lower than employee assessments. Reliability emerged as the strongest contributor to service quality, while empathy represented the weakest dimension, indicating opportunities for improving personalized service delivery and customer engagement.

Theoretically, this study contributes to the growing CBEC logistics literature in three important ways. First, it extends SERVQUAL research into the relatively underexplored China–Uzbekistan trade corridor, providing empirical evidence from an emerging Central Asian market. Second, by integrating employee and customer perspectives, the study offers a more comprehensive understanding of delivery service quality than studies relying solely on customer evaluations. Third, the combination of AHP and Fuzzy Comprehensive Evaluation demonstrates a robust methodological approach for assessing multidimensional logistics service quality under conditions of uncertainty and subjective judgment.

In terms of firm practices, the findings highlight the need for logistics providers to strengthen reliability through improved delivery predictability, customs coordination, and order tracking capabilities. Investments in digital tracking technologies, real-time communication systems, and automated customer support platforms can further enhance transparency and customer confidence. Also, e-commerce platforms and supply chain managers should improve service responsiveness and customer support mechanisms should become a strategic priority. Establishing efficient complaint resolution systems, flexible delivery options, and proactive customer communication can significantly improve customer experience.

For policymakers, the findings underscore the importance of trade facilitation measures aimed at reducing customs delays, improving cross-border logistics infrastructure, and promoting digital integration among logistics stakeholders. Such initiatives would enhance operational efficiency and strengthen Uzbekistan's position within the Belt and Road digital trade ecosystem. For consumers, improvements in reliability, communication, and service flexibility are likely to increase trust in cross-border e-commerce transactions and encourage greater participation in international online shopping.

5.3 Limitations and Future Research

Despite its contributions, this study has several limitations. First, the analysis focused exclusively on delivery service quality and did not incorporate other important determinants of CBEC performance, such as platform quality, product quality, pricing fairness, or customer trust. Future studies could adopt more comprehensive models that integrate logistics and platform-related factors. Second, the study examined a limited number of logistics firms operating within the China–Uzbekistan corridor. Although these firms represent key industry participants, the findings may not fully capture the diversity of service practices across the broader CBEC ecosystem. Future research should employ larger and more geographically diverse samples.

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