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Risk Prioritization from the Crowd-Shipping Provider's Perspective using the CIMAS Method

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ABSTRACT

Crowd-shipping presents a new trend in shipment distribution. It is a process in which the crowd is employed to deliver the items. Effective risk prioritization is essential in city logistics and delivery, especially with the emergence of crowd-shipping. As crowd-shipping platforms grow, they bring uncertainties and challenges that can significantly impact operational efficiency and customer confidence. Emphasizing risk prioritization is crucial for many reasons, including trust and security, improving operational efficiency, and ensuring regulatory readiness. Risk prioritization is more than a mere formality; it is a vital element in successfully managing the intricacies of crowd-shipping. By methodically addressing and mitigating risks, providers can strengthen their operational capabilities, foster better customer connections, and ultimately promote the sustainable advancement of crowd-shipping services. This paper prioritizes the risks in crowd-shipping from the crowd-shipping provider's perspective, using an MCDM approach such as CIMAS. The risks are prioritized in descending order. Comparative analysis with the BWM indicates the high reliability of the results obtained by the CIMAS method.

1. Introduction

Crowd-shipping presents a new trend in shipment distribution. The rapid growth of crowd-shipping platforms has transformed the modern logistics and commerce landscape, facilitating the efficient transportation of goods [1]. In simple words, it is a process where the crowd is employed to deliver the items. Pourrahmani and Jaller [2] defined crowd-shipping as outsourcing logistics services to many actors. Crowd-shipping operates on the concept of utilizing a commuter who is already traveling for other reasons to transport a shipment, thereby avoiding the need for additional travel

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distance specifically for the delivery operation [3]. Crowdshipping is one of the initiatives to enhance the sustainability of last-mile delivery in cities by reducing the overall number of urban trips by integrating freight and passenger flows. Integrating parcel delivery into an individual's route offers many benefits: it reduces the number of freight vehicles in urban networks, enhances the ecological footprint of the transport system, and potentially contributes to the resilience of the urban community [2]. However, implementing crowd-shipping in practice faces several challenges. Concerns about crowd shipping arise from individuals who wish to work as crowd shippers and delivery service providers considering the possibility of using crowd-shipping labor. From the perspective of delivery service providers, crowd-shipping represents an opportunity to reduce last-mile delivery costs, which explains the interest of logistics operators in this initiative. However, crowd shippers are not professional couriers but rather casual participants. Consequently, this form of collaboration presents new challenges for those coordinating such deliveries. Matching supply and demand levels remains one of the primary obstacles [4-5]. The increasing volume of last-mile deliveries and rising customer demands for faster service require significant resources to meet these expectations. As a result, the share of delivery demand that crowd shippers can realistically fulfill may prove disproportionate to the costs incurred by delivery coordinators in supporting a crowd-shipping initiative. Ensuring the system's financial viability is critical for crowd-shipping businesses [6]. Developing a comprehensive funding strategy for implementing, scaling, and reorganizing crowd-shipping services is an essential factor that may help mitigate the risk of economic inefficiency [7].

Another significant concern for participants in crowd-shipping is data privacy and security [8-9]. Issues surrounding the protection of personal information affect all delivery process participants. Additionally, delivery service providers are worried that breach of confidentiality by crowd shippers could reduce users' trust in crowd shipping and the senders who have chosen this alternative to fulfill their deliveries.

Trust in the service quality of non-professional couriers is also a concern for parcel senders [8]. Due to crowdshippers' potential lack of specific skills or a lower level of responsibility, deliveries might be delayed, and packages may be damaged or even lost in transit. This underscores the need to develop measures to minimize the likelihood of such occurrences. Careful formulation of clear delivery performance criteria and individual incentives for potential couriers is an area that requires greater attention than it currently receives [10-11]. Despite practical attempts to implement crowd-shipping initiatives, crowd-shipping delivery remains largely unregulated in many countries. Crowd shipping providers are concerned about the uncertain status of non-professional couriers (e.g. employees, voluntary helpers, or self-employed individuals), issues of parcel insurance against theft and damage, and the potential for subsidies from governmental or local authorities [12-14]. In addition, tax compliance is complicated in crowd-shipping, as informal earnings by non-professional couriers may go unreported, raising concerns about tax liabilities and requiring legal frameworks for income reporting and taxation. This paper addresses the risks of crowd-shipping from the crowd-shipping providers' perspective using the MCDM approach. Six risks have been considered as possible alternatives: quality control and consistency, security and privacy concerns, reliability and punctuality, scalability challenges, reputation risk, and regulatory and legal compliance. The results will be discussed in the following sections of the paper.

The rest of the paper is structured as follows: Section 2 is the literature review. Section 3 is the methodology. Section 4 is the results and discussion. Section 5 concludes the paper.

2. Literature Review

This section provides an overview of the existing problems in crowd shipping that various authors have solved. For instance, Punel and Stathopoulos [15] modeled the acceptability of crowdsourced goods deliveries. Marcucci et al. [16] addressed connected shared mobility for passengers and freight by investigating crowd-shipping potential in urban areas.

Behrend and Meisel [17] tackled the problem of collaborative consumption by delivering through the crowd. Gatta et al. [18] evaluated public transport-based crowd-shipping for sustainable city logistics from economic and environmental perspectives. Rai et al. [19] performed a stakeholder analysis of a crowd logistics platform in Belgium, considering the environmental impact. Allahviranloo and Baghestani [20] observed daily travel behavior and proposed a crowd-shipping model.

Using accurate data, Shen and Lin [21] addressed crowd-shipping delivery trip production. Dai et al. [22] assessed private vehicle-based crowd-shipping for intercity express transportation. Lin et al. [23] dealt with the performance and intrusiveness of crowd-shipping systems. During the simulation study, Simoni et al. [24] investigated the potential last-mile impacts of crowd-shipping services.

Strulak-Wójcikiewicz and Wagner [9] explored the opportunities for using the sharing economy in sustainable urban freight transport. Ahamed et al. [25] proposed the deep reinforcement learning model for crowdsourced urban delivery. Behrend [26] considered the integrated perspective of item-sharing and crowd-shipping. Triki [27] performed combinatorial auctions to procure occasional drivers in freight transportation.

Boysen et al. [28] tackled the problem related to crowd-shipping by employees of distribution centers. Ghaderi et al. [29] proposed an integrated crowd-shipping framework for green last-mile delivery. Wicaksono et al. [30] investigated the market potential of bicycle crowd-shipping.

Cebeci et al. [31] investigated the effect of trust on the choice of crowd-shipping services. Nascimento et al. [6] assessed critical factors from a business perspective in green crowd-shipping. Tsai et al. [32] addressed the problem of trajectory feature extraction and multi-criteria k nearest neighbor-based job-to-crowd matching for the crowd-shipping last-mile delivery.

Akbar et al. [33] assessed inter-urban crowd-shipping from a sustainability perspective. Cheng et al. [34] evaluated the potential impacts of public transport-based crowd-shipping. Fessler et al. [35] considered the drivers and barriers to adopting a crowd-shipping service. Hwang et al. [36] tackled supermarket-chain grocery delivery optimization problems through crowd-shipping. Macrina et al. [37] addressed pricing in crowd-shipping. Şardağ et al. [38] solved the crowd-shipping problem with dynamic compensations and transshipments. Sawik [39] proposed a multi-criteria approach with automated smart lockers, capillary distribution, and crowd-shipping logistics. Shen and Lin [40] considered a courier's choice for delivery gigs in a real-world crowd-shipping service with observed sender-courier preference discrepancy. Xiang et al. [41] proposed the centralized deep reinforcement learning method for dynamic multi-vehicle pickup and delivery problems with crowd-shippers.

The research on various crowd-shipping problems is summarized in Table 1. Based on the literature review, it can be concluded that there is no study addressing the risk prioritization problem from the crowd-shipping provider's perspective. The methodology and its application are presented in the following sections of this paper.

Table 1
Review of crowdshipping problems

Authors	Year	Problem considered
Punel and Stathopoulos [15]	2017	Modeling the acceptability of crowdsourced goods deliveries: role of context and experience effects
Marcucci et al. [16]	2017	Connected shared mobility for passengers and freight: investigating the potential of crowd-shipping in urban areas
Behrend and Meisel [17]	2018	Collaborative consumption by delivering through the crowd
Gatta et al. [18]	201	Public transport-based crowd-shipping for sustainable city logistics: economic and environmental impacts
Rai et al. [19]	2018	Environmental impact and stakeholder analysis of a crowd logistics platform in Belgium
Allahviranloo and Baghestani [20]	2019	Crowdshipping model and daily travel behavior
Shen and Lin [21]	2020	Crowdshipping delivery trip production with real-world data
Dai et al. [22]	2020	Private vehicle-based crowdshipping for intercity express transportation
Lin et al. [23]	2020	Performance and intrusiveness of crowd-shipping systems
Simoni et al. [24]	2020	Potential last-mile impacts of crowd-shipping services: a simulation-based evaluation
Strulak-Wójcikiewicz and Wagner [9]	2021	Exploring opportunities for using the sharing economy in sustainable urban freight transport
Ahamed et al. [25]	2021	Deep reinforcement learning for crowdsourced urban delivery
Behrend [26]	2021	Integrated perspective of item-sharing and crowdshipping
Triki [27]	2021	Combinatorial auctions for the procurement of occasional drivers in freight transportation
Boysen et al. [28]	2022	Crowd-shipping by employees of distribution centers
Ghaderi et al. [29]	2022	An integrated crowd-shipping framework for green last-mile delivery
Wicaksono et al. [30]	2022	Market potential of bicycle crowd-shipping
Cebeci et al. [31]	2023	Effect of trust on the choice of crowd-shipping services
Nascimento et al. [6]	2023	Green crowdshipping: critical factors from a business perspective
Tsai et al. [32]	2023	Trajectory feature extraction and multi-criteria k nearest neighbor based job-to-crowd matching for the crowdshipping last mile delivery
Akbar et al. [33]	2024	Sustainability assessment of inter-urban crowdshipping
Cheng et al. [34]	2024	Assessing the potential impacts of public transport-based crowd-shipping
Fessler et al. [35]	2024	Drivers and barriers to adopting a crowd-shipping service
Hwang et al. [36]	2024	Supermarket-chain grocery delivery optimization through crowd-shipping
Macrina et al. [37]	2024	Bundles generation and pricing in crowdshipping
Şardağ et al. [38]	2024	Crowd-shipping problem with dynamic compensations and transshipments
Sawik [39]	2024	Optimizing last-mile delivery: a multi-criteria approach with automated smart lockers, capillary distribution and crowd shipping. logistics
Shen and Lin [40]	2024	A courier’s choice for delivery gigs in a real-world crowd-shipping service with observed sender-courier preference discrepancy
Xiang et al. [41]	2024	Centralized deep reinforcement learning method for dynamic multi-vehicle pickup and delivery problems with crowd-shippers
Our study		*Risk prioritization from the crowd-shipping provider's perspective*

3. Methodology

This section primarily describes a step-by-step methodology for risk prioritization in crowd-shipping (Figure 1). The CIMAS method is a subjective technique recently created by Bošković et al.

[42]. The method can be used in situations when many experts participate in a decision-making process. The experts' purpose is to evaluate the considered parameters by importance and assist the decision maker in making the right decision.

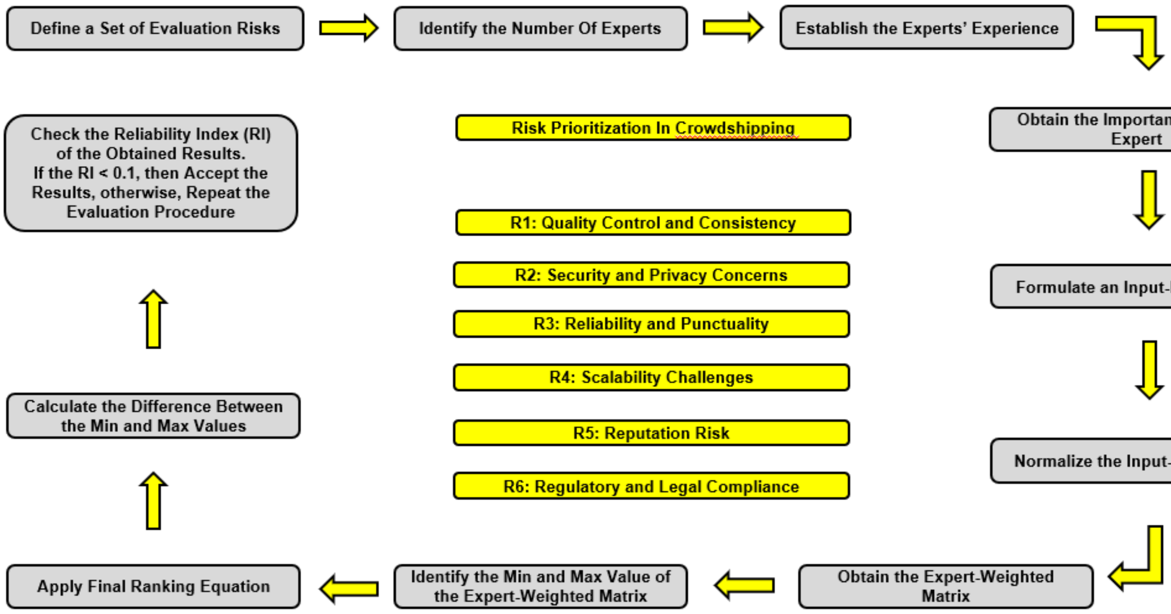

Fig. 1. A flowchart of the CIMAS methodology, along with the established risks

The CIMAS method is described through the following steps:

Step 1. Define a set of evaluation risks – The first step in a decision-making process is to define the risks by which importance should be assessed. The risks may be identified either from the literature or by consulting experts.

Step 2. Identify the number of experts – Decision-maker identifies the number of experts involved in the field and collects information regarding their years of experience.

Step 3. Establish the experts' experience (years) – The experts clarify their experience in the number of years spent in the field, and the decision-maker defines the importance of each expert.

Step 4. Calculate the importance of each expert – The importance of each expert is calculated by following this logic: let us suppose that "q" experts participate in the criteria assessment procedure. Expert 1 has five years of experience in the considered field, expert 2 has three years of experience, while expert q participates with seven years of experience. The importance of experts' evaluations (the expert weights) should be determined as 5/15 for expert 1, 3/15 for expert 2, and 7/15 for expert q. In the general case, the expert's importance can be calculated as follows (Equation 1):

$$W^{Ei} = \frac{Ei}{\sum_{i=1}^{q} Ei}, i = 1 \dots q \tag{1}$$

Step 5. Formulate an input data matrix based on the experts' assessment – In this step, an input decision-making matrix is defined. The experts use a one-to-ten-point scale to formulate an input data matrix where the most significant importance of one risk is denoted by 10, while the lowest one is denoted by 1. The input data matrix is presented in Table 2, where E_1,…, E_q is the number of experts, R_1,…,R_p is the number of risks, x_{ij} are the experts' risk assessments on the importance (on a scale of 1-10), and $W^{E1}, \dots, W^{Eq}$ are the experts' weights.

Table 2
Input data matrix

Experts/risks	R_1	R_2	…	R_j	…	R_p	Experts' weights
E_1	x_{11}	x_{12}	…	…	…	x_{1p}	W^{E1}
E_2	x_{21}	x_{22}	…	…	…	x_{2p}	W^{E2}
E_i	…	…	…	x_{ij}	…	…	…
E_q	x_{q1}	x_{q2}	…	…	…	x_{qp}	W^{Eq}

Step 6. Normalize the input-data matrix – After the input data matrix is formulated, we perform the data normalization. It means that the input data are structured in intervals 0 and 1. It further facilitates the decision-making process. In this method, the normalization technique is applied by Equation 2 and presented in Table 3:

$$x_{ij}^* = \frac{x_{ij}}{\sum_{i=1}^{q} x_{ij}}, i = 1, 2, \dots, q;\ j = 1, 2, \dots, p \tag{2}$$

Table 3
Normalized input-data matrix

Experts/risks	R_1	R_2	R_j	R_P
E_1	x_{11}^*	x_{12}^*	…	x_{1p}^*
E_2	x_{21}^*	x_{22}^*	…	x_{2p}^*
E_i	…	…	x_{ij}^*	…
E_q	x_{q1}^*	x_{q2}^*	…	x_{qp}^*

Step 7. Multiply each value of the normalized input data matrix by the importance of each expert (expert-weighted matrix) – In this step, the normalized input data are multiplied by the experts' weights obtained in Step 4. It is calculated by Equation 3 and presented in Table 4.

$$\widehat{x^*}_{ij} = x_{ij}^* \cdot W^{Ei}, i = 1,2, \dots, q; j = 1, 2, \dots, p \tag{3}$$

Table 4
Expert-weighted matrix

Experts/risks	R_1	R_2	…	R_j	…	R_P
E_1	$\widehat{x^*}_{11}$	$\widehat{x^*}_{12}$	…	…	…	$\widehat{x^*}_{1p}$
E_2	$\widehat{x^*}_{21}$	$\widehat{x^*}_{22}$	…	…	…	$\widehat{x^*}_{2p}$
E_i	…	…	…	$\widehat{x^*}_{ij}$	…	…
E_q	$\widehat{x^*}_{q1}$	$\widehat{x^*}_{q2}$	…	…	…	$\widehat{x^*}_{qp}$

Step 8. Identify the maximum and minimum value of each risk in the expert-weighted matrix – The primary purpose of this step is to identify the maximum ($H_{j\,max}$) and minimum value ($H_{j\,min}$) of each risk by columns. It is calculated by Equations 4-5 and presented in Table 5.

$$H_{j\,max} = \max_i \widehat{x^*}_{ij}, j = 1, 2, \dots, p \tag{4}$$

$$H_{j\,min} = \min_i \widehat{x^*}_{ij}, j = 1, 2, \dots, p \tag{5}$$

Table 5
Maximum and minimum value of each criterion in the expert-weighted matrix

Experts/risks	$\boldsymbol{R_1}$	$\boldsymbol{R_2}$	…	$\boldsymbol{R_j}$	…	$\boldsymbol{R_P}$
$\boldsymbol{E_1}$	$\widehat{x^*}_{11}$	$\widehat{x^*}_{12}$	…	…	…	$\widehat{x^*}_{1p}$
$\boldsymbol{E_2}$	$\widehat{x^*}_{21}$	$\widehat{x^*}_{22}$	…	…	…	$\widehat{x^*}_{2p}$
$\boldsymbol{E_i}$	…	…	…	$\widehat{x^*}_{ij}$	…	…
$\boldsymbol{E_q}$	$\widehat{x^*}_{q1}$	$\widehat{x^*}_{q2}$	…	…	…	$\widehat{x^*}_{qp}$
$\boldsymbol{H_{j\,max}}$	$H_{1\,max}$	$H_{2\,max}$	…	$H_{j\,max}$	…	$H_{p\,max}$
$\boldsymbol{H_{j\,min}}$	$H_{1\,min}$	$H_{2\,min}$	…	$H_{j\,min}$	…	$H_{p\,min}$

Step 9. Calculate the difference between minimum and maximum values – This step calculates the difference (B_j) between the minimum and maximum values from the previous step by applying Equation 6:

$$B_j = H_{j\,max} - H_{j\,min}, j = 1, 2, \dots, p \tag{6}$$

Step 10. Apply the final ranking formula – This step obtains the criteria importance (L_j) (Equation 7):

$$L_j = \frac{B_j}{\sum_{j=1}^{p} B_j}, j = 1, 2, \dots, p \tag{7}$$

3.1 Checking Reliability Index

In the procedure, a second round of interviews is conducted with experts unaware of the results of the first round's risk assessments. During this round, the experts are asked to evaluate the risks on a scale from 0 to 100%, determining the percentage importance of each risk. It is essential to ensure that the total evaluation for all "p" risks adds up to 100%. The results from both rounds are then compared to conclude the reliability of the assessments. Denoting the responses from the second round of interviews as *Pj* and the previously obtained CIMAS weights as *Lj,* the reliability index (RI) can be calculated using Equation 8:

$$RI = \frac{\sum_{j=1}^{n} |L_j * 100 - P_j|}{100} \tag{8}$$

The results are considered reliable if the RI is less than 0.1. On the contrary, the experts should repeat the risk assessment procedure.

4. Results

This section applies the previously described CIMAS method to prioritize the risks in crowd shipping. Six of the most essential risks have been identified and discussed by three experts in the field of postal traffic. The risks are further described and evaluated:

i. *Quality control and consistency* (R_1) – This presents the risk of quality control and consistency. When employing the crowd in a delivery process, an important issue is controlling the quality of service. Quality in crowdsourcing systems is characterized by two dimensions [43]: the worker's profile (reputation and expertise) and task design (definition, user interface, granularity, and compensation policy).

ii. *Security and privacy concerns* (R_2) – Security and privacy in crowd-shipping are crucial since the crowd is involved in the shipping process. The more people involved in the delivery process, the more concerns for privacy and security. This risk is associated with theft, revealing sensitive content, delivering to the wrong person, etc.

iii. *Reliability and punctuality* (R_3) – Crowd-shipping, which relies on non-professional shippers to deliver packages, faces challenges in ensuring that deliveries are consistently reliable and timely. Since these shippers often manage their schedules and may not have formal training or commitments to the shipping process, there is a bigger chance of delays or issues with delivery reliability.

iv. *Scalability challenges* (R_4) – Capacity limitations, customer satisfaction, technological infrastructure. To mitigate these risks and successfully scale a crowd-shipping operation, businesses must invest in robust technology platforms, establish clear guidelines and training for crowd-shippers, maintain strict quality control measures, and develop strategies to ensure regulatory compliance and manage liability.

v. *Reputation risk* (R_5) – Risk of losing reputation since controlling the crowd in the delivery process is complicated. Reputation is critical for any organization. It is built over time through consistent performance and quality products or services (delays, missing parcels, or poor service during delivery can affect customer satisfaction. If customers feel mistreated, they may express their frustrations publicly, harming the organization's reputation) and positive customer interactions. However, adverse incidents can quickly ruin this reputation.

vi. *Regulatory and legal compliance* (R_6) – Permits and licensing, insurance (crowd shipping providers and the goods in transit), consumer data protection, and consumer protection laws. For organizations considering crowd-shipping legal and regulatory aspects are vital to ensure compliance and reduce potential liabilities.

By applying the CIMAS method, the results are obtained and given in Tables 6–10.

Table 6
Expert information

Experts	Professional role	YoE	Experts' weights (W^{Ei})
E1	Postman	12	0.5217
E2	Postal network manager	8	0.3478
E3	Post office clerk	3	0.1304

Table 7
Risk assessment matrix

	R1	R2	R3	R4	R5	R6	Experts' weights (W^{Ei})
E1	9	9	6	6	5	4	0.5217
E2	8	8	7	9	6	7	0.3478
E3	10	9	6	7	7	6	0.1304
Total	27	26	19	22	18	17	

Table 8
Data normalization

	R1	R2	R3	R4	R5	R6
E1	0.3333	0.3462	0.3158	0.2727	0.2778	0.2353
E2	0.2963	0.3077	0.3684	0.4091	0.3333	0.4118
E3	0.3704	0.3462	0.3158	0.3182	0.3889	0.3529

Table 9
Expert-weighted normalized risk assessment matrix with prioritized risks

	R1	R2	R3	R4	R5	R6
E1	0.1739	0.1806	0.1648	0.1423	0.1449	0.1228
E2	0.1031	0.1070	0.1281	0.1423	0.1159	0.1432
E3	0.0483	0.0452	0.0412	0.0415	0.0507	0.0460
$H_{j\,max}$	0.1739	0.1806	0.1648	0.1423	0.1449	0.1432
$H_{j\,min}$	0.0483	0.0452	0.0412	0.0415	0.0507	0.0460
B_j	0.1256	0.1355	0.1236	0.1008	0.0942	0.0972
L_j	0.1856	0.2001	0.1826	0.1489	0.1392	0.1436

Table 10
Consistency ratio

	(L_j)	E1	E2	E3	Average (P_j)	Abs|Wj*100-P_j|	CI
R1	0.1856	12	15	20	15.6667	2.8917	0.0289
R2	0.2001	35	10	12	19.0000	1.0134	0.0101
R3	0.1826	20	18	15	17.6667	0.5911	0.0059
R4	0.1489	14	18	15	15.6667	0.7746	0.0077
R5	0.1392	14	15	25	18.0000	4.0812	0.0408
R6	0.1436	5	24	13	14.0000	0.3596	0.0036
		100	100	100			0.0971

The final results from Table 9 are depicted in Figure 2.

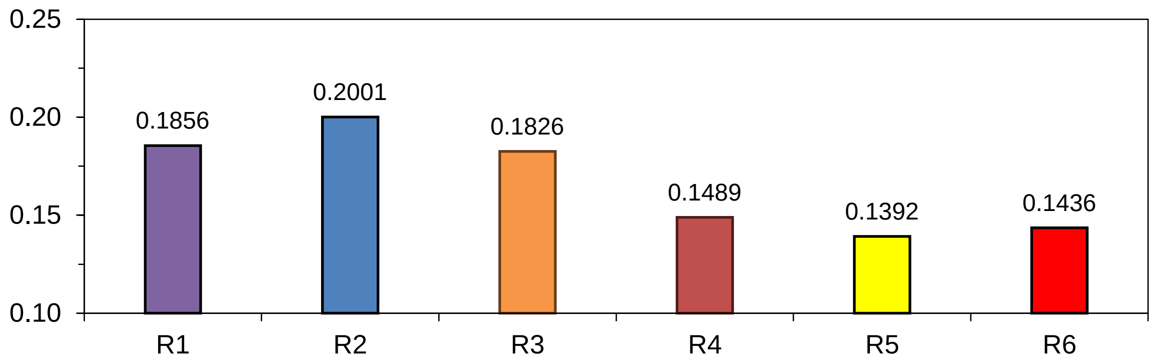

Fig. 2. Risk prioritization in crowd-shipping based on the CIMAS method

4.1 Comparative Analysis

A comparative analysis is performed to check the reliability of the results. The same problem was solved by the Best-Worst Method (BWM). The average values of three experts have been used and the BWM was applied. The results are presented in Table 11.

Table 11
Results of the BWM method

Risk number = 6	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5	Risk 6
Names of risks	R1	R2	R3	R4	R5	R6
Select the best	R2					
Select the worst	R5					
Best to others	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5	Risk 6
R2	4	1	3	7	9	2
Others to the worst	R5					
R1	3					
R2	7					
R3	3					
R4	2					
R5	1					
R6	6					
Risk importance	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5	Risk 6
	0.1136	0.3948	0.1515	0.0649	0.0478	0.2273
Input-based CR	0.0694					

The final results for the BWM method are depicted in Figure 3.

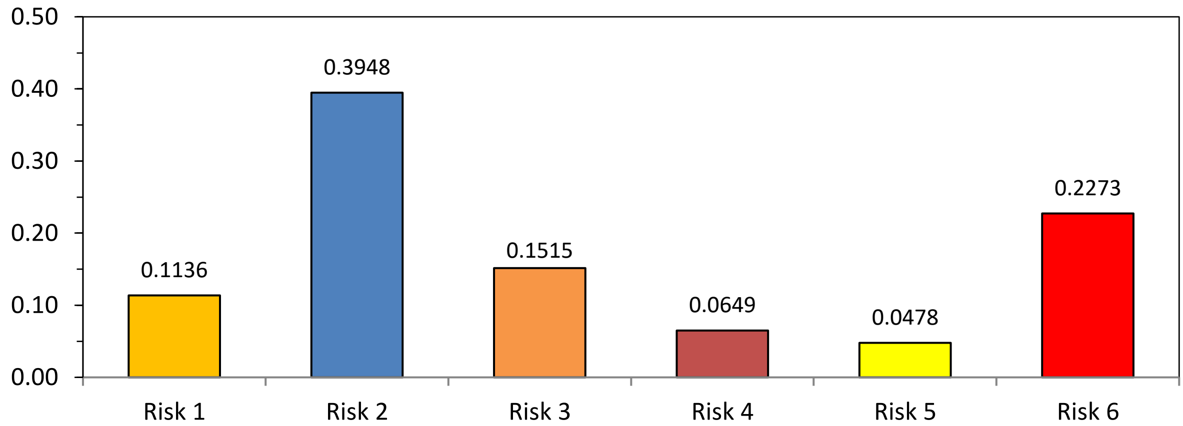

Fig. 3. Risk prioritization in crowd-shipping based on the BWM method

As can be noticed in Figure 2, the CIMAS method prioritized crowd-shipping risks in the following ranking order: R2>R1>R3>R4>R6>R5. The highest risk in crowd-shipping is related to security and privacy concerns. The lowest risk is related to the risk of losing reputation. The consistency ratio within the CIMAS method was 0.0971. On the other hand, the BWM prioritized the risks in crowd-shipping as follows (Figure 3): R2>R6>R3>R1>R4>R5. The consistency ratio in the case of the BWM was 0.0694, which is better than the CIMAS. However, both methods prioritized security and privacy concerns, with the most minor importance to the reputation risk (Figure 4).

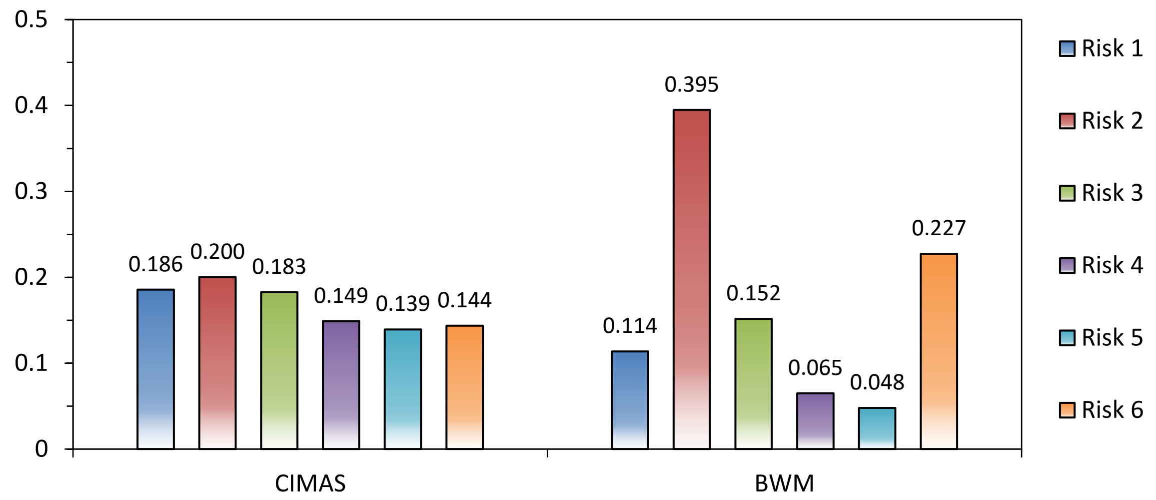

Fig. 4. Comparative analysis of the CIMAS and BWM methods

5. Conclusion

This paper addressed the risk prioritization problem from the crowd-shipper providers' perspective. Six essential risks were assessed: quality control and consistency, security and privacy concerns, reliability and punctuality, scalability challenges, reputation risk, and regulatory and legal compliance. The risks were discussed with the postal traffic experts. One recently developed MCDM method (CIMAS) was used to prioritize the risks. In addition, another well-known MCDM method (BWM) was used to compare the results.

The CIMAS method prioritized crowd-shipping risks as follows: R2>R1>R3>R4>R6>R5. On the other side, the BWM prioritized the risks as follows: R2>R6>R3>R1>R4>R5. The highest risk in crowd shipping, from the crowd shipping providers' perspective, according to both methods, is risk 2 – security and privacy concerns. In contrast, the lowest risk is associated with losing reputation. Another important risk is related to quality control and consistency. It is not so easy to control the quality of delivery, so high attention should also be paid to this risk. The third-ranked risk relates to reliability and punctuality since crowd-shipping relies on non-professional shippers to deliver goods.

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Conflicts of Interest
The author declares no conflicts of interest.

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