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Strategic Selection of Crowd Logistics Platforms: A Multi-Criteria Decision-Making Approach

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Abstract: Crowd logistics (CL) represents an innovative model within the logistics sector, leveraging the participation of individuals to enhance service provision, optimize resource utilization, and reduce operational costs. Among the various applications of CL, crowd distribution has emerged as one of the most prevalent methods. This study introduces a Multi-Criteria Decision-Making (MCDM) framework for the selection of CL platforms, examining key factors that contribute to their success. A comprehensive review of relevant literature and an in-depth analysis of both domestic and global platforms were conducted, revealing critical performance indicators for successful platform implementation. The Step-wise Weight Assessment Ratio Analysis (SWARA) and Measurement of Alternatives and Ranking according to Compromise Solution (MARCOS) methods were employed to evaluate essential criteria, including cost efficiency, delivery speed, reliability, environmental sustainability, flexibility, and customer support quality. The results of this analysis demonstrate that platforms such as Company 1, Company 2, and Company 3 have achieved market dominance in Serbia, attributed to their optimal balance across these performance criteria. This study's proposed model serves as a practical tool for businesses and consumers seeking to select the most suitable CL platforms, while also providing actionable insights for further enhancement of logistics systems. The findings contribute to the growing body of knowledge on CL, highlighting the importance of comprehensive evaluation in the selection process.

Keywords: Crowd logistics (CL); Step-wise Weight Assessment Ratio Analysis (SWARA); Measurement of Alternatives and Ranking according to Compromise Solution (MARCOS); Multi-Criteria Decision-Making (MCDM); Evaluation; Platforms

1 Introduction

CL is a concept that establishes an information-connected market for the supply and demand of logistics services performed by individuals with available capacity, either in terms of time or space. Participants in CL carry out these tasks voluntarily and receive compensation for their services [1]. This approach optimizes the use of existing resources, reduces the need for additional transport vehicles, and contributes positively to decreasing traffic congestion and greenhouse gas emissions [2]. CL offers flexibility and enables rapid responses to changes in demand, which has proven particularly valuable in urban areas facing challenges such as congestion and pollution. Given the rapid growth of e-commerce and the increasing need for faster and more efficient deliveries, the CL model is becoming increasingly important as it meets modern society's demands for sustainable, fast, and cost-effective logistics solutions. CL stands out as a sustainable alternative capable of addressing challenges in urban environments by minimizing environmental impact through more efficient utilization of available resources.

This paper aims to develop a multi-criteria model for the evaluation and ranking of CL platforms using the SWARA and MARCOS methods. The SWARA method is employed to determine criteria weights based on expert opinions, enabling decision-making through precise weighting of each factor's importance [3]. After determining the criteria weights, the MARCOS method facilitates the ranking of platforms based on their performance against the defined criteria. Through this comprehensive approach, the model provides practical guidelines for companies and users, allowing the selection of platforms that best meet their specific needs and preferences.

The implementation of the developed model is beneficial not only for businesses but also for individual users making informed decisions. With the help of this model, companies can optimize their logistics processes, while users can identify the most suitable CL platforms for their specific requirements. The analysis results offer insights into the strengths and weaknesses of various CL platforms, enabling both companies and users to compare different options and select those that best fulfill their criteria [2].

The paper is organized as follows. After the introduction, in section two, a problem description as well as a literature review are presented. In the third section, an analysis of CL platforms for distribution is performed. Criteria overview is presented in section four, followed by model development for CL platform evaluation in section five. Results are then analyzed in section six alongside theoretical and managerial implications. Finally, in the last section, concluding remarks with limitations and future research directions are provided.

2 Problem Description and Literature Review

The concept of CL involves delegating logistics activities, typically performed by companies, to ordinary individuals, or the crowd [4]. Unlike professional logistics service providers (LSPs), crowd services lack a professional character and are executed using individual or household resources (e.g., personal vehicles, storage space, handling equipment, or personal skills in logistics operations). Potential providers and users are connected through information and communication technologies, social networks, mobile applications, and other crowd platforms, where they submit or accept requests for specific logistics services [1]. The physical separation between the production and consumption of goods, particularly pronounced in cities, necessitates the transportation of large quantities of goods and waste within and beyond urban areas. While urban freight transport contributes to economic activities and industrial competitiveness, it also generates negative social and environmental consequences.

Crowd services, often facilitated through crowd networks and applications, are predominantly developed in urban rather than rural areas for several reasons. First, information and communication technologies, including platforms used for CL, are still more widely adopted in urban areas [4]. Second, urban areas have a higher population density, increasing the density of potential providers and users of crowd services. Finally, urban areas experience more intense individual flows, which can be utilized for crowd deliveries or waste collection.

Globally, CL is emerging as a significant trend in transportation and logistics, with many companies recognizing its advantages. However, while CL is becoming more prevalent in Serbia, it is still in the development stage compared to more mature markets in Europe and the United States. There is a need for further regulatory development, standardization, and education to ensure the concept reaches its full potential in the coming years [3]. Limited scientific research has been conducted on the potential economic, social, and environmental benefits of the sharing economy, particularly in the context of CL. Increasingly, experts are showing interest in CL, resulting in the rise of start-ups and platforms. New concepts are being introduced, deviating from the original idea—less through significant route deviations and more through reliance on dedicated delivery trips. For instance, UberRush and Postmates offer on-demand deliveries. Their couriers are available during self-selected time periods, using their own vehicles for purpose-specific deliveries. This raises the question of which types of CL concepts can enhance the sustainability of urban transportation for passengers and goods [2].

Despite numerous advantages, CL faces challenges, primarily the lack of standardization and regulation in this field, which can lead to issues with service quality and customer satisfaction. While there are rules and standards regarding service quality and execution, all participants must adhere to them. CL providers operate on a voluntary basis, are not employed, and do not have formal work contracts, allowing them the freedom to decide whether to accept a specific request. This delivery model is beneficial for retailers and their customers, as online orders are fulfilled quickly—often within an hour. Additionally, scheduling deliveries enables companies to meet customer needs for instant gratification. This feature is particularly important to younger consumers. By delivering orders when the recipient is home, additional time and costs from failed delivery attempts are eliminated. The concept of CL closely aligns with the last-mile delivery problem, which has become one of the biggest challenges in logistics, as this segment accounts for 53% of total delivery costs. For companies, CL alleviates the need to manage warehouses, fleets, or employee benefits, compensating for some of the high costs and complex logistics associated with its implementation.

CL resources can be classified into two primary categories: short-term and long-term resources and internal and external resources. Combining these categories results in four resource types: internal short-term resources, internal long-term resources, external short-term resources, and external long-term resources.

Internal short-term resources primarily include the infrastructure of information and communications technology (ICT), which relies on ICT expertise. This expertise is an essential prerequisite for the development of a stable platform capable of delivering high-quality services to a broad user base. In the long term, ICT infrastructure must have the capacity to scale alongside user growth. Consequently, ICT development is one of the most critical internal factors. Another significant internal long-term factor is robust financial planning, which ensures sustainable profitability. External long-term factors, on the other hand, focus on achieving a critical mass of customers, which depends on the usability of the platform and the trust placed in the CL company and its services. These external long-term factors are often viewed as critical success factors, as they generally lead to competitive advantages [3]. According to the framework proposed by Buldeo Rai et al. [2], CL platforms can be categorized into five types: business market platforms, community-based platforms, flexible work platforms, commission platforms, and logistics market platforms [5]. These platform types differ based on several key factors, including the direction of flows (B2B, B2C, C2C) and the characteristics of service providers (professional or non-professional):

Business market platforms (B2B) connect the supply and demand for transport services between companies, leveraging excess capacity to optimize freight flows. Community-based platforms (B2C or C2C) involve non-professionals and utilize existing passenger transport flows to optimize the stochastic movement of goods. Flexible work platforms (B2C or C2C) focus on providing flexible workers to fulfill the demand for logistics services. Commission platforms (B2C), which utilize both professionals and non-professionals, aim to streamline the organization of goods flows for commissioners with the support of traditional LSPs.

CL is an increasingly significant topic in logistics research, particularly in the context of optimizing supply chain processes. Research in this domain spans a wide array of topics, ranging from the foundational principles of CL to advanced methodological approaches for evaluating and ranking logistics platforms. For instance, references [6, 7] delve into the fundamental principles of CL, while reference [4] examines the role of local communities in developing flexible logistics solutions. References [8, 9] emphasize the efficient allocation of resources and the economic benefits for small and medium-sized enterprises (SMEs). References [10–12] investigate user experience and digitalization, highlighting the critical role of customer satisfaction in decision-making processes. Reference [13] explore the primary criteria for selecting logistics platforms, with providing detailed evaluations of cost and delivery speed. From an environmental sustainability perspective, references [14, 15] examine how CL can mitigate environmental impacts, contributing to more sustainable logistics practices. Reference [16] prioritizes stakeholder concerns in implementing CL solutions in urban areas, emphasizing ecological sustainability. A strategic opportunity for achieving sustainability in urban transportation was identified in reference [17]. Initiatives aimed at reducing traffic congestion and emissions are analyzed in references [18, 19]. The specific characteristics of CL in diverse geographical contexts are discussed in references [20, 21], which address the challenges and opportunities within European and rural settings. These findings are especially relevant as they highlight the necessity of tailoring CL models to different environments—a key focus of this research.

Studies on logistics innovations and their applications are covered in references [22–25]. More specifically, the technological aspects of CL, including the use of digital tools for shipment tracking and customer communication, are explored in references [12, 24]. These studies emphasize the importance of technological innovations in enhancing transparency and efficiency. References [25, 26] highlight the significance of initial investments in technology, while reference [3] underlines the role of mobile applications in optimizing processes. Reference [27] examines the standardization and economic effects of platforms, whereas references [28, 29] provide analyses of methodological approaches such as the SWARA and MARCOS methods. These methods enable structured evaluation and decision-making, which form a central part of this research. References [30–32] further explore how technology and mobile applications can improve user experience and delivery efficiency. Together, these studies offer a comprehensive insight into the challenges and potentials of CL, with a focus on sustainability, flexibility, delivery speed, reliability, and technological innovation. The findings suggest that CL offers significant opportunities to optimize transportation and reduce negative impacts in urban areas, while its potential in rural regions remains underexplored [33].

Despite the contributions of existing research to understanding CL, notable gaps remain that this study aims to address. Most previous studies have not covered the specificities of local markets or the preferences of various types of CL platform users. This research contributes to the development of a comprehensive evaluation model for CL platforms, employing specific criteria and multi-criteria methods for deeper analysis.

3 Analysis of CL Platforms for Distribution

CL platforms have become a vital component in modern distribution and transportation systems, enabling more efficient and flexible delivery of various goods. These platforms, encompassing both global companies and local startups, leverage digital technologies to connect service providers with users, ensuring rapid adaptation to changing demand. CL platforms utilize a range of capabilities, including matching, route planning, tracking, driver selection, feedback systems, and online payment. For instance, the matching capability employs algorithms or an auction-based model (e.g., first-come, first-served) to assess driver availability and suitability. Drivers are then assigned to deliveries and optimized routes. Once assigned, route planning assists drivers in making efficient decisions to enhance operational performance. Other features, such as tracking, background checks, driver ratings, and online payment, address longstanding logistical challenges, including delivery quality, accuracy, and product damage or loss. However, there is a growing need for a deeper understanding of CL platform capabilities. Broader categorization and analysis of these features could offer insights into how they can be better utilized to create value [7].

With the rapid growth of e-commerce and demand for faster deliveries, CL platforms play an increasingly prominent role in the global supply chain. Their applications range from food delivery and small parcel shipments to the transport of large freight, covering a wide array of modern consumer needs. Despite their advantages, these platforms face several challenges, including legal regulations, service reliability, and integration with traditional logistics models. Legal issues, such as defining the employment status of participants who function as independent contractors, raise questions about labor rights and liability. These concerns include accountability for damaged or lost shipments, where users often encounter limited insurance coverage provided by platforms. Furthermore, compliance with national and international regulations, such as customs laws and air transport policies, adds complexity to operations, especially in cross-border transactions.

The websites of CL companies are often designed to attract users, which can involve the collection of sensitive information. Ensuring adequate protection and security for all parties involved in the process necessitates the further development and adaptation of legal frameworks governing these platforms [4].

This study provides an overview of the current state of the global crowdsourcing market. Some platforms are specifically developed to fulfill delivery services, with such companies emerging as early as the 20th century. The growth of CL remains consistent across both developed and developing countries. With the advancement of ICT technologies and the application of CL-based solutions, this concept is most prevalent in the United States, followed by significant adoption in Europe. Additionally, the Asian market is becoming increasingly prominent, while Australia and Africa exhibit slower growth in this sector. Moreover, numerous platforms based on crowdsourcing concepts have been developed to connect people for various purposes. These platforms, often local, are widely used for information exchange, problem-solving, or collaboration.

The following section analyzes current global CL service providers and highlights some of their key characteristics. It is important to note that the study primarily relies on secondary data due to the specific nature of the business model, which predominantly involves private individuals rather than diverse governmental or scientific institutions. Additionally, since this is a relatively new concept that has not been extensively studied in academic and professional publications, the research was largely based on data collected from official platform websites, their LinkedIn profiles, app reviews on Google Play and the App Store, and publicly available industry information. A total of 17 representative CL platforms operating globally were identified. Figure 1 illustrates the current global landscape of CL development, showcasing the distribution of this concept across different regions of the world. North America accounts for the largest share of CL adoption, comprising 50% of the total market, indicating the region's dominant position in implementing new logistics solutions. Europe follows with a significant 31%, reflecting steady growth and increasing interest in CL. Asia contributes 12%, signaling potential for further expansion in this part of the world. Africa and Australia, along with Oceania, represent smaller shares at 4% and 3%, respectively, highlighting a slower pace of adoption in these regions.

This distribution mirrors global trends in adopting innovative logistics models, with developed regions leading the way. The findings underscore the need for further exploration of opportunities and challenges in less developed regions, where CL adoption is still in its nascent stages [3].

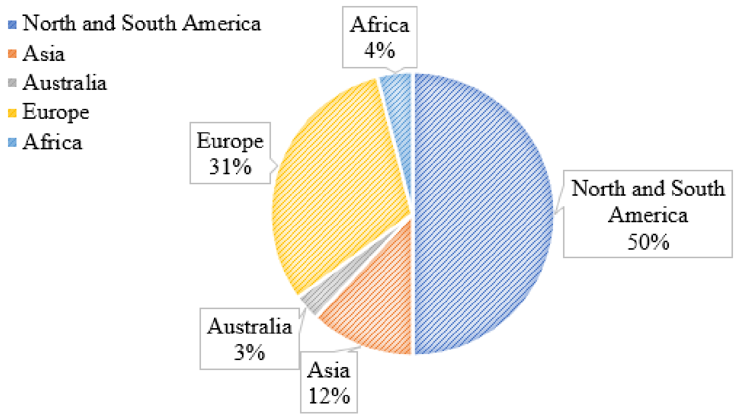

Figure 1. Coverage of global CL platforms

Market research conducted in Serbia has revealed that the rapid growth of CL companies occurred during the COVID-19 pandemic. Sudden shifts in global supply chains had a direct impact on the local market, where traditional delivery channels proved inadequate to meet the rising consumer demand. During this period, home delivery apps experienced substantial growth as they became one of the few ways for consumers to quickly and conveniently access products. The research identified six CL platforms currently operating in Serbia: Company 1, Company 2, Company 3, Company 4, Company 5, and Company 6.

Based on a marketing study of CL distribution platforms in Serbia, it can be concluded that these services are not as developed or popularized in Serbia compared to the American and European markets. The Serbian food delivery market, facilitated through mobile applications, is valued at approximately €10.8 million per month. According to the latest available data, there are roughly 356,000 users of food delivery apps in Serbia, ordering food an average of 2.7 times per month, with the average value of a single delivery being around 1,300 RSD [3]. However, the research indicates a continuous market growth for delivery services in Serbia, which is reflected in the increasing number of courier job advertisements. The appeal of these positions often lies in promises of reasonable earnings and flexible working hours, motivating many individuals to take up such roles [32].

Figure 2 shows the user ratings for all identified platforms. Globally, CL platforms typically receive ratings around 4.4, aiming to converge toward this value. In Serbia, each rating corresponds to a single platform, resulting in a more even distribution of ratings, ranging from 4.0 to 4.8. Interestingly, none of the platforms have a rating of exactly 4.4, which would represent the midpoint in this range. Notably, Companies 1 and 2 are present both in Serbia and globally, with ratings of 4.6 and 4.8, respectively, which are consistent across both markets. This distribution of ratings reflects a comparable level of user satisfaction among Serbian and global users, indicating that international platforms maintain consistent quality across markets while local platforms strive to establish their place in a competitive landscape.

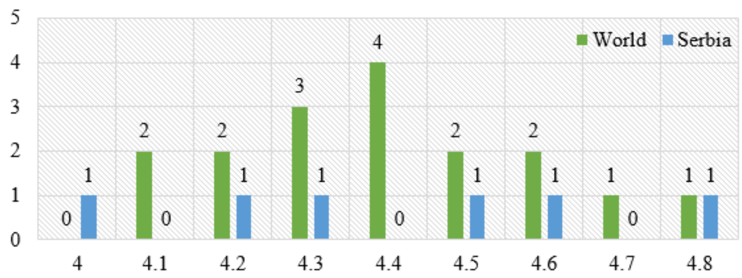

Figure 2. User ratings for CL platforms in world and Serbia

4 Criteria Overview

This section analyzes the relevant literature to identify and systematize key criteria for selecting CL platforms from a user perspective. The literature review encompasses a wide range of studies addressing the implementation of CL solutions in urban areas, with a particular emphasis on sustainability and user satisfaction. These studies provide valuable insights into how various factors influence the efficiency of CL platforms and their potential to optimize urban logistics flows.

A major focus of the research is on urban environments, where challenges such as traffic congestion, restrictions on freight vehicle movement, lack of infrastructure, noise, and pollution are central issues confronting modern logistics. The studies utilized diverse methodological approaches, including surveys and interviews, to draw conclusions about the criteria most important to users. The research included various stakeholders in the logistics chain - end consumers, LSPs, and local authorities. These investigations highlighted several major challenges in urban goods transport, such as congestion, insufficient delivery infrastructure, and restrictions imposed on freight vehicles in city centers. Respondents emphasized that CL solutions should, in addition to reducing traffic congestion and pollution, provide greater flexibility in delivery organization and better utilization of available capacities.

Key criteria from the user perspective include the speed, safety, and environmental sustainability of deliveries. The research also revealed that public actors, such as local authorities, are significantly more familiar with the CL concept compared to the private sector. This indicates the need for further education and promotion of these solutions among private companies to encourage wider adoption of innovative logistics models [5].

Following the analysis of numerous studies, the most frequently mentioned criteria have been identified. These include reliability, delivery speed, flexibility, cost, service quality, environmental sustainability, the ability to file complaints, parcel tracking, and user motivation [1, 3, 5, 11, 16, 20, 32]. These criteria form the basis of a framework for further evaluation and comparison of different CL platforms. Table 1 provides an overview of the key features of CL platforms available in the Serbian market. This analysis serves as a foundation for a deeper examination of the strengths and weaknesses of each solution, enabling users to choose the platform that best suits their specific needs and expectations.

Reliability: The reliability criterion, as reflected in user ratings on Google Play and App Store, indicates how much users trust the platforms to fulfill their promises regarding delivery quality and accuracy. Company 1, with a score of 4.8, and Company 5, rated 4.6, achieve the highest reliability. This suggests that users are highly satisfied with the service, delivery accuracy, and communication. These platforms stand out for their ability to consistently deliver food within agreed time frames. Company 3 (4.2) and Company 6 (4.0) have slightly lower reliability scores, which may point to occasional challenges with delivery accuracy or service quality.

Table 1. Key characteristics of Serbian CL platforms

Platform	R	T (min)	C (RSD)	PQ	CH	F	ST	ES	UM
Company 1	4.8	20-60	120-460	0.55	2	2	2	3	2
Company 2	4.3	15-60	0-400	0.5	2	2	2	3	2
Company 3	4.2	35-60	0-250	0.51	2	2	2	3	2
Company 4	4.5	75-120	470-1000	0.4	1	1	3	2	1
Company 5	4.6	30-180	350-1500	0.35	1	1	0	1	1
Company 6	4	35-75	0-500	0.38	1	1	1	2	1

Note: PQ, T, C, Q, CH, F, ST, ES, UM stands for Reliability, Time, Costs, Product Quality, Complaint Handling, Flexibility, Shipment Tracking, Environmental Sustainability and User Motivation

Time: The time required to complete deliveries is a critical factor for the user experience. Platforms with shorter delivery times have an advantage, as they better meet the needs of users seeking efficiency and speed. Analysis of various platforms shows significant differences in delivery time ranges. Company 2 and Company 1 lead with the shortest delivery times, ranging from 15 to 60 minutes, making them highly competitive for users who prioritize fast service. Company 3 and Company 4 have slightly longer delivery ranges, averaging 35 to 75 minutes, which is acceptable but less attractive compared to leading platforms. Company 5 exhibits the broadest delivery range, with a maximum time of 180 minutes, which may be problematic for users expecting quick service. On the other hand, Company 6 has the longest minimum delivery time (75–120 minutes), positioning it as a less suitable option for users requiring fast deliveries.

Costs: The implementation of the crowd-delivery concept generates economic benefits for all involved parties. Shippers, including commercial, hospitality, and other companies, experience lower costs when engaging crowd executors compared to performing deliveries in-house or hiring professional logistics providers. When companies handle deliveries independently, they incur operational delivery costs as well as investment and maintenance expenses for the transport system - expenses avoided with crowd delivery. On the other hand, professional logistics providers' services are significantly more expensive than those of crowd executors. Crowd executors use underutilized personal resources to provide services, gaining economic benefits such as monetary compensation or discounts on goods or services from the shippers. Customers also benefit economically, as the cost of crowd services is lower than that of professional services offered by shippers or logistics providers [1]. Generally, lower delivery costs contribute to the affordability of services and enhance the competitiveness of platforms in the market.

Product quality: Product quality is a critical factor that significantly influences user satisfaction and loyalty. In the delivery sector, this criterion encompasses aspects such as freshness, order accuracy, packaging quality, and the overall condition of the product upon arrival. High-quality deliveries foster trust in the platform and encourage repeat usage. Platforms like Company 1 and Company 2, which achieve high ratings in this category, provide superior user experiences through consistent product quality. This includes careful packaging, prompt delivery, and close collaboration with partners to ensure freshness and accuracy. Conversely, platforms with lower ratings often face challenges in maintaining quality standards, risking a decline in user loyalty. Issues such as poor packaging, inadequate partner selection, or delivery delays can negatively impact the product's condition. Some users are willing to pay a premium for delivery if assured of receiving a high-quality product, highlighting the importance of this criterion. Improving product quality is essential for enhancing competitiveness and reputation in the delivery market.

Complaint handling: The complaint-handling criterion is binary (values 1 and 2). Notably, only the top three platforms focused on food delivery actively support complaints. These platforms feature highly intuitive and well-developed user interfaces, allowing users to access services effortlessly. Applications address most potential issues through FAQ sections, enabling users to resolve problems independently. Contact with call center employees is almost eliminated, as all support requests, including complaints, are managed directly through the app, streamlining and simplifying the process for users.

Flexibility: Flexibility in delivery platforms relates to the ability to adjust delivery details such as location and timing through the app, without contacting customer support. Platforms like Company 1, Company 2, Company 3 and Company 6 allow users to modify delivery details, reducing stress and enhancing convenience, especially for users who prefer digital communication or avoid direct contact.

Real-time updates ensure timely implementation of changes, enhancing user confidence in service reliability. As consumers increasingly demand customizable services to fit their busy schedules, flexibility becomes a critical market differentiator. Platforms prioritizing adaptability gain a competitive edge, meeting diverse user needs and fostering long-term loyalty.

Shipment tracking: Shipment tracking is a vital feature of modern delivery platforms, offering transparency and security by providing real-time updates on order status. Platforms like Company 1, Company 2, Company 3 and Company 6 enable real-time tracking when their couriers handle deliveries. However, when restaurants manage deliveries, users receive only basic updates, such as order initiation and estimated arrival time. Company 4 offers comprehensive tracking regardless of the delivery method, leveraging advanced GPS systems for precise location information. By contrast, Company 5 provides no tracking features, which negatively impacts user satisfaction and competitiveness.

Environmental sustainability: Environmental sustainability is increasingly critical as logistics operations, especially transportation, significantly impact the environment through emissions, noise, and inefficient resource use. CL reduces these negative effects by consolidating flows and improving vehicle and infrastructure utilization. Most crowd deliveries leverage existing passenger flows, minimizing additional environmental impact. Platforms adopting alternative transportation modes like bicycles or walking achieve higher sustainability. Ratings range from 3 for platforms with robust environmental initiatives (e.g., electric vehicles or bicycle couriers), to 1 for those relying solely on cars, such as Company 5. Global companies often exhibit greater environmental awareness, attributed to larger delivery networks.

User motivation: User motivation plays a key role in fostering loyalty and increasing engagement with delivery platforms. Promotions, discounts, and loyalty codes strengthen user relationships and add value beyond the service itself. Platforms like Company 1, Company 2, Company 3, and Company 6 effectively employ these incentives to attract and retain users. Conversely, platforms like Company 4 and Company 5, which lack motivational programs, face challenges in sustaining long-term user loyalty. In a competitive market, platforms that neglect this aspect risk losing users to competitors actively employing promotions to attract and retain customers. To remain competitive, platforms must innovate promotional strategies, ensuring sustained user engagement and loyalty.

5 Model Development for CL Platform Evaluation

In this paper, an MCDM approach was applied to evaluate and prioritize criteria related to platform selection within the context of CL. Two key methods used in this process are SWARA and MARCOS. Each method plays a specific role in the decision-making process and complements the other to provide precise and reliable results. After describing the methods and the applied methodology, the results obtained from their application to the decision-making problem addressed in this paper were analyzed. Four scenarios were considered, reflecting different perspectives of characteristic user types on the importance of criteria in platform selection. The practical application of the developed model was also discussed.

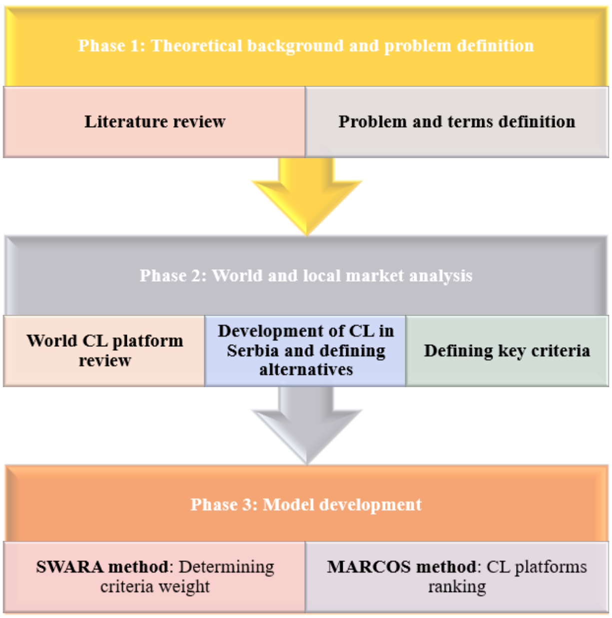

Figure 3. Methodology of the paper

The methodology (Figure 3) illustrates the key stages of the research and the development of the proposed model for evaluating CL platforms. The methodology is divided into three phases. The first phase encompasses the theoretical foundation through a literature review and the definition of key concepts and problems related to CL. The second phase involves an analysis of the global and local markets, examining the current situation globally and the development of CL in Serbia, along with the identification of existing alternative solutions. Additionally, criteria for platform evaluation were defined in this phase. The third phase includes the application of the SWARA method to determine criteria weights, followed by the use of the MARCOS method for ranking and evaluating platforms. This methodological approach enables a comprehensive analysis of CL platforms at both the global and local levels, providing specific guidelines for their assessment and comparison.

5.1 SWARA Method

The SWARA method was selected as the first step in the model development process, specifically used to determine the relative importance of different criteria. It is particularly useful for ranking criteria based on expert opinions, enabling decision-makers to gradually assess and adjust the importance of each criterion. The key advantage of the SWARA method lies in its ability to quantify subjective opinions and assign appropriate weights to criteria influencing the final decision. The steps for its application are as follows [28].

Step 1: All criteria should be sorted in descending order based on their significance.

Step 2: Experts express the relative importance of criterion j in relation to the $j+1$ criterion starting from the second criterion. In this way, the comparative importance of average value (S_j) is determined for each criterion.

Step 3: Calculating the coefficient k_j using Eq. (1):

$$k_j = \begin{cases} 1, & j = 1 \\ s_j + 1, & j > 1 \end{cases} \tag{1}$$

Step 4: Calculating the recalculated weight q_j using Eq. (2):

$$q_j = \begin{cases} 1, & j = 1 \\ \frac{q_{j-1}}{k_j}, & j > 1 \end{cases} \tag{2}$$

Step 5: Calculating the weight values of criteria by applying Eq. (3):

$$w_j = \frac{q_j}{\sum_{k=1}^{n} q_k} \tag{3}$$

5.2 MARCOS Method

After determining the criteria weights using the SWARA method, the next step involves applying the MARCOS method for ranking the alternatives. The MARCOS method is a quantitative approach that evaluates each alternative relative to the ideal (best) and anti-ideal (worst) solutions. Based on this evaluation, each alternative receives a score that indicates its position relative to these extreme solutions, helping decisionmakers clearly understand the strengths and weaknesses of each option before making a final choice. This method enables the identification of the alternative that represents the best compromise solution. As detailed in reference [29], the steps of the MARCOS method include:

Step 1: Determining an initial decision-making matrix consisting of n criteria and m alternatives.

Step 2: Determining an extended initial matrix by defining the ideal (AI) and anti-ideal (AAI) solution.

$$X = \begin{array}{c} \\ AAI \\ A_1 \\ A_2 \\ \dots \\ A_m \\ AI \end{array} \begin{array}{c} \begin{matrix} C_1 & C_2 & & C_n \end{matrix} \\ \begin{bmatrix} x_{aa1} & x_{aa2} & \dots & x_{aan} \\ x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \\ x_{ai1} & x_{ai2} & \dots & x_{ain} \end{bmatrix} \end{array} \tag{4}$$

The anti-ideal solution (AAI) represents the worst alternative, while the ideal solution (AI) represents an alternative with the best characteristics. Depending on the criteria type, AAI and AI are determined by applying Eqs. (5) and (6):

$$AAI = \min_i x_{ij} \text{ if } j \in B \text{ and } \max_i x_{ij} \text{ if } j \in C \tag{5}$$

$$AI = \max_i x_{ij} \text{ if } j \in B \text{ and } \min_i x_{ij} \text{ if } j \in C \tag{6}$$

where, B represents benefit criteria while C represents cost criteria.

Step 3: Normalization of the initial decision-making matrix using Eqs. (7) and (8):

$$n_{ij} = \frac{x_{ai}}{x_{ij}} \text{ if } j \in C \tag{7}$$

$$n_{ij} = \frac{x_{ij}}{x_{ai}} \text{ if } j \in B \tag{8}$$

where, elements x_{ij} and x_{ai} are the elements of the matrix X.

Step 4: Determining the weighted matrix $V = [v_{ij}]_{m \times n}$ which is obtained by multiplying the normalized matrix N with the weight coefficients of the criterion using Eq. (9).

$$v_{ij} = n_{ij} \times w_j \tag{9}$$

Step 5: Calculating the utility degree of alternatives K_i using Eqs. (10) and (11) in relation to the antiideal and ideal solution.

$$K_i^- = \frac{S_i}{S_{aai}} \tag{10}$$

$$K_i^+ = \frac{S_i}{S_{ai}} \tag{11}$$

where, $S_i(i = 1, 2, \ldots, m)$ represents the sum of the elements of the weighted matrix V, Eq. (12).

$$S_i = \sum_{i=1}^{n} V_{ij} \tag{12}$$

Step 6: Determining the utility function of alternatives $f(K_i)$. The utility function represents the compromise of the observed alternative in relation to the ideal and anti-ideal solution and is calculated using Eq. (13).

$$f\left(K_i\right) = \frac{K_i^+ + K_i^-}{1 + \frac{1-f\left(K_i^+\right)}{f\left(K_i^+\right)} + \frac{1-f\left(K_i^-\right)}{f\left(K_i^-\right)}} \tag{13}$$

where, $f(K_i^-)$ is the utility function in relation to the anti-ideal solution, while $f(K_i^+)$ is the utility function in relation to the ideal solution, using Eqs. (14) and (15).

$$f\left(K_i^-\right) = \frac{K_i^+}{K_i^+ + K_i^-} \tag{14}$$

$$f\left(K_i^+\right) = \frac{K_i^-}{K_i^+ + K_i^-} \tag{15}$$

Step 7: Ranking the alternatives using the values of utility functions, where the alternative with the highest value is the best-ranked.

6 Results Analysis

In the process of selecting a CL platform, it is crucial to identify and evaluate the different criteria that influence user decisions. The main criteria used for selecting a CL platform were defined in Section 4 (shown in Table 1), using a literature review and expert opinions. The selected criteria were weighted because they were not of equal importance. To assign weights, the SWARA technique was used. Since the importance of criteria varies from user to user, four scenarios were formed according to the priorities of four groups of characteristic users. Based on the defined criteria weights, a ranking of alternatives was conducted for each user type using the MARCOS method.

6.1 First Characteristic User (FCU)

The first group of characteristic users places the highest value on cost-effectiveness and efficiency when choosing a CL platform. For them, the most important criteria are low cost and quick delivery times, indicating a focus on minimizing expenses while maintaining a high level of service. Reliability and product quality are also important, but not to the same extent as cost and speed, which suggests that they seek a balance between price and speed without significant compromises on quality. They pay less attention to factors such as environmental sustainability and user motivations, indicating a pragmatic and operationally focused approach that prioritizes quick results and efficiency. As a result, their decision on selecting a CL platform is often driven by how quickly and affordably they can receive the service, with environmental and other additional benefits taking a backseat. The specific values of the weight coefficients for these criteria are provided in Table 2. This prioritization structure clearly reflects their inclination toward solutions that allow them to achieve their goals with minimal costs and maximum operational efficiency.

Table 2. Criteria weights for FCU

	Criteria	S_j	$K_j = S_j + 1$	Q_j	W_j
C1	Costs	-	1	1	0.16
C2	Time	0.04	1.04	0.962	0.153
C3	Reliability	0.07	1.07	0.899	0.143
C4	Product Quality	0.09	1.09	0.824	0.132
C5	Flexibility	0.32	1.32	0.625	0.1
C6	Complaint Handling	0.1	1.1	0.568	0.091
C7	Shipment Tracking	0.05	1.05	0.541	0.086
C8	User Motivation	0.14	1.14	0.474	0.076
C9	Environmental Sustainability	0.27	1.27	0.374	0.06
Σ				6.266	1

The following is the initial table for analysis using the MARCOS method. The table contains key criteria and values for each of the CL platforms, labeled from A1 to A6: Company 1, Company 2, Company 3, Company 4, Company 5, and Company 6, respectively. For each criterion, generated values are presented, along with values for the positive (AI) and negative (AAI) ideal solutions. These data serve as a starting point for assessing the performance of each platform across various aspects such as cost, time, reliability, and environmental sustainability. The criteria are classified as minimization (min) or maximization (max) based on whether lower or higher values are preferred, enabling clearer comparisons between different variants. Table 3 will serve as the basis for MARCOS analysis to determine the most favorable CL platform, considering all defined criteria and their target values. This approach allows for a comprehensive evaluation that encompasses different user priorities.

Table 3. Initial decision-making matrix for FCU

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
optimal	min	min	max	max	max	max	max	max	max
AAI	925	105	4	0.35	1	1	0	1	1
A1	290	30	4.8	0.55	2	2	2	2	3
A2	200	38	4.3	0.5	2	2	2	2	3
A3	125	48	4.2	0.51	2	2	2	2	3
A4	735	98	4.5	0.4	1	1	3	1	2
A5	925	105	4.6	0.35	1	1	0	1	1
A6	250	55	4	0.38	1	1	1	1	2
AI	125	30	4.8	0.55	2	2	3	2	3

The normalized matrix presented in Table 4 shows the relative values of each alternative in relation to the positive ideal (AI) and negative anti-ideal (AAI) solution for each criterion. Normalization brings the values of all criteria to the same level, allowing for comparison across different alternatives based on multiple factors. Values are expressed as relative coefficients where 1 represents the most favorable value (positive ideal), and values closer to 0 represent less desirable options in relation to the ideal solution. Based on this normalized matrix, further analysis can be conducted to determine which platform best meets the defined criteria and to what extent.

In the next step, a weighted matrix was defined, showing the recalculated values for each alternative in relation to the defined criteria, taking into account their weights (W_i). Each alternative (Al-A6) has its values normalized across all criteria (C1-C9), allowing for more precise comparison of their performances. Table 5 presents the S_i values, which represent the sum of weighted values across the criteria for each variant. Based on these values, coefficients K_i^- and K_i^+ were calculated, showing the relative position of each variant in relation to the antiideal and the ideal solution. The final functions $f\left(K_i^-\right), f\left(K_i^+\right)$, and $f\left(K_i\right)$ determine the ranking of the alternatives in the analysis (Table 6), where a higher value indicates better alignment with the ideal solution.

Table 4. Normalized decision-making matrix for FCU

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
AAI	0.135	0.286	0.833	0.636	0.5	0.5	0	0.5	0.333
A1	0.431	1	1	1	1	1	0.667	1	1
A2	0.625	0.789	0.896	0.909	1	1	0.667	1	1
A3	1	0.625	0.875	0.927	1	1	0.667	1	1
A4	0.17	0.306	0.938	0.727	0.5	0.5	1	0.5	0.667
A5	0.135	0.286	0.958	0.636	0.5	0.5	0	0.5	0.333
A6	0.5	0.545	0.833	0.691	0.5	0.5	0.333	0.5	0.667
AI	1	1	1	1	1	1	1	1	1
$W_{(j)}$	0.160	0.153	0.143	0.132	0.1	0.091	0.086	0.076	0.06

Table 5. Normalized decision-making matrix for FCU

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	S_i	$\boldsymbol{K_i^-}$	$\boldsymbol{K_i^+}$	$f\left(K_i^-\right)$	$f\left(K_i^+\right)$	$f\left(K_i\right)$
AAI	0.022	0.044	0.120	0.084	0.050	0.045	0.000	0.038	0.020	0.422					
A1	0.069	0.153	0.143	0.132	0.100	0.091	0.058	0.076	0.060	0.880	2.089	0.880	0.297	0.703	0.783
A2	0.100	0.121	0.128	0.120	0.100	0.091	0.058	0.076	0.060	0.852	2.022	0.852	0.297	0.703	0.757
A3	0.160	0.096	0.125	0.122	0.100	0.091	0.058	0.076	0.060	0.886	2.102	0.886	0.297	0.703	0.788
A4	0.027	0.047	0.134	0.096	0.050	0.045	0.086	0.038	0.040	0.563	1.336	0.563	0.297	0.703	0.501
A5	0.022	0.044	0.137	0.084	0.050	0.045	0.000	0.038	0.020	0.439	1.043	0.439	0.297	0.703	0.391
A6	0.080	0.084	0.120	0.091	0.050	0.045	0.029	0.038	0.040	0.575	1.365	0.575	0.297	0.703	0.512
AI	0.160	0.150	0.140	0.130	0.100	0.090	0.090	0.080	0.060	1					

Table 6. Alternative ranking for FCU

	A	$f\left(K_i\right)$
1	A3	0.788
2	A1	0.783
3	A2	0.757
4	A6	0.512
5	A4	0.501
6	A5	0.391

The results show that Company 3 is the most favorable option with $f\left(K_i\right) = 0.788$, closely followed by Wolt with $f\left(K_i\right) = 0.783$. The difference between them is minimal, indicating that these two platforms are almost equally wellaligned with the defined criteria. Company 2 is in third place with $f\left(K_i\right) = 0.757$, also very close to the leading options. After this, there is a significant drop, indicating that A3, A1, and A2 are the best options, while the remaining three are less aligned with the defined criteria.

6.2 Second Characteristic User (SCU)

The SCU is strongly focused on cost-effectiveness and value when selecting a CL platform. For this group, the most important criteria are costs and user motivation, which are reflected in the high weighting coefficients (W_j) of 0.226 and 0.218, as shown in Table 7. This indicates that their primary concern is cost reduction, as well as additional benefits such as discounts, promo codes, and promotions offered by the platforms. In addition, they place importance on time and the ability to request refunds, which reflects a need for fast and secure service. Other criteria, such as flexibility, product quality, reliability, shipment tracking, and environmental sustainability, are ranked lower, suggesting that these factors are less prioritized compared to direct economic value. These users seek a platform that offers the optimal combination of low costs, speed, and additional promotions, willing to forgo some other service aspects to achieve this.

Table 7. Criteria weights for SCU

	Criteria	S_j	$K_j = S_j + 1$	Q_j	W_j
C1	Costs	-	1	1	0.226
C2	User Motivation	0.04	1.04	0.962	0.218
C3	Time	0.5	1.5	0.641	0.145
C4	Complaint Handling	0.04	1.04	0.616	0.140
C5	Flexibility	0.4	1.4	0.440	0.100
C6	Product Quality	0.5	1.5	0.294	0.066
C7	Reliability	0.3	1.3	0.226	0.051
C8	Shipment Tracking	0.7	1.7	0.133	0.030
C9	Environmental Sustainability	0.27	1.27	0.105	0.024
Σ					4.416

Table 8. Initial decision-making matrix for SCU

	C1	C2	C3	C4	C5	C6	C7	C8	C9
optimal	min	max	min	max	max	max	max	max	max
AAI	925	1	105	1	1	0.35	4	0	1
A1	290	2	30	2	2	0.55	4.8	2	3
A2	200	2	38	2	2	0.5	4.3	2	3
A3	125	2	48	2	2	0.51	4.2	2	3
A4	735	1	98	1	1	0.4	4.5	3	2
A5	925	1	105	1	1	0.35	4.6	0	1
A6	250	1	55	1	1	0.38	4	1	2
AI	125	2	30	2	2	0.55	4.8	3	3

Table 9. Normalized decision-making matrix for SCU

	C1	C2	C3	C4	C5	C6	C7	C8	C9
AAI	0.135	0.5	0.286	0.5	0.5	0.636	0.833	0	0.333
A1	0.431	1	1	1	1	1	1	0.667	1
A2	0.625	1	0.789	1	1	0.909	0.896	0.667	1
A3	1	1	0.625	1	1	0.927	0.875	0.667	1
A4	0.17	0.5	0.306	0.5	0.5	0.727	0.938	1	0.667
A5	0.135	0.5	0.286	0.5	0.5	0.636	0.958	0	0.333
A6	0.5	0.5	0.545	0.5	0.5	0.691	0.833	0.333	0.667
AI	1	1	1	1	1	1	1	1	1
$W_{(j)}$	0.226	0.218	0.145	0.140	0.100	0.066	0.051	0.030	0.024

Table 10. Weighted decision-making matrix for SCU

	C1	C2	C3	C4	C5	C6	C7	C8	C9	S_i	K_i^-	K_i^+	$f(K_i^-)$	$f(K_i^+)$	$f(K_i)$
AAI	0.03	0.11	0.04	0.07	0.05	0.04	0.04	0.00	0.01	0.39					
A1	0.098	0.218	0.145	0.140	0.100	0.066	0.051	0.020	0.024	0.861	2.189	0.861	0.282	0.718	0.775
A2	0.142	0.218	0.115	0.140	0.100	0.060	0.046	0.020	0.024	0.863	2.194	0.863	0.282	0.718	0.777
A3	0.226	0.218	0.091	0.140	0.100	0.062	0.045	0.020	0.024	0.924	2.350	0.924	0.282	0.718	0.832
A4	0.039	0.109	0.044	0.070	0.050	0.048	0.048	0.030	0.016	0.454	1.153	0.454	0.282	0.718	0.408
A5	0.031	0.109	0.041	0.070	0.050	0.042	0.049	0.000	0.008	0.400	1.016	0.400	0.282	0.718	0.360
A6	0.113	0.109	0.079	0.070	0.050	0.046	0.043	0.010	0.016	0.535	1.361	0.535	0.282	0.718	0.482
AI	0.230	0.220	0.150	0.140	0.100	0.070	0.050	0.030	0.020	1					

Here, three key tables (initial, normalized, and weighted) are presented for analysis from the perspective of the SCU. Table 8 contains the initial matrix for each platform (A1–A6), along with the optimal (AI) and worst (AAI) values, providing a foundation for analysis and initial insight into the performance of each platform. Table 9 displays the normalized values, allowing for comparison across different platforms regardless of the different units of measurement, eliminating discrepancies in the scale of each criterion's values. This normalization gives a more objective view of each platform's alignment with the optimal values. Finally, Table 10 presents the weighted values, which take into account the weighting coefficients (W_j) assigned to each criterion. This weighting is crucial for highlighting the priorities of this user and for determining the final ranking of each platform, showing which one best meets the specific requirements and preferences of the user.

Table 11. Alternatives ranking for SCU

	A	$f(K_i)$
1	A3	0.832
2	A1	0.777
3	A2	0.775
4	A6	0.482
5	A4	0.408
6	A5	0.360

Based on the previous three tables, an analysis was conducted to determine the ranking of alternatives for SCU. After applying the MARCOS method, the ranking shown in Table 11 reveals that A3 (Company 3) is the most favorable alternative. Following this is A1 (Company 1), and immediately behind is A2 (Company 2). These three CL platforms emerged as the best-ranked options according to the defined criteria of this user and significantly stand out from the rest. Alternatives A6 (Company 6), A4 (Company 4), and A5 (Company 5) are found in lower positions, indicating that they are less aligned with the preferences of this user. This ranking highlights clear differences in the performance of the platforms when the priorities of this user type are taken into account.

It is interesting to note that, although FCU and SCU have quite different priorities, the ranking of alternatives remains the same. This indicates a pronounced advantage of the top three platforms. These results suggest that these platforms are generally recognized as the most competitive on the market, offering a wide range of benefits that meet different user needs. This makes them universally attractive, even in situations where user preferences differ. Such stability in ranking can be attributed to their high efficiency, affordable pricing, service quality, as well as their wide presence and market recognition.

6.3 Third Characteristic User (TCU)

The third user type approaches the evaluation of criteria in a completely equal manner, assigning the same importance to each of them. As shown in Table 12, all criteria, including costs, time, reliability, product quality, flexibility, complaint handling, shipment tracking, user motivation, and environmental sustainability, have an equal weight (W_j) of 0.111. This approach suggests that this user does not distinguish between different aspects of the CL platform, instead aiming for a holistic assessment where each element is considered equally relevant. For this user, the success of a CL platform is based on a balanced combination of all criteria, without emphasizing certain advantages or making significant compromises. This universal perspective can be useful in situations where different factors are equally important for decision-making, allowing for an objective evaluation of each platform as a whole.

Table 12. Criteria weights for TCU

	Criteria	S_j	$K_j = S_j + 1$	Q_j	W_j
C1	Costs	-	1	1	0.111
C2	Time	0	1	1	0.111
C3	Reliability	0	1	1	0.111
C4	Product Quality	0	1	1	0.111
C5	Flexibility	0	1	1	0.111
C6	Complaint Handling	0	1	1	0.111
C7	Shipment Tracking	0	1	1	0.111
C8	User Motivation	0	1	1	0.111
C9	Environmental Sustainability	0	1	1	0.111
Σ					9

For the TCU, who considers all criteria equally important, a MARCOS analysis was conducted using the provided data, shown in Tables 13-15, respectively. This approach, without prioritizing among the criteria, provides a different perspective in which all CL platforms are viewed through the lens of complete equality. Analyzing these tables allows us to evaluate the platforms solely based on overall quality, rather than specific preferences. This is particularly useful for identifying solutions that consistently perform well across all aspects. In this way, we can observe which CL platforms maintain a high level of efficiency and functionality when all criteria are equally represented, indicating their universal competitiveness and adaptability to different user needs.

Table 13. Initial decision-making matrix for TCU

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
optimal	min	min	max	max	max	max	max	max	max
AAI	925	105	4	0.35	1	1	0	1	1
A1	290	30	4.8	0.55	2	2	2	2	3
A2	200	38	4.3	0.5	2	2	2	2	3
A3	125	48	4.2	0.51	2	2	2	2	3
A4	735	98	4.5	0.4	1	1	3	1	2
A5	925	105	4.6	0.35	1	1	0	1	1
A6	250	55	4	0.38	1	1	1	1	2
AI	125	30	4.8	0.55	2	2	3	2	3

Table 14. Normalized decision-making matrix for TCU

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
AAI	0.135	0.286	0.833	0.636	0.500	0.500	0.000	0.500	0.333
A1	0.431	1.000	1.000	1.000	1.000	1.000	0.667	1.000	1.000
A2	0.625	0.789	0.896	0.909	1.000	1.000	0.667	1.000	1.000
A3	1.000	0.625	0.875	0.927	1.000	1.000	0.667	1.000	1.000
A4	0.170	0.306	0.938	0.727	0.500	0.500	1.000	0.500	0.667
A5	0.135	0.286	0.958	0.636	0.500	0.500	0.000	0.500	0.333
A6	0.500	0.545	0.833	0.691	0.500	0.500	0.333	0.500	0.667
AI	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
W_j	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111

Table 15. Weighted decision-making matrix for TCU

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	S_i	$\boldsymbol{K_i^-}$	$\boldsymbol{K_i^+}$	$f\left(K_i^-\right)$	$f\left(K_i^+\right)$	$f\left(K_i\right)$
AAI	0.015	0.032	0.093	0.071	0.056	0.056	0.000	0.056	0.037	0.413					
A1	0.048	0.111	0.111	0.111	0.111	0.111	0.074	0.111	0.111	0.899	2.175	0.900	0.293	0.707	0.803
A2	0.069	0.088	0.099	0.101	0.111	0.111	0.074	0.111	0.111	0.875	2.118	0.876	0.293	0.707	0.782
A3	0.111	0.069	0.097	0.103	0.111	0.111	0.074	0.111	0.111	0.898	2.174	0.899	0.293	0.707	0.802
A4	0.019	0.034	0.104	0.081	0.056	0.056	0.111	0.056	0.074	0.589	1.425	0.590	0.293	0.707	0.526
A5	0.015	0.032	0.106	0.071	0.056	0.056	0.000	0.056	0.037	0.427	1.034	0.428	0.293	0.707	0.381
A6	0.056	0.061	0.093	0.077	0.056	0.056	0.037	0.056	0.074	0.563	1.361	0.563	0.293	0.707	0.502
AI	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.999					

Table 16. Alternatives ranking for TCU

	A	$f\left(K_i\right)$
1	A1	0.803
2	A3	0.802
3	A2	0.782
4	A4	0.526
5	A6	0.502
6	A5	0.381

The ranking obtained (Table 16) for TCU shows that Company 1 and Company 2 are nearly equal. This result suggests that these two CL platforms are the most suitable when all criteria are viewed as equally important, indicating their versatile efficiency. Company 2 ranks third, very close to the leading options. These three platforms consistently stand out and dominate the ranking, demonstrating their ability to meet various user requirements. Significantly lower on the list are Company 4, Company 6, and Company 5. They lack the broad range of qualities that would make them universally competitive. The ranking shows that Company 1, Company 2, and Company 3 are versatile options that consistently achieve high performance across all aspects, making them suitable choices for users with diverse needs. These are the same companies that previously stood out, further confirming their competitiveness.

6.4 Fourth Characteristic User (FrCU)

The FrCU, whom we can describe as environmentally conscious, places the highest importance on environmental sustainability when choosing a CL platform. As shown in Table 17, this criterion has the highest weight (W_j) of 0.267, indicating that environmental protection is a key factor in their decision-making. Time and costs also hold significant importance with weights of 0.140 and 0.135, respectively, indicating that this user values efficiency and affordability as well. However, aspects such as user motivation and shipment tracking were rated significantly lower, suggesting that they are secondary in comparison to environmental impact. This user seeks a CL platform that combines sustainability with reasonable speed and cost while paying less attention to additional benefits like promotions and tracking.

Table 17. Criteria weights for the FrCU

	Criteria	S_j	$K_j = S_j + 1$	Q_j	W_j
C1	Environmental Sustainability	-	1	1	0.267
C2	Time	0.9	1.9	0.526	0.140
C3	Costs	0.04	1.04	0.506	0.135
C4	Complaint Handling	0.1	1.1	0.460	0.123
C5	Product Quality	0.02	1.02	0.451	0.120
C6	Flexibility	0.3	1.3	0.347	0.093
C7	Reliability	0.4	1.4	0.248	0.066
C8	Shipment Tracking	0.8	1.8	0.138	0.037
C9	User Motivation	0.9	1.9	0.072	0.019
Σ				3.748	1.000

Table 18. Initial decision-making matrix for FrCU

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
optimal	max	min	min	max	max	max	max	max	max
AAI	1	105	925	1	0.35	1	4	0	1
A1	3	30	290	2	0.55	2	4.8	2	2
A2	3	38	200	2	0.5	2	4.3	2	2
A3	3	48	125	2	0.51	2	4.2	2	2
A4	2	98	735	1	0.4	1	4.5	3	1
A5	1	105	925	1	0.35	1	4.6	0	1
A6	2	55	250	1	0.38	1	4	1	1
AI	3	30	125	2	0.55	2	4.8	3	2

For this user, a MARCOS analysis was also conducted using the initial, normalized, and weighted matrices (Tables 18-20). By analyzing these tables, we can understand how each platform balances between the ecological and practical requirements of this user. This type of user often follows information about a company's environmental impact and prefers those that transparently report their ecological initiatives. Furthermore, they are likely willing to pay a slightly higher price for a service that guarantees a smaller carbon footprint and the implementation of sustainable practices in logistics.

The ranking for FrCU (Table 21) shows that A1 (Company 1) and A3 (Company 3) are again at the top of the list. A2 (Company 2) is immediately behind, suggesting that these three platforms are the most successful in meeting the ecological and other key criteria set by this user. Although this user emphasizes environmental sustainability, Company 1, Company 2, and Company 3 manage to maintain high positions, indicating their overall quality and ability to meet a broad range of user requirements. On lower positions are A6 (Company 6), A4 (Company 4), and A5 (Company 5). These platforms failed to achieve the same standards as the leading variants, especially when ecological sustainability is prioritized. These results once again confirm the dominant position of Company 1, Company 2, and Company 3 platforms, emphasizing their ability to meet different user types, including those who prioritize ecological values.

Table 19. Normalized decision-making matrix for FrCU

	C1	C2	C3	C4	C5	C6	C7	C8	C9
AAI	0.333	0.286	0.135	0.500	0.636	0.500	0.833	0.000	0.500
A1	1.000	1.000	0.431	1.000	1.000	1.000	1.000	0.667	1.000
A2	1.000	0.789	0.625	1.000	0.909	1.000	0.896	0.667	1.000
A3	1.000	0.625	1.000	1.000	0.927	1.000	0.875	0.667	1.000
A4	0.667	0.306	0.170	0.500	0.727	0.500	0.938	1.000	0.500
A5	0.333	0.286	0.135	0.500	0.636	0.500	0.958	0.000	0.500
A6	0.667	0.545	0.500	0.500	0.691	0.500	0.833	0.333	0.500
AI	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
W_j	0.267	0.140	0.135	0.123	0.120	0.093	0.066	0.037	0.019

Table 20. Weighted decision-making matrix for FrCU

	C1	C2	C3	C4	C5	C6	C7	C8	C9	S_i	K_i^-	K_i^+	$f(K_i^-)$	$f(K_i^+)$	$f(K_i)$
AAI	0.089	0.040	0.018	0.061	0.077	0.046	0.055	0.000	0.010	0.396					
A1	0.267	0.140	0.058	0.123	0.120	0.093	0.066	0.024	0.019	0.911	2.299	0.911	0.284	0.716	0.819
A2	0.267	0.111	0.084	0.123	0.109	0.093	0.059	0.024	0.019	0.890	2.245	0.890	0.284	0.716	0.800
A3	0.267	0.088	0.135	0.123	0.112	0.093	0.058	0.024	0.019	0.918	2.317	0.918	0.284	0.716	0.825
A4	0.178	0.043	0.023	0.061	0.088	0.046	0.062	0.037	0.010	0.547	1.381	0.547	0.284	0.716	0.492
A5	0.089	0.040	0.018	0.061	0.077	0.046	0.063	0.000	0.010	0.405	1.021	0.405	0.284	0.716	0.364
A6	0.178	0.077	0.068	0.061	0.083	0.046	0.055	0.012	0.010	0.590	1.488	0.590	0.284	0.716	0.530
AI	0.267	0.140	0.135	0.123	0.120	0.093	0.066	0.037	0.019	1					

Table 21. Alternatives ranking for FrCU

	A	$f(K_i)$
1	A3	0.832
2	A1	0.777
3	A2	0.775
4	A6	0.482
5	A4	0.408
6	A5	0.360

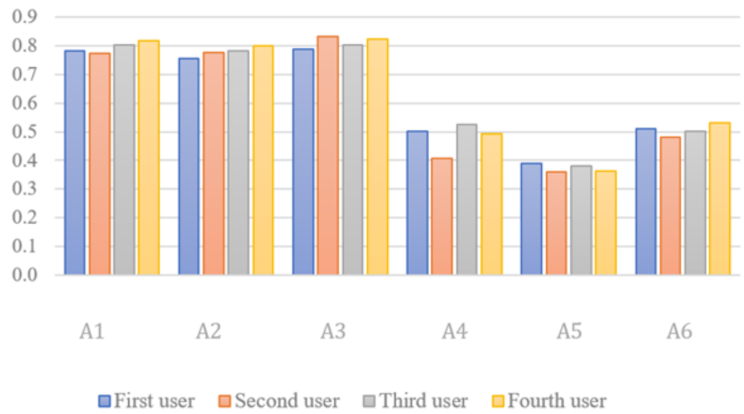

Figure 4. Alternatives ranking for different characteristic users

Based on the analysis of all four characteristic users, it is evident that the three CL platforms - Company 1, Company 2, and Company 3 - consistently stand out as the most favorable options. Visual graphics that make this trend more apparent are presented in Figure 4. Despite differences in priorities and evaluation criteria, these platforms have shown a high level of adaptability and versatility, successfully meeting the diverse needs of users. The first and second types of users, focused on cost-effectiveness and practicality, as well as the third user who equally values all criteria, ranked these platforms at the top of their lists. Even the fourth user, with a focus on ecological sustainability, exhibits a similar pattern in ranking, indicating that these platforms manage to maintain a balance between environmental and operational performance.

These results suggest that Company 1, Company 2, and Company 3 are successful because they offer a wide range of benefits that satisfy diverse criteria, from costs and speed to environmental sustainability. Their consistent dominance across all four analyses implies that they provide a balanced offering attractive to different market segments. In contrast, the other platforms, Company 4, Company 5, and Company 6, are ranked worst throughout all analyses. Their lower rankings suggest that they may not have a sufficiently comprehensive approach to be competitive in the eyes of different types of users.

6.5 Theoretical and Managerial Implications

The developed approach for evaluating CL platforms has a wide range of practical implications, enabling its application across various contexts, from business environments to individual decision-making. This model provides concrete benefits for all stakeholders in the CL sector, whether it's about optimizing business operations or improving user experience. For example, SMEs can use this model to easily choose the CL platform that best meets their specific needs and limited resources. This is crucial for achieving an optimal balance between cost and delivery speed, which can be key to their competitiveness in the market. For large corporations, the model offers an opportunity to focus on sustainability and efficiency within their complex supply chains. By using this approach, they can enhance their logistics operations and reduce their environmental footprint, which is increasingly a priority for large corporations.

The model is not only beneficial for businesses but also individual users. In choosing a CL platform for personal use, whether speed of delivery, cost efficiency, or environmental sustainability is their priority, the model can serve as a guide to facilitate decision-making. Users with specific preferences, like those who value ecological sustainability above other criteria, can easily identify which platform best matches their values. Additionally, the CL platforms themselves can use the model as a tool for self-evaluation and service improvement, or for internal benchmarking. By analyzing the model's results, platforms can identify areas where they lag and adjust their strategies to better meet the needs of different user segments.

Further implementation of the model can be realized through the development of specialized evaluation tools. For instance, a software application could be developed that allows companies to quickly and easily assess different CL platforms, providing real-time recommendations. This can significantly speed up and simplify the decision-making process in a dynamic business environment. The model also has a place in education and research; it can be a valuable tool for students and researchers studying MCDM methods and the complexity of logistics systems. Additionally, policymakers can use the model as a framework to promote sustainable practices in the logistics sector. The model's results can help identify CL platforms that meet environmental standards, thereby encouraging the development of regulations and guidelines that support sustainable logistics.

All these applications show that the model is not just a theoretical concept but a useful tool that can guide stakeholders in different aspects of the CL sector. Whether used for strategic planning, service improvement, or making everyday decisions, the model provides a structured approach to analysis that can contribute to more efficient and sustainable business operations. This approach can be compared to the practical decisions made by actors like Amazon and Wolt, whose strategies during the COVID-19 pandemic demonstrated similar principles in optimizing logistics operations.

7 Conclusion

This paper highlights the crucial role of CL as an innovative approach enabling more efficient and sustainable distribution in modern logistics systems. Through a comparative analysis of traditional CL, it is clear that CL provides more flexible, cost-effective, and environmentally friendly solutions, particularly in urban areas where delivery costs and traffic congestion are significant.

By analyzing both global and local CL platforms, the study identifies challenges such as business model sustainability, regulatory compliance, labor shortages, and high ad-hoc shipping costs. It shows that the key criteria for evaluating these platforms are delivery speed, costs, environmental sustainability, flexibility, and quality of customer support. Using MCDM methods, specifically the SWARA and MARCOS methods, precise ranking of six CL platforms was carried out, providing insights into how different users value these aspects. The results demonstrated that platforms like Company 1, Company 2, and Company 3 dominate the market by successfully balancing critical factors like costs, speed, and sustainability. The developed model for evaluating CL platforms serves as a practical tool for companies and users in choosing the most suitable platform. It can also be used as a basis for further improvement of existing services in the CL domain. These findings have important practical implications.

Primarily, the model assists users in making decisions by considering the criteria that are most important to them. It also provides CL platforms with insights into areas that need improvement to better meet the needs of different users.

The limitations of this research are seen in the specificity of the local market and the use of secondary data. Future research can expand this model by including additional criteria or analyzing new types of users, thereby enriching the evaluation framework and selection of CL platforms according to the changing needs and trends in the market. Furthermore, future research could focus on analyzing the impact of CL on rural areas, as well as legal and regulatory aspects shaping the development of these platforms.

In conclusion, CL demonstrates significant potential for transforming the logistics sector by offering solutions that meet contemporary needs for sustainability, speed, and cost-efficiency. The multi-criteria approach, as applied in this study, is crucial for understanding the complexity of the CL sector and making effective and sustainable decisions, which is vital for its future development.

Data Availability

The data supporting our research results are included within the article or supplementary material.

Conflicts of Interest

The authors declare no conflicts of interest.

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