Research on the Influencing Factors of Last-Mile Delivery Service Quality Based on Service Quality Scale (SERVQUAL)

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***Abstract*—In the 21st century, my country's economy is developing rapidly, and the logistics industry is also gradually emerging. With the development of e-commerce and the popularization of online shopping, the 'last mile' problem, as the end distribution of the logistics service chain, is a social problem closely related to people. It directly affects the efficiency of logistics, the cost of logistics, and the quality of logistics services. There are also many problems in last-mile delivery, such as high delivery costs, low efficiency, and high pollution, which will affect customers' evaluation of the quality of delivery services. Therefore, it is necessary to study the factors that affect the quality of distribution services, so as to provide suggestions for logistics companies and improve the distribution services. This article summarizes and studies the influencing factors of the last-mile delivery service quality by reviewing relevant literature and combining with the Service Quality Scale (SERVQAUL) framework.**

***Index Terms*—Delivery service quality, influencing factors, last mile, Service Quality Scale (SERVQUAL).**

I. Introduction

With the blowout development of the Internet, e-commerce has penetrated into all aspects of people's lives, and the continuous expansion of online retail has led to a surge in express delivery. The last-mile delivery is particularly important as the end of the logistics service chain and the link that directly contacts customers. Therefore, it is necessary to study the factors affecting the quality of the last-mile delivery service.

Some literatures are based on the Service Quality Scale (SERVQUAL) model to study the quality of the last-mile delivery service. Baki *et al*. used the Service Quality Scale (SERVQUAL) to define the advantages and disadvantages of the logistics services of a well-known Turkish freight company, and used the Kano model to classify service quality attributes to understand how these attributes can meet customer needs [1]. Czajkowska and Stasiak-Betlejewska proposed the results obtained on the basis of the logistics service evaluation of quality management tools [2], and compared customer expectations and perceptions with the SERVQUAL method. Kadłubek and Grabara draw lessons from the application of the SERVQUAL method in the theory of logistics service quality, and introduce and analyze it through examples [3]. It can be seen that it is appropriate to apply the dimensions of the SERVQUAL model to logistics services. Based on the SERVQUAL framework, this paper sorts out the factors affecting the quality of the last-mile delivery service, and explores new research opportunities for the last-mile delivery service.

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II. Influencing Factors of the Last Mile Delivery Service Quality under the SERVQUAL Dimension

In the process of collating the literature, I found that in addition to the five dimensions contained in SERVQUAL, there are also some literatures on the low-carbon nature of the last-mile delivery service quality. I summarize it as 'greenness'. Next, I sort out the detailed factors that affect the quality of the last-mile delivery service from the perspective of tangibility, reliability, responsiveness, assurance, empathy, and greenness.

A. Tangibility

Among the factors affecting the quality of the last-mile delivery service, the tangible ones mainly include transportation vehicles and systems. Baldi *et al*. (2019) [4] considered the differences in cost and service quality among different shipping companies, pointing out that in order to minimize the total cost and maximize the total service quality, the courier must decide which shipping company to choose to provide the service. The tactical problem of setting up a last-mile package delivery service in a city is addressed by considering transport companies that differ in cost and quality of service. Hoffmann T. (2018) [5] proposed that although the technology of automatic delivery robots is mature, there are regulatory issues, such as tort liability and traffic regulations. By emphasizing the legal implications, they will analyze and further develop the regulatory framework for automatic package delivery robots. Lin *et al*. (2020) proposed a quantitative method to determine the optimal locker locations to maximize the overall service provided by the alliance [6]. Melkonyan *et al*. (2020) applied system dynamics (SD) simulations and multi-criteria decision-making (MCDA) to evaluate the sustainability performance of distribution channel selection, using a local Austrian food cooperative and a logistics service provider as examples studied [7]. In order to improve the quality of delivery services, Chen *et al*. (2021) studied the vehicle routing problem with time windows and delivery robots, proposed an adaptive large neighborhood search heuristic algorithm, and verified its effectiveness [8]. Wang *et al*. (2020) comprehensively considered the vehicle routing problem in e-commerce and O2O, and proposed a mixed integer programming model to derive its optimal solution and verify it [9]. Zhong *et al*. (2020) studied the coordination of semi-centralized and centralized decision-making models by dividing the logistics service supply chain into an e-commerce mall, a courier company, and a terminal

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distribution service provider in order to improve the quality of last-mile delivery services. Comparative analysis showed that the centralized model outperforms the semi-centralized model [10]. Wang *et al*. (2019) proposed that the complementary capabilities of drones and trucks constitute an innovative delivery model, and proposed an improved non-dominated sorting genetic algorithm [11]. Ha *et al*. (2018) proposed a scheme for combined transportation of trucks and UAVs, listed the cost calculation formula, proposed the problem of minimum cost, and constructed a greedy stochastic adaptive search process model to solve this problem [12]. Yildiz *et al*. (2021) [13] explored the feasibility of an 'express-friendly' crowdsourcing model for express package delivery in urban areas. Little administrative control is exercised over the occasional courier to maximize their willingness to participate, and models are built that recommend the use of transshipment points to improve operational efficiency. A dynamic programming method was proposed to solve the routing problem that needs to be solved in the real-time management of crowdsourced networks. Ehrler *et al*. (2019) took the German market as the research object and a well-known logistics service provider as a case to explore the potential shift in the use of electric vehicles in commercial transportation, and concluded that from the perspective of sustainable development, electric vehicles could be an attractive and viable alternative to currently used combustion vehicles [14].

B. Reliability

Yuen *et al*. (2019) [15] analyzed the determinants of customers using smart lockers for last-mile delivery. Using the method of stratified sampling, the survey data of 230 smart locker users in my country were collected, and the structural equation model was used for analysis. It was concluded that perceived value and transaction cost adequately mediate the effects of convenience, privacy security and reliability on customer intentions. She and Ouyang (2021) [16] studied the self-organizing UAV traffic flow in low-altitude 3D space to improve the convenience and flexibility of last-mile delivery, and expressed the user balance condition as a set of partial differential equations. A finite element scheme was proposed to numerically solve traffic equilibrium and calculate system performance. The operating costs and energy consumption of traditional and novel systems under various system configurations are evaluated. Yi and You (2018) [17] analyzed the distribution service of hairy crabs in Yangcheng Lake, which followed the classic channel model of 'farmer-distributor-localdistributor-supermarket/retailer-consumer', and introduced the specific packaging and transportation of hairycrabs. They found ways to make recommendations for improving service quality: cooperating with logistics service providers, taking into account emergency logistics strategies, and avoiding seasonal marketing strategies. It can be seen that reliability-related factors mainly include distribution convenience, flexibility and accuracy, of which accuracy is the most important.

C. Responsiveness

In terms of responsiveness, the most important factor is the punctuality of delivery. Tunyaplin and Chanpuypetch (2019) built a last-mile delivery service quality evaluation system for household furniture products based on the SCOR model, which includes four aspects: asset management, complete delivery, responsiveness, and cost [18]. Li *et al*. (2021) proposed a vehicle routing problem for simultaneous delivery of products and services with time windows and order release dates based on the goal of a third-party logistics service provider to save customers time, improve service quality, and competitiveness [19]. Zhou *et al*. (2020) [20] developed a model to empirically test the influence of psychological factors on online consumers' behavioral intentions, and concluded that performance expectations, effort expectations, social influences and convenience conditions are the positive determinants of online consumers' use of self-service delivery services , and perceived risk is a negative influence factor of behavioral intention. Kapser and Abdelrahman (2020) [21] identified the structures that influence the acceptance of autonomous delivery vehicles by potential users in Germany by creating a context-specific research model to derive price sensitivity, performance expectations, convenience, social impact, hedonic motivation and perceived risk are direct factors. Refaningati T. *et al*. (2020) proposed an innovative method of smart lockers in order to solve the problems of last-mile distribution, studied the characteristics of smart lockers, and compared them with direct distribution, and concluded that smart lockers conclusion that the system is more efficient than the drop shipping service [22]. Seghezzi and Mangiaracina (2021) [23] developed an analytical model to estimate the cost of crowd sourced logistics and traditional last-mile delivery services in order to achieve customer satisfaction service levels while reducing costs, and applied the model to a typical case of Milan, Italy. Bányai (2018) [24] proposed a mathematical model of the last mile distribution problem, including scheduling problem and allocation problem, to improve energy efficiency. The goal of this model was to determine the optimal allocation and scheduling of each order, a heuristic algorithm based on black hole optimization was described, and its performance was verified by different benchmark functions and the effectiveness of the model was verified. It was concluded that the time frame and the loading capacity of the package delivery truck are important constraints in terms of package delivery service providers. De Araujo and Etemad (2021) [25] established an end-to-end system for predicting parcel delivery time in smart cities based on the IoT paradigm by taking into account weather, temperature, and amount of rain and snow to solve the problem of parcel delivery time prediction. And they used a case to verify its effectiveness. Zhou. *et al*. (2016) [26] proposed a hybrid evolutionary search algorithm combining genetic algorithm and local search in order to solve the problem of expensive, serious pollution but low efficiency in the 'last mile' distribution. They combined home delivery and customer pickup to build a more efficient system. Giret *et al*. (2020) [27] described a platform for collaborative urban logistics, mainly considering economic and time factors. The proposed platform relied on intelligent technology to support

the coordination and coordination among last-mile delivery companies in the same city, and its effectiveness was verified with case studies. Banerjee *et al.* (2019) [28] studied the subsidized rice program in Indonesia, conducted surveys on households and distributors respectively, and concluded that the overall satisfaction is actually the satisfaction of information processing, and concluded that the last resort for local governments to choose to outsource subsidized food mile delivery, which can reduce prices without sacrificing other aspects of quality. Zhang *et al*. (2019) [29] established a model to approximate the customer waiting time by considering the meal preparation and delivery process in order to enable online restaurants to provide customers with reliable and timely services. Bjørgen *et al.* (2019) [30] explored the sustainability of home delivery, concluded that time saving is an important reason for customers to choose home delivery, and proposed that city governments should incorporate urbanization and digital trends into sustainable transportation and efficient urban freight planning, strengthening supervision and strengthening the relationship between transportation planning and land use. Kull and Boyer (2007) [31] used order time as an important performance indicator to investigate online grocers and concluded that the efficiency of the supply chain depends on the availability of online ordering systems. Lim *et al*. (2018) [32] revisited existing research on last mile logistics models and consider the distribution structure of last mile logistics, which covers all stages from order fulfillment to delivery to the final consignee's preferred destination , also studied as well as recent developments in the context of e-commerce digital supply chains, taking into account the time convenience of customers. Verlinden *et al*. (2020) [33] explored the urban logistics of hotels-restaurants-cafes, pointing out that the industry's cost factors in the logistics process include location, cargo characteristics, and handling processes, and concluded that transportation operators should focus on improving labor-based activities to improve service quality.

D. Assurance

Among the factors related to assurance, the more important ones are the service attitude, sense of responsibility and proficiency of the delivery staff. Yang *et al*. (2021) [34] constructed and tested a customer satisfaction model for the service quality of the last mile in rural areas. The assurance includes the delivery staff's proficiency in the work process, the confidentiality of personal information during the delivery process, and the politeness of the delivery staff. Jiang *et al*. (2019) [35] concluded that the four factors of 'return convenience', 'commodity integrity', 'pre-order delivery' and 'distribution cost' are the most basic factors affecting the sustainability of rural last-mile delivery, and they are also the most influential factors and the most indispensable factor.

E. Empathy

Rai *et al*. (2021) [36] surveyed consumers about their interest in crowdsourcing the last mile and found that 19.2% of consumers support crowdsourcing the last mile. These consumers are more home delivery users and prefer to rely on their neighbors in case the delivery fails. It has shown greater interest in 'last mile' innovations and a more positive attitude towards sustainability improvements. The service includes empathy, where the logistics service provider manages, collects and delivers my order simultaneously at a time and place convenient for the customer. A fixed-price annual subscription plan that offers free shipping and other benefits. Mancini and Gansterer (2021) [37] proposed a hybrid delivery approach to improve service quality that combines the use of door-to-door delivery and shared delivery locations in an innovative way. Furthermore, two mathematical methods are proposed to solve large instances efficiently. Emphasis on empathy, that is, customers can choose the time they like. In order to improve the quality of last-mile delivery services, Khairuddin *et al*. (2019) [38] proposed technologies to improve the Internet of Things from the perspective of safety and comfort. Using qualitative research methods, a case study of several express delivery companies in Malaysia, the results showed that the Internet of Things can help improve productivity and improve the efficiency of companies. Janjevic *et al*. (2020) [39] proposed an integrated modeling framework for the last mile design of a three-tier multimodal network strategy in an omni-channel environment, which differentiates customer needs based on different time-differenced service delivery and different product exchange options. Lee *et al*. (2021) [40] discussed that the last mile delivery should adopt a direct or indirect way to form flexible logistics and improve customer satisfaction, and proposed a mathematical programming model and an approximate optimal heuristic based on a meme algorithm. method. Tounsi *et al*. (2016) [41] introduced a two-layer model to optimize the delivery system and modeled the customer response with stochastic user equilibrium. It can be seen that the empathy factor is mainly the convenience for customers and the customers can choose the appropriate express service according to their own situation.

F. Greenness

The main factor influencing the greenness of the last-mile delivery service quality is the carbon emissions of the delivery link. Wygonika and Goodchild (2018) [42] considered three supply chain structures and concluded that increasing road density or reducing distance to warehouses reduces the impact of dependent variables (vehicle mileage, CO_2, NOx, and PM10). Prandtstetter *et al.* (2021) [43] examined the impact of parcel lockers and their location on the distance traveled by a car, and the resulting CO2 emissions. The effectiveness of implementing parcel lockers was derived. Brotcorne *et al.* (2019) [44] proposed the integration of traditional transportation methods and low-emission vehicles in order to improve the quality of distribution services, and verified the feasibility of integrating business and operating models in urban package delivery, as well as its benefits and impacts, such as economic and environmental sustainability. Saenz *et al*. (2016) [45] assessed the greenhouse gas emissions of a tricycle logistics company providing last-mile delivery services, comparing the carbon footprint of tricycle logistics

services with traditional urban logistics companies.

III. Summary, Limitations and Future Research

This article combines the SERVQUAL dimension with the last-mile delivery service quality, and adds a new dimension, namely greenness, on the basis of the original five dimensions: tangibility, reliability, responsiveness, assurance and empathy. Sorting out the literature corresponding to each dimension, we found that there are more studies on, tangibility, responsiveness and empathy.

Like other documents, this article also has certain limitations. The first limitation is that related studies may be missed in the literature screening process. Excluding conference papers, there may also be some related documents in conference papers. Moreover, the search only includes articles published in English, articles published in other languages may be relevant. Second, the classification of documents is based on the dimensions of the SERVQUAL model, and other classification methods may also exist. Third, this review is organized according to the SERVQUAL dimension, which may be subjective.

In future research, researchers can screen out documents of different types and languages to improve the integrity of the documents; they can use other models to sort the documents, and they can also study the quality of services in other industries.

Conflict of Interest

The author declares no conflict of interest.

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