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# Research on Last-Mile Crowdshipping: Identification of Barriers Impacting Willingness-To-Work as a Crowdshipper Across Diverse Groups and Countries

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## Abstract

Last-mile crowdshipping or crowdsourcing refers to using a crowd of individuals to perform the last-mile distribution. This delivery model has gained attention due to its many advantages. However, it also poses some challenges, and one of the greatest is providing a critical mass of crowdshippers (deliverers). This research focuses on last-mile crowdshippers, examining the impact of previously unexplored barriers on their Willingness-To-Work (WTW). Drawing from a comprehensive review of the literature on crowdshipper preferences and practical implementation challenges of crowdshipping, an extensive list of barriers was compiled. Then, the significance of these barriers on the WTW of two key crowdshipper groups (employees and students) was analysed through surveys conducted in the Czech Republic, Slovenia, and Ukraine and the fuzzy ranking method was applied. This method was also used to assess the influence of respondents' sociodemographic characteristics on their perception of the importance of individual barriers on WTW as a crowdshipper. The research aims to identify significant barriers hindering the likelihood of individuals becoming last-mile crowdshippers in each country and assess potential differences or similarities among these factors across the selected countries and countries included in past research. These insights are beneficial for individual package providers and contribute to developing efficient crowdshipper targeting, retention business models, and management strategies.

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*Keywords:* Last-mile crowdshippers; Willingness-To-Work; barriers; Slovenia; Ukraine; Czech Republic; survey; fuzzy ranking method.

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## 1. Introduction

Last-mile crowdshipping is an innovative delivery option where regular individuals, who frequently travel for various purposes such as work, study, etc., deliver parcels for payment. These individuals are called crowdshippers, and they work voluntarily (Le and Ukkusuri, 2018a). Thus, the challenge for crowdshipping providers is to maintain a critical mass of crowdshippers (Samad et al., 2023). To address this challenge it is crucial to understand their needs and requirements. Additionally, attention must be given to organisational aspects and performance issues that crowdshipping providers face to achieve mutually beneficial and sustainable crowdshipping services (Pourrahmani and Jaller, 2021, Gatta et al., 2019).

Research on Willingness to Work (WTW) as a crowdshipper has been growing steadily, with a significant body of literature examining the impact of sociodemographic factors (gender, age, education, income, remuneration, employment status, means of transport, and social media) on crowdshippers' WTW in different European Union (EU) countries and the United States (Miller et al., 2017, Serafini et al., 2018, Le and Ukkusuri, 2019b, Dietmann, 2020, Galkin et al., 2021, Le and Ukkusuri, 2019a, Mordey and Kolb, 2021, Neudoerfer et al., 2021, Upadhyay et al., 2022, Bathke and Münch, 2023, Karli et al., 2022, Tapia et al., 2023, Marcucci et al., 2017, Le and Ukkusuri, 2018b, Ukkusuri, 2018a, Gatta et al., 2019, Wicaksono et al., 2022). Specific attributes related to crowdshipping content, including the detour distance and time, parcel dimensions, and the potential reduction of carbon footprint have been analysed to a lesser extent (Tapia et al., 2023, Bathke and Münch, 2023, Wicaksono et al., 2022, Fessler et al., 2022, Neudoerfer et al., 2021, Marcucci et al., 2017) have also analysed the potential reduction of carbon footprint.

Some researchers such as Bathke and Münch (2023), Samad et al. (2023), and Fessler et al. (2022) have stressed the importance of understanding the diverse geographical and cultural contexts in assessing transferability. However, there is still a lack of studies on WTW in eastern and southern EU countries. Fessler et al. (2022) argue that to promote the growth and success of crowdshipping, it is necessary to conduct studies that go beyond analysing sociodemographic and limited content-specific data. Furthermore, Pourrahmani and Jaller (2021) emphasise the insufficient scientific attention given to the challenges encountered by crowdshipping providers in real-world scenarios, whereas Gatta et al. (2019) underscore the importance of participatory planning in attaining mutually beneficial and sustainable results.

This study aims to advance the field of crowdshipping by delving into unexplored or underemphasised potential factors that may negatively impact WTW among crowdshippers. Furthermore, due to the heterogeneity among potential groups of crowdshippers, this study examines the impact of these factors on two distinct groups of crowdshippers: employed individuals, and students. To ensure a comprehensive analysis and account for varying contextual, geographical, and cultural settings, a survey methodology was conducted across Slovenian, the Czech Republic, and Ukrainian potential crowdshippers, including a fuzzy number method to determine the importance of barriers and to assess the influence of the sociodemographic characteristics of the respondents on the WTW.

## 2. Literature review

### 2.1. A review of studies on WTW as crowdshippers

A total of 18 relevant studies have been identified and a review of these has revealed that the influence of sociodemographic data on crowdshippers' WTW is well-studied, along with a limited number of context-specific factors such as remuneration, additional travel time, detour distance, parcel weight and dimensions, number of parcels, and working schedule. Below are the more detailed findings of the studies.

Miller et al. (2017) discovered that higher profit positively influences WTW, while longer travel time negatively affects it. Further, individuals with high and low incomes are less likely to engage in crowdshipping. Moreover, the study found that males are more willing to take up this role in the evening than females. According to a study conducted by Marcucci et al. in 2017, the WTW decreases as the size of the parcel increases the remuneration decreases, or both. Additionally, crowdshippers prefer not to spend extra time during deliveries, are not willing to make more than five stops, and do not want to be tracked. However, they are interested in WTW if it comes with measurable environmental benefits. A study conducted by Le and Ukkusuri (2018a) found that individuals with higher incomes are less likely to become crowdshippers. However, for Vietnamese respondents, earning money was a

significant factor that influenced their decision to become crowdshippers. Both Vietnamese and American respondents were willing to deliver any type of package, provided they were paid. Furthermore, Americans had a greater concern for transporting hazardous or illegal goods. Other studies by Le and Ukkusuri (2018b, 2019a), focused solely on American respondents, found that people over the age of 30 were more likely to work as crowdshippers. Additionally, respondents with a college degree or higher and lower income were also found to be more likely to work as crowdshippers. Gatta and colleagues in 2019 discovered that older people generally were not as interested in crowdshipping. However, being able to plan when deliveries happen has a good effect. Also, where a parcel locker is located matters more than how much money you receive. Le and Ukkusuri in 2019 found that people with more money are less likely to undertake crowdshipping. Meanwhile, a study by Dietman and Limborg in 2020 showed that people who want to partake in crowdshipping are usually around 30 years old and believe they will make more money. Also, how big the package is, how far it goes off track, and how much money they expect all affect how much people want to undertake crowdshipping. Gender also matters as a survey in Bratislava found (Galkin et al., 2021). Mordey and Kolb in 2012 found that higher income means you are willing to carry a lighter parcel. In the Neudoerfer et al. (2021) study, compensation was found to be the most important motivator for WTW. However, WTW is also influenced by gender and travelling distance. The study also revealed that respondents are more concerned about the content of the shipment than damage or loss. Serafini et al. (2018) found that older people are less interested in acting as crowdshippers when using public transport. Additionally, individuals who have a higher 'green' attitude are more likely to choose crowdshipping. According to a study by Fessler et al. (2022), people under the age of 40 are more interested in crowdshipping parcels, while individuals above the age of 60 have a lower interest. Students and employed individuals are more likely to participate in crowdshipping as compared to unemployed individuals or those who are not studying. The study also found that older respondents and respondents with higher income experience greater disutility for time, while individuals with higher education are more willing to spend extra time picking up parcels. Another study by Upadhyay et al. (2022) discovered that economic benefits and monetary rewards have a positive impact on WTW as a crowdshipper. A study by Wicaksono et al. (2022) found that profit, an adjustable delivery time window, and a reduction of emissions have a positive impact on the WTW as bicycle crowdshippers. However, an increase in travel time or package weight can reduce WTW. According to Bathke and Münch's (2023) study, the primary factors that influence people to become crowdshippers are delivery time and remuneration. Parcel weight was found to be less significant. The study also revealed that women are more willing to become crowdshippers, while full-time employees are a more promising target group.

## 2.2. A review of studies on practical challenges faced by crowdshipping providers

The challenges encountered during practical implementation and pertinent to crowdshippers were extracted from three studies: Pourrahmani and Jaller (2021), Le et al. (2019), and Samad et al. (2023) (Table 1).

Table 1. Summary of publications on practical challenges of crowdshipping.

| Source                         | Operational challenges  |
|--------------------------------|---|
| (Le et al., 2019)              | hazardous or illegal products, rating of crowdshippers, insurance of delivery with a credit card, sharing personal info, lack of knowledge on crowdshipping, working schedules, redelivery of parcel,   |
| (Pourrahmani and Jaller, 2021) | lack of basic labour protection, expensive insurance, payment for parking spaces, heavy packages, safety and security of crowdshippers and parcels (accidents, dangerous behaviour of receiver/sender), privacy concerns (sharing personal info), insurance of delivery with a credit card, rating of crowdshippers, direct communication with sender/receiver, hazardous or illegal products, owning a mobile phone, familiarity with working with apps, finding parking space, receiver absence, delivery to parcel lockers |
| (Samad et al., 2023)           | work schedule, robust compensation/pricing schemes, lack of professional training, lack of parcel lockers, lack of dedicated high-occupancy vehicle lanes, trust among individuals, illegal or hazardous products, lack of contractual obligations, safety and security concerns, lack of legal frameworks  |

We compared the above challenges (Table 1) with those identified in a review of studies on WTW (Section 2.1.). We have classified and transformed them into 17 statements that represent barriers. These barriers include the following: B1. I am not familiar enough with this delivery method; B2. I don't support this delivery method; B3. I think the fee will not be enough for me; B4. I don't have enough time; B5. I am afraid I will not be able to deliver on time; B6. I don't know how to use crowdshipping platforms or apps; B7. I'm not particularly eager to communicate with strangers; B8. I don't want the sender/receiver of the package to evaluate the quality of my services; B9. I am

concerned about the security of personal data; B10. I don't want to share my phone number or other personal information with strangers; B11. I don't want the sender/recipient of the package to track me; B12. I don't want to insure the risk of non-delivery/loss/theft of the parcel by using my credit card; B13. I am afraid I might lose/damage parcel; B14. I am afraid I may inadvertently deliver dangerous or prohibited things; B15. I don't want to make a second delivery in case of the absence of the recipient; B16. I don't want to deliver to another location in the absence of the recipient; B17. I may have difficulties during the trip by public transport due to the presence of the package. All factors regardless of their frequency were included, except for sociodemographic factors, due to ample research. Barriers-related statements were evaluated in the quantitative analysis presented in the following section.

### 3. Methodology and results overview

#### 3.1. Survey design and data description

Data collection was carried out through an online questionnaire during the summer and autumn of 2023 among respondents from three countries—the Czech Republic, Slovenia, and Ukraine. As a result, 237 completed questionnaires were received from Czech respondents, 326 questionnaires from Slovenian respondents, and 207 questionnaires from Ukrainian respondents. Only responses from employees and students were selected for analysis since the number of representatives of other types of employment is not sufficiently represented in the survey. Finally, 192 answers from Czech respondents (42% students and 58% employees), 271 answers from Slovenian respondents (47% students and 53% employees), and 186 answers from Ukrainian respondents (52% students and 48% employees) remained for processing. Respondents also indicated their age, gender, level of education, and income level.

The questionnaire included 17 statements that represented the barriers to WTW found in the literature review (refer to Section 2.2, last paragraph). Respondents rated each statement on a 5-point linguistic scale: 1. It doesn't concern me; 2. It concerns me a little; 3. It slightly concerns me; 4. It concerns me; 5. It concerns me a lot.

#### 3.2. A fuzzy numbers method

A fuzzy numbers method is used to determine the importance of barriers for WTW as a crowdshipper. This technique has two main advantages (Cheng, 2004): the ability to reflect the uncertainty and subjectivity inherent in human judgment, and the ability to represent the central tendency and divergence of the rating results.

A triangular fuzzy number is a fuzzy number represented with three points:  $a_{ij} = (l_{ij}, m_{ij}, u_{ij})$ , where  $m$  = the most probable value of indicator,  $l$  = the smallest likely value,  $u$  = the largest possible value.

The first stage of fuzzy numbers construction is the formation of the corresponding relative distance matrix. The values of the matrix cells are filled with the differences  $d$  between the rating of the barrier by respondent  $i$  ( $g_i$ ) and the rating of the same barrier by the respondent  $j$  ( $g_j$ ).

The pair-wise comparison matrix  $P = [p_{ij}]_{n \times n}$  is formatted in the next stage, where:

$$p_{ij} = \frac{\bar{d}_j}{\bar{d}_i} \tag{1}$$

The degree of importance of  $g_i$  is solved as:

$$w_j = \frac{1}{\sum_{i=1}^n p_{ij}}, j = 1, 2, \dots, n \tag{2}$$

The degree of importance is associated with  $g_i$  when evaluating the mode  $m$  of the fuzzy number:

$$m = \sum_{i=1}^n w_i \cdot g_i \tag{3}$$

An average deviation of fuzzy numbers from the sample of scores is defined as:

$$\sigma = \sum_{i=1}^n w_i \cdot |g_i - m| \tag{4}$$

The ration  $\eta$  (the ratio of the left spread to the right spread of fuzzy number) can be calculated:

$$\eta = \frac{m - g^l}{g^u - m} \tag{5}$$

Where:

$$g^l = \frac{\sum_{i \in A} w_i \cdot g_i}{\sum_{i \in A} w_i}, A = \{i | g_i < m, i = 1, \dots, n\} \tag{6}$$

$$g^u = \frac{\sum_{i \in B} w_i \cdot g_i}{\sum_{i \in B} w_i}, B = \{i | g_i > m, i = 1, \dots, n\} \tag{7}$$

Then,

$$l = m - \frac{3 \cdot (1 + \eta) \cdot \eta \cdot \sigma}{1 + \eta^2} \tag{8}$$

$$u = m + \frac{3 \cdot (1 + \eta) \cdot \sigma}{1 + \eta^2} \tag{9}$$

To describe the linguistic variables used to assess the importance of barriers in a fuzzy number scale, this study used triangular fuzzy numbers of the form (Hsu, 2015):  $\tilde{1} = (1, 1, 2)$ ,  $\tilde{2} = (1, 2, 3)$ ,  $\tilde{3} = (2, 3, 4)$ ,  $\tilde{4} = (3, 4, 5)$ ,  $\tilde{5} = (4, 5, 5)$ . Given the values of the points of the fuzzy triangular number and the applied linguistic scale, with a  $m_{ij} < 1.5$  the statement is most likely not a barrier to WTW as a crowdshipper for the respondents. With  $1.5 < m_{ij} < 2.5$  a barrier concerns respondents a little (minor barrier), with  $2.5 < m_{ij} < 3.5$  a barrier concerns respondents slightly more (moderate barrier), with  $3.5 < m_{ij} < 4.5$  a barrier concerns respondents (significant barrier) and with  $m_{ij} < 4.5$  a barrier concerns respondents a lot (major barrier). To assess the difference between students' and employees' perceptions of the importance of barriers for WTW, fuzzy number calculations were performed separately for respondents of each country. Table 2 presents the results.

Table 2. Assessment of the importance of barriers for respondents of individual countries.

| Barrier | The meaning of the midpoint of a fuzzy number (m) and the standard deviation |                    |                    |             |                    |                    |
|---------|--|--------------------|--------------------|-------------|--------------------|--------------------|
|         | Czech Republic   |                    | Slovenia           |             | Ukraine            |                    |
|         | employee   | student            | employee           | student     | employee           | student            |
| B1      | 3.82 (1.03)  | 4.05 (0.67)        | 3.26 (0.9)         | 2.96 (0.48) | 3.78 (0.57)        | 3.86 (1.09)        |
| B2      | 2.66 (0.81)  | 2.49 (0.65)        | 2.04 (0.68)        | 1.85 (0.77) | 1.82 (0.76)        | 2.56 (0.93)        |
| B3      | 3.55 (0.96)  | 3.06 (0.8)         | 3.02 (0.68)        | 2.9 (0.77)  | 2.53 (1.05)        | 2.87 (1.13)        |
| B4      | <b>4.07</b> (0.5)  | 2.45 (0.63)        | <b>3.87</b> (0.75) | 3.26 (0.69) | <b>3.73</b> (0.87) | <b>3.64</b> (0.89) |
| B5      | 3.74 (0.5)   | 3.66 (0.87)        | 2.98 (0.72)        | 2.46 (0.79) | 3.0 (1.01)         | 3.25 (1.03)        |
| B6      | 2.57 (1.02)  | 3.34 (1.06)        | 2.2 (0.81)         | 2.65 (0.82) | 2.37 (0.95)        | 2.97 (1.1)         |
| B7      | <b>3.91</b> (0.86)   | 2.97 (1.07)        | 2.2 (0.7)          | 2.29 (0.81) | 2.6 (1.22)         | 2.7 (1.2)          |
| B8      | 2.88 (0.69)  | 2.4 (0.69)         | 2.85 (1.0)         | 2.46 (0.95) | 3.09 (1.1)         | 2.35 (0.94)        |
| B9      | 3.72 (0.82)  | 2.83 (1.1)         | 2.79 (0.91)        | 2.63 (1.05) | 2.41 (1.02)        | <b>3.50</b> (1.04) |
| B10     | <b>4.09</b> (0.86)   | 3.13 (0.97)        | <b>3.54</b> (0.97) | 2.91 (0.85) | 2.83 (1.14)        | 3.39 (1.12)        |
| B11     | <b>4.06</b> (0.7)  | 3.36 (1.1)         | <b>3.93</b> (0.90) | 3.34 (0.89) | 3.10 (1.21)        | 2.97 (1.08)        |
| B12     | 3.66 (1.06)  | 3.64 (0.93)        | <b>4.11</b> (0.81) | 3.09 (0.97) | 3.17 (0.81)        | <b>3.64</b> (1.07) |
| B13     | 3.42 (1.01)  | 3.20 (1.04)        | 3.35 (0.92)        | 2.72 (0.93) | 3.07 (1.02)        | <b>3.51</b> (1.1)  |
| B14     | <b>3.71</b> (1.01)   | 3.32 (1.1)         | 3.38 (0.84)        | 2.99 (1.0)  | 3.56 (0.99)        | 3.87 (0.87)        |
| B15     | 4.81 (0.31)  | <b>4.3</b> (0.77)  | <b>4.18</b> (0.66) | 3.1 (0.8)   | 3.93 (1.04)        | 3.71 (1.11)        |
| B16     | 4.78 (0.37)  | <b>4.19</b> (0.82) | <b>4.05</b> (0.71) | 2.94 (0.82) | 3.10 (0.82)        | 3.46 (1.17)        |
| B17     | <b>4.07</b> (0.68)   | 3.3 (1.03)         | 2.68 (0.69)        | 2.24 (0.63) | 2.8 (1.2)          | 3.20 (1.15)        |

dark grey – particularly important; light grey – important for employees and students; bold – important; italics – more important for a group

Particularly important barriers for Czech Republic employees were found to be barriers B15 and B16 (Table 2) and important barriers for Czech Republic employees and students were found to be B1, B5 and B12. B3, B4, B7, B9, B10, B11, B14, B17 are only important for Czech Republic employees but not students. Of the 17 barriers, only B6 is more important for Slovene students than employees. Interestingly, any barrier is particularly important for both groups of potential crowdshippers in Slovenia. B4, B10, B11, B12, B15, B16 were identified as important for employees but not students. B6 was observed to be more important for Slovene students than employees. B1, B4, B14, B15 are particularly important for Ukrainian employees and students. Unlike in Slovenia and the Czech Republic, barriers have a greater impact on students than on employees. B12 and B13 were identified as particularly important and important only for the student group of potential crowdshippers. A more important barrier for employed individuals in Ukraine is B8. These findings address the first objective of the paper.

For all considered countries, barrier B6 is more important for students than for the working population (Table 2). Barriers B4, B8, B11, and B15 are more important for the working population than for students in all considered countries. Barriers B2, B3, B5, B9, B10, B12, B13, B14, B16, and B17 pose greater challenges for Czech and Slovenian workers, as well as Ukrainian students, rather than Ukrainian employees. Barriers B1, and B7 are more important for Slovenian workers but not students, but are for Ukrainian and Czech students. In the case of the Czech Republic and Ukraine, however, the situation is the opposite. Lack of knowledge on how to use crowdsourcing applications (B6) unexpectedly turned out to be a more important barrier for students in the Czech Republic and Ukraine.

To assess the influence of the sociodemographic characteristics of the respondents on their perception of the importance of separate barriers to crowdshipping delivery, calculations of fuzzy numbers were carried out separately for different groups of respondents (using eq. 3, 8 and 9). Certain sociodemographic characteristics (age, gender, level of education and income bracket) have a noticeable impact on barriers B2, B6, B8, B9, B10, B11 and B12. In this context, we have both similarities and differences between the studied countries. The obtained results are presented in Table 3 (only results showing differences).

Table 3. Influence of sociodemographic characteristics on the perception of crowdshipping delivery barriers.

| Barrier | Sociodemographic characteristics |                                  |                        |                          |                         |
|---------|----------------------------------|----------------------------------|------------------------|--------------------------|-------------------------|
|         | School                           | Secondary professional education | Bachelor               | Master's                 | Doctorate               |
| B6: CZ  | {0.62, 3.62, 5} – I*             | {0.42, 3.28, 5} – MoI            | {0, 3.0, 3.22} – MoI   | {0, 2.78, 5} – MoI       | {1.01, 4.4, 5} – I      |
| B6: SI  | {0, 3.12, 4.59} – MoI            | {0.08, 2.47, 5} – MiI            | {0, 2.49, 4.21} – MiI  | {0.89, 2.14, 5} – MiI    | {0.77, 1.39, 5} – NI    |
| B6: UA  | {0, 2.94, 5} – MoI               | {0.16, 3.13, 5} – MoI            | {0, 2.81, 5} – MoI     | {0.65, 2.41, 5} – MiI    | {1.84, 2.28, 4.6} – MiI |
| B9: UA  | {0.21, 3.65, 5} – I              | {0, 2.81, 5} – MoI               | {0, 2.89, 5} – MoI     | {0, 2.73, 5} – MoI       | {0, 1.92, 4.24} – MiI   |
| B11: CZ | {0.62, 2.62, 3.4} – MoI          | {0.25, 3.62, 5} – I              | {0.24, 3.82, 5} – I    | {0.94, 3.74, 5} – I      | {2.34, 4.6, 5} – PI     |
| B11: SI | {0.59, 3.16, 5} – MoI            | {0.56, 3.39, 5} – MoI            | {1.94, 4.08, 5} – I    | {0.3, 3.6, 5} – I        | {1.38, 4.01, 5} – I     |
|         | Income bracket 1                 | Income bracket 2                 | Income bracket 3       | Income bracket 4         |                         |
| B10: CZ | {0.24, 3.40, 5.0} – MoI          | {0.53, 3.17, 5.0} – MoI          | {1.46, 3.81, 4.89} – I | {0, 3.96, 5.0} – I       |                         |
| B10: SI | {0, 2.85, 4.48} – MoI            | {0.7, 3.56, 5.0} – I             | {0, 3.59, 5.0} – I     | {1.4, 3.51, 5.0} – I     |                         |
| B12: CZ | {1.63, 3.89, 4.48} – I           | {0, 3.27, 5} – MoI               | {2.54, 4.62, 5.0} – PI | {1.4, 3.26, 5.0} – MoI   |                         |
| B12: SI | {0.58, 3.34, 5} – MoI            | {1.25, 4.06, 5} – I              | {0.77, 3.94, 5.0} – I  | {1.52, 3.65, 4.77} – I   |                         |
| B12: UA | {0, 3.62, 5} – I                 | {0, 2.94, 4.14} – MoI            | {1.16, 3.90, 5} – I    | {0.15, 3.39, 5} – MoI    |                         |
|         | Age <18                          | Age 18 – 29                      | Age 30 – 39            | Age > 39                 |                         |
| B8: CZ  | {0.72, 2.08, 5} – MiI            | {0, 2.41, 5} – MiI               | {0, 2.96, 5} – MoI     | {0.17, 2.96, 4.61} – MoI |                         |
| B9: UA  | {0.78, 3.66, 5} – I              | {0, 3.35, 5} – MoI               | {0.1, 2.27, 5} – MiI   | {0, 2.48, 4.7} – MiI     |                         |
| B11: CZ | {0, 2.73, 4.38} – MoI            | {0.14, 3.75, 5} – I              | {1.82, 3.68, 5} – I    | {0.17, 3.60, 5} – I      |                         |
| B11: SI | {0, 2.47, 4.49} – MiI            | {0.47, 3.33, 5} – MoI            | {1.14, 4.13, 5} – I    | {0.86, 3.92, 5} – I      |                         |
| B11: UA | {0.86, 3.03, 5} – MoI            | {0, 2.93, 5} – MoI               | {0, 3.13, 5} – MoI     | {0.18, 3.59, 4.87} – I   |                         |
|         | Female                           |                                  |                        | Male                     |                         |
| B2: CZ  | {0.59, 2.82, 3.85} – MoI         |                                  |                        | {0.66, 2.48, 4.55} – MiI |                         |
| B2: UA  | {1.14, 2.23, 5} – MiI            |                                  |                        | {0, 2.60, 4.5} – MoI     |                         |
| B10: CZ | {0.09, 3.76, 4.85} – I           |                                  |                        | {0.48, 3.25, 5} – MoI    |                         |
| B10: UA | {0.14, 2.63, 5} – MoI            |                                  |                        | {0.37, 2.46, 4.6} – MiI  |                         |
| B10: SI | {0.64, 3.57, 5} – I              |                                  |                        | {0.30, 2.94, 4.85} – MoI |                         |

\*NI – no importance, MiI - minor importance, MoI - moderate importance, I – importance, PI – particularly important

#### 4. Conclusions

The survey results have confirmed some of the findings from previous research but have also presented some discoveries. Slovenian and Czech students and employees support crowdshipping (B2), which confirms many past studies (Bathke and Münch 2023, Galkin et al. 2021, Marcucci et al. (2017)). Among Czech respondents a more sceptical attitude towards crowdshipping is detected among women which is contrary to the research of Bathke and Münch (2023) but confirms the results of Marcucci et al.'s (2017) research. According to the Ukrainian survey, male respondents tend to be more sceptical than female respondents. The study also revealed that most barriers were more important for Slovenian and Czech employees than for students. There may be a better understanding of the practical challenges and constraints associated with last-mile crowdshipping with employees, particularly those who are actively engaged in the workforce. However, in Ukraine, the situation is the opposite. Ukrainian students, often combining work and study already have problems with a lack of time (only for Ukrainian conditions, the time factor (B4) is equally significant for both employees and students). Therefore, additional employment creates some scepticism, especially since it is associated with a certain concern about the safety and security of delivering packages to unknown recipients or locations, especially given the current socio-political climate in Ukraine.

Besides, the 17 barriers were only considered important for employees and students in Slovenia and Ukraine, rather than particularly important, but for Czech Republic employees, B16 and B15 were found to be particularly important. Among all barriers, B15 was ranked as the most important by employees in Slovenia and Ukraine, but it was still less important for them than for Czech employees. A lack of time (B4) is an important barrier for employees across all three countries, which confirms the insights of Neudoerfer et al. (2021) and Le and Ukkusuri's (2018a) research. One potential solution for addressing B15 and B16 is a parcel locker system, which already exists in all countries. The crowdshipping provider could also offer scheduled pickup and delivery services to accommodate employees' busy schedules. However, the lack of familiarity with crowdshipping is the only important barrier for employees in the Czech Republic and Ukraine. Barriers related to privacy (B10, B11) significantly hinder the WTW of Czech and Slovene employees. However, as age and education level decrease, the importance of personal data security-related barriers (B9) increases in Ukraine. In all three countries, females are less willing to share a phone number (B10) than males. Moreover, this barrier is more important for respondents with higher income levels among Slovene and Czech respondents. Tracking (B11) was identified as an important barrier for students in Marcucci et al.'s (2017) study but was not found to be an important barrier for students in any of the three countries in our study. However, its importance increases with an increased education level in Slovene and the Czech Republic, and increased age in all three countries.

Any barrier is very important for students of any of the three countries. For Slovene students, any barrier is important. No familiarity with crowdshipping (B2), the unwillingness to insure the risk (B12) and make a second delivery (B15) are more important for Czech and Ukrainian students than employees. Logistics providers should invest in better informing and providing rapid training for potential crowdshippers, as B6 is more relevant for students of all three countries than for employees. The importance of this barrier decreases with education level in Slovenia and Ukraine, but surprisingly not in the Czech Republic where this barrier is important for those with a scientific degree. The risk of losing or damaging a parcel (B13) is only an important barrier for Ukrainian students. On the other hand, the fear of delivering dangerous or prohibited items (B14) is an important concern for all other groups except Slovene employees and Slovene and Czech students. Slovenia only had a few incidents or publicised cases involving the delivery of dangerous or prohibited items, which may be a factor. A high level of trust in the crowdshipping companies may also be a reason. In Slovenia, parcel providers have rigorous screening processes and safety measures in place to ensure that only legal and safe items are transported. The barrier has also been identified as important in Le and Ukkusuri's (2018a) and Neudoerfer et al.'s study. Communication with strangers (B7) is only an important hindrance for Czech employees which also confirms Bathke and Münch's (2023) survey. However, the barrier of not being willing to be evaluated (B8) does not seem to be an important factor for any group of potential crowdshippers in all three countries. Among Czech respondents, the importance of B8 increases with age. Interestingly, the remuneration (B3) which was found to be a significant barrier in many past studies (Miller et al. 2017, Bathke and Münch's 2023, Neudoerfer et al., 2021, Le and Ukkusuri, 2018a) is only considered important for Czech employees but not for any other group of respondents.

A study confirmed that travellers are a heterogeneous group, so it is crucial to identify the motivational factors and barriers for single groups of crowdshippers for a more successful and cost-effective targeting strategy. Some

similarities between countries that are culturally similar were shown, so it would be reasonable to further investigate this issue with a larger sample.

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