



Assessing Risk in Postal Services – The Role of Users’ Subjective Security Perceptions

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ABSTRACT

The paper explores the possibility and necessity of incorporating users’ subjective perceptions of safety into risk assessments. The survey has been done as a statistical analysis of questionnaires fulfilled by Croatian Post (HP – Hrvatska pošta) users, highlighting their perceptions of various aspects and suggestions about physical security, transaction security and postal items handling. This way, subjective perception is offered as a base for further definition or calibration of already existing variables used for risk assessment calculations. At the same time, this aspect of monitoring and analysing postal services offers the possibility of assessing service quality not only based on transit time or the number of complaints, as is currently the case, but also through the function of perceived safety. The results show a high level of user confidence in their interactions with the postal system, although there is significant room and need for improvement in procedures when an unwanted incident occurs. The survey results provide a comprehensive overview of user perceptions and areas for improvement in the security and protection of postal services.

KEYWORDS

risk assessment; postal services; users security; safety.

1. INTRODUCTION

In the modern world, postal services remain a crucial component of global communication and logistics. Despite and because of the rise of digital communication, the physical transmission of goods, documents and other parcels through postal services continues to be indispensable [1–3]. This enduring relevance underscores the importance of ensuring the security and protection of users in the postal system. User security in postal services encompasses various aspects, including the protection of personal safety in post offices, personal data, the physical safety of parcels, and the assurance that communications and goods reach their intended recipients without interference, delay or loss. Given the sensitive nature of many items sent through postal services, such as personal letters, confidential documents and valuable goods, robust security measures are paramount [4, 5]. The significance of user security in postal services can be attributed to several key factors [6–9]:

- Personal protection: Primarily the physical safety of users during their interaction with the postal system (whether in post offices, at parcel lockers, etc.). On the other side, postal services handle a vast amount of personal data, including addresses, contact details and sometimes even financial information. Ensuring the confidentiality and integrity of these data is crucial to prevent identity theft, fraud and other malicious activities.

- Trust and reliability: Users must have confidence that their mail and parcels will arrive safely and on time. Trust in the postal system is fundamental for its operation, as any breach in security can lead to a loss of credibility and user trust.
- Regulatory compliance: Postal services are subject to various national and international regulations aimed at safeguarding user information and ensuring the secure handling of mail. Compliance with these regulations is essential to avoid legal repercussions and maintain operational integrity.
- Economic impact: The postal sector is a significant contributor to the economy, facilitating commerce and trade. Ensuring the security of postal services helps sustain economic activities and supports businesses that rely on secure and reliable delivery channels.
- Technological advancements: The integration of new technologies in postal services, such as automated sorting, tracking systems and digital platforms, has improved efficiency but also introduced new security challenges. Addressing these challenges is vital to leveraging technology while maintaining high security standards.

The aim of this research is to highlight the importance of including user perception in risk assessments for specific elements of the postal system (facilities, service processes, shipments, people, etc.). Currently, assessments are based solely on evaluations conducted by certified safety experts in accordance with various regulations and rulebooks [10–12]. By collecting more detailed data on user experiences, we assume it is possible to evaluate existing variables more accurately within risk assessment models, potentially exclude some of the current variables from the model, and include new ones (depending on new forms of threats or protections that have not existed until now).

HP, as the national postal service provider of Croatia, plays a critical role in the country's communication and logistics infrastructure. It operates an extensive network of post offices and distribution centres that facilitate the delivery of letters, parcels and various postal services to both domestic and international destinations. To protect the physical integrity of parcels and letters, HP employs a range of security practices, including secure facilities equipped with surveillance systems, restricted access areas for sensitive operations and the use of tamper-evident packaging. Postal employees are trained to handle mail securely and to recognise and report any suspicious activities or packages.

With the increasing digitisation of postal services, HP has invested in robust digital security measures. These include secure online platforms for tracking parcels, encrypted communication channels and advanced cybersecurity systems to protect against data breaches and cyber-attacks. Despite comprehensive security measures, HP faces several challenges in ensuring the security and protection of its users. The nature of threats to postal security is continually evolving. HP must stay ahead of these threats through continuous monitoring and adjustment. Maintaining high security standards requires significant resources. Financial and human resources constraints can limit the ability to implement advanced security solutions and conduct extensive training programs for employees [13–15].

Ensuring users are aware of security best practices is crucial. Many security breaches occur due to user errors, such as sharing sensitive information or failing to recognise phishing attempts. HP needs to invest in user education and awareness campaigns to mitigate these risks. Adhering to national and international regulations can be complex and demanding. HP must navigate a landscape of varying legal requirements while ensuring seamless service delivery. To address these challenges and further enhance user security, HP has initiated several strategic initiatives [16, 17]. However, the evolving threat landscape and resource constraints present ongoing challenges [18–20]. By continuing to invest in technology, training, user education and collaboration, HP can enhance its security framework and maintain the trust and confidence of its users. User safety in postal services extends beyond the physical security of parcels and letters to encompass a holistic approach that includes data protection and the physical well-being of both users and employees. The rise of e-commerce and online transactions has amplified the volume of sensitive data passing through postal systems, making robust cybersecurity measures indispensable [20–22]. This research will delve deeper into these aspects, providing a thorough analysis of the current state of user security at HP and offering recommendations for further improvements. Research in the area of postal service security and user protection is vital for several reasons [23]. Firstly, it helps in understanding the evolving threat landscape. This continuous improvement is essential for staying ahead of potential threats and ensuring the highest standards of user safety.

By exploring new technologies and methodologies, cutting-edge solutions that enhance security can be adopted. For example, blockchain technology can provide transparent and tamper-proof tracking of parcels, while artificial intelligence can be used to detect and respond to security threats in real-time. When users are assured that their personal information and parcels are secure, they are more likely to trust and use postal

services. This trust is crucial for the sustainability and growth of postal operations, particularly in an era where digital alternatives are readily available.

Although customer orientation has long been integrated into the operations of modern service companies, including postal and courier services such as HP, analyses are primarily conducted to gather data on the economic perception of postal services, procedural perception and similar dimensions. The security aspect is largely overlooked and can only be indirectly inferred from quality indicators of postal services. Such analyses are available through the Croatian Regulatory Authority for Network Industries (HAKOM) [24]. However, these data largely bypass direct user experience and perception, as they are based on records of initiated claims or compensation procedures in response to more serious security incidents – processes that many users, for various reasons, never initiate, even when justified.

A wide range of incidents that do not meet the threshold of a serious event but are nonetheless perceived as discomforts by users are excluded from such analyses. What is objectively secure from the company's perspective may not yield the same or even a similar effect on the user. Quite the contrary, some costly and demanding measures implemented by the company may have a negative impact on user satisfaction, whereas alternative measures might be far more acceptable and effective from the users' standpoint. This is one of the key reasons for establishing procedures for collecting such user-centric data.

In our research, we did not target a specific group of users (e.g. individual or business clients). Survey questionnaires were distributed in physical (paper) form at post offices, and participation was random and voluntary. Users were primarily differentiated based on general demographic data (such as gender and age), as well as by the frequency of postal service usage. Naturally, this study represents only a preliminary pilot effort, which can be further enhanced through other data collection channels (e.g. online), a broader user sample, longer-term observation, and so on. Our primary objective was to highlight the need and potential for improving existing risk management procedures in the postal system by incorporating users' subjective perceptions in a more direct and detailed manner.

In this research, a survey questionnaire was used as a measuring instrument. The survey questionnaire was composed of 30 different questions that were divided into different categories and measured attitudes related to safety aspects in the workplace. The survey questionnaire has been given to the users of Croatian Post in the post offices. The questionnaire was successfully completed by 158 users. The survey was conducted during 2024 and 2025. The research methodology through a survey questionnaire represents a structured approach to collecting data from respondents in a systematic way. Questionnaires were distributed in different spots of the postal network, representing the density of postal users. Questionnaires were fulfilled on places where postal services are provided (commonly post offices). Some of the questions were conducted through a Likert scale.

2. RESULTS

All respondents answered every question. The questionnaires were completed in paper form and subsequently entered into an Excel spreadsheet. The resulting Excel file was then converted into an SPSS data file. Based on the SPSS file, statistical analyses were conducted using IBM SPSS Statistics 25 (SPSS Inc., Chicago, IL, USA). The methods of statistical analysis used included: descriptive methods, inferential methods and multivariate methods. Conclusions regarding differences and correlations among variables were drawn at the conventional significance level of 0.05, i.e. with a 95% confidence level.

2.1 Descriptive statistical analysis

The first group of questions aimed to assess participants' awareness and personal experiences with incident situations during the provision of postal services.

Table 1 – Survey respondents by estimated annual number of robberies

| Estimated number of robberies | Number | % |
|-------------------------------|--------|----|
| Under 10 | 48 | 30 |
| 10–50 | 67 | 42 |
| 50–100 | 29 | 18 |
| Over 100 | 14 | 9 |

Table 1 shows that users tend to positively assess the annual number of robberies, with nearly 75% estimating fewer than 50 incidents annually, which is lower than the actual reported figures.

Table 2 indicates that most respondents have no direct personal experience with incident situations in the postal system. However, this does not necessarily diminish the value of their responses, as they may draw from analogous experiences in similar service sectors (e.g. banking).

Table 2 – Respondents based on whether they witnessed a robbery or similar incident

| Have you ever been present in a post office during a robbery, or have you witnessed or been a victim of incidents such as theft, loss of shipments, or similar events? | Number | % |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|
| Yes | 9 | 6 |
| No | 149 | 94 |
| Total | 158 | 100 |

In Table 3, users estimated the number of annual claims for damaged, delayed or lost shipments with HP. Again, a more favourable perception than reality is evident.

Table 3 – Estimated annual number of claims for damaged, delayed or lost shipments with HP

| Estimated number of claims | Number | % |
|----------------------------|--------|-----|
| Under 1000 | 61 | 39 |
| 1000–5000 | 55 | 35 |
| 5000–10000 | 23 | 15 |
| Over 10000 | 19 | 12 |
| Total | 158 | 100 |

One survey question asked users whether they had ever experienced a shipment being lost, damaged or significantly delayed. Out of 158 respondents, 69 (44%) answered affirmatively, which is a relatively high percentage.

The remaining questionnaire items were presented on a 7-point Likert scale, where the scale values represented the following:

- 1 = Strongly disagree
- 2 = Mostly disagree
- 3 = Disagree
- 4 = Neither agree nor disagree
- 5 = Agree
- 6 = Mostly agree
- 7 = Strongly agree

Thus, scores from 1 to 3 indicate varying degrees of disagreement, 4 indicates a neutral stance, and scores from 5 to 7 indicate varying degrees of agreement.

Table 4 presents the frequencies of responses for each statement, categorised by scores from 1 to 7. Table 5 provides descriptive statistics for the same statements, including means, standard deviations and coefficients of variation. The means offer insight into the relative level of agreement with each statement, while the coefficients of variation reflect the consistency of respondents' attitudes. Lower coefficients indicate greater homogeneity, while higher coefficients suggest more heterogeneous responses.

Table 4 – Frequency of individual responses

| Statement | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----|----|-----------|-----------|-----------|-----------|
| 1. I feel completely safe in a post office operated by Croatian Post. | 2 | 3 | 7 | 14 | 26 | 35 | 71 |
| 2. To what extent are you aware of the security measures implemented by the post office during the provision of postal services? | 13 | 8 | 18 | 21 | 19 | 30 | 49 |
| 5.1. During a security-related incident in the post office, I did not feel threatened. | - | - | - | 3 | 2 | 4 | - |
| 5.2. I am satisfied with the reaction and behaviour of the Croatian Post employees during a security-related incident (they informed me of the procedures to follow, etc.). | 1 | 2 | - | - | - | 3 | 3 |
| 5.3. I am satisfied with the conduct, approach, and/or procedures of the police following a robbery or security-related incident in the post office. | 1 | 1 | 2 | 3 | - | 1 | 1 |
| 6. I believe that conducting financial transactions (deposits/withdrawals) is safer at the post office than at other financial institutions (banks, Fina, TISAK, etc.). | 24 | 7 | 27 | 32 | 30 | 22 | 16 |
| 7. Is access to the post office (parking area, surroundings) sufficiently well-lit and safe? | 10 | 11 | 13 | 30 | 30 | 33 | 31 |
| 8. How safe do you feel when using the Croatian Post web shop and other online applications? | 11 | 9 | 9 | 29 | 35 | 28 | 37 |
| 9.a) Video surveillance will improve security in post offices. | 3 | 2 | 5 | 18 | 17 | 29 | 84 |
| 9.b) Access control via card or code will improve security in post offices. | 12 | 10 | 10 | 20 | 28 | 22 | 56 |
| 9.c) Partition walls, dividers, etc., will improve security in post offices. | 14 | 12 | 16 | 22 | 31 | 24 | 39 |
| 9.d) Time-delay doors will improve security in post offices. | 7 | 5 | 9 | 10 | 25 | 42 | 60 |
| 9.e) The presence of security personnel will improve security in post offices. | 8 | 6 | 10 | 11 | 25 | 32 | 66 |
| 10. I am afraid of the possibility of loss, significant delay or damage to a shipment I have sent. | 15 | 12 | 19 | 29 | 30 | 27 | 26 |
| 13.1 When my shipment was lost, I felt extremely uncomfortable. | 1 | 2 | 7 | 10 | 7 | 12 | 30 |
| 13.2 I am satisfied with the claims process. | 20 | 6 | 17 | 13 | 3 | 4 | 6 |
| 13.3 I believe that sending shipments via Croatian Post is safer than using services offered by other postal providers. | 14 | 12 | 13 | 16 | 7 | 2 | 5 |
| 14.a) A more precise and informative shipment tracking application will enhance the security of postal item transmission. | 2 | 3 | 3 | 13 | 23 | 28 | 86 |
| 14.b) Improvement of the claims process for lost or damaged shipments will enhance the security of postal item transmission. | - | 3 | 5 | 18 | 19 | 37 | 76 |
| 14.c) Training and motivation of Croatian Post employees will enhance the security of postal item transmission. | 2 | 1 | 11 | 15 | 21 | 37 | 71 |
| 14.d) More frequent delivery of shipments will enhance the security of postal item transmission. | 5 | 4 | 6 | 24 | 33 | 33 | 53 |
| 14.e) Parcel lockers will enhance the security of postal item transmission. | 14 | 10 | 16 | 17 | 31 | 26 | 44 |

Table 5 – Descriptive indicators for user statements

| Statement | Arithmetic mean | Standard deviation | Coefficient of variation ¹⁾ |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------|----------------------------------------|
| 1. I feel completely safe in a post office operated by Croatian Post. | 5,84 | 1,405 | 24 |
| 2. To what extent are you aware of the security measures implemented by the post office during the provision of postal services? | 4,97 | 1,953 | 39 |
| 5.1. During a security-related incident in the post office, I did not feel threatened. | 5,11 | 0,928 | 18 |
| 5.2. I am satisfied with the reaction and behaviour of Croatian Post employees during a security-related incident (they informed me of the procedures to follow, etc.). | 4,89 | 2,472 | 51 |
| 5.3. I am satisfied with the conduct, approach, and/or procedures of the police following a robbery or security-related incident in the post office. | 3,78 | 1,856 | 49 |
| 6. I believe that conducting financial transactions (deposits/withdrawals) is safer at the post office than at other financial institutions (banks, Fina, TISAK, etc.). | 4,06 | 1,842 | 45 |
| 7. Is access to the post office (parking area, surroundings) sufficiently well-lit and safe? | 4,78 | 1,768 | 37 |
| 8. How safe do you feel when using the Croatian Post web shop and other online applications? | 4,90 | 1,778 | 36 |
| 9.a) Video surveillance will improve security in post offices. | 5,96 | 1,438 | 24 |
| 9.b) Access control via card or code will improve security in post offices. | 5,10 | 1,933 | 38 |
| 9.c) Partition walls, dividers, etc., will improve security in post offices. | 4,72 | 1,932 | 41 |
| 9.d) Time-delay doors will improve security in post offices. | 5,58 | 1,660 | 30 |
| 9.e) The presence of security personnel will improve security in post offices. | 5,53 | 1,758 | 32 |
| 10. I am afraid of the possibility of loss, significant delay or damage to a sent shipment. | 4,47 | 1,853 | 41 |
| 13.1 When my shipment was lost, I felt extremely uncomfortable. | 5,55 | 1,641 | 30 |
| 13.2 I am satisfied with the claims process. | 3,13 | 1,886 | 60 |
| 13.3 I believe that sending shipments via Croatian Post is safer than using services offered by other postal providers. | 3,23 | 1,742 | 54 |
| 14.a) A more precise and informative shipment tracking application will enhance the security of postal item transmission. | 6,04 | 1,349 | 22 |
| 14.b) Improvement of the claims process for lost or damaged shipments will enhance the security of postal item transmission. | 5,96 | 1,286 | 22 |
| 14.c) Training and motivation of Croatian Post employees will enhance the security of postal item transmission. | 5,83 | 1,411 | 24 |
| 14.d) More frequent delivery of shipments will enhance the security of postal item transmission. | 5,45 | 1,550 | 28 |
| 14.e) Parcel lockers will enhance the security of postal item transmission. | 4,87 | 1,945 | 40 |

Note: 1) A coefficient of variation between 0–10% denotes very low variability, 10–30% indicates low variability, 30–50% moderate, 50–70% high, and above 70% very high variability; 2) Statements 10 and 13.1 are negatively worded compared to the others.

For negatively worded statements (10 and 13.1), the scale was reversed (i.e. 1 became 7, 2 became 6, etc.) before recalculating the means. The recalculated means are presented in *Table 6*, while standard deviations remained unchanged. The coefficients of variation were adjusted accordingly due to changes in the means.

Table 6 – Descriptive indicators for recoded and reworded statements

| Statement | Arithmetic mean | Standard deviation | Coefficient of variation ¹⁾ |
|--------------------------------------------------------------------------------------------------------|-----------------|--------------------|----------------------------------------|
| 10. I am not afraid of the possibility of loss, significant delay or damage to a shipment I have sent. | 3,53 | 1,853 | 52 |
| 13.1 When my shipment was lost, I did not feel extremely uncomfortable. | 2,45 | 1,641 | 67 |

The calculated means from *Tables 5 and 6* range from 2.45 (recoded statement 13.1) to 6.04 (statement 14a). The four least accepted statements (means below 4.0) are:

- 2.45 – Statement 13.1: I did not feel significant discomfort when my shipment was lost
- 3.13 – Statement 13.2: I am satisfied with the claims process
- 3.23 – Statement 13.3: I believe that HP is safer than other postal service providers
- 3.78 – Statement 5.3: I am satisfied with the police’s response after a robbery or security incident

The three most accepted statements (means above 5.9) are:

- 5.96 – Statement 9a: Video surveillance will improve security in post offices
- 5.96 – Statement 14b: Enhancing the claims process will improve the security of postal transmission
- 6.04 – Statement 14a: A more precise and informative tracking application will improve postal security

Coefficients of variation ranged from 18% (statement 5.1) to 67% (statement 13.1), indicating low, moderate or high variability.

To quantify perceived postal security, scores from individual statements were summed. Lower totals imply weaker agreement; higher totals indicate stronger agreement. Negatively worded items were recoded accordingly to ensure comparability. Averages were then computed, forming a distribution for which several descriptive indicators were calculated and presented in *Table 7*, alongside results from the Kolmogorov-Smirnov normality test and reliability analysis (Cronbach’s alpha), which confirmed satisfactory internal consistency.

Table 7 – Descriptive indicators for perceived security scores

| Arithmetic means | | Kolmogorov-Smirnov test | |
|--------------------------|-------|--------------------------------------------|--------------|
| arithmetic mean | 5,03 | z-value in the test | 0,044 |
| median | 5,00 | p-value in the test | 0,200 |
| mode | 5,00 | Normality of distribution | yes |
| Measures of dispersion | | Reliability analysis | |
| minimum value | 2,58 | Cronbach’s alpha coefficient ¹⁾ | 0,736 |
| maximum value | 7,00 | Number of variables | 16 |
| standard deviation | 0,817 | reliability | satisfactory |
| coefficient of variation | 16% | | |

Note: Cronbach’s alpha < 0.6 is unsatisfactory, >0.7 satisfactory, >0.8 good, >0.9 excellent.

Theoretically, perceived security scores can range from:

- Minimum = 1
- Average = 4
- Maximum = 7

The actual average (5.03) exceeds the theoretical mean, indicating generally positive perceptions. Similarly, the lowest observed score (2.58) exceeds the theoretical minimum, reinforcing this conclusion. Based on quartile values, respondents were categorised into groups (Postal service users $Q1=4.53$, $Q3=5.63$):

- Low perceived security (2.58–4.50): 38 respondents (24%)
- Moderate perceived security (4.51–5.63): 83 respondents (53%)
- High perceived security (5.64–7.00): 37 respondents (23%)

2.2 Inferential statistical analysis

Various inferential methods were employed. The first set includes *t-tests* (for differences between two means) and *F-tests* (ANOVA for differences among three or more means). Statistical significance is determined based on *p*-values: random variation if $p > 0.05$, and significant difference if $p < 0.05$.

Table 8 – Results of *t-tests* and *F-tests* comparing means

| Variable | Subgroup of respondents | No. of respondents | Arithm. means | t or F | p |
|--------------------------------|-------------------------|--------------------|---------------|------------|-----------|
| Users' gender | male | 98 | 5,06 | t = 0,485 | 0,628 |
| | female | 51 | 5,12 | | |
| Users' age (years) | up to 20 | 7 | 5,31 | F = 0,932 | 0,427 |
| | 20-40 | 63 | 5,11 | | |
| | 40-60 | 68 | 4,91 | | |
| | over 60 | 20 | 5,06 | | |
| Users' education | high school | 88 | 5,07 | F = 0,252 | 0,778 |
| | polytechnic | 31 | 4,08 | | |
| | college | 39 | 4,97 | | |
| Frequency of post office usage | never | 7 | 4,07 | F = 15,931 | <0,001*** |
| | almost never | 17 | 4,43 | | |
| | occasional | 45 | 4,70 | | |
| | frequent | 48 | 5,24 | | |
| | very frequent | 41 | 5,55 | | |

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; t = *t-test* value, F = *ANOVA* value, p = *significance level*.

Key findings from Table 8:

- 1) Gender: Males report lower perceived security than females ($5.06 < 5.12$), but the difference is not statistically significant ($p = 0.628$).
- 2) Age: No statistically significant difference among age groups ($p = 0.427$).
- 3) Education: No significant differences based on education level ($p = 0.778$).
- 4) Frequency of post office usage: Statistically significant differences exist ($p < 0.001$). Less frequent users report lower perceived security.

Specifically significant differences (6 of 10 potential pairwise comparisons) were observed between:

- Non-users and frequent/very frequent users
- Infrequent users and frequent/very frequent users
- Occasional users and frequent/very frequent users

The second group of analyses involved chi-square tests (Table 9) to assess associations between nominal variables.

Table 9 – Chi-square test results

| Variables in a contingency table | Format of contingency table | n | χ^2 | df | p | Φ |
|-------------------------------------------------------------------------------------------|-----------------------------|-----|----------|----|-----------|--------|
| Frequency of PO usage (4 groups) Groups of users according to perceived security | 4 x 3 | 158 | 49,324 | 6 | <0,001*** | 0,56 |
| Witnessed safety incident (yes, no) P6 Groups of users according to perceived security | 2 x 3 | 158 | 3,720 | 2 | 0,156 | |

Note: n = sample size, χ^2 = chi-square value, df = degrees of freedom, p = significance level. Φ coefficient interpretation: 0.00–0.15 very weak, 0.15–0.20 weak, 0.20–0.25 moderate, 0.25–0.30 moderately strong, 0.30–0.35 strong, >0.35 very strong.

Conclusions regarding the conducted Chi-square tests:

- 1) There is a statistically significant and very strong association between the frequency of post office usage by users and their perception of security ($p < 0.001$, $\Phi = 0.56$). An examination of the contingency table (Table 10) reveals that, out of 100 users who never or almost never use postal services at post offices, 67 had a low perception of security, while only 8 had a high perception of security. In contrast, among 100 users who use post offices very frequently, only 7 reported a low perception of security, whereas as many as 41 reported a high perception. Thus, lower frequency of post office use is associated with lower perceived security, while higher usage frequency corresponds with higher perceived security.
- 2) There is no statistically significant association between users’ experiences of incident situations (yes or no) and their categorisation into the three groups based on perceived security (low, moderate, high), as $p = 0.156$. In other words, whether or not users had experienced an incident situation did not influence their perception of security in post offices.

Table 10 – Surveyed postal service users by frequency of service usage and perceived security of post offices

| Frequency of PO use | Perceived security | | | Total | % | | | Total |
|---------------------|--------------------|----------|------|-------|-----|----------|------|-------|
| | low | moderate | high | | low | moderate | high | |
| never | 16 | 6 | 2 | 24 | 67 | 25 | 8 | 100 |
| occasional | 14 | 29 | 2 | 45 | 31 | 64 | 4 | 100 |
| frequent | 5 | 27 | 16 | 48 | 10 | 56 | 33 | 100 |
| very frequent | 3 | 21 | 17 | 41 | 7 | 51 | 41 | 100 |
| Total | 38 | 83 | 37 | 158 | 24 | 53 | 23 | 100 |

2.3 Exploratory factor analysis

The purpose of the factor analysis was to reduce a larger number of original (manifest) interrelated variables into a smaller number of derived, new variables (factors, constructs, dimensions) that are mutually uncorrelated. The questionnaire, which contained 16 items related to the security of postal services, was subjected to factor analysis.

Prior to conducting the analysis, data suitability was assessed using the following tests:

- The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of 0.710,
- Bartlett’s test of sphericity resulted in $\chi^2 = 668.17$, with 120 degrees of freedom ($p < 0.001$).

Both tests indicated that the dataset met the necessary assumptions for conducting factor analysis. The factor analysis procedure involved calculating the intercorrelation matrix for the 16 questionnaire items,

extracting factors using the principal component method, performing varimax rotation and calculating factor scores for all respondents.

According to the Kaiser-Guttman criterion (eigenvalue > 1), the first five extracted factors were deemed significant. The eigenvalues for these five factors were 3.73, 2.25, 1.59, 1.24 and 1.11. A visual inspection of the scree plot (*Figure 1*), which displays the relationship between the number of extracted components and their eigenvalues, confirmed the presence of a five-factor structure in the questionnaire. Based on the factor loading matrix (the final three columns in *Table 11*), the factors were interpreted as follows:

- 1) Organisational security optimisation measures: Statements 14a–14e relate to shipment tracking applications, improvements in the claims process and staff training.
- 2) Physical security: Statements 1, 2, 6, 7 and 8 reflect users' perceptions of basic physical safety.
- 3) Physical security enhancement measures: Statements 9a–9e pertain to video surveillance, access control via cards or codes, partitions, time-delay doors and security personnel.
- 4) Improved delivery options: Statements 14d and 14e refer to more frequent deliveries and the use of parcel lockers.
- 5) Delivery failure prevention: Statement 10 addresses the prevention of shipment loss, delay or damage.

These five factors together explain 61.96% of the total variance from the original set of 16 items. Key results of the factor analysis are presented below. *Table 11* contains descriptive statistics (means, standard deviations and coefficients of variation) and the rotated factor loading matrix.

Table 11 – Descriptive statistics and rotated factor structure matrix

| Statement | Descriptive indicators | | | Component (factor) ¹⁾ | | | | |
|-----------|------------------------|------------------|------------------|----------------------------------|--------------|--------------|--------------|--------------|
| | Mean | Stand. deviation | Coeff. variation | 1 | 2 | 3 | 4 | 5 |
| 1 | 5,84 | 1,405 | 24 | 0,365 | 0,730 | | | |
| 2 | 4,97 | 1,953 | 39 | | 0,605 | | | |
| 6 | 4,06 | 1,842 | 45 | | 0,506 | | 0,351 | |
| 7 | 4,78 | 1,768 | 37 | | 0,653 | | | |
| 8 | 4,90 | 1,778 | 36 | | 0,786 | | | |
| 9a | 5,96 | 1,438 | 24 | 0,503 | | 0,511 | | |
| 9b | 5,10 | 1,933 | 38 | | | 0,698 | | |
| 9c | 4,72 | 1,932 | 41 | | | 0,565 | 0,581 | |
| 9d | 5,58 | 1,660 | 30 | | | 0,738 | | |
| 9e | 5,53 | 1,758 | 32 | | | 0,667 | | |
| 10 recode | 3,53 | 1,853 | 52 | | | | | 0,767 |
| 14a | 6,04 | 1,349 | 22 | 0,555 | | | | -0,442 |
| 14b | 5,96 | 1,286 | 22 | 0,820 | | | | |
| 14c | 5,83 | 1,411 | 24 | 0,731 | | | 0,314 | |
| 14d | 5,45 | 1,550 | 28 | 0,386 | | | 0,727 | |
| 14e | 4,87 | 1,945 | 40 | | | | 0,696 | |

Note: Only factor loadings greater than 0.3 are displayed. Loadings representing the primary factor association for each item are shown in bold.

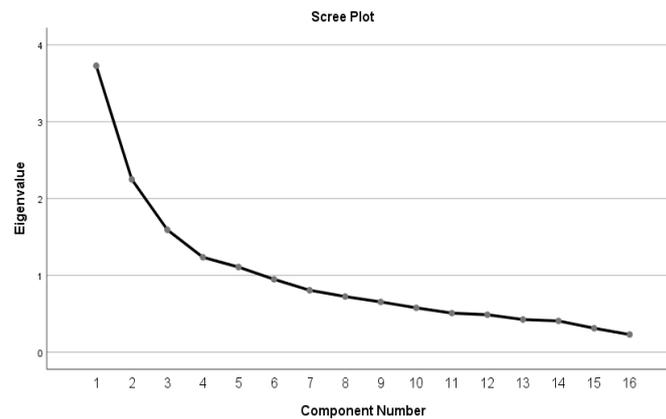


Figure 1 – Graphical representation of eigenvalues by component (Scree Plot)

The higher the arithmetic means shown in the first column of Table 22, the higher or more favourable the users’ assessment of security. This is due to the reverse coding of negatively worded statement 10. Therefore, the means are directly comparable. The coefficients of variation range between 22% and 52%, indicating that the variability in users’ security assessments is either low or moderate.

2.4 Multiple regression analysis

A standard multiple regression analysis was conducted, with the dependent variable being the perceived security of postal operations. The selection of independent variables was deliberately limited to general respondent characteristics: age, education level and frequency of post office usage. The ENTER method (simultaneous entry of predictors into the model) was applied.

The variables in the model are as follows:

- Dependent variable (Y): User-perceived security of postal operations
- Independent variable (X₁): User age (categorised into 4 groups)
- Independent variable (X₂): Level of user education (categorised into 5 groups)
- Independent variable (X₃): Frequency of postal service usage (categorised into 5 levels)

The results of the regression analysis, presented in Table 12, include regression coefficients along with their corresponding standard errors, *t*-values and *p*-values.

Table 12 – Results of the multiple regression analysis of postal service users

| Variable | Unstandardised coefficients | | Standardised coefficients | t | p |
|--------------------------------------------------|-----------------------------|----------------|---------------------------|--------|------------------|
| | B | Standard error | Beta | | |
| Constant | 3,820 | 0,294 | - | 12,990 | <0,001 |
| X ₁ User age | -0,050 | 0,075 | -0,046 | -0,667 | 0,506 |
| X ₂ User educational level | -0,028 | 0,047 | -0,041 | -0,586 | 0,559 |
| X ₃ Frequency of postal service usage | 0,391 | 0,050 | 0,533 | 7,853 | <0,001 |

Based on the obtained results of the analysis, it can be concluded that, within the given model, only the variable frequency of postal service usage is statistically significant ($p < 0.001$). The other two independent variables – X₁: user age and X₂: user education level – are not statistically significant, as their *p*-values exceed the conventional threshold of 0.05 ($p = 0.506$ and $p = 0.559$, respectively). Consequently, these variables were excluded from further interpretation.

The results of the ANOVA test ($F = 21.294$, $p < 0.001$) indicate that the multiple correlation coefficient is statistically significant. The multiple correlation coefficient is $R = 0.541$, indicating a moderately strong positive correlation between the dependent variable (user-perceived security of postal operations) and the independent variable X₃ (frequency of postal service usage).

The coefficient of determination (R^2) is 0.293, meaning that 29.3% of the variance in the dependent variable is explained by its relationship with X_3 . Thus, the overall explanatory power of the multiple regression model is relatively limited. The adjusted R^2 is 0.279, accounting for the number of predictors included in the model. The equation of the multiple regression model is as follows: $\hat{Y} = 3.820 + 0.391 X_3$.

3. DISCUSSION

The analysis of user security and protection reveals both the strengths and areas for improvement. Based on the survey results, users generally feel secure when visiting post offices, which reflects positively on the physical security measures implemented by the postal operator. These measures include well-lit facilities, secure parking areas and effective video surveillance, which together create a safe and welcoming environment for users. However, this sense of security is not universally extended to all aspects of postal operations, particularly in the realm of transaction security and parcel handling.

The frequency of security incidents reported by users, ranging from fewer than 10 to more than 100 annually, suggests that while most users experience a moderate number of incidents, there are specific areas or situations where security vulnerabilities are more pronounced. This variability emphasises the need for targeted improvements and continuous monitoring to address and mitigate these vulnerabilities effectively. The reported loss of more than 1,000 parcels annually is particularly concerning, as it significantly undermines user trust and has substantial financial and reputational implications. This issue underscores the urgent need for comprehensive measures to track, manage and secure parcels throughout the delivery process. Implementing advanced tracking technologies, improving employee training and enhancing the overall logistics infrastructure are crucial steps to reducing parcel loss and improving user satisfaction.

User suggestions for improving the parcel delivery experience further highlight key areas for development. Accurate delivery information and a better tracking application were identified as significant improvements that could enhance user experience. Users want real-time updates and detailed tracking information, which suggests that an enhanced tracking application with features like notifications and direct communication with delivery personnel would be highly valued. The importance of employee motivation and education also emerged as a crucial factor. Users believe that well-trained and motivated employees can significantly enhance the delivery experience, suggesting that investing in ongoing training programs and incentives for postal workers could lead to improved service quality and efficiency. Additionally, more frequent deliveries and the increased use of automated package lockers were identified as desirable improvements, indicating a demand for a more responsive and flexible delivery service.

When comparing these findings with other research in the field, similar trends and challenges can be observed. For instance, studies conducted on postal services in other countries, such as the United States Postal Service (USPS) and Royal Mail in the UK, also highlight the importance of robust security measures and user trust. Research by the U.S. Postal Service Office of Inspector General (OIG) emphasises the critical role of video surveillance and secure handling procedures in maintaining user trust and preventing security breaches. Like HP, these organisations face challenges related to parcel handling and the need for continuous improvement in security protocols [25–27].

Furthermore, international studies on postal service security underscore the significance of employee training and user education. Research by Copeland and Henry [23] on workplace violence and safety perceptions among postal workers in the U.S. highlights the need for regular training programs and a culture of safety to mitigate risks and enhance service quality. These findings align with the survey results from HP, indicating that well-trained and motivated employees are essential for providing a secure and efficient postal service. Additionally, the integration of advanced technologies, such as blockchain for secure tracking and artificial intelligence for threat detection, is a common theme across various studies. For example, research by Alshaikh and Adamson [28] on improving security behaviour through technological innovations suggests that adopting cutting-edge solutions can significantly enhance security measures and user confidence [29–32].

Users' familiarity with the security systems at post offices is generally high, but there is still room for improvement in educating users more thoroughly about specific security measures. Enhanced awareness and understanding of these protocols could further strengthen users' sense of security, addressing any gaps in knowledge and potentially reducing user errors that lead to security breaches. The feedback on transaction security indicates a less favourable perception, with users not significantly considering their transactions at HP to be safer than those conducted elsewhere. This highlights a critical area for improvement. HP could benefit from enhancing the visibility and communication of its transaction security features to reassure users of their

safety. Additionally, consistent security performance across all locations is essential, as the survey results showed variability in the reported frequency of security incidents.

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The importance of employee motivation and education also emerged as a crucial factor. Users believe that well-trained and motivated employees can significantly enhance the delivery experience, suggesting that investing in ongoing training programs and incentives for postal workers could lead to improved service quality and efficiency. Additionally, more frequent deliveries and the increased use of automated package lockers were identified as desirable improvements, indicating a demand for a more responsive and flexible delivery service. The survey results provide a comprehensive overview of user perceptions and areas for improvement in the security and protection of postal services at HP. While there are strengths in physical and digital security measures, as well as user familiarity with security systems, areas such as transaction security and parcel handling require significant attention.

Such an approach represents an extension of the concept of risk assessment for individual elements of the postal system. The assumption is that this method can identify relevant indicators related to subjective perceptions of security and protection within the postal system. By repeating such surveys over time, across different locations and targeting different user profiles (urban/rural, individual/business, disabled, etc.), it is possible to validate or evaluate the proposed approach. Additionally, similar studies would be conducted with other stakeholders in postal processes (various employees of postal service providers, primarily those involved in operational activities), enabling the identification of potential overlaps in responses with those of postal service users. This would further focus attention on precisely these indicators. These initial investigations and the identification of relevant indicators can be effectively expanded upon by applying methodologies from similar studies in other traffic sectors [33–35], which are fundamentally based on the same underlying assumption – the importance of incorporating the subjective perceptions of stakeholders within a given traffic system into the overall risk assessment and safety outcomes.

4. CONCLUSIONS

The research on the security and protection perception of postal services users highlights several key findings and areas for improvement. Users generally feel secure when visiting post offices, attributing this to effective physical security measures such as well-lit facilities, secure parking areas and comprehensive video surveillance systems. These elements create a safe and welcoming environment, fostering user confidence in the physical aspects of postal services. Furthermore, the variability in the reported frequency of security incidents, ranging from fewer than 10 to more than 100 annually, indicates that security performance may be inconsistent across various locations or periods.

The reported loss of over 1,000 parcels annually is a major concern, undermining user trust and indicating substantial financial and reputational implications for HP. This issue underscores the urgent need for comprehensive measures to improve parcel tracking, management and security throughout the delivery process. Implementing advanced tracking technologies, improving employee training and enhancing the logistics infrastructure are crucial steps to address this challenge. User suggestions for improving the parcel delivery experience, such as more accurate delivery information, a better tracking application and increased use of automated package lockers, provide clear guidance. These improvements, along with more frequent

deliveries and investment in employee motivation and education, are essential for enhancing user satisfaction and trust in postal services.

Research points out some other, quite unexpected findings, such as:

- Lower frequency of post office use is associated with lower perceived security, while higher usage frequency corresponds with higher perceived security,
- Whether or not users had experienced an incident situation did not influence their perception of security in post offices,
- Demographic characteristics (age, education, gender) do not have significant differences in perceived security in post offices or with other usage of postal services,
- Although postal users have a high sense of security in post offices and with using postal services, on almost every suggested enhancement of security measures, responses got maximum points on scale.

Comparative analysis with other postal services, such as the United States Postal Service (USPS) and Royal Mail, reveals similar trends and challenges. These organisations also emphasise the importance of robust security measures, user trust and continuous improvement in security protocols. This ongoing commitment to security and user protection is essential for the sustained success and reliability of postal services.

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