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ENHANCING PEDESTRIAN SAFETY BY PROVIDING A LIDAR-BASED ANALYSIS OF JAYWALKING CONFLICTS AT SIGNALIZED INTERSECTIONS

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ABSTRACT

Motives: In response to the inherent vulnerability of pedestrians in urban settings, this paper is driven by a commitment to enhancing their mobility and safety. Recognizing the prevalence of jaywalking as a significant concern, the study seeks practical solutions through the application of LiDAR sensors at signalized intersections. By delving into the complexities of jaywalking events and their contributing factors, the research aims to provide valuable insights that extend beyond mere statistical analysis. The motivations behind this endeavour lie in the imperative to comprehensively understand and address the risks associated with jaywalking, ultimately fostering a safer environment for pedestrians navigating urban crossroads.
Aim: The primary aim of this paper is to assess and analyse the diverse factors influencing the frequency of jaywalking at signalized intersections, leveraging the capabilities of LiDAR sensors for safety applications. Through a meticulous examination of 1000 jaywalking events detected over a six-month period, the study aims to pinpoint highly correlated independent variables to the frequency of jaywalking events. These variables include traffic signal controller patterns, signal phases, vehicle-pedestrian conflicts, weather conditions, vehicle volume, walking patterns toward the median, pedestrian volume, and the unique jaywalker's ratio. Employing advanced statistical regression models, the research seeks to identify optimal models and unravel key insights into the nuanced dynamics of jaywalking behaviour. The overarching goal is to equip decision-makers and transportation specialists with data-driven knowledge, enabling them to implement targeted safety measures that mitigate pedestrian risks and enhance safety infrastructure at critical urban crossroads.
Results: The outcomes of the study, derived from the optimal Poisson regression model, yield crucial insights into the multifaceted nature of jaywalking events at signalized intersections. The morning and mid-day signal controller patterns exhibit a substantial decrease of 44.7% and 34.4%, respectively, compared to the evening (PM) pattern, shedding light on temporal nuances in jaywalking behaviour. Additionally, the severity of vehicle-pedestrian conflicts escalates proportionally with the number of jaywalkers, emphasizing the importance of addressing pedestrian flow in mitigating potential conflicts. Notably, the presence of vegetation in the median emerges as a significant factor, significantly

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increasing the frequency of jaywalking. These results contribute to a nuanced understanding of the intricate interplay between environmental, temporal, and behavioural factors in jaywalking incidents. Decision-makers and transportation specialists can leverage these findings to formulate targeted safety interventions, fostering a safer pedestrian experience at crucial urban crossroads.

Keywords: LiDAR sensor, jaywalking event, vehicle-pedestrian conflicts, safety analysis, statistical regression models

INTRODUCTION

Jaywalking refers to crossing the road illegally and unsafely by a pedestrian (Norton, 2007). When a pedestrian cross against a red light or does not yield to oncoming traffic, it may also be considered jaywalking. There is no doubt that jaywalking can be extremely dangerous, however the danger of jaywalking may not seem obvious at first glance. According to the National Highway Traffic Safety Administration (NHTSA) released statistics (NHTSA, 2021), a total of 42,795 people were killed in motor vehicle crashes. The number of fatalities in 2022 dropped by about 0.3% as compared to 42,939 in 2021. According to Governors Highway Safety Association (GHSA) statistics (Association, 2022) in 2022, there continues to be an incredibly high death rate for pedestrians on roadways in the USA troubling trend of elevated pedestrian mortality rates has continued since 2020, with 2.37 pedestrian deaths per billion vehicle miles traveled (VMT) in 2022. The state of Maryland experienced 1.10 pedestrian fatality rate per 100,000 population and the report (Association, 2022) highlighted that California, Florida and Texas were responsible for over one-third (38%) of pedestrian fatalities in the first half of 2022. However, their combined population makes up only 28% of the total population in the United States. Warmer climates and large urban areas in certain states may explain the higher incidence of pedestrian-vehicle collisions. Factors contributing to increased pedestrian fatalities include economic growth, lower gas prices, distracted driving, and impaired driving. Other elements, like the proliferation of smartphones, legalization of recreational marijuana, and disparities in street infrastructure, further contribute to pedestrian crash rates, particularly in less affluent neighborhoods (Eluru et al.; 2008, Thomas et al., 2020; Tyndall, 2021).

Crossing the road outside of designated crosswalks, commonly known as jaywalking, can increase the chances of being involved in a vehicle-pedestrian collision. There are various reasons why pedestrians may choose to cross outside of a designated crosswalk. In certain instances, the distance between the available crosswalk and their intended destination, the presence of crosswalks may not be apparent to pedestrians or they might not be aware of the requirement to use them. Furthermore, pedestrians may attempt to cross if they are in a rush, especially if pedestrian signals malfunction, which could lead to serious or even fatal injuries.

It is crucial to recognize that jaywalking is generally considered illegal in the majority of states in the United States. Nonetheless, it is important to note that the specific laws and regulations regarding jaywalking can vary from state to state. In some states, jaywalking tickets may only be issued if the pedestrian is causing a traffic hazard. Jaywalking in California can result in a $196 ticket (VC, 2022). Other states, such as Florida, allow the pedestrian to cross outside of a crosswalk if they yield to oncoming traffic. In busy cities with a lot of pedestrian traffic, jaywalking laws are also more strictly enforced. To prevent car crashes and promote pedestrian safety, police may even conduct sting operations to catch people who are illegally crossing the street. Traditionally, jaywalking laws primarily focus on pedestrian behavior in relation to crosswalks and intersections. These laws are designed to ensure pedestrian safety and orderly traffic flow. At signalized intersections, pedestrian signal compliance becomes a critical issue. Pedestrian signals are an integral part of traffic control systems

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and are designed to regulate pedestrian movements and vehicle-pedestrian interactions. Compliance with pedestrian signals is essential for the safe and efficient operation of these intersections. Several factors can influence pedestrian signal compliance at signalized intersections. These factors may include pedestrian awareness and understanding of signal indications, pedestrian volume, signal timing, urban design, enforcement efforts, and the presence of amenities such as countdown timers and audible signals. Addressing the issue of jaywalking at signalized intersections may involve a combination of enforcement measures, educational campaigns, and infrastructure improvements. Law enforcement agencies may issue citations to violators, and public awareness campaigns can help educate pedestrians about the importance of following pedestrian signals.

Jaywalking can also contribute to traffic congestion. Jaywalkers can prompt drivers to abruptly brake or maneuver around them and leading to potential disruptions in traffic flow. A pedestrian may jaywalk if they are drunk, if they are not from the area (pedestrians who are visiting an area for the first time), or if pedestrians don't think jaywalking is a big deal (Guo et al., 2014; Pasha et al., 2015; TSS 2022).

This paper aims to address the application of accurate real-time traffic data collection and less--used statistical analysis models as the existing gaps in jaywalking studies by utilizing LiDAR technology, a recent and efficient technology to study jaywalking at signalized intersections. LiDAR technology offers an efficient and objective alternative to traditional manual or video-based methods for analyzing jaywalking conflicts at signalized intersections. LiDAR technology provides precise three-dimensional spatial information, facilitating accurate identification and assessment of pedestrian movements. The high--resolution data enables a nuanced understanding of jaywalking behaviors, expediting research and ensuring a reliable examination for enhancing pedestrian safety. By providing detailed and precise spatial data, LiDAR enables a comprehensive understanding of pedestrian behaviors at signalized intersections, identifying specific trends and potential conflict points. This rich dataset becomes the foundation for data-driven analyses, allowing for the development of targeted safety measures. The precision of LiDAR ensures that safety interventions are tailored to address specific jaywalking scenarios, ultimately contributing significantly to an effective and robust enhancement of pedestrian safety in complex urban traffic environments.

While LiDAR technology has been employed for various purposes, its application to investigate jaywalking in different traffic signal phases/patterns and in different weather conditions has not been explored. Hereupon, the effect of signal controller timing and phasing, daily patterns, and the potential risk of vehicle-pedestrian conflicts is investigated whether LiDAR has provided any additional insight over previous non-LiDAR-based studies. In light of the importance of jaywalking, it would be worthwhile to study the independent variables that affect the frequency of jaywalking and how people behave during jaywalking intervals. Thus, LiDAR sensor was used to record the trajectory of jaywalkers, and the conflicts between vehicles and pedestrians at Hillen Rd – E 33rd street intersection in Baltimore city, USA. The remainder of this article is structured as follows: Section 2: Literature Review, Section 3: Methodology, Section 4: Data Analysis, Section 5: Statistical modeling results, Section 6: Discussion, Section 7: Conclusion, and Section 8: References.

LITERATURE REVIEW

Pedestrian and bicyclist traffic crashes have become a critical safety issue worldwide (Mei, Xiaobao et al. 2013). Multiple crossing facilities have been designed to enhance pedestrian safety while crossing roadways including crosswalks at both signalized and unsignalized intersections, as well as pedestrian overpasses and underpasses, situated at intersections and midblock. These infrastructure facilitates pedestrians with safer and more accessible means of crossing, reducing the risk of crashes and enhancing overall pedestrian mobility and convenience (Ansariyar and Jeihani 2023). Pedestrians' crossing

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behavior is strongly influenced by human factors. Therefore, pedestrians may cross illegally rather than using crossing facilities. As a result of subjectivity and randomness, pedestrian behavior is complicated (Guo et al., 2014). Understanding and accommodating the diverse behaviors and needs of pedestrians is essential for creating safer and more efficient transportation facilities. This includes designing pedestrian--friendly infrastructure, improving crosswalks and signalization, implementing traffic calming measures, and promoting pedestrian education and awareness.

Different characteristics can affect the pedestrian's behavior when crossing intersections. The effect of low-income pedestrians in interaction with approaching vehicles at midblock road crossings was studied by Vasudevan et al. (2022). Financial limitations may restrict low-income individuals' access to transportation options, leading them to rely more on walking and crossing roads unsafely. To account for different pedestrian crossing paths, Vasudevan et al. (2022) developed a trajectory-based pedestrian modified Post-Encroachment Time (PET) model to account for the various possible pedestrian crossing trajectories. In terms of the new technologies application to study the behavior of jaywalkers, LiDAR technology was installed (Ansariyar & Jeihani, 2023) at one signalized intersection with high pedestrian injury rate to identify highly correlated independent variables associated with the frequency of jaywalking. Choi et al. (2013) by using human factor analysis highlighted that high-speed drivers are disproportionately involved in fatal crashes when it comes to incidents related to jaywalkers. The higher speeds of motorized vehicles reduce their reaction time and increase the severity of collisions to jaywalkers. Furthermore, other factors e.g., the vulnerable age group, road and environment factors, and dry/icy pavement conditions may increase the frequency and severity of jaywalker's conflicts. In another study, Li et al. (2023) demonstrated that improper signal timing often leads to higher delays and insufficient walk times for pedestrians, which could result in risky behaviors such as jaywalking. They (Li et al., 2023) developed a pedestrian behavioral data collecting system based on the emerging LiDAR sensor to analyze the pedestrian waiting time before crossing, their perception-reaction time to walk and their crossing speed at signalized intersections when the traffic signal performance is not properly. Ning-bo and Li-ying (2021) developed a microscopic simulation model for pedestrians and vehicles interactions at signalized intersections, which can include pedestrians' jaywalking. By using observed crossing speed, crossing trajectories, and conflicts between pedestrians and vehicles, the model provided a realistic representation of how pedestrians navigate and interact within the crossing environment. By collecting pedestrian trajectories, geometric and crosswalk characteristics using the video-graphic technique, Bansal et al. (2022) demonstrated that the independent variables e.g., gender, crossing pattern, type of signal at arrival, number of lanes, width of crosswalk, presence of guard rails and average pedestrian delay are crusial factors affecting on the probability of pedestrian jaywalking. Urban forms and environmental designs easily influence pedestrian behavior (Elvik et al., 2013). It is possible to design facilities in a way that encourages walking without compromising safety or convenience (Shriver, 1997). Waiting time and crossing distance (distance between the destination and crossing point) are also external factors (TSS, 2022) that may lead to unsafe crossings, such as jaywalking. A significant percentage of pedestrians fail to comply with pedestrian signal controllers or crossing facilities since they are in a rush or want to keep moving along the shortcut. The scholars e.g., Lambrianidou et al. (2013) and Li (2013) studied pedestrian behavior influenced by time and distance. Guo et al. (2012) by using the reliability theory examined the waiting behavior at street crossings. They (Guo et al., 2012) found that jaywalking violations enhanced significantly with a longer waiting time. Last but not least, Hamidun et al. (2021) studied the effect of surrounding factors that influenced the jaywalking e.g., the presence of median and vegetation on median, the location of land-uses and public transport stations near the intersection.

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As can be seen in the state-of-the-art studies, jaywalking may be taken into account as one of key reasons to decrease the safety of pedestrians in interaction with motorized vehicles. In areas without adequate pedestrian crossings or pedestrian traffic signals (Li et al., 2014; Museus & Park, 2015), jaywalking frequency may increase. The literature on jaywalking behavior at signalized intersections revealed a correlation with median locations, vehicle flows, and vehicle-pedestrian conflicts. While specific numerical values and findings may vary among studies due to different locations and methodologies, the overall body of research underscores the importance of designing safer pedestrian infrastructure, considering traffic volumes and speeds, and implementing measures to reduce jaywalking behaviors for improved pedestrian safety at intersections (Nassiri & Sajed, 2009). In terms of the "median locations", the literature review highlighted that intersections lacking medians or with narrow medians that do not provide a safe refuge for pedestrians are associated with higher instances of jaywalking. Regarding the "vehicle flows", higher vehicle flows and faster traffic speeds can influence pedestrian decision-making regarding jaywalking. Regarding "the correlation with vehicle-pedestrian conflicts", pedestrians who jaywalk, especially at signalized intersections, are at a greater risk of being involved in conflicts with vehicles. Hence, to investigate the potential risk of jaywalking at signalized intersections, the objective of this paper is to examine the highly correlated independent characteristics that associate with jaywalking frequency. To achieve this, the study employs LiDAR technology as a precise tool for collecting jaywalker's real-time data. The study also seeks to investigate the relationships between various independent variables, such as traffic signal controller patterns, signal phases, vehicle-pedestrian conflicts, weather conditions, vehicle volume, pedestrian volume, and jaywalker frequency, and the frequency of jaywalking events. The overarching objective is to elucidate how these variables interrelate and contribute to the observed occurrences of jaywalking, with the ultimate goal of enhancing pedestrian safety and mobility. By formulating clear hypotheses that delineate the expected relationships between these variables, the study endeavors to address the identified research problem comprehensively. For instance, it is hypothesized that an increase in vehicle volume or pedestrian volume may correlate positively with a higher frequency of jaywalking events, as pedestrians may perceive greater traffic congestion as an opportunity to engage in jaywalking behavior. Conversely, it is anticipated that the implementation of stricter traffic signal controller patterns or the presence of vegetation in the median may serve as deterrents, leading to a decrease in jaywalking occurrences. By elucidating these relationships, the study aims to contribute valuable insights towards developing targeted interventions aimed at reducing pedestrian risks and improving safety infrastructure at signalized intersections. While emphasizing its potential contribution to enhancing pedestrian safety, this study acknowledges the importance of situating its findings within the broader context of existing research in the field. By elucidating the hypotheses and research objectives, the study aims to not only build upon but also expand the current state of knowledge regarding jaywalking behavior at signalized intersections. Specifically, the research endeavors to provide a more nuanced understanding of the intricate dynamics influencing pedestrian decision-making processes and the factors contributing to jaywalking occurrences. By leveraging advanced LiDAR sensor technology and rigorous statistical analysis, the study seeks to introduce new perspectives and insights into the realm of pedestrian safety, ultimately paving the way for the development of more effective strategies and interventions aimed at mitigating the risks associated with jaywalking. Moreover, by explicitly highlighting the expected relationships between independent variables and jaywalking frequency, the study aims to contribute to the refinement and validation of existing theories while also advancing novel hypotheses for future exploration. Through this comprehensive approach, the research endeavors to make a meaningful impact on the state of knowledge surrounding pedestrian safety and jaywalking behavior, fostering a safer and more sustainable urban environment for vulnerable road users.

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MATERIALS AND METHODS

Materials

In this study, the LiDAR (Light Detection and Ranging) sensor technology was utilized as the primary tool for data collection and analysis at signalized intersections. LiDAR sensors offer several advantages for studying pedestrian behavior and jaywalking events due to their high-resolution spatial and temporal data capabilities. LiDAR sensors accurately track the movement of pedestrians within intersection areas, recording their positions and velocities with exceptional precision. This level of detail provides possibility to analyze pedestrian trajectories, assess compliance with signal indications, and identify instances of jaywalking with a high degree of accuracy. Moreover, LiDAR data can be collected continuously, allowing for comprehensive and long-term monitoring of pedestrian behavior, providing insights into variations over different times of the day, days of the week, or seasons. One significant advantage of LiDAR technology is its ability to operate effectively in various weather conditions and lighting scenarios, making it a versatile tool for year-round data collection. Unlike traditional methods that may be affected by adverse weather or low light conditions, LiDAR sensors reliably capture pedestrian behavior in diverse environments, ensuring data accuracy and consistency. Additionally, LiDAR data can be synchronized with other traffic-related data sources, such as traffic signal information or vehicle trajectories, to gain a comprehensive understanding of the interactions between pedestrians, vehicles, and signal timings. This interdisciplinary approach allows for a holistic analysis of jaywalking events, identifying potential correlations with traffic flow patterns or signal cycle lengths, and ultimately guiding evidence-based decisions to enhance pedestrian safety at signalized intersections.

Furthermore, the inclusion of LiDAR sensor technology in this study allows for real-time monitoring and assessment of pedestrian behavior at intersections. By comparing LiDAR data with signal information, instances where pedestrians cross outside designated crosswalks or against pedestrian signal indications can be identified. This synchronized approach offers insights into patterns of pedestrian non-compliance and jaywalking behavior, facilitating the implementation of automated warning systems or adaptive signal control strategies to enhance pedestrian safety.

Data sources

To ensure the accuracy and reliability of the data collected using LiDAR sensor technology, various data sources were employed in this study. These sources include:

1. Closed-circuit Television cameras (CCTVs) installed at the intersection: Recorded videos from CCTVs were used to double-check jaywalking paths provided by LiDAR sensors, ensuring the accuracy of recorded events.
2. Field observations: Road infrastructure characteristics such as the presence of medians, building entrances, side fences, vegetation on medians, and the presence of bus/taxi stops at each approach were recorded during field observations. These observations contribute to a more comprehensive understanding of factors influencing jaywalking conflicts at signalized intersections.
3. Previous studies: The accuracy of real-time traffic data collection by a LiDAR sensor was evaluated in the author's previous study (Ansariyar & Jeihani, 2023) and the results showed that the LiDAR sensor can collect the real-time jaywalking data with 99.4% accuracy rate. In order to analyze the behavior of jaywalking events and to develop statistical analysis of dependent and independent variables affecting the frequency of jaywalking, a daily database were prepared including the statistics of the frequency of jaywalking occurring in each pattern of the traffic signal controller (AM, MD, and PM patterns), the frequency of repeated signal controller phase(s) during each jaywalking event, frequency and severity of vehicle-pedestrian conflicts in each approach, weather conditions change throughout the day and at different times during jaywalking events, entering motorized vehicle volume to each approach (PCU/day), and the frequency of jaywalkers who were interested

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in walking toward the road median or public transport stations around the intersection. This previous research provides confidence in the reliability of LiDAR data for analyzing jaywalking events.

4. Daily database: A daily database was prepared to analyze the behavior of jaywalking events and develop statistical analysis of dependent and independent variables affecting the frequency of jaywalking. This database includes statistics such as the frequency of jaywalking occurring in each pattern of the traffic signal controller, frequency and severity of vehicle-pedestrian conflicts, weather conditions, motorized vehicle volume, and pedestrian preferences regarding walking toward road medians or public transport stations.

Overall, the combination of LiDAR sensor technology with complementary data sources allows for a comprehensive analysis of pedestrian behavior and jaywalking events at signalized intersections. This multidimensional approach enables evidence-based decision-making and targeted interventions to enhance pedestrian safety and improve traffic flow in urban environments.

Statistical methods

By using SPSS software, two regression models including Poisson and Negative Binomial were developed since the response variable is the number of jaywalking events per day. Poisson distributions and Poisson regressions are characterized by equidispersion, which means the mean and variance are equal (Consul & Famoye, 1992). Equation 1 shows the general mathematical form of Poisson Regression model.

$$\ln(y) = a_0 + a_1x_1 + a_2x_2 + \cdots + a_px_p \quad (1)$$

Where,

y: The dependent (response) variable
a_i: numeric coefficients, $i = 0, 1, \ldots, p$
x_i: The independent (the predictor/explanatory) variable

To determine whether the data follow the Poisson distribution and to evaluate the effectiveness of the Poisson test, the Chi-Squared Goodness-of-Fit test is used. In the Chi-Square Goodness-of-Fit test, the observed counts are compared to the expected counts based on the Poisson distribution. A p-value larger than 0.05 can result in failure to reject the null hypothesis (=The sample data follow the Poisson distribution).

In addition to Poisson regression, Negative Binomial Regression that can account for overdispersion (=when variance is greater than mean) in the data is also tested (Hilbe, 2011). Since the Negative Binomial Regression model has the same mean structure as Poisson regression and has an additional parameter to model over-dispersion, it is a generalization of Poisson regression. Compared to Poisson regression models, the confidence intervals for Negative binomial regression are likely to be wider if the conditional distribution of the outcome variable is over-dispersed (Ver Hoef & Boveng, 2007). In Negative Binomial Regression, the dependent variable (y) is modeled by mean parameter (μ) and reciprocal dispersion parameter (Ω) as shown in Equation 2. NegBin is the abbreviation of "Negative Binomial" that represents the Negative Binomial distribution, a probability distribution commonly used in regression analysis to model count data.

$$y|\mu, \Omega \sim NegBin(\mu, \Omega);$$
$$\log(\mu) = a_0 + a_1x_1 + a_2x_2 + \cdots + a_px_p \quad (2)$$

In Negative Binomial Regression, the relationship between the dependent variable (=y) and the mean parameter (=μ) along with the reciprocal dispersion parameter (=Ω) is modeled using the Negative Binomial distribution. The Negative Binomial distribution allows for the characterization of count data, such as the frequency of jaywalking events, by considering both the mean parameter and the dispersion parameter. The mean parameter represents the average count value for the dependent variable y, while the dispersion parameter accounts for the variability or overdispersion in the data.

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By incorporating the Negative Binomial distribution into the regression model, it becomes possible to account for the inherent variability in count data and effectively model the relationship between predictor variables and the frequency of jaywalking events.

Considering y has conditional probability mass function (=pmf, characterizes the distribution of a discrete random variable. It associates to any given number the probability that the random variable will be equal to that number) (NCSS), the fundamental negative binomial regression model can be expressed as shown in Equation 3.

$$\Pr(Y = y_i|\mu_i, \Omega) = \binom{y_i + \Omega - 1}{\Omega}\left(\frac{\Omega}{\mu_i + \Omega}\right)^{\Omega}\left(\frac{\mu_i}{\mu_i + \Omega}\right)^{y_i};$$
$$E(Y = y_i|\mu_i, \Omega) = \mu_i$$
$$\text{and } Var(Y = y_i|\mu_i, \Omega) = \mu_i + \frac{\mu_i^2}{\Omega} \quad (3)$$

In Equation 3,

Y: Represents the dependent variable, which in this case refers to the count data being analyzed, such as the frequency of jaywalking events.

y_i: Denotes a specific count value of the dependent variable Y.

μ_i: Represents the mean parameter associated with the negative binomial distribution, indicating the average count value for the dependent variable.

Ω: Stands for the dispersion parameter, which accounts for the variability or overdispersion in the count data.

$Pr(Y = y_i|\mu_i, \Omega)$: Indicates the conditional probability mass function (pmf) of the negative binomial distribution, representing the probability of observing a specific count value y_i given the mean parameter μ_i and dispersion parameter?Ω.

$E(Y = y_i|\mu_i, \Omega)$: Refers to the expected value or mean of the count variable Y given the mean parameter μ_i and dispersion parameter Ω.

$Var(Y = y_i|\mu_i, \Omega)$: Represents the variance of the count variable Y given the mean parameter μ_i and dispersion parameter Ω.

To analyze the goodness-of-fit of the negative binomial regression model, the Likelihood Ratio Chi-Square test is used. It is worth mentioning that in the Likelihood Ratio Chi-Square test, the overall goodness-of-fit of the model is assessed, not specific predictors or assumptions. In negative binomial model, the dispersion parameter (=θ) is analyzed that represents the degree of over dispersion. Theta (θ) measures the extra variability in the data beyond what is accounted for by the mean. A lower value of Theta suggests a better fit to the data.

The choice of LiDAR sensors stems from their inherent capability to provide high-resolution spatial and temporal data, less-used device in the state-of-the--art to study jaywalking events, and facilitating precise tracking of pedestrian movements and behaviors within signalized intersections. The decision to employ Poisson and negative binomial regression models was driven by their suitability for analyzing count data and accounting for potential over dispersion, aligning with the nature of the jaywalking event frequency data collected in this study. Moreover, the selection of these models was guided by their ability to handle the inherent complexities and non-linearity often present in transportation data, ensuring robustness and reliability. Additionally, a thorough discussion of analytical assumptions is presented, including potential sources of bias or confounding factors, such as measurement errors in LiDAR data and temporal dependencies within the dataset.

Case study description

The LiDAR sensor was installed in the north-east side of the Hillen Rd – 33rd street intersection in Baltimore city, MD. This intersection was chosen as one of the signalized intersections in Baltimore City where vehicles and pedestrians have the highest conflicts. Additionally, in this intersection, pedestrians have a significant interest in crossing outside the cross section to reach Montobello Lake in the intersection's southbound direction. As can be seen in Fig. 1, E 33rd street is a primary east-west road with two lanes in each direction and Hillen Rd is a secondary north-south road with three lanes each

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way. As shown in Fig. 1, the LiDAR sensor installed on the pole is indicated by a red circle. The LiDAR sensor collects jaywalking characteristics around the area of the E 33rd-Hillen Rd signalized intersection through its high-resolution scanning capabilities. Positioned strategically in the vicinity of the intersection, the LiDAR sensor emits laser pulses that bounce off surrounding objects, including pedestrians. By measuring the time, it takes for these pulses to return, the LiDAR sensor creates precise 3D maps of the surrounding environment, capturing the positions and movements of pedestrians with exceptional accuracy. Specifically, when pedestrians deviate from designated paths and engage in jaywalking behavior, the LiDAR sensor detects these movements and records relevant data points, such as the time interval, geographical coordinates, duration, and speed of each jaywalking event. This comprehensive data collection process enables detailed analysis of pedestrian behavior and jaywalking occurrences.

As can be seen in Fig. 1, the sensor's location was selected to capture frequent instances of jaywalking, as southbound traffic often experiences higher pedestrian volumes due to factors such as nearby residential areas, commercial establishments, or public transportation stops. Additionally, the proximity to Montebello Lake may influence pedestrian movement patterns, making it an ideal spot for detecting jaywalking behaviors. Moreover, the chosen location offers strategic advantages for integrating with existing infrastructure, such as CCTV cameras at the intersection. By collocating the LiDAR sensor with these surveillance systems, it facilitates comprehensive monitoring of pedestrian activities, enhancing overall safety surveillance capabilities at the intersection. Furthermore, the decision to position the LiDAR sensor in the southbound direction was informed by considerations of optimal coverage of the internal space of the intersection.

The heat map in Fig. 2 illustrates the number of jaywalking events detected by the LiDAR sensor in each approach from December 2022 to May 2023. According to Fig. 2, 97.7% of jaywalking events occurred in the northern approach. Due to the location of residential land-uses and Montebello Lake on the southbound of the intersection, as well as a spacious median adorned with vegetation (grass), pedestrians may cross outside the designated crosswalk on the northern approach (south-bound). The blue color in Fig. 2 indicates locations where jaywalking occurs

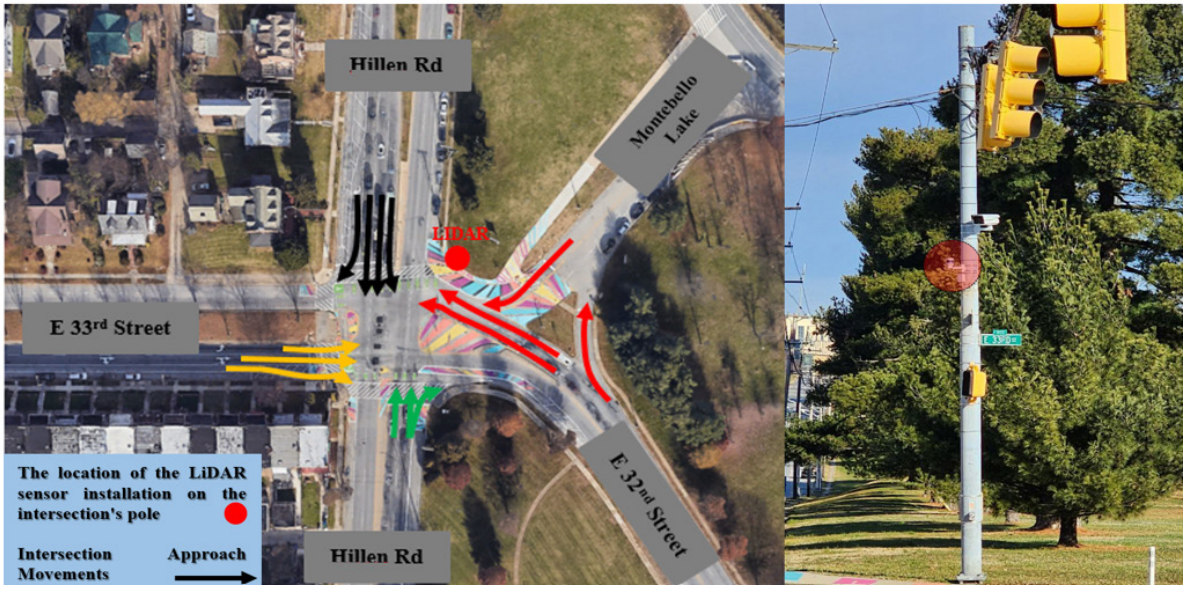

Fig. 1. Hillen Rd and E 33rd Street Intersection
Source: own elaboration.

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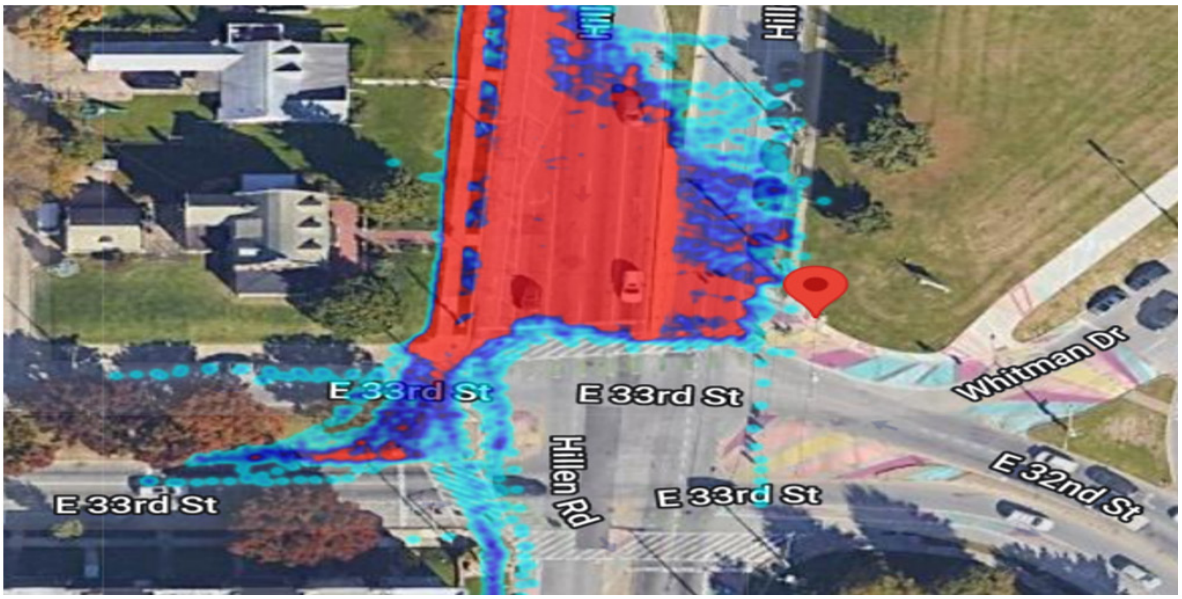

Fig. 2. Frequency Heat Map of Jaywalking Events in Diverse Intersection Approaches
Source: own elaboration.

less frequently and severely. On the other hand, red indicates a higher frequency of jaywalking events and a greater likelihood of severe conflicts between vehicles and pedestrians. As can be seen in Fig. 2, if a pedestrian crosses the road by following a path perpendicular to the direction of vehicular flow, the pedestrian will pass through some blue and some red zone. The differentiation in color signifies varying levels of risk associated with different segments of the crossing route. The blue zones suggest areas with a lower frequency of jaywalking events and, consequently, a reduced likelihood of severe conflicts between vehicles and pedestrians. These segments can be considered relatively safer for pedestrian crossings. Conversely, the red zones indicate higher frequencies of jaywalking events, highlighting areas where the risk of severe conflicts is greater. When an individual follows a path perpendicular to vehicular flow and traverses both blue and red zones, it implies that their route intersects locations with varying risk profiles. This nuanced representation allows stakeholders to pinpoint specific sections of the crossing route that may pose elevated risks and others that exhibit lower risks. From a technical perspective, this granularity in color representation on the heat map provides a spatially detailed understanding of the distribution of jaywalking incidents. The variation in colors enables a fine-grained analysis of risk along the entire crossing route, helping stakeholders identify precise locations where interventions may be needed. This tailored approach ensures that safety measures are targeted to address specific risk levels in different segments of the signalized intersection, enhancing the effectiveness of pedestrian safety interventions. Hereupon, statistical analysis of the northern approach is presented in this paper due to the significant safety concerns associated with this approach. An investigation was conducted into the trajectory of jaywalking events. The trajectory of jaywalkers over a six-month is shown in Fig. 3.

In conclusion to this section and in order to address the stages of this study with the research schema, the LiDAR sensor technology as the primary tool can accurately track the movement of pedestrians within intersection areas, recording their positions and velocities with exceptional precision. Moreover, LiDAR data can be synchronized with other traffic-related data sources, such as traffic signal information or vehicle

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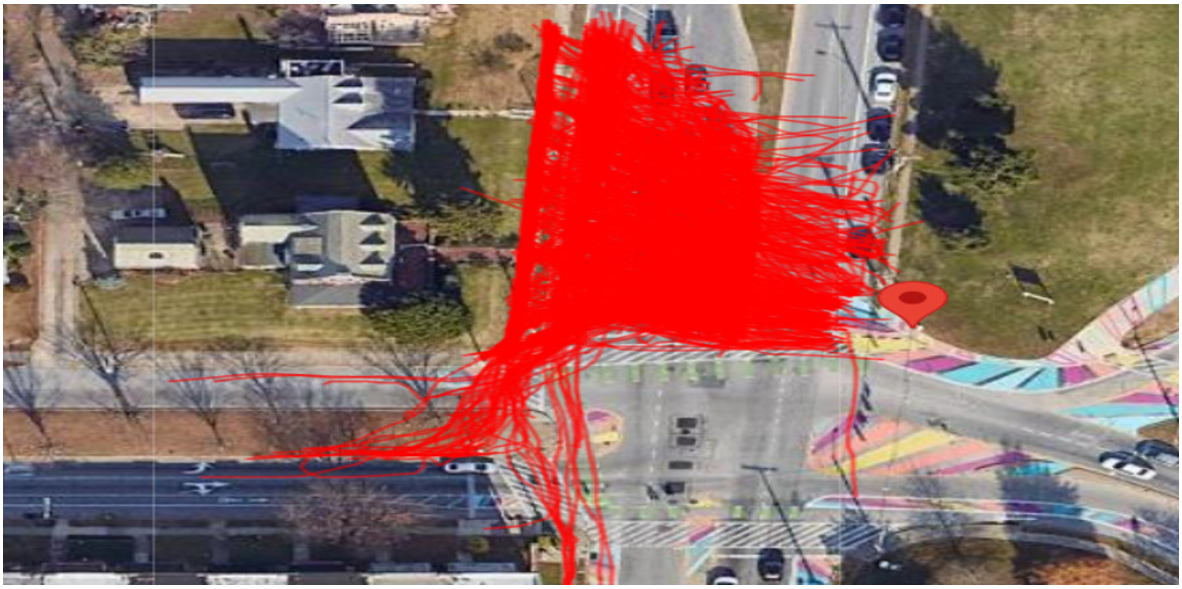

Fig. 3. Jaywalking Event Trajectories
Source: own elaboration.

trajectories, to gain a comprehensive understanding of the interactions between pedestrians, vehicles, and signal timings. This interdisciplinary approach allows for a holistic analysis of jaywalking events, identifying potential correlations with traffic flow patterns or signal cycle lengths, and ultimately guiding evidence-based decisions to enhance pedestrian safety at signalized intersections. To provide a clear visual representation of the methodology, a research schema was developed outlining the stages of the study. The stages include: (1) Data Collection Preparation, involving site selection, LiDAR sensor installation, and data synchronization setup; (2) Data Collection and Calibration, encompassing LiDAR data collection, CCTV video recording, and field observations; (3) Data Analysis and Validation, comprising trajectory analysis, cross-validation, and statistical modeling; (4) Integration and Synthesis, involving the integration of data sources and synthesis of findings; (5) Results Interpretation and Application, encompassing the interpretation of results and application of insights; and (6) Validation and Refinement, including the validation of recommendations and refinement of strategies. This structured approach ensures a comprehensive analysis of pedestrian behavior and jaywalking events, facilitating evidence--based decision-making and targeted interventions to enhance pedestrian safety and improve traffic flow at signalized intersections.

DATA ANALYSIS

Vehicle and pedestrian counts

The paper examined the average daily traffic and pedestrian counts per approach. The LiDAR sensor collected vehicle counts including cars, buses, trucks, trailers, and motorcycles, as well as pedestrian counts at 15-minute intervals. Fig. 4 illustrates the average daily vehicle counts (PCU per day), while Fig. 5 depicts the average daily pedestrian counts (in people per day) observed over a period of six months. It is worth mentioning that Fig. 5 does not include jaywalkers in the ADT of pedestrians. Considering Figures 4 and 5, the results demonstrate the considerable vehicle and pedestrian counts in the northern approach (SB) to the intersection.

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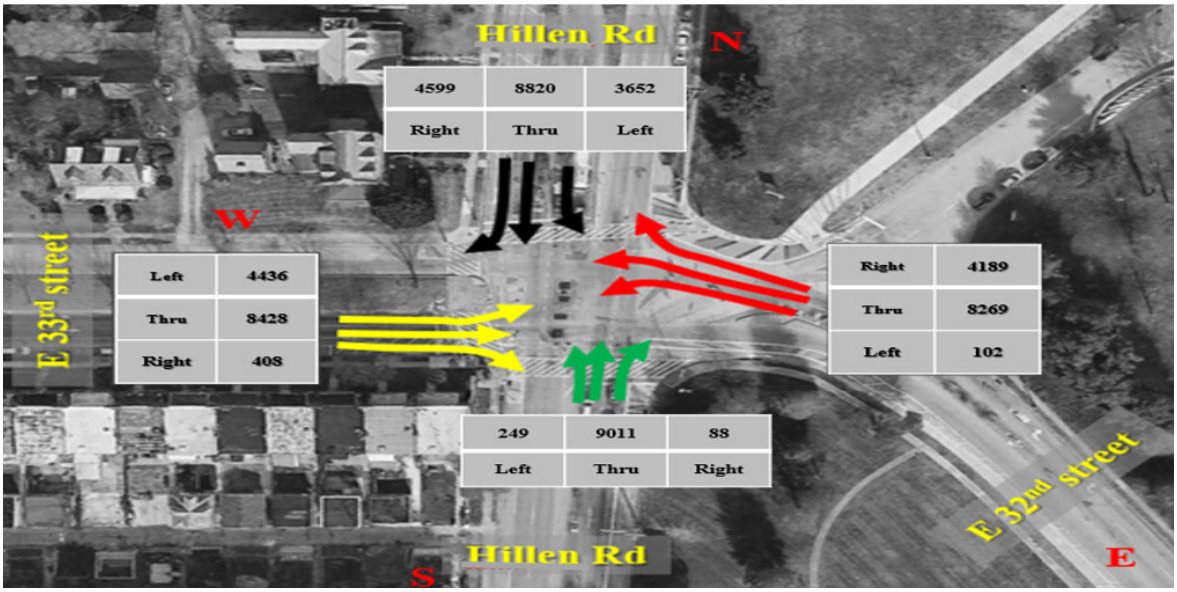

Fig. 4. Average Daily Traffic (ADT) of Motorized Vehicles at Intersection
Source: own elaboration.

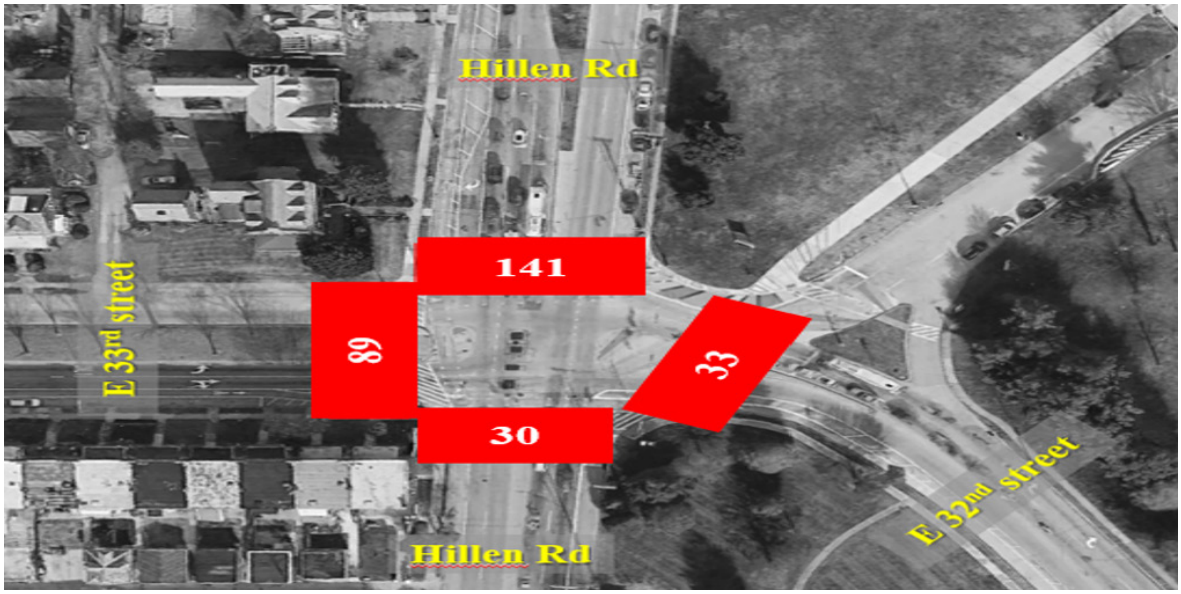

Fig. 5. Average Daily Pedestrian Traffic Counts at Intersection
Source: own elaboration.

Speed changes

At different approaches to the intersection, the speed of vehicles was monitored. A box chart of vehicle speed changes in the directions "east-west & west--east" and "north-south & south-north" is shown in Fig. 6. As can be seen in Fig. 6, the average vehicle speed in the north-south direction was changed from 33 to 49 km/hour, in the south-north direction was changed from 34 to 42 km/hour, in the east--west direction was changed from 35 to 39 km/hour, and in the west-east direction was changed from

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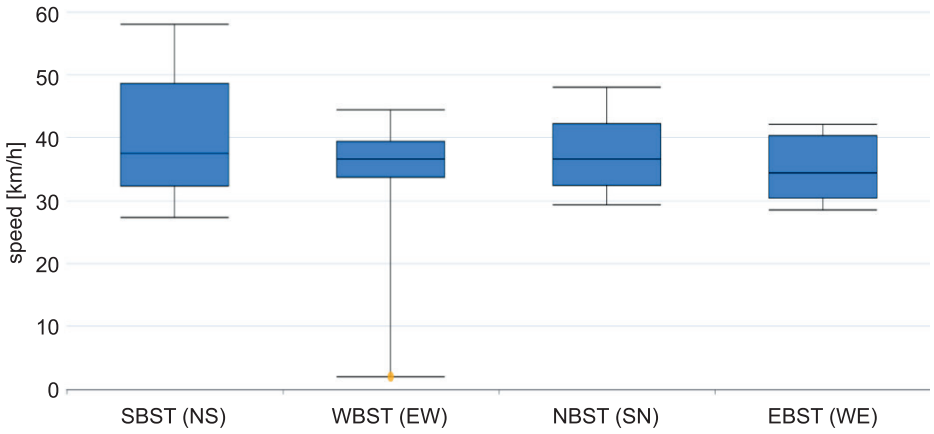

Fig. 6. Box Chart of Vehicle Speed Fluctuations
Source: own elaboration.

30 to 41 km/hour. Vehicle-pedestrian crashes are more likely to occur in north-south and south-north directions due to the higher average daily speed.

The speed of vehicles at a signalized intersection plays a crucial role in influencing the frequency of jaywalking conflicts, presenting a significant area of concern for urban traffic safety and pedestrian behavior studies. Higher vehicle speeds tend to correlate with an increased likelihood of jaywalking behavior. When vehicles are traveling at elevated speeds, pedestrians may perceive the crosswalk as less safe and hesitate to use it. This hesitation can result in pedestrians choosing to jaywalk, believing that they can cross the road more quickly and safely without having to wait for a green signal. Consequently, vehicle speed becomes a contributing factor to pedestrian non-compliance with traffic signals and crosswalks. Moreover, higher vehicle speeds also reduce the time available for drivers to react to pedestrians at crosswalks, increasing the risk of pedestrian-vehicle conflicts and crashes. This risk further discourages pedestrians from using designated crosswalks, as they may perceive them as unsafe due to the limited reaction time afforded to drivers. Therefore, mitigating the frequency of jaywalking conflicts necessitates a comprehensive approach that addresses not only pedestrian education and enforcement but also includes measures to reduce vehicle speeds, such as traffic calming strategies and improved intersection design, to create a safer environment that encourages pedestrian compliance with signalized crossings.

The frequency and severity of vehicle-pedestrian conflicts

The LiDAR sensor is capable of collecting hourly vehicle-pedestrian conflicts. Additionally, the sensor records the Post Encroachment Time (PET) values associated with these conflicts. PET refers to the time difference between the termination of encroachment by the first vehicle/pedestrian and the entrance of the second vehicle/pedestrian into the conflict zone (Ansariyar and Taherpour 2023). Non-zero PET values indicate crash proximity, while PET values of 0 indicate a crash. Lower PET values indicate a more severe crash, whereas higher PET values indicate a less severe crash. The LIDAR sensor collected 6709 vehicle-pedestrian conflicts over six months. The frequency of vehicle-pedestrian conflicts is shown in Table 1. The severity of conflicts was calculated by $\frac{1}{\sum \text{PET values}}$. The equation presented as the conflict's severity, which calculates conflict severity as the inverse of the sum of post-encroachment time (PET) values. PET is a recognized metric used to quantify the duration during which pedestrians are exposed to potential collision risk after entering a conflict zone. By summing up the PET values for

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all conflicts, the equation provides a comprehensive measure of pedestrians' overall exposure to collision risks at the intersection. Taking the inverse of this sum aligns with the concept that higher PET values correspond to lower conflict severity, as longer post--encroachment times indicate a greater safety buffer for pedestrians. Thus, by prioritizing conflicts with shorter PET values, which indicate more severe and potentially hazardous situations for pedestrians, the equation effectively quantifies conflict severity. This approach ensures that conflicts with shorter PET values contribute more significantly to the overall severity measure, emphasizing the urgency of addressing situations where pedestrians face higher collision risks within a shorter time frame.

The research utilized a predetermined PET threshold to delineate conflicts during jaywalking events at signalized intersections. The PET threshold may vary based on factors such as local traffic conditions, pedestrian volumes, and safety regulations. Typically, PET thresholds are determined based on safety standards and the desired level of risk mitigation. This study examined PET thresholds between 0 and 5. This threshold was carefully selected to identify instances where pedestrians' encroachment into vehicular space exceeded a predefined time duration, signifying potential safety risks. The incorporation of PET as a quantitative measure adds precision to the analysis, allowing for a standardized assessment of conflicts and facilitating a more nuanced understanding of pedestrian-vehicle interactions in the studied context.

This threshold was carefully selected to identify instances where pedestrians' encroachment into vehicular space exceeded a predefined time duration, signifying potential safety risks. The incorporation of PET as a quantitative measure adds precision to our analysis, allowing for a standardized assessment of conflicts and facilitating a more nuanced understanding of pedestrian-vehicle interactions in the studied context. To comprehensively measure the Post-Encroachment Time (PET) in conflicts between pedestrians and vehicles, the proposed methodology intricately incorporates the advanced capabilities of LiDAR for meticulous three-dimensional spatial data collection. The deployment of LiDAR sensors is strategically orchestrated to provide comprehensive coverage of the signalized intersection, enabling the capture of highly detailed trajectories for both pedestrians and vehicles. Subsequent trajectory analysis identifies precise instances of conflicts, delineating the exact initiation and resolution points within the spatial data. Leveraging LiDAR data, the temporal boundaries of the conflict are precisely defined, establishing the duration from conflict initiation until resolution when the pedestrian successfully clears the vehicular path. The calculation of PET involves determining the time elapsed between conflict resolution and the termination of the signal phase. This method capitalizes on the inherent high resolution and accuracy of LiDAR data, ensuring a meticulous quantification of the temporal intricacies inherent in conflicts, thereby providing a nuanced and detailed comprehension of pedestrian-vehicle interactions at signalized intersections.

Table 1 shows that more frequent and severe vehicle-pedestrian conflicts occurred in the WN (=EBL), EN (=WBR), WE (=EBT), and SN (=NBT) movements. As shown in Table 1, a significant percentage of conflicts between vehicles and pedestrians occur when either the origin or destination of the movement is in the north of the intersection. Considering the frequency and severity of conflicts in Table 1, the movements WN or EBL (=1381 conflicts with the severity 538.3), EN or WBR (=967 conflicts with the severity 353.5), and SN or NBT (=809 conflicts with the severity 299.1) have higher probability of vehicle-pedestrian crashes. The hourly frequency of vehicle-pedestrian conflicts was analyzed. As shown in Fig. 7, the intervals 14:00-15:00 PM (=10.2% of total conflicts), 08:00-09:00 AM (=9.4% of total conflicts), and 15:00-16:00 PM (=8.9% of total conflicts) were recognized as critical daily intervals.

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Table 1. Frequency and Severity of Recorded Conflicts by LiDAR Sensor

Movement*	Leading Object (Vehicle or Pedestrian)		Following Object (Vehicle or Pedestrian)		Total (Sum of Leading and Following Objects)	
	Frequency of collected conflicts	Severity of conflicts (1/PET)	Frequency of collected conflicts	Severity of conflicts (1/PET)	Frequency of collected conflicts	Severity of conflicts (1/PET)
EN	597	237.96	370	115.52	967	353.48
EW	445	180.39	128	40.77	573	221.17
ES	6	2.51	13	3.57	19	6.08
NW	452	196.5	307	90.01	759	286.51
NS	405	158.06	157	49.99	562	208.05
NE	480	214.32	192	61.51	672	275.84
WS	26	9.94	18	5.19	44	15.13
WE	642	279	226	73.48	868	352.74
WN	845	353.3	536	184.89	1381	538.22
SE	5	2.892	3	0.867	8	3.76
SN	625	238.212	184	60.884	809	299.09
SW	36	14.04	11	3.148	47	17.18
SUM	4564	1887.43	2145	689.86	6709	2577.29

* EN (=WBR), EW (=WBT), ES (=WBL), NW (=SBR), NS (=SBT), NE (=SBL), WS (=EBR), WE (=EBT), WN (=EBL), SE (=NBR), SN (=NBT), SW (=NBL)

Source: own elaboration.

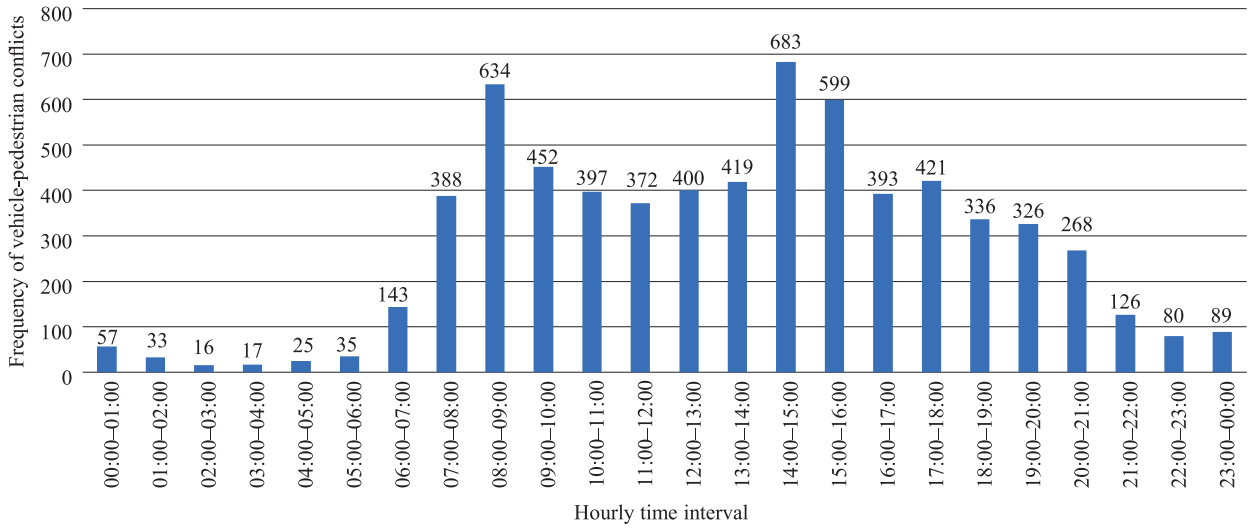

Fig. 7. Hourly Frequency of Vehicle-Pedestrian Conflicts, December 2022 – May 2023

Source: own elaboration.

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The frequency of jaywalking events

LiDAR sensor collected 1000 jaywalking events over a six-month interval, with a significant proportion occurring in the northern approach (=southbound) to the intersection. As shown in Fig. 8, the intervals 15:00–16:00 PM (=12.8% of total jaywalking events), 16:00–17:00 PM (=11.8% of total events), and 09:00-10:00 AM (=9.7% of total events) were recognized as critical daily intervals. As shown in Fig. 3, the trajectory of jaywalking events highlighted that a significant percentage of jaywalking events occurred in the southbound direction between residential land uses and the lake. Despite the pedestrian signal working well on all approaches to the intersection, pedestrians prefer to walk outside of the cross section in northern approach (southbound).

Traffic signal controller at Hillen Rd – E 33rd street intersection

The traffic signal at Hillen Rd – E 33rd street intersection is controlled as a pre-timed signal with three daily patterns including morning (AM), mid-day (MD), and afternoon (PM). The traffic signal is controlled from 00:00 – 06:30 by MD pattern with 110 sec cycle time and 46 sec offset, from 06:30 – 09:00 by AM pattern with 165 sec cycle time and 79 sec offset, from 09:00 – 14:30 by MD pattern, from 14:30 – 19:00 by PM pattern with 180 cycle time and 98 sec offset, and from 19:00 – 00:00 by MD pattern. The optimization of pedestrian crossing timings, phase splits, and phase sequences at signalized intersections is a critical aspect of traffic management and safety. When signal timings do not align with the natural flow of pedestrian activity or fail to accommodate the needs of pedestrians, it can create frustration and impatience, compelling individuals to take unnecessary risks by crossing the road outside designated crosswalks. For instance, during peak traffic hours, if the pedestrian phase is too short or infrequent, pedestrians may resort to jaywalking to save time, as they perceive the official crossing time as excessive. This misalignment between signal timing and pedestrian behavior can result in dangerous situations and heightened risks of crashes. In the United States, according to the Manual on Uniform Traffic Control Devices (MUTCD), which provides standards for traffic control devices including pedestrian signals, the "walk interval" for pedestrian is suggested a minimum duration of 7 seconds. This allows pedestrians to begin crossing the road safely. After the "Walk" interval, the MUTCD recommends that the "Flashing Don't Walk" interval should provide

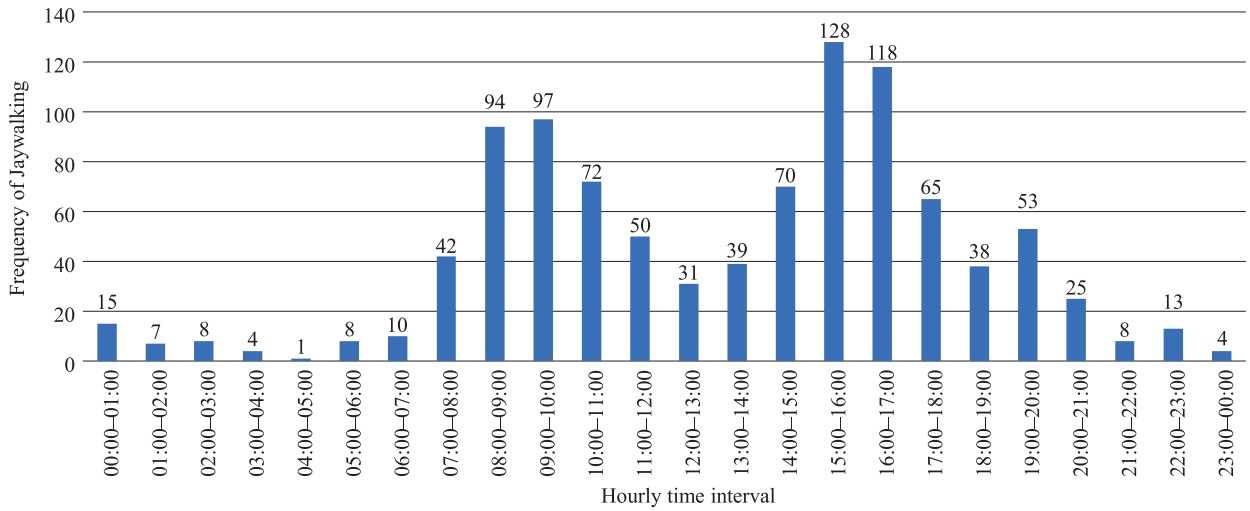

Fig. 8. Hourly Frequency of Jaywalking Events, December 2022 – May 2023
Source: own elaboration.

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a minimum of 3.5 feet per second of walking speed for pedestrians to complete their crossing. For example, if the road is 40 feet wide (=12.192 meters), the flashing "Don't Walk" interval should be a minimum of 11.4 seconds (40 feet / 3.5 feet per second). After the "Flashing Don't Walk" interval, there is often a clearance interval where the signal displays a solid "Don't Walk" indication. This allows any pedestrians who have already started crossing to finish safely. At Hillen Rd – E 33rd street intersection, the minimum "walk interval", flashing "don't walk" interval, and "acceptable clearance interval" are included.

Moreover, the issue of jaywalking frequency can also be exacerbated by inadequate synchronization between vehicle and pedestrian phases. When pedestrian crossings are not coordinated with vehicle green phases, pedestrians may be left waiting for extended periods, leading to impulsive decisions to jaywalk during gaps in traffic. Furthermore, during off-peak hours, signalized intersections often prioritize vehicular flow with longer green times, leaving pedestrians with limited opportunities to cross safely. In such cases, pedestrians may resort to jaywalking as a means of avoiding extended waiting times, further emphasizing the need for a comprehensive understanding of pedestrian behavior and careful consideration of pedestrian-oriented timing plans. It is worth mentioning that there has been an acceptable synchronization between vehicle and pedestrian phases at the intersection of Hillen Rd and E 33rd street. Fig. 9 shows how different approaches are controlled by the phases of the traffic signal controller.

Table 2 shows the frequency and severity of vehicle-pedestrian conflicts and the frequency of jaywalking in different phases of the traffic signal controller.

Table 2. Characteristics of Traffic Signal Controllers at E 33rd – Hillen Rd Intersection

Time interval	Signal Controller pattern	Signal Cycle Time (sec)	Frequency of jaywalking	Frequency of Veh-Ped Conflicts	Severity (1/PET) of Veh-Ped Conflicts
00:00–06:30	MD	110	53	255	131.8
06:30–09:00	AM	165	233	1092	549.2
09:00–14:30	MD	110	262	2382	888.9
14:30–19:00	PM	180	350	2091	788.7
19:00–00:00	MD	110	102	889	218.6

Source: own elaboration.

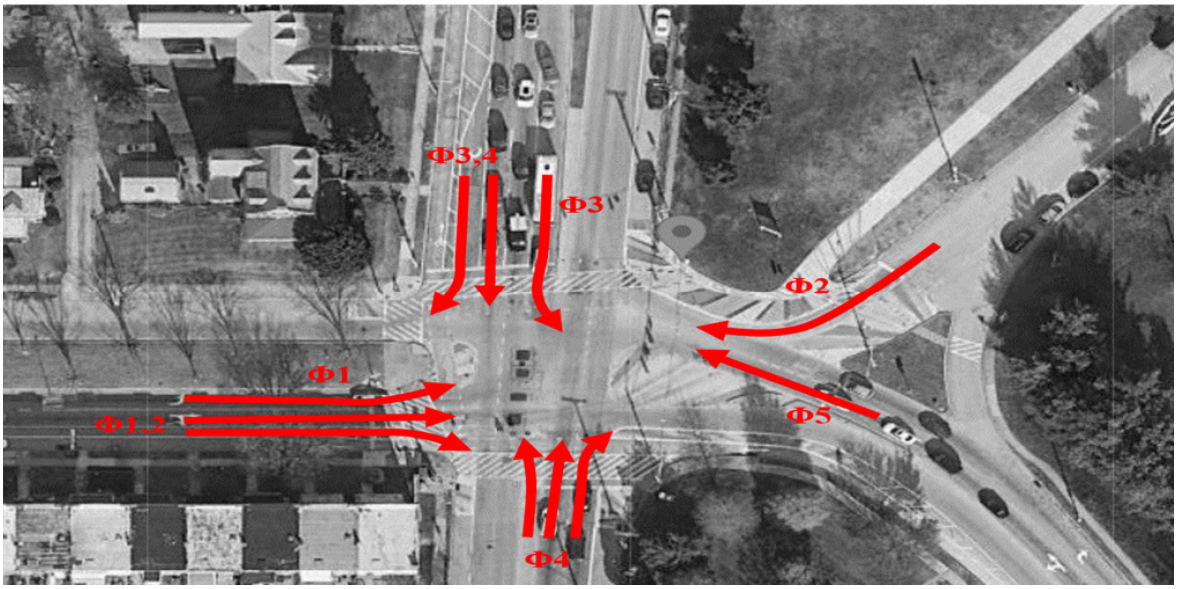

Fig. 9. Phases of Traffic Signal Controller at Hillen Rd - E 33rd Street Intersection
Source: own elaboration.

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As shown in Table 2, 2382 conflicts with severity 888.9 were collected in time interval 09:00 AM – 14:30 PM. The results emphasized that this particular time interval was crucial for jaywalkers due to the significant frequency and severity of vehicle-pedestrian conflicts. It is not entirely correct to claim that a higher cycle length at a traffic signal usually corresponds to heavier demands at intersections and that pedestrians are less likely to jaywalk in such situations. The relationship between cycle length and pedestrian behavior is more nuanced and depends on various factors. While it is true that longer cycle lengths can indicate a higher volume of traffic, they may not necessarily discourage jaywalking among pedestrians. In some cases, longer cycle lengths can lead to frustration and impatience among pedestrians, especially during peak hours when there is a substantial wait time for the pedestrian crossing signal to change. This can actually increase the likelihood of jaywalking, as pedestrians may perceive the official crossing times as too lengthy and decide to take risks by crossing outside designated crosswalks. Conversely, shorter cycle lengths might not always correspond to lighter demands at intersections. Shorter cycles are often implemented to prioritize pedestrian flow and reduce waiting times, which can be beneficial for pedestrian safety. Pedestrians are more likely to use designated crosswalks when they feel that the signal timing is responsive to their needs. Therefore, the relationship between cycle length and jaywalking is influenced by multiple factors, including pedestrian behavior, traffic volume, signal design, and urban context. It is essential to consider these factors comprehensively when designing signal timing plans to effectively address jaywalking concerns and promote pedestrian safety.

STATISTICAL MODELING RESULTS

Different independent variables were evaluated in order to establish a logical relationship to daily frequency of jaywalking events as dependent variable. The trajectory of each jaywalking event (=1000 events in total) during a six months' interval was evaluated. The location of trip attraction land-uses around the intersection, the attractiveness of vegetation in the median, the traffic signal controller pattern when a jaywalking event occurs, the phase(s) of the traffic signal controller when a jaywalking event occurs, the frequency and severity of vehicle-pedestrian conflicts, the vehicles and pedestrians volume entering different approaches where the jaywalking event occurs, the ratio of jaywalkers, and the weather conditions during each jaywalking event were investigated. Jaywalkers who walk towards the median and pass through it are considered to attract to the median. In order to identify the highly correlated independent variable(s) to the frequency of jaywalking, Pearson correlation test was conducted and the results showed there is a highly correlated relationship between the frequency of jaywalking event and the traffic signal control pattern (0.264^{**}), frequency of vehicle-pedestrian conflicts (0.678^{**}), severity of vehicle-pedestrian conflicts (0.712^{**}), walk toward the median (0.610^{**}), and the vehicle volumes/flow (0.956^{**}). A numerical value in parenthesis indicates the significance of each independent variable, and two stars indicate that there is less than 1% error for each independent variable. Table 3 shows the independent variables used in the statistical models. Two statistical regression models are explained below. It is worth mentioning that the distance to the crosswalk, time of day, and active phase at the controller were all taken into account based on the jaywalking events' trajectories.

The variability of traffic signal variables on a daily basis is justified by the dynamic nature of traffic patterns and signal control strategies. Traffic signals often operate under different signal plans based on time-of-day, accommodating variations in traffic demand. These variations can include adjustments in signal cycle length, phase sequences, and signal timings to optimize traffic flow. Furthermore, signal plans may be adapted for specific days of the week or to address events, leading to variations in signal operations. This adherence to traffic engineering principles ensures that signalized intersections are efficiently managed, and the study's consideration of daily variations in traffic signal variables aligns with standard practices in traffic signal control and

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Table 3. Statistical Analysis of Independent Variables

Independ Variable	Definition	Mean*	Standard Deviation*
Traffic Signal Controller Patterns	The pattern of traffic signal controller (AM, MD, and PM) when jaywalking occurs	AM: 1.39 MD: 2.54 PM: 2.13	AM: 1.60 MD: 2.41 PM: 5.10
Traffic Signal Phases	The phase(s) of the traffic signal controller when jaywalking occurs	Ø1: 2.59 Ø1,2: 1.0 Ø2: 1.18 Ø3: 0 Ø3, 4: 6.05 Ø4: 2.49 Ø5: 2.46	Ø1: 1.55 Ø1,2: 0 Ø2: 0.4 Ø3: 0 Ø3, 4: 6.35 Ø4: 1.37 Ø5: 1.43
Frequency of Vehicle-Pedestrian Conflicts	Number of vehicle-pedestrian conflicts collected by LiDAR when jaywalking occurs	3.15	5.36
Severity of vehicle-Pedestrian Conflicts	The severity $\left(\frac{1}{\sum PET}\right)$ of vehicle-pedestrian conflicts collected by LiDAR when jaywalking occurs	0.77	1.24
Weather Condition	When jaywalking occurs, the frequency of the weather conditions	Sunny: 2.22 Cloudy: 2.76 Overcast: 0.58 Rainy: 0.48 Snowy: 0.01	Sunny: 4.30 Cloudy: 5.58 Overcast: 1.50 Rainy: 1.48 Snowy: 0.08
Vehicles Volume	Vehicle counts (flow)	4354	3603.6
Walk Toward the Median	Walking toward the median based on jaywalkers' trajectory	Yes: 5.34 No: 0.72	Yes: 5.73 No: 1.34
Pedestrians Volume	Pedestrian counts (pedestrian flow)	73.31	27.73
Jaywalker's Ratio	Jaywalker frequency divided by pedestrian frequency	0.08	0.07

* Each independent variable's mean and standard deviation based on the collected dataset.
Source: own elaboration.

management. The incorporation of AM (morning), MD (midday), and PM (afternoon) signal controller patterns is essential for a comprehensive analysis of daily variations in pedestrian behaviors at signalized intersections. The temporal segmentation of signal controller patterns aligns with real-world traffic dynamics, where distinct traffic conditions exist during different parts of the day. Through the independent analysis of AM, MD, and PM periods, variations in traffic demand, pedestrian volumes, and signal timings unique to each time segment are considered. This methodology amplifies the precision of the examination, enabling the identification of subtle patterns in jaywalking behavior linked to distinct signal controller configurations throughout the day.

Poisson regression model

The Poisson distribution represents the probability of a given number of cases happening in a set period of space or time if these cases happen at an identified constant mean rate. Several models were developed based on the frequency of jaywalking events as the dependent variable and the highest significant Poisson model was identified. Based on the p-values

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of independent variables and goodness-of-fit, Table 4 shows the proposed Poisson model results. As shown in Table 4, two categories for the walk toward the median (Yes as Category 1, and No as Category 2) were defined. Additionally, three categories were considered for the traffic signal controller pattern including AM as category 1, MD as category 2, and PM as category 3. The overall results of the model show that all error values are within 5% confidence intervals for all independent variables, indicating that the proposed Poisson regression model is accurate. As can be seen in Table 4, a significant relationship between the frequency of jaywalking events and independent variables e.g., traffic signal controller phases, frequency of vehicle-pedestrian conflicts, and weather condition was not obtained. Hereupon, these variables were excluded from the final model. In the statistical analysis, pedestrian volume was also taken into account. However, this variable error (p-value) exceeded 5%. Hereupon, pedestrian volume was excluded from the final model. Taking into account the limited amount of data for jaywalkers who are not interested in walking towards the median (category 2 – less than 2% of total data) and traffic signal controller pattern in the afternoon peak hour (PM) (category 3 – less than 15% of total data), the results indicated that changes in these two categories do not affect the frequency of jaywalking events.

Negative binomial regression model

A negative binomial regression model has the same form as a Poisson regression model. Unlike the Poisson distribution, the variance and the

Table 4. Results of Poisson Regression Model

Parameter Estimates										
Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	1.227	.2100	.816	1.639	34.149	1	<.001	3.412	2.261	5.149
[Walk toward the median=1]	.336	.1678	.007	.665	4.010	1	.045	1.399	1.007	1.944
[Walk toward the median =2]	0[a]	.	.	.	.	.	.	1	.	.
Severity of Veh-Ped Conflicts	.183	.0113	.161	.206	265.867	1	<.001	1.201	1.175	1.228
[Traffic Signal Controller Pattern=1]	-.593	.0917	-.772	-.413	41.800	1	<.001	.553	.462	.662
[Traffic Signal Controller Pattern=2]	-.422	.0813	-.581	-.263	26.989	1	<.001	.656	.559	.769
[Traffic Signal Controller Pattern=3]	0[a]	.	.	.	.	.	.	1	.	.
Vehicles Volume (Flow)	.003	.0011	.001	.005	8.934	1	.003	1.003	1.001	1.005

Dependent Variable: Frequency of Jaywalking events

Model: (Intercept), Walk toward the median, Severity of vehicle-pedestrian conflicts, Traffic signal controller pattern, Vehicles volume (flow)

a. Set to zero because this parameter is redundant.

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mean are not equivalent. The variance of a negative binomial distribution is a function of its mean and has an additional parameter as called the dispersion parameter. Negative binomial distributions converge to Poisson distributions as the dispersion parameter increases. As shown in Table 5, the overall results of the model show that all error values are within 5% confidence intervals. Additionally, a significant relationship between the frequency of jaywalking events and independent variables e.g., traffic signal controller phases, severity of vehicle-pedestrian conflicts, and weather condition was not obtained. Hereupon, these variables were excluded from the final model.

As shown in Tables 4 and 5, the exclusion of weather conditions as a proportion in the model is justified by the statistical analysis, which revealed that the correlation between weather and jaywalking behavior lacked a high level of significance in both Poisson and negative binomial models. The decision to not represent weather as a proportion is based on the observation that this variable did not exert a substantial influence on the variation in jaywalking incidents. Prioritizing variables with stronger correlations and higher significance levels enhances the focus on factors that more significantly impact jaywalking behavior at signalized intersections, ensuring the model's effectiveness in capturing meaningful relationships. The limited correlation between weather conditions and the frequency of jaywalking events in the presented analysis can be attributed to several key factors. Firstly, pedestrians' decision to engage in jaywalking may be influenced more strongly by factors such as traffic signal patterns, pedestrian volumes, and vehicular flow, which might overshadow the impact of weather conditions. Additionally, the study area's climate may not exhibit extreme variations, diminishing the significance of weather in relation to jaywalking incidents. These factors collectively contribute to the observed lower significance of weather in the proposed Poisson and negative binomial models, leading to the decision not to represent it as a proportion in the analysis. The exclusion of pedestrian volume as a variable in the presented analysis is justified by the intricate nature of pedestrian behavior at signalized intersections. While pedestrian volume is undoubtedly a crucial factor, its direct correlation with the frequency of jaywalking events may be influenced by various nuanced dynamics. One reason for the decision is that the presence or absence of jaywalking incidents is likely not solely determined by the absolute number

Table 5. Results from Negative Binomial Regression Model

Parameter Estimates										
Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	1.261	.2096	.850	1.672	36.188	1	<.001	3.529	2.340	5.322
[Traffic Signal Controller Pattern=1]	-.645	.0908	-.823	-.467	50.436	1	<.001	.525	.439	.627
[Traffic Signal Controller Pattern=2]	-.458	.0803	-.616	-.301	32.604	1	<.001	.632	.540	.740
[Traffic Signal Controller Pattern=3]	0[a]	.	.	.	.	.	.	1	.	.
[Walk toward the median =1]	.353	.1677	.024	.682	4.430	1	.035	1.423	1.025	1.977
[Walk toward the median =2]	0[a]	.	.	.	.	.	.	1	.	.
Frequency of Veh-Ped Conflicts	.042	.0026	.037	.047	258.375	1	<.001	1.043	1.037	1.048
Vehicles Volume (Flow)	.003	.0011	.001	.005	8.577	1	.003	1.003	1.001	1.005

a. Set to zero because this parameter is redundant.
Source: own elaboration.

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of pedestrians but rather by complex interactions involving other variables such as traffic signal patterns, vehicle volumes, and specific temporal conditions. Moreover, the observed lower correlation between pedestrian volume and jaywalking events may be attributed to the influence of traffic control measures and signal timings, which play a substantial role in regulating pedestrian movements. Pedestrian behaviors might be more responsive to signal changes and vehicular flow than solely contingent on the overall volume of pedestrians.

Optimal model

The Likelihood Ratio (LR) test was conducted to determine the most efficient model between Poisson and negative binomial regression models. As can be seen in Table 6, the likelihood ratio chi-square provides a test of the overall model by comparing it to a model without any predictors (a "null" model). In the comparison of calculated LR statistics between Poisson and negative binomial tests, the greater LR statistic implies a significantly better fit for the model. Additionally, models with low AIC are generally preferred over models with high AIC, as a general statement. Hereupon, considering the higher Chi--Square value and lower AIC, it is clear that the Poisson model provides better results.

DISCUSSION

As can be seen in the column Exp(B) of Table 4, jaywalking frequency can increase the severity of vehicle-pedestrian conflicts by 20% that showed the severity of vehicle-pedestrian conflicts appears to be significantly correlated with the frequency of jaywalking events in the Poisson model. Jaywalking in the morning and mid-day signal controller's pattern is 44.7% and 34.4% less compared to the PM's pattern, respectively. Lastly, there is a 39.9% higher probability that Jaywalkers will walk toward the median, resulting in an increase in frequency of jaywalking. In other

Table 6. Overall Results of Poisson and Negative Binomial Regression Models

Model	Independent variables	Wald Chi-Square	df	Sig	Likelihood Ratio Chi-Square	Deviance	Finite Sample Corrected AIC (AICC)b
Poisson	(Intercept)	43.900	1	<.001	311.714[a]	416.343	980.870
	Walk toward the median	4.010	1	.045			
	Severity of veh-ped conflicts	265.867	1	<.001			
	Traffic signal controller pattern	50.152	2	<.001			
	Vehicles volume (flow)	8.934	1	.003			
Negative binomial	(Intercept)	44.787	1	<.001	305.392[a]	422.665	987.192
	Traffic signal controller pattern	61.171	2	<.001			
	Walk toward the median	4.430	1	.035			
	Frequency of veh-ped conflicts	258.375	1	<.001			
	Vehicles volume (flow)	8.577	1	.003			

a. For df=5 and sig <.001
b. the AICC is interpreted as the sum of the" goodness of fit to the model" and the" model complexity penalty"
Source: own elaboration.

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word, this finding suggests that while vehicle volume does play a role in shaping pedestrian behavior, it is not the sole or predominant factor influencing jaywalking occurrences. This interpretation was provided based on the statistical analysis results that has examined the multifaceted nature of jaywalking behavior. Several other factors, such as pedestrian signal timing, infrastructure design, pedestrian perceptions of safety, and local enforcement practices, can have a more substantial impact on the occurrence of jaywalking. Therefore, the slight influence of vehicle volume, as indicated in the sentence, underscores the importance of considering a comprehensive set of factors when addressing jaywalking behavior and designing effective interventions to enhance pedestrian safety. The negative binomial model (Table 5) showed that the frequency of vehicle--pedestrian conflicts is significantly correlated with the frequency of jaywalking events. The frequency of jaywalking events is increased by 42.3% due to vegetation in the median. The Poisson model also yields similar results regarding the effect of vegetation in the median. The frequency of jaywalking can increase the frequency of vehicle-pedestrian conflicts by 4.3%. Jaywalking in the morning and mid-day signal controller's pattern is 47.5% and 36.8% less compared to the PM's pattern, respectively.

In order to compare the goodness-of-fit of Poisson and negative binomial regression models, the likelihood ratio (LR) Chi-Square test was conducted. In a Likelihood Ratio Chi-Square test, the observed frequency is compared with the expected frequency. The test compares the fit of two models so that the null hypothesis is that the smaller model is "best", it is rejected when the test statistic is large. Stronger support is indicated by a higher likelihood ratio. Considering the outcome of the Poisson model, this model better fits the data. Consequently, the Poisson model revealed that traffic signal controller patterns, jaywalker's interest walking toward the median, frequency of vehicle-pedestrian conflicts, and vehicles volume (flow) were correlated to jaywalking frequency.

The results of the statistical analysis from both the Poisson and negative binomial regression models provide valuable insights into the relationship between jaywalking behavior and the severity of vehicle--pedestrian conflicts at signalized intersections. In the Poisson model, the Exp(B) values in Table 4 indicate that jaywalking frequency can increase the severity of vehicle-pedestrian conflicts by 20%. This finding underscores the significant correlation between jaywalking events and the occurrence of conflicts between vehicles and pedestrians. Interestingly, the analysis also reveals variations in jaywalking frequency based on the signal controller's pattern, with jaywalking being 44.7% and 34.4% less prevalent during morning and mid-day patterns compared to the PM pattern. Furthermore, a 39.9% higher probability of pedestrians walking toward the median is associated with an increase in jaywalking frequency. These findings suggest that while vehicle volume plays a role in shaping pedestrian behavior, it is not the sole or predominant factor influencing jaywalking occurrences. This interpretation is consistent with previous studies highlighting the multifaceted nature of jaywalking behavior, wherein factors such as pedestrian signal timing, infrastructure design, pedestrian perceptions of safety, and local enforcement practices can have a more substantial impact on jaywalking occurrences.

The negative binomial model, as presented in Table 5, corroborates the findings of the Poisson model regarding the correlation between jaywalking frequency and the frequency of vehicle-pedestrian conflicts. Additionally, the negative binomial model highlights the impact of vegetation in the median, indicating a 42.3% increase in jaywalking events associated with its presence. Consistent with the Poisson model, the negative binomial model also demonstrates variations in jaywalking frequency based on signal controller patterns, with morning and mid-day patterns exhibiting lower levels of jaywalking compared to the PM pattern.

To assess the goodness-of-fit of the Poisson and negative binomial regression models, a Likelihood Ratio (LR) Chi-Square test was conducted. The results indicate that the Poisson model better fits the data, suggesting its superiority in explaining the relationship

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between jaywalking frequency and associated factors. Specifically, the Poisson model reveals that traffic signal controller patterns, pedestrians' inclination to walk toward the median, frequency of vehicle-pedestrian conflicts, and vehicle volume (flow) are correlated with jaywalking frequency.

In synthesizing the results gained from this study with findings from other research studies in the state-of-the-art, it becomes evident that jaywalking behavior is influenced by a complex interplay of factors. This study's emphasis on factors like signal controller patterns and pedestrian behavior tendencies aligns with previous research studies highlighting the multifaceted nature of jaywalking behavior. Notably, urban design, land use characteristics, and cultural norms have been identified as significant influencers in shaping pedestrian behavior. By contextualizing the findings within this broader framework, the study underscores the intricate interplay between various environmental and social factors in influencing jaywalking occurrences. The interpretation of these findings in the context of urban planning underscores their practical relevance, particularly in guiding the development of targeted interventions aimed at enhancing pedestrian safety. For instance, the identification of specific factors influencing jaywalking frequency provides valuable insights for optimizing crosswalk layouts to improve visibility and accessibility for pedestrians. Furthermore, the synchronization of pedestrian signal timings with vehicular phases can be strategically implemented to facilitate safer pedestrian crossings and minimize conflicts with vehicular traffic. In the realm of road infrastructure design, the study's insights offer opportunities for integrating pedestrian-friendly features into roadway environments. This may entail the incorporation of pedestrian amenities such as well-marked crosswalks, pedestrian islands, and refuge areas to enhance pedestrian safety and comfort. Additionally, strategic placement of vegetation can serve as a natural deterrent to jaywalking behaviors, effectively guiding pedestrian movement and promoting adherence to designated crossing areas. Overall, by considering the broader contextual factors and practical implications, the study contributes to the advancement of strategies aimed at creating safer and more pedestrian-friendly urban environments.

CONCLUSIONS

Jaywalking poses many risks, including injury, death, and traffic congestion. In order to cross the roads safely, pedestrians should always use crosswalks and look both ways before proceeding. The conclusion of this study underscores the imperative for a comprehensive strategy to mitigate the inherent risks associated with jaywalking, encompassing injuries, fatalities, and traffic disruptions. In addressing this concern at signalized intersections, the focus must prioritize pedestrian safety while minimizing adverse effects on traffic flow. The proposed solutions center on promoting pedestrian compliance with crosswalks and adherence to proper pedestrian signal indications. Essential to this approach is the role of public education campaigns in instilling the significance of utilizing designated crosswalks for secure road crossing, underscoring advantages such as heightened visibility to drivers and reduced exposure to traffic hazards. Furthermore, well-crafted crosswalks not only serve as visual guides but also contribute to an enhanced overall pedestrian experience, fostering increased safety and convenience. Moreover, the alignment of pedestrian signal timings with vehicular phases, particularly during peak hours, serves to minimize waiting times and encourage synchronized pedestrian behavior. The multifaceted nature of addressing jaywalking at signalized intersections necessitates a holistic strategy that integrates education, infrastructure enhancements, and effective enforcement. The concerted efforts towards fostering pedestrian adherence to crosswalks and synchronizing signal timings with pedestrian needs are pivotal for fostering a safer road environment and reducing jaywalking incidents.

Pedestrian crossing behavior is strongly influenced by human factors and traffic circumstances. The pedestrian's perception-judgment-decision-action process determines when and where to cross.

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An individual's crossing decision is influenced by a number of factors (e.g., origin and destination, complexity and length of route), infrastructure (e.g., pedestrian facilities, road geometry, and traffic conditions), and individual characteristics (e.g., age, gender, and safety awareness). According to the nature of human behavior, crossing behavior is subject to a significant amount of subjectivity and randomness. As a result, pedestrian crossing behavior may become risk-taking and result in conflicts with vehicles. Pedestrians will make their most satisfactory decision based on the type and location of the crossing facility. As a result, pedestrian behavior may be changed to do jaywalking on a case-by-case basis. To study jaywalking behavior at signalized intersections and in order to improve the safety of pedestrians as one of the vulnerable road users, a LiDAR sensor was installed at the intersection of Hillen Rd and E 33rd Street in Baltimore city. The LiDAR sensor can record the jaywalking events, including the time interval, the geographical coordinates, the duration, and the speed of each jaywalking event. The LiDAR sensor is able to recognize each jaywalking event from the moment the pedestrian attempts to walk out of the crosswalk to the moment the pedestrian terminates the jaywalking. Due to a recognized gap in the state-of-the-art and as the key contribution of this research, this paper attempted to investigate how the timing and phasing of the traffic signal controller and the pattern of signal controller affect the frequency of jaywalking at signalized intersections. In addition to the traffic signal controller characteristics, the paper highlighted a variety of highly correlated independent factors, including vehicle-pedestrian conflict frequency and severity, weather conditions, the volume of vehicles entering each approach, and the interest of jaywalkers toward vegetation-covered medians.

The inherent risk of being hit by other motorized vehicles passing through the intersection has risen as a result of jaywalking. Hereupon, the LiDAR sensor installed at the Hillen Rd – E 33rd street intersection has accurately collected the real-time conflicts between vehicles and pedestrians. In order to provide a safety analysis for pedestrians, the frequency of jaywalking events over a six-month interval from December 2022 to May 2023 was examined. LiDAR data showed 1000 jaywalkers, and 97.7% of total jaywalkers were found in the northern approach (=southbound) to the intersection. The paper emphasized the safety of the southbound due to safety concerns. Jaywalkers' trip origins and destinations, jaywalker's trajectories in terms of accessing to land-uses and public transport stops around the intersection, and the frequency and severity of vehicle-pedestrian conflicts were assessed. A daily-based dataset including the independent variables affecting the frequency of jaywalking was obtained and two statistical regression models including Poisson, and negative binomial were developed. Furthermore, pedestrian trajectories revealed that a significant percentage of pedestrians prefer to walk toward the median; this may lead to more jaywalking and more severe conflicts between vehicles and pedestrians. Vehicle-pedestrian conflicts can be made more severe and frequent by 20% and 4.3%, respectively, when jaywalking occurs more frequently. As a result of jaywalkers, drivers may be forced to abruptly brake, and causing disruptions to traffic flow. Consequently, traffic can back up and crashes can occur. Jaywalking causes pedestrian injuries, lead to deaths, and clog up traffic. Jaywalking can be prevented by being aware of the surroundings and following road rules. The frequency of jaywalking may be reduced by educating pedestrians only cross in crosswalks, providing them with safety equipment that alarms by audible or visible warnings, and providing real-time dynamic pedestrian safety messages to vehicles via roadside units (RSUs) that alert the location of pedestrians. As a result of this research findings, the most important independent variables influencing jaywalking frequency were identified. The researchers, policymakers, and practitioners can use the results as a basis for conducting future research, making practical rules, and improving pedestrian crossing facilities so that pedestrians crash risk is decreased.

This study underscores the imperative for a comprehensive strategy to mitigate the risks associated with jaywalking at signalized intersections,

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prioritizing pedestrian safety while minimizing adverse effects on traffic flow. Through the application of LiDAR sensor technology, significant insights were gained into the factors influencing jaywalking behavior and its impact on vehicle-pedestrian conflicts. The findings highlight the importance of promoting pedestrian compliance with designated crosswalks and synchronizing pedestrian signal timings with vehicular phases to enhance safety. Furthermore, the study identified the influence of environmental factors such as vegetation in the median on jaywalking frequency, emphasizing the need for urban planning interventions to enhance pedestrian safety infrastructure. While the study provides valuable insights, it is essential to acknowledge certain limitations. The study's duration of six months may not fully capture seasonal variations in pedestrian behavior, warranting longer-term data collection efforts. Additionally, the study did not explore demographic factors such as gender and age due to privacy concerns, representing a potential avenue for future research. Furthermore, the inability to analyze video recordings of jaywalking events due to privacy constraints highlights the importance of ethical considerations in data collection and analysis. While the study acknowledges limitations such as the limited time interval of data collection spanning six months and the lack of investigation into jaywalkers' gender and age due to privacy concerns, it could benefit from a more detailed discussion of their implications for the generalizability of results. For instance, the short duration of data collection may limit the representation of seasonal variations and long-term trends in jaywalking behavior, potentially impacting the extrapolation of findings to different time periods or geographical locations. Additionally, the absence of demographic information on jaywalkers may restrict the applicability of results to specific population groups or urban contexts, warranting caution in generalizing the findings to broader settings.

Looking ahead, future research endeavors should focus on addressing the identified limitations and further refining our understanding of pedestrian behavior and jaywalking phenomena. Longitudinal studies spanning multiple seasons could provide deeper insights into seasonal variations in jaywalking behavior and inform the development of targeted interventions. Additionally, incorporating demographic variables into the analysis could elucidate potential disparities in jaywalking patterns and inform equitable safety interventions. Moreover, advancements in machine learning techniques offer promising avenues for developing predictive models that integrate vehicle-pedestrian conflicts and jaywalking events, facilitating real-time safety assessments and proactive intervention strategies. State-of-the-art machine learning algorithms, such as deep learning neural networks, support vector machines (SVM), and random forests, can effectively capture complex patterns and interactions within vast datasets comprising variables related to pedestrian movement, traffic flow, infrastructure characteristics, and environmental factors. By harnessing the power of these advanced models, future studies can not only predict the likelihood of jaywalking events based on real-time data inputs but also identify key contributing factors and their relative importance in influencing pedestrian behavior. Additionally, ensemble learning techniques, which combine multiple models to enhance predictive accuracy, can further refine the reliability and robustness of jaywalking prediction models. Such predictive models hold the potential to revolutionize pedestrian safety research by enabling real-time safety assessments and proactive intervention strategies, thereby contributing to the development of smarter and safer urban environments.

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THE SENSITIVITY OF EMPLOYMENT IN THE HOTEL INDUSTRY TO THE COVID-19 PANDEMIC: A CASE STUDY OF POLAND

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ABSTRACT

Motives: The COVID-19 pandemic has presented an unprecedented disruption to the global tourism economy. The diminished demand for hotel services, coupled with substantial operational uncertainty, compelled hoteliers to adopt survival strategies, often entailing workforce reductions.
Aim: The objective of the article was to assess the influence of the COVID-19 pandemic on employment levels in hotel establishments in Poland and to suggest a strategy that would enable these facilities to navigate similar challenges in the future.
Results: The article explores the sensitivity of employment in the hotel industry to the COVID-19 pandemic, focusing on a case study of Poland. It highlights significant changes in the hotel labour market during the COVID-19 pandemic. The study includes a detailed analysis of individuals working in the hotel industry from 2012 to 2021. Additionally, the impact of the COVID-19 pandemic on employment in Polish hotels was examined based on the collected primary data. The research findings affirm the industry's susceptibility to pandemic risks, but they indicate that appropriate measures can mitigate negative effects. Consequently, the article proposes strategies to assist hotel facilities in overcoming similar challenges in the future.

Keywords: hotel industry, hotel enterprise, employment, labour market, COVID-19 pandemic

INTRODUCTION

The hotel industry constitutes a crucial component of the tourism economy, providing accommodation, meals, entertainment, and various tourist services. Recognized for its labour-intensive nature, the industry encompasses diverse aspects of operations, including guest services, building maintenance, marketing, kitchen, and restaurant services, among others. Thus, the hotel sector plays a pivotal role in attracting tourists, generating employment opportunities, and bolstering local economies. This, in turn, contributes significantly to the overall development of the tourism sector within a specific region.

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The COVID-19 pandemic, caused by the SARS-CoV-2 coronavirus, marked an unprecedented disruption in the global economy, particularly affecting the tourism sector (Tokarz-Kocik et al., 2023). According to the World Tourism Organization (UNWTO), the pandemic led to a significant reduction of approximately 1.1 billion international tourists and posed a threat to 100–120 million jobs (Chen et al., 2023). Two key factors contributed to this impact (Gössling et al., 2020). Firstly, there was a diminished demand for tourist services, including hotel services, due to prevailing uncertainties (Sharma & Nicolau, 2020). Secondly, administrative restrictions were imposed, limiting movement, particularly international travel. To navigate the challenges posed by the COVID-19 crisis, numerous hotel companies worldwide opted for workforce reductions through layoffs (Kim et al., 2023), voluntary retirements, and the substitution of full-time employees with part-time or contract workers (Filimonau et al., 2020).

In Poland, throughout the pandemic period (i.e., from March 2020 to March 2022), hotels and similar establishments faced numerous restrictions stemming from border closures, specific movement regulations, and limitations on accommodation availability for tourists. Following the declaration of an epidemic threat in Poland on March 14, 2020, some hotel facilities were repurposed as isolation centers or designated for individuals undergoing quarantine. Starting April 1, 2020, activities related to operating hotel facilities were curtailed, with access granted solely to individuals carrying out professional duties, including those on business trips (Podhorodecka & Bąk-Filipek, 2022). The provision of hotel services was permitted only from May 4, 2020, until the early days of November 2020. Subsequently, on November 7, 2020 (amid the second wave of the pandemic), the operations of hotel facilities faced renewed limitations. These establishments were accessible solely to a limited group of guests, such as business travelers, medical professionals, patients, and their caregivers. The implementation of these restrictions led to significant declines, with hotel facilities experiencing over a 70% decrease in November 2020 (in comparison to the same month in 2019), and by December 2020, these declines had escalated to nearly 80% (GUS, 2021; 2023). The third wave of the pandemic, occurring from March 20 to April 9, 2021, resulted in the suspension of hotel operations, excluding employee hotels, and the provision of accommodation exclusively for business trips. Hotels were permitted to reopen on a larger scale from June 2021, albeit with restrictions on guest numbers. During the fourth wave of the COVID-19 pandemic (starting December 1, 2021), only 50% of hotel facilities were accessible to unvaccinated individuals, while the remaining places were reserved for those able to demonstrate COVID-19 vaccination. As of March 1, 2022, all restrictions on occupancy were lifted, with only the continued requirement to wear masks in enclosed spaces. In April 2022, the mandatory mask-wearing in tourist and sports facilities was lifted as well (Podhorodecka & Bąk-Filipek, 2022).

The pandemic had a significant impact on hotel occupancy rates, with the percentage of guests staying in hotels in Poland declining from 49% in 2019 to 26% in 2020 and slightly recovering to 29% in 2021 (*Hotel market in Poland – REPORT 2022*, 2022). The diminished demand for hotel services, coupled with operational uncertainties, compelled hoteliers to adopt survival strategies, often involving workforce reduction. The primary objective of this article is to assess the repercussions of the COVID-19 pandemic on employment levels within hotel facilities in Poland. Additionally, the article aims to propose a strategic approach for hotel facilities to navigate similar challenges in the future. To achieve this, the study addresses the following research question:

1. What was the sensitivity of employment in the hotel industry due to the risk of a pandemic?
2. What strategies and mechanisms were employed by the hotel industry to sustain employment and mitigate the impacts of the realized pandemic risk?

The conducted research showed that the hotel industry went through the crisis caused by the COVID-19 pandemic moderately mildly. This was mainly due to the protective instruments proposed by state institutions and used by the tourism industry.

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They thus allowed individual hotel facilities to limit the effects of the pandemic risk. Hotels were the most resilient.

LITERATURE REVIEW

The tourism sector stands as one of the largest and fastest-growing segments of the global economy (Kugiejko & Żyto, 2022). Through job creation, export revenues, investments, and infrastructure development, the tourism economy significantly contributes to the socio-economic development of the world and individual countries, both directly and indirectly. Key components of the tourism sector encompass the hotel industry, transportation, catering, and the travel agency sector (Alreahi et al., 2023). Regrettably, recent years have witnessed a severe setback in the development of tourism services across all continents, largely due to the COVID-19 pandemic caused by the SARS-CoV-2 virus (Alotaibi & Khan, 2022; Mastronardi et al., 2020). This unprecedented event led to a substantial decline in international tourism, resulting in the loss of millions of jobs within the sector. Hundreds of thousands of companies worldwide, primarily accommodation facilities, travel agencies, and other entities in the tourism market, faced bankruptcy (Niedziółka, 2021; Li et al., 2021).

The existing studies that pertain to the COVID-19 pandemic in the context of the hotel industry mainly deal with the impact of COVID-19 on hotels (Alotaibi & Khan, 2022; Filimonau et al., 2020; Hao et al., 2020; Jiang & Wen, 2020; Kim & Han, 2022). There are also endeavors, which are albeit limited, that contributed to examine consumer behavior (Shin & Kang, 2020; Han et al., 2020). Nevertheless, attempts have seldom been made to grades the sensitivity of employment in the hotel industry to the COVID-19 pandemic.

The pandemic imposed and accelerated changes in the enterprises (Alam, 2020; Pietrzyk & Szczepańska, 2022; Prochazka et al., 2020), in particular the shift to the remote working mode (Da et al., 2022; Kaushik & Guleria, 2020; Kramer & Kramer, 2020). The contemporary labour market operates within an ever-evolving environment marked by constant change. These changes predominantly involve escalating employer requirements and swift transformations in the social, legal, political, and technological landscapes. The influence of globalization, technological advancements, and the internationalization of employees and the labour market significantly impacts not only economic and societal transformations (Pruchnik & Pruchnik, 2020) but, most importantly, the conditions governing the functioning of the labour market. Human capital assumes a pivotal role in this context (Nazarczuk & Cicha-Nazarczuk, 2014), delineating an individual's position within the aforementioned market.

The primary focus of analyses aimed at understanding the labour market is on the provisions and decisions of employees, constituting the labour supply, and the behavior of employers, representing the demand for labour. The interactions between them, embedded within the legal and institutional framework, establish what is known as the labour market order. The principles of this order encompass the obligations and regulations applicable to both employees and employers (Organiściak-Krzykowska et al., 2014). Occasionally, this order faces disruptions and encounters challenges that may jeopardize its continuity. One such challenge involved the restrictions introduced during the COVID-19 pandemic (Bogacka, 2021; Salih & Hussein, 2021). The onset of the COVID-19 pandemic in March 2020 and the measures taken to safeguard the health and lives of citizens led to an immediate curtailment of economic activities in numerous industries. The various restrictions, manifested in national or regional lockdowns, disrupted the volume and nature of demand for services and goods, thereby adversely affecting the overall functioning of the labour market (Radlińska, 2020). These disruptions altered existing trends and necessitated a range of adjustments.

The repercussions of restrictions and limitations in the economy had widespread effects on both employers and employees. The former found themselves engaged in an uneven struggle to sustain businesses that often represented their sole source of income and the foundation of their entire livelihoods. Virtually

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overnight, they confronted dwindling revenues, declining customer numbers, and the abandonment of planned investments. The balance between profits and losses hinged not only on the size of the enterprise but, more crucially, on the industry itself. The opening and closing of economies, coupled with various other restrictions, predominantly impacted the financial health of production enterprises, retail chains, and entire sectors associated with tourism, culture, entertainment, and gastronomy. Operating amidst the epidemic compelled many entrepreneurs to take decisive actions, as highlighted in studies such as those conducted by (Botha et al., 2021; Wawrzonek, 2020):
– reduction of working hours;
– salary reduction;
– job reduction or company closure;
– receiving benefits and bonuses.

The implementation of restrictions and the contraction of economic activity directly contributed to a reduction in employment and a surge in unemployment. Unlike previous crises, where these shifts occurred gradually and unfolded over time, the pandemic crisis led to an immediate job loss scenario. Overnight, the global economy witnessed the disappearance of millions of jobs. The decline in employment was not only linked to a drop in domestic demand but also resulted from a decrease in export volumes, stemming from disrupted supply chains. Consequently, many households faced challenges in maintaining their current financial liquidity (Soliwoda, 2020).

Administrative decisions made by governments worldwide to suspend economic activities, production, and consumption significantly disrupted the functioning of labour markets. The consequences include a reduction in employment, an increase in unemployment, professional inactivity, and interference in employer-employee relations. The economic crisis triggered by the pandemic brought about substantial changes in the modern labour market, introducing new trends and influencing the nature and methods of performing professional duties. Sudden events such as a pandemic often act as catalysts for significant changes, particularly technological ones, which in turn force employees to adapt their qualifications and forms of professional activity to them. The pandemic turned out to be a crash course in, among others, digitalization, which made it possible to work in many professions. It has therefore accelerated the development of digital competences. Consequently, there has been a shift in the perception of work by both employees and employers. The latter now recognize the importance of seeking employees with competencies related to the use of new technologies, time management skills, self-discipline, and stress resistance. This shift emphasizes the significance not only of digital competencies but also of soft skills.

The alterations in the labour market's dynamics during the pandemic, coupled with job losses across various sectors, have heightened employees' inclination to undergo retraining for future endeavors. Abruptly, individuals employed in industries severely impacted by the pandemic found themselves compelled to seek new opportunities, gravitating towards professions more resilient to such economic shocks (Hensvik et al., 2021). This proclivity for industry change should be seen as an indication of society's increasing recognition of the importance of being a flexible employee capable of responding and adapting more successfully to evolving market conditions.

The measures implemented by governments worldwide to safeguard citizens' lives and health disrupted the normal functioning of the labour market. Prior to the pandemic, employee conditions were consistently improving, with unemployment reaching historically low levels, rising wages, and the primary challenge centered on enhancing labour supply. However, the limitations imposed on social and economic activities due to the COVID-19 pandemic triggered a profound global economic crisis, adversely impacting the labour market, particularly in the hotel industry. Successive restrictions led to a diminished demand for employees, a surge in unemployment, and a deceleration in recruitment processes. It is crucial to recognize that countries adopted diverse approaches in addressing the economic repercussions of the pandemic on employment. Various governments

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adopted different strategies to mitigate the impact of unemployment during the economic disruptions caused by the pandemic and provided benefits to individuals who lost their jobs, potentially influencing unemployment statistics. In contrast, others allocated funds for initiatives primarily focused on job preservation, resulting in a more modest uptick in the unemployment rate. Individuals who were displaced from jobs in the tourism sector due to closures sought employment in other sectors deemed less susceptible to health threats, such as the construction industry (Aigbedo, 2021; Alotaibi & Khan, 2022).

Unfortunately, employers face challenges in restoring the employment potential in tourism services (including the hotel industry) to the pre-2019 levels. Escalating costs may compel them to impose additional responsibilities on existing workforce members. Difficulties in recruiting new personnel could potentially hinder their ability to manage the anticipated influx of tourists in the upcoming seasons (Podhorodecka & Bąk-Filipek, 2022).

MATERIALS AND METHODS

The validation of the research questions and the attainment of the stated objective were accomplished through a critical examination of the existing literature, an analysis of secondary data, and an assessment of survey findings from primary research, incorporating selected statistical methods. In pursuit of the article's aim, reference was made to secondary data for the years 2012 and 2021, with a baseline set in 2019 – before the onset of the COVID-19 pandemic.

To assess the influence of the COVID-19 pandemic on employment-related decisions within hotel enterprises, a nationwide survey was conducted in November and December 2022. A combination of data acquisition methods, including PAPI (is a traditional method of conducting surveys using paper questionnaires that are completed by respondents), CATI (is a computer-assisted telephone interviewing technique), and CAWI (is a research technique using online surveys), was employed to reach hotel facilities. To ensure representativeness, a minimum sample size of 344 entities was established, considering a 95% probability, a margin of error of 5%, and accounting for the population size. A non-random, purposive selection method was adopted, with efforts made to reflect the distribution of facilities across voivodeships and facility types. Questionnaires were presented to a total of 437 respondents, yielding 386 appropriately completed forms. The following statistical methods were used in the article. The chi-square test of independence was used in the article to check whether there is a statistically significant relationship between two qualitative variables. Then, the Cramér V coefficient (or Cramér fi) was used, which is one of the measures of dependence, determining the level of dependence between two nominal variables, at least one of which has more than two values. The article also uses the Mann-Whitney test. This test uses the rank of each observation to check whether the groups were drawn from the same population. The Mann-Whitney test is used to check whether two sampled populations are identical in location. Observations from both groups are combined and assigned a rank. The use of statistical methods allowed for examining the relationships and drawing conclusions from the study.

The study encompassed various types of facilities, including hotels, motels, guesthouses, campsites, youth hostels, travel lodges, and hostels. However, due to the limited representation of youth hostels, travel lodges, and shelters, the results were combined. The distribution of participating entities is illustrated in Fig. 1.

The majority of surveyed establishments were hotels, comprising approximately 77%, followed by guesthouses at around 12%, and campsites at approximately 5%. Collectively, these categories represented over 94% of all surveyed facilities.

In terms of employment, it is noteworthy that micro-enterprises (employing between 1 to 9 people) dominated among the surveyed facilities, constituting more than half of the respondents (see Fig. 2).

Approximately 41% of the facilities were categorized as small enterprises, employing between 10 to 49 people, while over 8% were identified as medium-sized

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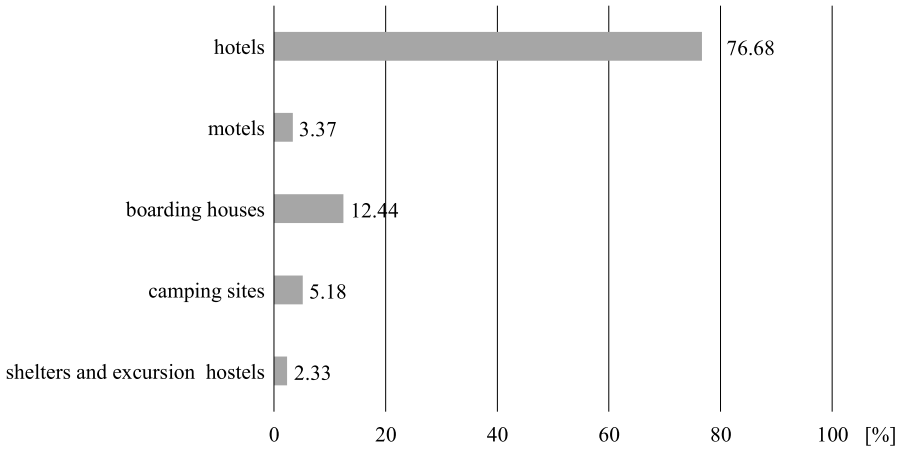

Fig. 1. Structure of the number of hotel facilities by type of facility

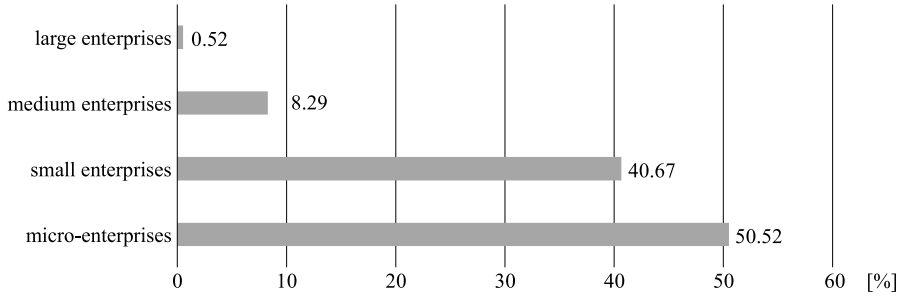

Fig. 2. Structure of hotel facilities in terms of size

enterprises. Notably, only two facilities employing over 250 people participated in the study, representing a mere 0.52% of the respondents.

RESULTS

Employment in the hotel industry in Poland in 2012–2021

Research on employment levels in the hotel industry faced a notable limitation due to the accessibility of homogeneous statistical data. Although comprehensive data on the overall workforce in the Polish hotel industry is available in public statistics over an extended period, more granular information depicting employees in specific types of facilities (such as hotels and similar establishments, tourist accommodation facilities, camping sites and tent sites, and other forms of lodging) has only been published by Statistics Poland since 2020. Furthermore, there is a lack of data pertaining to individuals employed in the accommodation sector across individual voivodeships, contributing to the challenge of conducting a detailed analysis at the regional level.

Another limitation arises from the integration of statistical data on accommodation with gastronomy in Polish public statistics, complicating the isolated analysis of the accommodation sector. In 2021, the workforce in the catering sector was nearly 2.5 times larger than that in the accommodation sector, reaching a total of 222,000 individuals. The substantial disparities between the two fields make it evident that their amalgamation in this research would introduce distortions to the findings. To ensure the accuracy of the research outcomes specific to the hotel industry, the decision was made to exclusively utilize data for the accommodation sector, leading to a more focused analysis.

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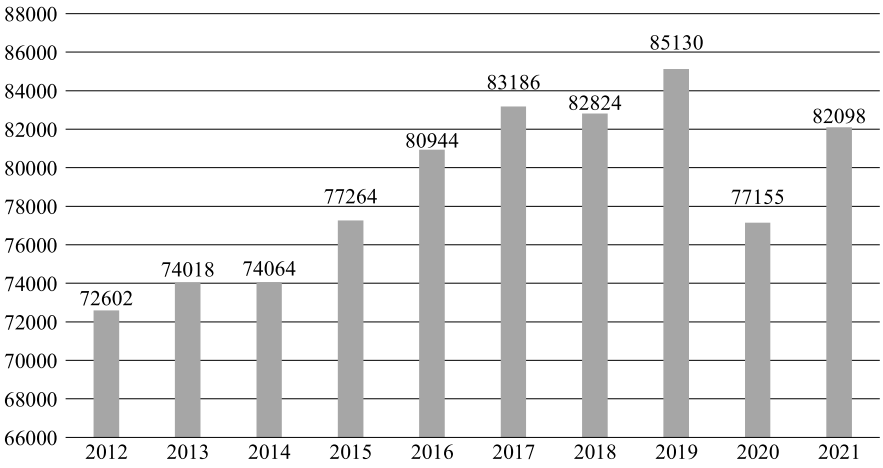

Fig. 3. Number of employees in the hotel industry in Poland in 2012-2021
Source: own elaboration based on GUS (2013–2022).

In Poland, from 2012 to 2021, there was a rise in the workforce within the accommodation sector, escalating from 72.6 thousand individuals in 2012 to nearly 82.1 thousand in 2021. This signifies a growth of 13.1% over the span of a decade (see Fig. 3).

During the analyzed period, the overall trajectory in employment remained upward, with a minor decline in 2018 and a substantial shift during the onset of the COVID-19 pandemic in Poland, specifically in 2020, where a 9.4% decrease in the analyzed sector was noted compared to 2019. The COVID-19 pandemic significantly impacted employment in the hotel industry. However, it is noteworthy that there was a recovery in 2021, marked by another increase in the number of individuals employed in the accommodation sector. Thus, the adverse effects of the pandemic on employment in this sector were relatively short-lived.

It is noteworthy that women were predominant among those employed in the accommodation sector. In 2012, they constituted 64.8%, and in 2021, 65.8%. The proportion of men was 35.2% and 34.2%, respectively. Throughout the entire study period, the sex distribution of employees in the hotel industry remained similar. However, it is important to highlight that in the year of the COVID-19 pandemic outbreak in Poland, the number of employed women in accommodation decreased by 9.6% compared to 2019 (from 55,157 to 49,847), and for men, it decreased by 8.9% (from 29,973 to 27,308). In summary, it can be concluded that the pandemic had a more pronounced impact on women working in hotel facilities.

The percentage of individuals employed in the accommodation sector relative to the total workforce in Poland was 0.51% in 2012 and increased to 0.55% in 2021, marking its highest level (see Table 1).

Throughout the examined period, fluctuations in this metric were marginal in consecutive years. However, in the year of the COVID-19 pandemic

Table 1. Employed persons in Poland and in the polish hotel industry

Year	Total employed persons in Poland (thousand)	Employed persons in the hotel industry (thousand)	Share of employed persons in the hotel industry in the total number of employed persons in Poland (%)
2012	14 172,0	72,6	0,51
2013	14 244,3	74,0	0,52
2014	14 563,4	74,1	0,51
2015	14 829,8	77,3	0,52
2016	15 293,3	81,0	0,53
2017	15 710,8	83,2	0,53
2018	15 949,7	82,8	0,52
2019	16 120,6	85,1	0,53
2020	16 021,4	77,2	0,48
2021	15 002,6	82,1	0,55

Source: own elaboration based on GUS (2013–2022).

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outbreak, it reached its lowest point at 0.48%. It is noteworthy that in the subsequent year, 2021, the percentage of employees in the analyzed sector relative to the total workforce increased to 0.55%. In summary, while the examined sector did not hold substantial significance in the Polish labour market, its proportion experienced a slight uptick.

Interesting insights into individuals working in the accommodation sector are also revealed through the analysis considering the form of ownership (see Table 2).

Table 2. Employed persons in hotel industry in Poland by ownership forms in 2012–2021

Year	Public sector		Private sector			
	total		total		including owners, co-owners and helping members of their families	
	persons	%	persons	%	persons	%
2012	12832	17,7	59770	82,3	9068	15,2
2013	11358	15,3	62660	84,7	n.d.	n.d.
2014	11395	15,4	62669	84,6	9226	14,7
2015	10015	13,0	67249	87,0	11283	16,8
2016	9789	12,1	71155	87,9	12821	18,0
2017	9454	11,4	73732	88,6	12139	16,5
2018	9618	11,6	73206	88,4	12284	16,8
2019	9454	11,1	75676	88,9	11465	15,2
2020	7771	10,1	69384	89,9	12019	17,3
2021	7428	9,0	74670	91,0	13434	18,0

n.d. – (no data) data unavailable
Source: own elaboration based on GUS (2013–2022).

In the decade under review, the public sector's share in this aspect declined from 17.7% in 2012 to 9.0% in 2021, while the private sector's share increased from 82.3% in the base year to 91.0% in the target year. These observed changes are linked to the transformation of the Polish economy initiated in 1989 and are characteristic of a free-market economy. Importantly, the period of the pandemic did not halt these ongoing transformations. During the COVID-19 pandemic in 2020–2021, the share of individuals employed in accommodation in the private sector also increased. Furthermore, it is noteworthy that among those working in accommodation in the private sector, the proportion of individuals who are owners and co-owners, including family members assisting, rose. In 2012, this working group comprised 15.2%, increasing to 18.0% in 2021, indicating a growth of 2.8 percentage points. This shift can be attributed to increased business activity in the hotel industry related to accommodation services and the expansion of family entrepreneurship in this sector.

Employment analysis in the hotel industry. Results of empirical research

During the survey, respondents were queried with the question: Has the number of employees in your company been reduced as a result of the COVID-19 pandemic? Remarkably, a substantial 84.46% of the surveyed companies responded negatively to this question. This suggests that, in this regard, the hotel industry has managed to weather the challenges posed by the pandemic quite effectively.

The study sought to investigate whether the type of facility, its size (based on the number of employees), or legal form could have exerted an influence on employment reduction. It is crucial to note that these variables are qualitative in nature. Thus, to test the hypothesis regarding a significant relationship between company layoffs and the mentioned criteria, the Pearson's test of independence was employed at a significance level of 0.05. The distribution of responses concerning the impact of the type of facility on employment reduction during the pandemic is illustrated in Fig. 4.

Among accommodation facilities, hotels, hostels, and travel lodges were primarily affected by layoffs. Employment reduction occurred to a very small extent (only in 2% of facilities) in guesthouses. No layoffs were reported in the motels and campsites surveyed.

The next level of analysis focused on the change in the level of employment depending on the size of the facility (see Fig. 5).

As shown in Fig. 5, medium-sized hotel companies performed the worst, with 41% of them being forced to lay off employees among establishments employing

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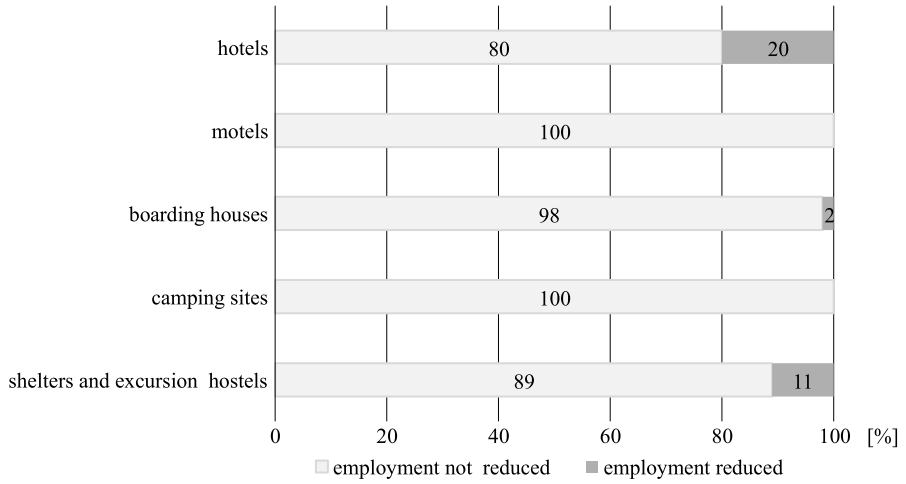

Fig. 4. Employment reduction as a consequence of the COVID-19 pandemic by type of facility

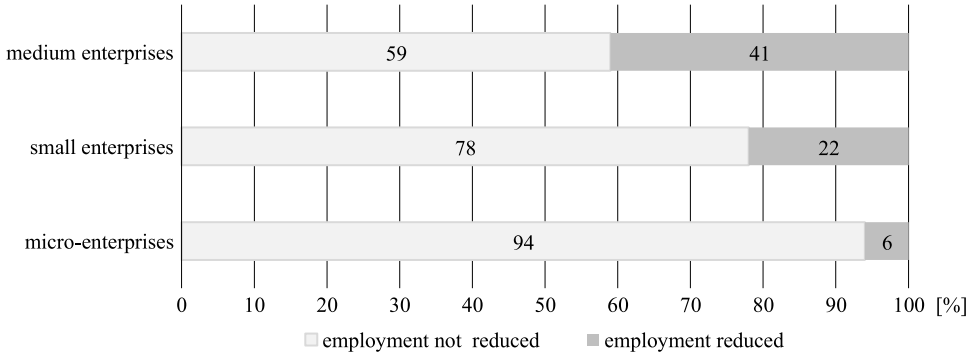

Fig. 5. Employment reduction as a consequence of the COVID-19 pandemic due to the size of the enterprise

50 to 249 people. However, this problem affected only 6% of micro-enterprises.

The next stage of the study examined how facilities, depending on their legal form, coped with employee layoffs. The structure of the answers to this question is shown in Fig. 6.

As shown in the data presented in Fig. 6, layoffs primarily affected limited liability companies followed by sole proprietorships (SP) and other types of companies (i.e., limited partnerships, professional partnerships, and general partnerships). Civil partnerships performed the best, with almost 94% of these entities not reducing employment.

The Pearson's test of independence confirmed, in all three cases, the existence of a statistically significant relationship between layoffs and the type of facility, company size, and legal form. Additionally, the Cramér's V coefficient was calculated to determine the strength of this relationship (Table 3).

All three Cramér's V coefficients suggest that there is a moderate relationship between employee layoffs and the adopted variables. The highest value of this coefficient was for „Employment size".

The Mann-Whitney test was employed to enhance the certainty of the obtained result, specifically in the case of employment. Since the variable „employment level" is ordinal, the utilization of this non-parametric test is both possible and recommended. The size of the company served as the dependent variable, with the response to the question about reducing employment

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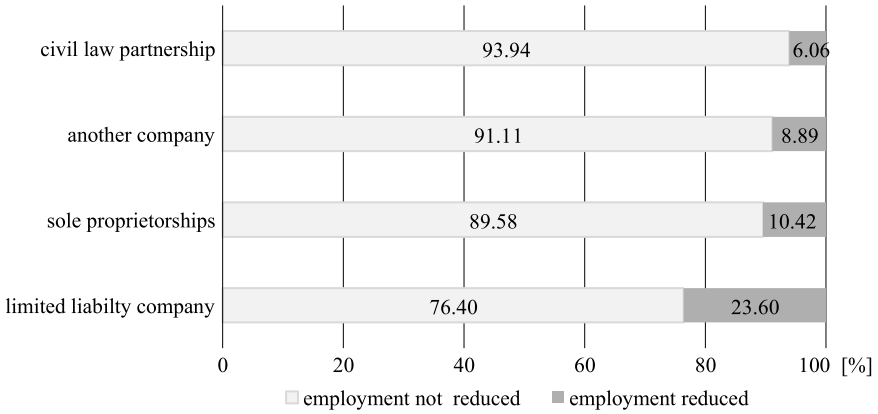

Fig. 6. Employment reduction as a consequence of the COVID-19 pandemic due to the legal form of the enterprise

Table 3. Results of the Pearson's test of independence between exemptions and selected features characterizing accommodation facilities

Variable	N	Chi2	p	V-Cramera
Object type	386	16,53(16,828)*	0,00238(0,00854)*	0,206
Employment volume	384	33,202(36,657)*	0,00000(0,00000)*	0,294
Legal form	385	16,716(17,67)*	0,00081(0,00711)*	0,208

* in brackets are the results for the cafeteria without any changes in the form of accumulation or omissions.

acting as the grouping variable. The results of the test are presented in Table 4.

The Mann-Whitney test confirmed a significant relationship between these variables. Therefore, it can finally be assumed that both the type of facility, the size of the company, and the legal form had an impact on layoffs as a consequence of the COVID-19 pandemic.

The considerations contained in the article have certain limitations. Firstly, the limitation of the study is the territorial scope of the empirical research, which concerns only one country – Poland. In the future, it is worth expanding further research, including: to other EU countries. This would allow us to assess the extent to which employment in the hotel industry during the COVID-19 pandemic was influenced by the protective instruments used by individual countries. It would also be interesting to examine the impact of the pandemic on the functioning of other service sectors, not only the hotel industry.

Table 4. Results of the Mann-Whitney test – the company's employment against the background of layoffs due to COVID-19

Variable	Mann-Whitney U test (with continuity correction) Relative to the variable: question 3. The marked results are significant with p <.05000								
	Sum.rank no	Sum.rank yes	U	Z	p	Z with correction	p	N important. no	N important. yes
How many employees does your company have?	58637,50	15282,50	5662,500	-5,00353	0,000001	-5,59367	0,000000	325	59

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DISCUSSION

To summarize the results of both secondary and primary research, it should be stated that the analysis of the Statistics Poland reports showed a decrease in employment in the hotel industry in Poland in 2020–2021. This phenomenon may be explained by the fact that, as a result of the pandemic, the total number of hotel facilities decreased by 11.6% (from 11,251 facilities in 2019 to 9,942 in 2021) (GUS, 2021; 2023).

A survey of hotel facilities in Poland conducted in November-December 2022 revealed a relatively high resistance of these entities to the actual risk of a pandemic. In contrast to global trends, the vast majority (as many as 84.46%) of surveyed hotel enterprises in Poland did not reduce employment during the pandemic. This resilience may be attributed to the effectiveness of protective measures implemented by the Polish government, known as the „Anti-Crisis Shields". Throughout the pandemic, seven packages of such solutions were introduced in Poland (Shields 1.0 - 6.0 and Industry Shield). The Shields' scope was extensive and varied based on the size of the enterprise and the type of business activity. The most frequently utilized forms of assistance by entrepreneurs in the hotel industry included (Manczak & Gruszka, 2021):

– exemption from paying ZUS contributions for specific periods in 2020 and 2021, particularly covering contributions to social security, health insurance, the Labour Fund, the Solidarity Fund, the Guaranteed Employee Benefits Fund, and the Bridging Pension's Fund;
– co-financing a portion of the costs of employee remuneration and the corresponding social security contributions from the Guaranteed Employee Benefits Fund; salary subsidies for a duration of 3 months; in Shield 1.0, these subsidies applied exclusively to employees affected by economic downtime or reduced working hours. The extension of these provisions to employees not covered by economic downtime or reduced working time was introduced in Shield 4.0 and continued in the Industry Shield;
– a low-interest loan from the Labour Fund was designed for micro-entrepreneurs to cover current business costs, with a maximum limit of PLN 5,000. This financial support, tailored for micro-entrepreneurs, would be completely forgiven if the business continued operations for at least three months from the date of loan disbursement. This initiative was implemented as part of Shield 1.0.

Anti-crisis shields were implemented to mitigate the financial repercussions stemming from COVID-19. As the pandemic situation unfolded, the government continuously introduced new measures, adjusted existing programs, and tailored its anti-crisis policy to the evolving needs. A specific initiative aimed at supporting the hotel industry was the introduction of the tourist voucher – a digital document providing families utilizing hotel services in Poland with a PLN 500 discount for each child. These measures successfully heightened the interest of Polish tourists in domestic hotel offerings, surpassing levels seen in previous years.

The government program aimed to safeguard jobs and sustain essential financial liquidity for companies meeting the specified criteria to receive financial assistance. Despite these efforts, the program could not shield the entire hotel industry from the repercussions of the pandemic. Some hotel establishments ceased operations, leading to employees in these facilities having to seek new employment opportunities.

CONCLUSIONS

The COVID-19 pandemic has significantly affected employment in the hotel industry, necessitating a profound adaptation to a new reality. Both employees and employers grappled with challenges stemming from travel restrictions, shifts in guest behavior, and the implementation of safety measures. These factors had a notable impact on staffing dynamics and team structures within hotels. Owing to a decrease in guest numbers, operational constraints, and revenue loss, certain establishments were compelled to declare bankruptcy or carry out layoffs, affecting positions such as receptionists and cleaning staff. Nevertheless,

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the scale of this phenomenon in Poland was relatively limited and of short duration.

In response to the instability in the labour market, certain hotels implemented more flexible employment arrangements, such as temporary contracts, to better align with changing needs. Notably, in departments like marketing, employees were transitioned to remote work to mitigate the risk of virus transmission and reduce operational costs. The anti-crisis shields proved to be significantly beneficial for entrepreneurs. Government-level initiatives, coupled with adaptive measures taken by surveyed enterprises, yielded positive outcomes. These results underscore the adaptability of hotel enterprises in Poland to fluctuating and even turbulent economic conditions. This adaptability is crucial given the subsequent external factors that have come to influence the functioning of Polish enterprises post-pandemic. These factors include events like the war in Ukraine, inflation, escalating energy costs, external migrations, the associated influx of foreigners, and prevailing political conditions.

There is a suggestion that, in the post-pandemic era, hotel companies should shift from a competitive to a cooperative paradigm among individual facilities. This transformation is anticipated to enhance entrepreneurs' social capital, enabling them to collaboratively plan and recover more effectively from potential external disruptions, including future pandemics or other natural disasters. The adaptation of hotels to epidemic threats or other crises necessitates the formulation of suitable strategies. These strategies aim to ensure the safety of both guests and employees and minimize the impact of crises on the overall operations of the hotel. Crucial for the survival and success of contemporary hotel enterprises during future crises are several key factors: innovation (e.g., self-service kiosks, hotel applications, and online reservations to limit direct contact), robust IT systems safeguarding hotels and guests against cybercrime, and adaptability with the capability to swiftly adjust to evolving socio-economic realities. Insights gained from observing the hotel industry's responses during the pandemic and the lessons learned can be instrumental in modeling protective and supportive actions for the future, applicable at both governmental and industry levels.

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PRICE DISPARITIES ON THE HOUSING MARKET VS. TRANSPORTATION COSTS FOR HOUSEHOLDS. A CASE STUDY OF REAL ESTATE DEVELOPMENT PROJECTS IN SZCZECIN

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ABSTRACT

Motives: Land situated on the outskirts of cities and even outside their borders is being seized for urban development, as well as for housing purposes. Properties in such locations are usually significantly cheaper than those located in the city centers. However, living in a suburban location often entails higher commuting, education, and entertainment costs. Therefore, the following question arises from a property buyer's point of view: is it more economically advantageous to purchase more expensive property in a downtown district or a cheaper one located peripherally and incur higher transportation costs?
Aim: The purpose of the study was to compare the transportation costs incurred by households in peripheral locations with the property price differentials between suburban and central city districts.
Results: The study covered the city of Szczecin. Data for the study were obtained from public sources and analyzed with tools such as the payback period, simple rate of return, net present value (NPV) for 10 and 20 years, and internal rate of return (IRR) for 10 and 20 years. The results indicate that in certain cases, very high commuting costs might encourage potential buyers to consider the purchase of more expensive property in a central city location where these costs are significantly lower or not necessary.

Keywords: housing prices, transportation costs, Szczecin, Poland

INTRODUCTION

Since prehistoric times, human settlements have increased in size through the development of outer areas. These processes were limited by the distance that could be traveled on foot within reasonable time. Urban spread accelerated significantly with the arrival of public transportation, and the growing popularity of individual transportation subsequently led to uncontrolled mass settlement. In Western Europe, the construction of modernist settlements outside the inner city intensified after World War II, and this trend gained speed in Poland in the 1980s-1990s (Małek, 2011). Currently, suburbanization is a process that affects most European cities, including Poland (Głuszak & Marona, 2013). Various aspects of suburbanization, which is defined as the effect of civilizational changes accompanied by decentralization and urban growth, have received much attention in the scientific literature (Champion, 2001; Ciok & Leśniak, 2015; Gałka & Warych-Juras, 2020; Gnat & Bas, 2013; Harasimowicz, 2018; Hirt, 2008; Hollow,

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2011; Jackson, 1985; Jadach-Sepioło & Legutko-Kobus, 2021; Kokot, 2006; Korwel-Lejkowska, 2022; Kuzara & Szmytkie, 2022; Mantey & Sudra, 2019; Szmytkie, 2021; Wojewnik-Filipkowska & Koszarek-Cyra, 2022). The most obvious effect of suburbanization is the increase in population density in suburbs and the relocation of social and business activities from the city center to the suburbs. However, suburbanization affects many of these activities, including the real estate market, particularly the land market and the housing market. The effect of suburbanization on price differentiation on the housing market has been rarely analyzed. In particular, it is difficult to find studies on housing price differentiation in the context of higher costs associated with travel from peripheral locations to the inner city, where social and economic functions are concentrated. In contrast, the time and cost of commuting have been extensively researched in the context of typical transportation problems (Manaugh et al., 2015; Nguyen, 2022; Rakowska, 2014; Schéele & Andersson, 2017; Sen et al., 2019; Sen et al., 2021; Ubbels & Verhoef, 2007). Several studies have investigated the impact of commuting time on the residents' health and households' ability to satisfy their life needs (Bergstad et. al., 2011; Choi et al., 2013; Hilbrecht et al., 2014; Simón et al., 2020). A substantial part of the research on commuting costs focuses on the problems related to the choice of transportation mode. In this regard, the research findings indicate that commuting time significantly affects the choice of transportation mode. Above all, commuters tend to opt for private cars if they have to change transportation modes or walk longer distances (Ha et al., 2020; Kerr et al., 2009). Other factors that influence the choice of transportation mode include the work and residence environment and the family model (Maat & Timmermans, 2009). The impact of socially motivated factors on the propensity to work in locations far from home was also examined in the literature. The household income is one of such factors because low-paying, unskilled jobs are available in geographically diverse areas (Axisa et al., 2012). Low-income workers are not willing to bear the costs of longer travel. In contrast, high-income workers travel farther and pay more for transportation, but still prefer to live in remote and attractive locations (Rouwendal & Nijkamp, 2004). In reality, the problem is more complex, and different trends can be observed in certain professional environments. Research has shown that in Shanghai and Melbourne, affluent people live in expensive inner-city areas that are close to their workplace, whereas low-income workers tend to live on the outskirts of the suburbs and travel longer (Berry, 2006; Li, 2010).

Notwithstanding the above, housing prices in various locations and the related factors have been extensively examined (Cellmer et al., 2021; Kuryj-Wysocka & Osiecka, 2014; Wang et al., 2017; Wiliński et al., 2017; Xifilidou et al., 2012), but there is a general scarcity of research analyzing the influence of transportation costs on property prices.

The aim of the study was to compare the transportation costs incurred by households in peripheral locations with the property price differentials between suburban and central city districts. The study compared the costs associated with daily commuting to downtown districts from peripheral locations with the average difference between the prices of typical downtown and suburban properties. The following research hypothesis was formulated: the purchase price of a more expensive property in a downtown district is compensated by the absence of costs associated with commuting to downtown areas where most jobs, education and entertainment are located. In other words, the study was undertaken to determine whether buyers of cheaper, but peripherally located property actually save money, or whether these are illusory savings that would be later absorbed by higher commuting costs. From this point of view, the purchase of more expensive property can be regarded as an investment that pays for itself through lower transportation costs.

It should be noted that the present calculations are general in nature and correspond strictly to the described case. In reality, transportation costs vary between individuals and households and depend on where they work, whether they can work remotely, how often they commute, what lifestyle they prefer,

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whether they have children and how they organize children's activities, the number of cars in the household, the type of vehicles (type of fuel, fuel consumption, and other operating costs). The results are also heavily influenced by factors relating to the analyzed properties. Residential properties may also differ significantly in terms of size and price. The differences in housing prices do not result solely from travel costs, and can be significantly associated with pure market factors, in particular the attractiveness of the neighborhood, the availability of services and infrastructure, and the popularity of certain locations on local real estate markets. In the present study, higher transportation costs incurred by peripheral households are associated with location, rather than with lower housing prices. The study was not undertaken to identify the causes of differences in housing prices, but to examine differences in the cost of commuting to the inner city as one of the consequences of differences in location. The residential properties selected for the study were similar in structural design and the offered standard. The compared apartments were also selected by ensuring that the price per square meter was not affected by differences in floor area. Therefore, the obtained results constitute a benchmark for comparing properties that are most similar to those analyzed in the study.

The study focused exclusively on private car transport. The analyzed properties are located in the city of Szczecin, where private cars dominate and, despite the indicated objective impediments, continue to be the fastest mode of transport. In the surveyed locations, buses are the only type of public transportation which is as affected by rush-hour traffic as cars, and they run relatively infrequently – every 40–60 minutes. Bus services often have "down times" due to staff absences. As a result, public transportation is chosen only by people who do not own cars. The above is frequently observed in rapidly expanding medium-sized cities (with a population of 100,000 to 500,000) which do not have and probably will never have a subway system. For this reason, the results of this study cannot be directly related to cities with different social and transportation logistics, such as Berlin or Amsterdam. At present, only one Polish city has a designated zone where car traffic is limited. The offsetting of public transportation costs with differences in housing prices is an important consideration, but it is beyond the scope of this study because it requires other, specially formulated research assumptions, and therefore may be the subject of a separate study and publication. The study did not consider rental costs due to the perishable nature of such contracts. Rental agreements are usually concluded for 1 year, rarely for longer. Within this time horizon, rentals cannot be regarded as a substitute for property investments, and the differences in rents cannot be directly confronted with transportation costs. The study demonstrated that when buying an apartment, such differences can be large and offset for years.

MATERIALS AND METHODS

The survey was conducted in February 2023 based on current information for the Polish city of Szczecin. Data for the analysis was obtained from public sources, in particular:

- websites of real estate development companies, including the offered properties, prices and location;
- telephone conversations with real estate developers (to obtain information that was not available online);
- Google Maps to calculate travel times and distances;
- legal acts concerning remuneration rates and reimbursement rates for the use of vehicles that are not owned by the employer, but are used by the employees for business purposes (mileage).

To determine the boundaries of Szczecin's downtown district, the author relied on expert knowledge as well as own knowledge about the area and the operational conditions of the urban road network. Up-to-date information on fuel prices and other data were also obtained from the websites referenced in the text.

The study was divided into the following research steps:

1. The downtown district, defined as a typical area where the local community's professional activity

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is concentrated, was designated. Development projects with residential property available for purchase were identified.
2. The available property was analyzed to determine its feasibility for the study.
3. Travel times and distances from individual development projects to the boundary of the downtown district were measured.
4. Assumptions were made about the number of vehicles and the frequency of trips.
5. The procedure of calculating the cost of commuting from selected suburban locations to the district boundary was selected. Three approaches were considered:
   – based on the rate applied by employers to reimburse the cost of traveling to work in a private vehicle (mileage);
   – based on the sum of the above reimbursement rate and driving time;
   – based on travel cost parameters established by experts.
6. Data analyses.

The analyses involved the following measurements and calculations:

1. Measurement and calculation of daily and annual input parameters for trip costing, i.e. travel times, distances, travel time costs, fuel consumption, mileage.
2. Calculation of travel costs according to the three approaches.
3. Calculation of capitalized and discounted 10-year travel costs from suburban locations to the boundaries of the central district according to the three approaches.
4. Calculation of payback periods and simple rates of return on investments in higher-priced housing in the downtown district according to three approaches.
5. Calculation of the capitalization rate and the discount rate for further analysis.
6. Calculation of 10-year and 20-year discounted net cash flows (net present value – NPV).
7. Calculation of 10-year and 20-year internal rates of return (IRR).

Therefore, the study relied on parameters that are commonly used in cost-effectiveness analyses of investments because the examined problem was also viewed as an investment in more expensive property, where the associated cost is recouped through lower spending on travel.

The research assumptions and the results of the calculations are presented and discussed in detail in the following section describing individual research steps.

RESULTS

The downtown district, defined as a typical area where the local community's professional activities are concentrated, was mapped in the first step of the study. This was done based on expert knowledge, as well as the author's familiarity with the area under study. The designated downtown district in Szczecin is demarcated by the following streets: Ku Słońcu, Santocka, Traugutta, Wojska Polskiego, Zaleskiego, Słowackiego, Wyzwolenia, Staszica, Emilii Plater, Gontyny, Matejki, Trasa Zamkowa, Kolumba, Dąbrowskiego, and Bohaterów Warszawy (Fig. 1).

In the next stage of the study, the available housing offers were identified and residential properties were selected for the analysis based on the following assumptions:

1. Properties available on the primary market, excluding renovated properties in the existing buildings.
2. Apartments with a floor area of 40–50 m^2.
3. Typical residential properties outside the luxury market segment; top locations (Old Town, Boulevards, etc.) were excluded from the analysis.

The selected residential estates that met the above specifications and fetched prices typical of apartments with a floor area of 40–50m^2 are summarized in Table 1.

Two residential estates are located in the designated downtown district (Osiedle Pomorzany and 34 Malczewskiego Street), and four are located outside the downtown district in areas that can be accessed on foot within 20 minutes from the nearest

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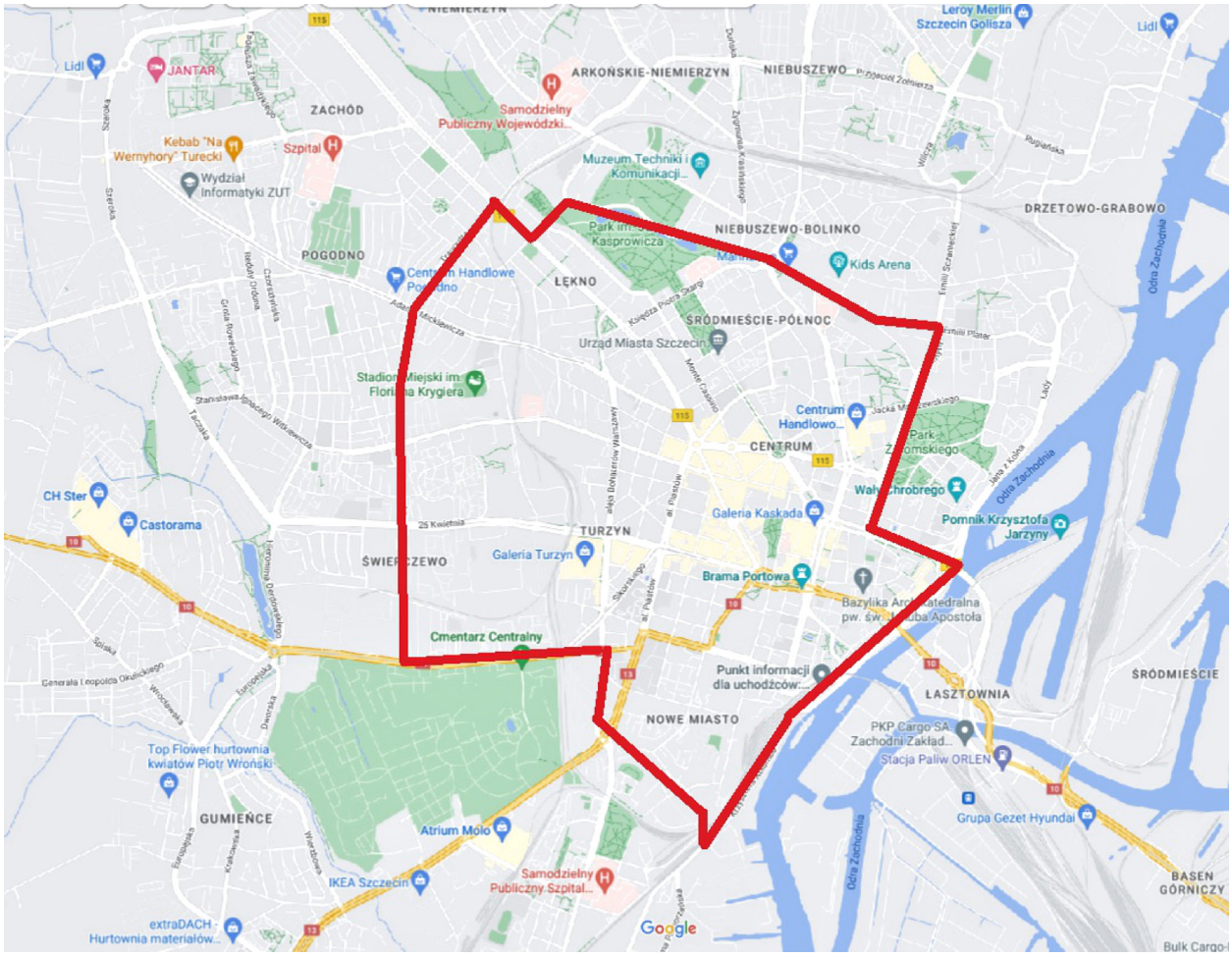

Fig. 1. Downtown district in Szczecin mapped for the purpose of the study
Source: Google Maps (07.03.2023).

district boundary (times measured in Google Maps). These include:

1. EP7 – 9-minute walk to the intersection of E. Plater and Gontyny streets.
2. OKIDOKI – 12-minute walk to the intersection of E. Plater and Gontyny streets.
3. Kutrzeby 12- to 20-minute walk to the intersection of Mickiewicza and Traugutta streets.
4. Pogodno Gardenia – 17-minute walk to the intersection of Traugutta and al. Wojska Polskiego streets.

The remaining four estates (Nowa Północ, Jaśminowe Wzgórza, Nowe Warzymice and Osiedle Jarzębinowe) are located outside the downtown district, relatively far from its boundaries. Three of these were selected for further analysis because two estates are adjacent to each other (Nowa Północ and Jaśminowe Wzgórza).

The differences in the prices of a 45 m^2 apartment located in the downtown district and in suburban locations were calculated on the assumption that the typical unit price of property in the central district was PLN 9,500 per m^2 (calculated as the average price of two apartments in the downtown district) (Table 2).

Only apartments in implemented residential projects were selected for the analysis. All investments implemented in Szczecin and its vicinity were identified for the needs of the study. It should be

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Table 1. Selected residential estates that met research specifications and fetched prices typical of apartments with a floor area of 40–50 m^2

Residential estate, location	Developer	Unit price [PLN/m^2]
EP7, Miedziana Street, Szczecin	Sowińskiego 72 sp. z o.o.	11,700
OKIDOKI, Nocznickiego/Firlika streets, Szczecin	Vastbouw Polska sp. z o.o.	11,500
Kutrzeby 12, Kutrzeby Street, Szczecin	Vastbouw Polska sp. z o.o.	11,550
Pogodno Gardenia, Unii Lubelskiej/Zakładowa Streets, Szczecin	Gardenia Developer, A&M-PROJEKT Spółka z ograniczoną odpowiedzialnością Spółka komandytowa	11,400
Osiedle Pomorzany, 29 Powstańców Wielkopolskich Street, Szczecin	Zakład Budowlany SIEMASZKO sp. z o.o	9,400
34 Malczewskiego street, Szczecin	Zakład Budowlany SIEMASZKO sp. z o.o	9,600
Nowa Północ, 2. Sobola Street, Szczecin	Ronson Development Management sp. z o.o.	8,400
Jasminowe Wzgórza, Sobola Street, Szczecin	Tomaszewicz Development sp. z o.o.	8,100
Nowe Warzymice, 1 Spacerowa Street, Rajkowo	Ronson Development Management sp. z o.o.	8,100
Os. Jarzębinowe, Wejherowska Street	Murbud Developer Spółka Jawna	8,200

Source: own elaboration based on data from: https://ep7.pl, https://vastbouw.pl/inwestycje/nowe-mieszkania-domy-szczecin/nowe-mieszkania-firlika-oki-doki/cennik/, https://vastbouw.pl/inwestycje/nowe-mieszkania-domy-szczecin/nowe-mieszkania-kutrzeby-12/, https://gardenia-deweloper.pl, https://siemaszko.pl, https://ronson.pl/nowa-polnoc, www.tomaszewicz.pl/jasminowe-wzgorze, https://ronson.pl/nowe-warzymice, https://murbud-invest.pl/osiedle-jarzebinowe (14.02.2023) and own research.

Table 2. Unit prices of apartments and price differentials

Price of a downtown apartment	Residential estate	Price of an apartment in the residential estate	Difference
427,500	Jaśminowe Wzgórze	364,500	63,000
	Nowe Warzymice	364,500	63,000
	Os. Jarzębinowe	369,000	58,500

Source: own elaboration based on data from: https://tomaszewicz.pl/jasminowe-wzgorze, https://ronson.pl/nowe-warzymice, https://murbud-invest.pl/osiedle-jarzebinowe (14.02.2023) and own research.

noted that a limited number of such investments is implemented at any given time. All investments meeting the established criteria were included in the study. The analyzed apartment prices reflected the state of the market at the time of the study, as well as the prospective buyers' decision-making strategy.

Car travel time to the nearest district boundary in the morning peak traffic and from the district boundary in the afternoon peak traffic hours was examined for each apartment. Commuting times was analyzed on the following assumptions:

1. Popular commuting routes were mapped. In some cases, longer alternative routes appeared to be faster during rush hours. The shortest routes, i.e. routes that were also fastest outside peak hours, were chosen.
2. Commuting time to the boundary of the downtown district was measured as the part of the journey between peripheral locations and downtown Szczecin that was the source of greatest inconvenience. In fact, the commuting time from home to the city center is longer, but traffic conditions along the district border are the same for the residents of the downtown district and the residents of other areas. This assumption cancels out the difference in travel times to specific downtown locations from points within the central district and from suburban locations.

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3. Travel times to the central district were measured on 27 February, 28 February, 1 March and 7 March 2023 with the Google Maps traffic measurement tool. The weather was fair without precipitation on the first three dates. On the last day of the measurements, the streets were covered by a thin layer of snow in the morning, and strong wind (30 km/h according to the Interia weather service) with occasional hail showers were noted at midday. The measurements were performed during the morning (6:40–8:20 AM) and afternoon (3:00–5:00 PM) rush hours at 10-minute intervals. The average of the longest commuting times recorded on each day was used for the analysis. This approach is justified by the fact that the residents of peripheral districts must account for maximum travel times to the workplace in their daily routines. The results were rounded up to the nearest minute. The calculated times and the route lengths determined based on Google Maps are shown in Table 3.

Travel routes and travel times measured from each location are shown in Figures 2–4.

In the next step, prospective property buyers (households) were characterized based on the following assumptions:

1. The household has 1 car.
2. One trip to and from the downtown district is made on each working day. Other trips are undertaken sporadically. A representative household makes such trips back and forth 300 times a year.

It seems that the way a household operates is the most differentiating factor affecting the actual cost of living in a peripheral location. These costs can increase in households that own more than one vehicle. Similarly, a higher number of trips, for example to transport children to kindergartens, schools or extracurricular activities, significantly affects the transportation costs incurred by a family. In contrast, remote working or simply working from home or close to home significantly reduces these costs. Therefore, the present results are relevant only for households that meet the adopted, typical assumptions, and they constitute a reference point for other situations.

The last assumption was related to the method of calculating the cost of commuting from selected peripheral locations to the boundaries of the downtown district. These costs were calculated with the use of three approaches.

The first approach was based on the reimbursement rate for the use of vehicles that are not owned by the employer, but are used by the employees for business purposes (mileage). At the time of the study, the reimbursement rate was PLN 1.15 per kilometer for a car with an engine capacity of more than 900 cc. The reimbursement rate is stipulated by the Regulation of the Minister of Infrastructure of 25 March 2002 on the conditions for determining and the manner of reimbursing the costs associated with passenger cars, motorcycles and mopeds that are not owned by the employer, but are used for business purposes (Journal of Laws of 2002 No. 27 item 271, as amended). According to the legislator, this reimbursement rate covers the costs of fuel and vehicle operation. The advantage of this approach is that it is based on official, presumably objectively calculated costs of operating a typical vehicle, and the simplicity of the calculation. The main limitation is that this approach does not account for commuting time.

In the second approach, the cost of commuting time was added to the values calculated in the first approach. The cost of commuting time was calculated

Table 3. Commute times and route lengths from each location to the boundaries of the downtown district

Residential estate	Travel time to the downtown district in the morning (minutes)	Travel time from the downtown district in the afternoon (minutes)	Route length (km)
Jaśminowe Wzgórza, Szczecin, Sobola Street	26	22	7.1
Nowe Warzymice, Rajkowo, 1 Spacerowa Street	22	15	5.0
Os. Jarzębinowe, Wejherowska Street	20	19	10.7

Source: data from Google Maps (07.03.2023).

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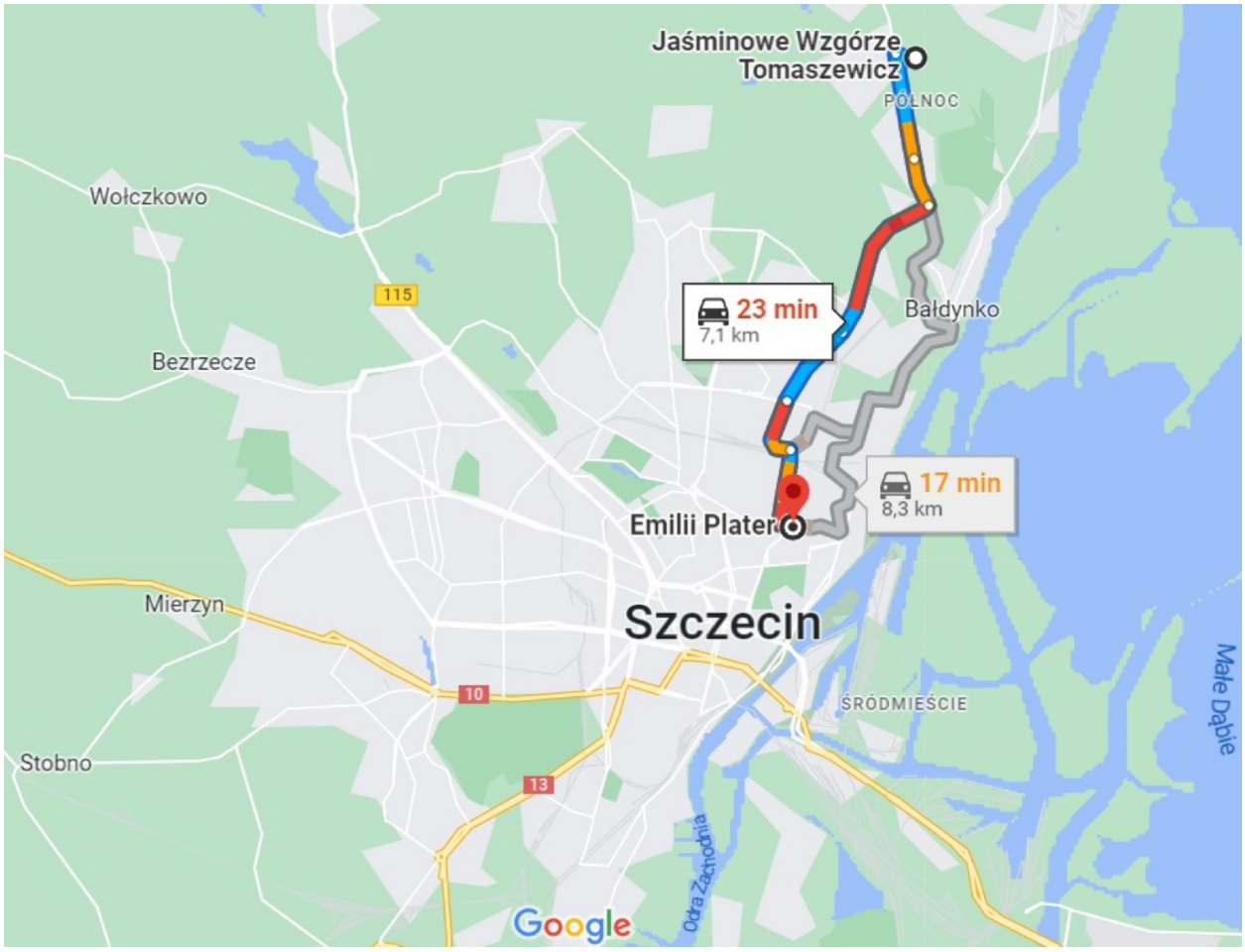

Fig. 2. Travel routes and travel times measured from Jaśminowe Wzgórze estate
Source: Google Maps (07.03.2023).

based on an hourly rate corresponding to the lowest net hourly wage stipulated by a Regulation of the Council of Ministers of 13 September 2022 on the minimum wage and the minimum hourly rate in 2023 (Journal of Laws of 2022, item 1952) which was set at PLN 17.75 per hour (PLN 22.80 per hour gross).

In the third approach, the calculations were performed based on the parameters determined by experts:

1. Fuel consumption and prices: typical fuel consumption was set at 10 L/100 km and fuel price per liter was set at PLN 7.
2. Cost of travel time – calculated based on the second approach.
3. The remaining vehicle operating costs consisted of maintenance, repairs, and insurance. These costs were determined at PLN 3,000/year. This amount may seem low, but it should be borne in mind that the costs of operating a vehicle for commuting from a peripheral location to the place of professional and non-professional activities in the downtown district should correspond only to the portion of the actual operating costs incurred, since vehicles are also used by households for other purposes. According to mubi.pl, the average annual mileage of a car in Poland is 8607 kilometers. In the examined scenario, the owner of a car resides in a peripheral district of a large city; therefore, it seems reasonable to assume that the distance covered each year

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is twice higher, where commuting to downtown locations accounts for only around 30% of that distance based on the adopted assumptions (3000–6420 km, depending on the location). In turn, according to the wygodnie.pl service, in 2022 the average annual total cost of operating a car without purchase and fuel costs ranged from PLN 3042 to 7378. Thirty percent of the higher of these figures gives PLN 2459. Non-fuel related costs of operating a vehicle were adjusted for high inflation (16.1% in March 2023 according to *Statistics Poland*), and rounded to PLN 3000/year.

None of the above approaches accounts for vehicle depreciation. Cars lose value with age and mileage. Vehicle depreciation was disregarded in the analysis on the assumption that a typical homeowner would own a vehicle regardless of their place of residence. Therefore, age-related depreciation seems irrelevant in the examined scenario. Moreover, depreciation caused by intensive vehicle use (greater mileage) and differences in depreciation were not taken into account because such estimates depend on the make, model and age of a car, as well as the owners' propensity to care for their vehicles. It should be noted, however, that depreciation caused by wear and tear is a real cost that reveals itself periodically when the vehicle is sold and replaced, and it may additionally increase the cost of living in a suburban area.

The last consideration in the process of estimating the cost of daily commuting from peripheral locations to the boundaries of the central district is the capitalization rate and the discount rate

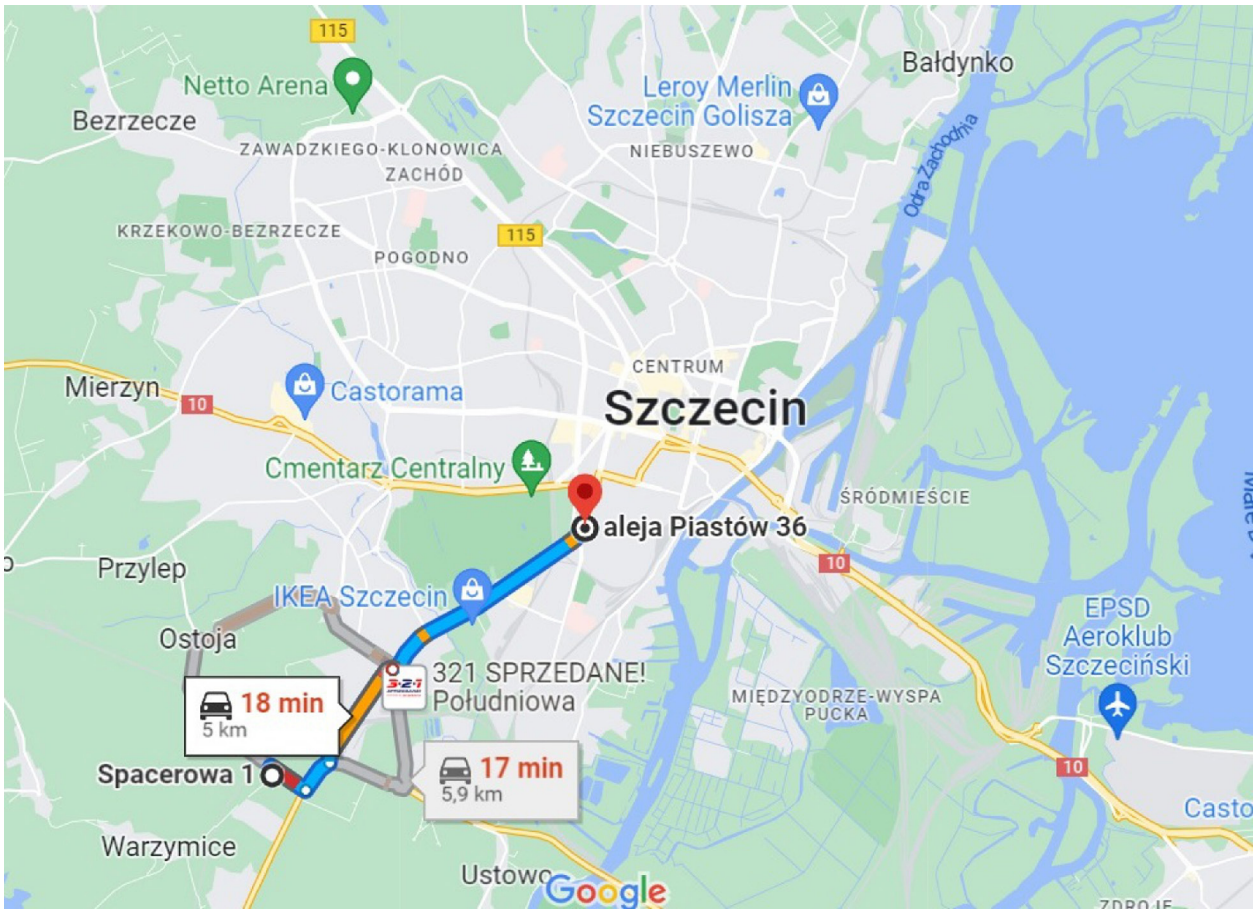

Fig. 3. Travel routes and travel times measured from Nowe Warzymice estate
Source: Google Maps (07.03.2023).

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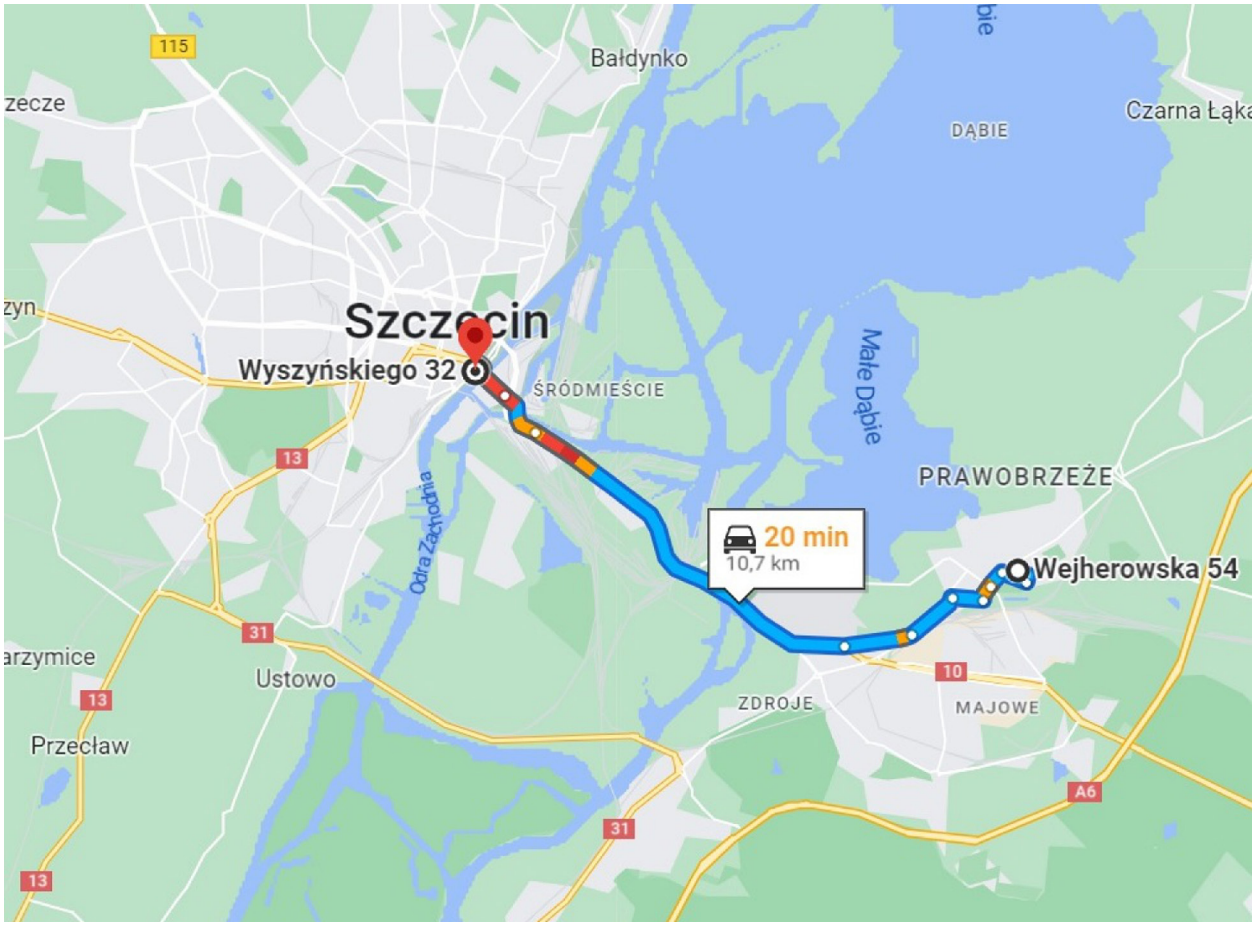

Fig. 4. Travel route and travel time measured from Os. Jarzębinowe estate
Source: Google Maps (07.03.2023).

used in some of the travel costing methods. It was assumed that travel costs would be incurred over a long, indefinite period of time; therefore, capitalized costs were estimated and compared with differences in housing prices in the downtown district and in peripheral locations. A capitalization rate of 4% was adopted because it corresponds to the typical mortgage rates under normal economic conditions. At present, mortgage rates are significantly higher, but the expected long-term average rate was used for the purpose of the analysis. A capitalization rate that corresponds to mortgage rates was selected because a buyer of a property in a peripheral district could potentially consider buying a more expensive property in the suburbs by financing the difference in price with a mortgage credit. The capitalization of costs carries with it the assumption that they will be incurred over an infinitely long period of time. In practice, we usually operate on a shorter time horizon. Therefore, in this study, discounted travel costs were also calculated for a 10-year period on the assumption that they would be constant throughout the analyzed period, and the discount rate was also set at 4%.

The resulting input parameters for calculating commuting costs with the use of the presented approaches are shown in Table 4 (daily parameters) and Table 5 (annual parameters).

The annual travel costs calculated in each of the presented approaches based on the data shown in Table 5 are presented in Table 6.

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Table 4. Daily input parameters for calculating commuting costs

Residential estate	Travel time (h)	Distance (km)	Cost of travel time (PLN)	Fuel consumption (L)	Fuel cost (PLN)	Cost of travel in terms of mileage (PLN)
Jaśminowe Wzgórze	0.80	14.20	14.20	1.42	9.94	16.33
Nowe Warzymice	0.62	10.00	10.95	1.00	7	11.5
Os. Jarzębinowe	0.65	21.40	11.54	2.14	14.98	24.61

Source: own study.

Table 5. Annual (300-day) input parameters for calculating commuting costs

Residential estate	Travel time (h)	Distance (km)	Cost of travel time (PLN)	Fuel consumption (L)	Fuel cost (PLN)	Cost of travel in terms of mileage (PLN)
Jaśminowe Wzgórze	240	4260	4260	2982	2982	4899
Nowe Warzymice	185	3000	3284	2100	2100	3450
Os. Jarzębinowe	195	6420	3461	4494	4494	7383

Source: own study.

Table 6. Annual costs of commuting from suburban locations to the boundaries of the central district calculated according to three approaches

Residential estate	Travel costs (PLN)		
	Approach I	Approach II	Approach III
Jaśminowe Wzgórze	4899	9159	10242
Nowe Warzymice	3450	6734	8384
Os. Jarzębinowe	7383	10844	10955

Source: own study.

The travel costs calculated with the use of the second and third approach are similar, but the estimated costs are higher for properties located relatively far from the border of the downtown district due to the greater distance. The travel costs estimated in the first approach are clearly lower, mainly because the cost of travel time was not considered. Thus, already in this stage of the study, it could be concluded that travel costs are strongly influenced by how people value their time, in particular whether they regard the time spent commuting as a specific cost, or whether they believe that their time costs nothing. Such assessments are always highly subjective. At this stage of the study, it can also be seen that the cost of travel is not negligible, but, depending on the adopted approach and the location of the property, accounts for 1.3 to more than 4 times the net minimum monthly salary (according to the referenced regulation, PLN 3490 gross, i.e. around PLN 2709 net) and from 0.7 to 2.1 of the average net salary (according to the announcement of the President of *Statistics Poland*, in February 2023, the average monthly salary in the enterprise sector was PLN 7065.56 gross, i.e. around PLN 5145 net). Therefore, given the salary levels in Poland, these amounts should be considered significant.

The capitalized and discounted 10-year annualized travel costs in each of the three approaches, calculated based on the data in Table 6, are presented in Table 7.

Capitalized travel costs denote the present value of future transportation expenditures on the assumption that these costs will be incurred forever and that the portion corresponding to the assumed capitalization rate, rather than its nominal amount, should be subtracted from the present value of an expense that will be incurred in a year's time. In mathematical

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Table 7. Capitalized commuting costs and discounted 10-year commuting costs from suburban locations to the boundaries of the central district calculated according to three approaches

Residential estate	Capitalized travel costs (PLN)			Discounted 10-year travel costs (PLN)		
	Approach I	Approach II	Approach III	Approach I	Approach II	Approach III
Jaśminowe Wzgórze	122475	228975	256050	39735	74288	83072
Nowe Warzymice	86250	168344	209593,8	27983	54617	68000
Os. Jarzębinowe	184575	271106	273881,3	59883	87957	88857

Source: own study.

terms, these discounts are introduced on the assumption that transportation costs will be incurred for an infinite number of years. Therefore, capitalized costs have informative rather than real value. Nevertheless, it can be seen that these amounts are significant, ranging from 23.7% to as much as 75.1% of the amount paid for property outside the downtown area. From a practical point of view, these amounts can be regarded as higher valued discounted 10-year commuting costs, since this is the typical and realistic time horizon that investors consider when purchasing property. In the examined case, depending on the investment and the adopted approach, travel costs are determined in the range of PLN 39,735–88,857, which means that they account for 7.6–24.4% of the property price. Hence, if property is purchased in a peripheral district under the adopted assumptions, the resulting additional costs must inevitably be paid over 10 subsequent years, which can be equated with higher property purchasing costs.

The estimated commuting costs (Table 7) and the differences in housing prices (Table 2) were used to evaluate investments in more expensive property in the downtown district and to recover the difference between the prices of property within and outside the central district from the amount saved due to the absence of commuting costs. This amount can be regarded as an investment in the "housing price differential" because the buyer of a downtown property is initially charged with higher costs due to the difference in price between this property and an alternative property in a peripheral location. These costs are subsequently recovered because the owners of downtown property save on commuting costs. The following indicators were used to assess such investments:

1. Payback period, calculated as the difference in housing price divided by the annual cost of travel.
2. A simple rate of return, namely the inverse of the payback period which is calculated as the annual cost of travel divided by the difference in property price.

These indicators were calculated with the use of all three approaches to estimating travel costs, and the results are presented in Table 8.

The results in Table 8 indicate that in the first approach, where the cost of travel is disregarded, the investment will pay off nominally over a period of 8.5 (Osiedle Jarzębinowe) to more than 18 years (Nowe Warzymice), which means the rate of return ranges from 5.48% to 11.72%. Based on the current interest rates on bank deposits, these return rates should be rated as typical to highly favorable. These investments compare even more favorably when the cost of travel

Table 8. Payback periods and simple rates of return on investments in more expensive property in a downtown district

Residential estate	Payback period (years)			Simple rate of return (%)		
	Approach I	Approach II	Approach III	Approach I	Approach II	Approach III
Jaśminowe Wzgórze	12.86	6.88	6.15	7.78	14.54	16.26
Nowe Warzymice	18.26	9.36	7.51	5.48	10.69	13.31
Os. Jarzębinowe	8.53	5.81	5.75	11.72	17.21	17.39

Source: own study.

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time is included in the calculations (Approaches II and III). In this case, the maximum payback period is less than 10 years, and the return rates range from 10.69% to even 17.39%.

The above indicators for assessing the profitability of investments belong to a group of static indicators that do not account for the fact that the present value of a future expense is below its nominal value. This phenomenon is captured by dynamic methods. In the first method, the profitability of an investment is determined by calculating the sum of discounted cash flows (NPV). As previously mentioned, the study was conducted on the assumption that a buyer of a downtown property is initially charged with higher costs that are partly recovered due to the absence of costs associated with commuting from a suburban location to the downtown district. These calculations are based on the assumption that the current nominal values represent, from the present perspective, real amounts in future periods (thus eliminating the impact of inflation). This discount rate was adopted in the calculations based on the premise that, in the long term, the mortgage rate will reach 4% in real terms. The calculations were performed for 10- and 20-year periods, and the results are shown in Table 9.

The NPV values obtained under the adopted assumptions indicate that the purchase of property in a peripheral district, which is associated with higher commuting costs, may be advantageous in a 10-year perspective for buyers who do not regard commuting time as a cost. This is evidenced by the negative NPV values in Approach I. The NPVs for the New Warzymice estate, which is closest to the downtown district and entails the shortest travel time (even allowing for the cost of travel time), suggest that this location is a viable alternative to downtown locations relative to other residential estates. An increase in the time horizon to 20 years significantly affects the NPV. In this case, only property in the New Warzymice estate can be regarded as profitable, provided that the cost of travel time is not included in the calculations. The choice of location should also be guided by the buyer's planned length of residence. A suburban property appears to be a better choice if an investor expects to live in a particular location for a limited period of time (for example, until starting a family) and then buy a larger property. However, locations that do not generate regular travel costs should be considered if the property is meant to be a place of residence for a long, unspecified period of time, Depending on the investment and the method of calculating transit costs, the present value of expenses to be incurred over 20 years can exceed PLN 80,000, which is evidently higher than the difference between the price of a downtown property and a suburban property.

The IRR offers yet another approach to assessing the cost-effectiveness of a property investment by analyzing changes in the value of money over time. The IRR is calculated on the assumption that the sum of discounted capital expenditures and the investment income incurred in different years is equal to 0. An investment project is profitable when the IRR is equal to or greater than the cap rate (for example, the interest rate on a loan). The higher the IRR, the higher the profitability of an investment project. The IRR is widely used to evaluate the cost-effectiveness of investment projects, usually in combination with NPV, despite the fact that the results may be difficult to interpret in some situations (Wawrzyszuk, 2004). The IRR was used as an alternative approach

Table 9. 10-year and 20-year net present value at r = 4%

Residential estate	10-year NPV (PLN)			20-year NPV (PLN)		
	Approach I	Approach II	Approach III	Approach I	Approach II	Approach III
Jaśminowe Wzgórze	-22370	10854	19300	3441	59109	73261
Nowe Warzymice	-33670	-8059	4809	-15494	27420	48982
Os. Jarzębinowe	1329	28321	29187	40228	85455	86906

Source: own study.

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Table 10. 10-year and 20-year internal rates of return

Residential estate	10-year IRR (%)			20-year IRR (%)		
	Approach I	Approach II	Approach III	Approach I	Approach II	Approach III
Jaśminowe Wzgórze	-4.33	7.45	9.98	4.63	13.35	15.32
Nowe Warzymice	-9.68	1.23	5.56	0.88	8.66	11.90
Os. Jarzębinowe	4.47	13.15	13.40	11.08	17.84	18.05

Source: own study.

to interpreting the results obtained in this study. Similarly to NPV, the IRR was calculated for 10 and 20 years. The IRRs on hypothetical investments in more expensive property, i.e. investments in the price differential between favorably and less favorably located properties, including the cost of travel, are presented in Table 10.

To a certain extent, the calculated values of IRR confirm the conclusions drawn from the NPV analysis. In the first approach, negative values of 10-year IRR were obtained for Jaśminowe Wzgórze and Nowe Warzymice residential estates. Such values merely indicate that the investment is not profitable. As a rule, investments with an IRR higher than the expected minimum rate of return should be regarded as worthwhile. If the IRR is 4% and the considered payback period is 10 years, a downtown property appears to be more profitable than a property in Osiedle Jarzębinowe, regardless of the cost of travel time, and, in the second approach, more profitable than properties in the remaining residential estates. If the payback period is extended to 20 years, only the purchase of a property in the downtown district instead of New Warzymice may not yield a satisfactory return.

CONCLUSIONS

The results of this study indicate that the purchase of residential property in the downtown district of Szczecin is more profitable than properties in peripheral locations when travel costs are included in the calculations in each of the presented approaches. The resulting benefits are least pronounced when the cost of travel time is not included in the calculation of transit costs. In this case, discounted 10-year travel costs are even less than the difference in the price of property located in the downtown district relative to a peripheral location. However, travel costs begin to approximate the price differential when transit times are included in the calculations. If travel costs are to be incurred indefinitely, the purchase of property in the downtown district will generate profits due to the absence of regular commuting costs that significantly exceed the price differential. The purchase of property in a peripheral district is a worthwhile alternative only if the buyer does not regard his free time as an economic good, or if his professional and non-professional activities do not require daily travel whose cost and duration are similar to the assumptions made in the analysis.

The present calculations apply strictly to the analyzed case study. The results of similar calculations may be interpreted differently in other cities, other residential estates, or in different periods of time. However, the research findings indicate that such assessments should be carried out because they can deliver measurable benefits in specific cases. The knowledge and application of basic indicators for assessing the profitability of an investment can and should be taken into account by prospective buyers when considering the purchase of property in alternative locations. To assess the profitability of various investments, the input parameters should be modified and adapted to specific scenarios, and the buyer's lifestyle should be taken into consideration to calculate the actual costs of travel, including the estimated annual number of trips and the cost of travel time. For the needs of this study, properties were selected from all residential projects currently under way in Szczecin based on objective criteria. The obtained results, including the rates of return, payback periods, NPV and IRR refer to a specific

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place and time, which can be largely attributed to the specific characteristics of this type of research. The present results also support the formulation of practical conclusions, albeit less precise. The study demonstrated that transportation costs should be taken into account as one of the factors that affect the choice of property location in the context of differences in housing prices in various locations. However, these observations cannot be directly translated to other European cities. Thus, further studies should be carried out on other local real estate markets to expand our knowledge of such phenomena. However, such studies should rely on assumptions that are adapted to the unique characteristics of the examined area. In this context, the present results constitute benchmarks that could be applied in the search for similar phenomena on other local real estate markets.

The present calculations do not account for potential changes in housing prices in different locations. It was assumed that the prices of attractively located properties are less sensitive to market turbulence and are more likely to increase.

It should also be noted that the present study refers only to costs in financial terms. However, long commutes to places of work and education, especially by means of private transportation, also generates non-financial costs for households, including:

– environmental pollution caused by exhaust emissions and consumption of various materials such as tires, oil, automotive fluids, or car parts;
– cost of stress and health hazards;
– social costs associated with the erosion of family ties.

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ENVIRONMENTAL POLICY IN RURAL DEVELOPMENT MANAGEMENT INVOLVING TERRITORIAL PARTNERSHIPS

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ABSTRACT

Motives: Local authorities are seeking new approaches to development, with a strong emphasis on multifunctional development. Taking into account the state of the natural environment, they need to implement various activities that effectively reduce anthropogenic pressure. Poland's membership in the EU requires the implementation of the European Green Deal. The neighbouring Polish and Ukrainian regions of Lublin and Lviv, which share similar environmental conditions and a common cultural heritage, were chosen for this study. The Polish border regions have the potential to serve as an important model for Ukrainian border regions as they strive to integrate into the European Union. This paper provides an overview of development and environmental support policies, as well as in-depth case studies, to establish a basis for assessing the sustainable functioning of rural municipalities and territorial partnerships.
Aim: This study examined supra-local strategic documents concerning environmental protection and rural development in Polish and Ukrainian municipalities. Their socio-economic situation was characterised, and the goals and activities proposed under their environmental protection programmes and local development strategies were identified.
Results: Based on the research findings, a proposal was formulated for implementing systemic solutions in the development of strategic plans to ensure that local strategies become fundamental tools for implementing measures that support environmental protection and sustainable development.

Keywords: environmental protection, strategic planning, Local Action Groups, municipality (*gmina/hromada*), Poland, Ukraine

INTRODUCTION

The modern world is facing the catastrophic effects of global climate change and environmental degradation. One approach to addressing these issues is the Green Deal Concept which aims to achieve climate neutrality in Europe by 2050 at the latest. The Paris Agreement of 2015 has reaffirmed the obligations of developed countries to strengthen climate policy. These developments directly impact

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partner countries, particularly Ukraine, and the European Union Member States, where an updated common climate policy is currently taking shape. The UN General Assembly's post-2015 Development Agenda – Transforming our World: 2030 Agenda for Sustainable Development is an equally important document which sets out 17 sustainable development goals. These goals are embedded in the fundamental principles of environmental policy in Poland and Ukraine.

Currently, Ukraine faces a significantly higher anthropogenic burden on the environment than developed countries worldwide, and this burden is constantly increasing. In the past year, Ukraine's overall situation has been compounded by the war which has considerably worsened the state of the environment. In this challenging situation, implementing the state's environmental policy and addressing local environmental issues is a crucial and complex aspect of domestic and foreign policy. The activities implemented as part of this framework focus on restoring natural resources, ensuring the stability of the nature conservation system, securing the livelihoods of the population, and implementing effective environmental policy mechanisms at different levels of the country's territorial division (Burdak & Makar, 2020).

In Poland, despite a long history of environmental protection measures, many negative impacts have not been adequately reduced, which is largely due to ineffective environmental policy instruments. Poland has significantly reduced its atmospheric emissions, increased the levels of wastewater treatment, and improved waste management since the political and economic transformations of 1989. However, smog continues to pose a threat during the heating season due to the dominance of traditional energy sources. Little progress has been made in development of the nature conservation system, and the decline in biodiversity has not been halted (Karaczun, 2020).

International obligations, as well as the need to improve the citizens' lives compel both countries to develop a system that effectively links economic development programming with environmental protection requirements. A formal basis and the appropriate instruments have to be developed for the effective implementation of environmental policy and environmental management at different levels of territorial division in the country. At the same time, "the Union's priorities for rural development should be pursued within the framework of sustainable development and the Union's promotion of the goal of protecting and improving the environment" (European Union 2013, Article 5).

Intersectoral partnership is a voluntary cooperation of actors in three sectors (state, economic, social) in the process of identifying and solving social problems in joint effort. Local associations play an important role in the rural development process. The European Union has introduced LEADER, an innovative local development tool that is being implemented by local action groups (LAGs) (Lengerer et al., 2023; Ray, 2000). This instrument has been in place since the 1990s (Bocher, 2008; Bruckmeier, 2002; Pollemann et al., 2020; Thusen, 2011). Initially (between 1991 and 1990), LEADER was a pilot initiative. The last programming period (2014–2020) had been included in the second pillar of the Common Agricultural Policy (CAP) (European Union 2013, Articles 29, 31–33, 42–44, 59 and 65). The programme's scope was increased upon the enlargement of the EU (Dax et al., 2016; Navarro et al., 2016; Konečný, 2019). The activities implemented under LEADER contribute not only to innovation and economic improvement (Bosworth et al., 2016; Navarro et al., 2018), but also to strengthening local communities and raising living standards (Convery et al., 2018; Shucksmith et al., 2020). The LEADER programme has a special place in post-socialist countries (Chevalier & Maurel, 2010; Konečný et al., 2020; Macken-Walsh, 2010; Marquardt et al., 2012).

Local action groups are an example of effective associations in Poland (Falkowski, 2010; Furmankiewicz et al., 2010; Furmankiewicz, 2012; Hochleitner, 2011; Psyk-Piotrowska & Zajda, 2013; Wojewódzka-Wiewiórska, 2017). Their contribution to various areas of local development has been discussed extensively in the literature (Brańka, 2015; Brańka

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et al., 2015; Furmankiewicz et al., 2016; Kołomycew & Pawłowska, 2013; Szamrowski & Pawlewicz, 2015; Turek, 2013). Musiał-Malago' and Marcisz (2019) and Wiza (2021) pointed out that local associations organically complement the activities of local government agencies by integrating and activating municipal inhabitants, which confirms their importance. The role of local partnerships and grassroots initiatives is particularly emphasised (Brodziński, 2009; Gulc, 2013; Kalisiak-Mędelska, 2013; Nycz, 2013). However, some researchers have argued that LAGs insufficiently stimulate the multifunctional development of rural areas (Guzal-Dec & Zwolińska-Ligaj, 2017).

Territorial partnership is a new concept in Ukraine, and the Polish example is only beginning to make inroads into the scientific literature. Korinets (2023) discussed the importance and advantages of local partnerships. Therefore, Polish experiences in improving environmental policy should be examined in the context of territorial partnerships for Ukraine.

MATERIALS AND METHODS

The aim of the study was to assess environmental policies and strategic programmes, to define their spatial dimensions, and to identify factors that determine the choice of development directions. The specific objective was to present the role of environmental policy and programming in strategic documents, and to assess the extent to which Polish experiences can be implemented in Ukraine.

The research sample was selected based on an analysis of legal acts, strategic documents and materials available on the official websites of territorial units. The documents prepared for selected municipalities (*gminas*) in Lublin Voivodeship in Poland and the municipalities (*hromadas*) in Lviv Oblast in Ukraine were subjected to a detailed analysis. Territorial units were selected for the study based on the following criteria:

– the Polish region and the Ukrainian region must be directly adjacent to each other;
– one LAG is selected in Lublin Voivodeship, and all participating municipalities should have an up-to-date local strategy;
– one of the priority objectives in the local strategy should relate to environmental policy;
– three adjacent municipalities are selected in a district (*raion*) of Lviv Oblast (to propose a local partnership and a joint strategy);
– all three Ukrainian municipalities should have an up-to-date strategy, where the development of an environmental policy is one of the priorities.

Various information sources, methods, research tools and techniques were considered in the study. The literature and legal acts were reviewed, and the existing development strategies and environmental protection programmes were assessed at different levels of territorial division in both countries. A comparative analysis of strategic planning systems and environmental protection programmes in Poland and Ukraine was carried out.

Several research methods were used in the study, in particular:

– critical analysis (review and evaluation of the literature);
– statistical methods (collection and analysis of statistical data concerning the studied territorial units and their documents);
– comparative analysis (comparison of activities in rural areas in Poland and Ukraine);
– monographic method (analysis of Local Development Strategies (LDS) and rural clusters in Ukraine),
– case study (characterisation of LDS and their effectiveness in Poland, and the strategies of rural communities in Ukraine),
– abstract-logical method (formulation of concepts, conclusions and recommendations).

The environmental protection objectives in the analysed documents were collated in the following stage of the study. Case studies were also discussed based on the experiences of local government agencies and their associations. The study was undertaken to determine the advantages and disadvantages of the existing systems in both countries, and to formulate conclusions and recommendations.

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SELECTED INSTRUMENTS FOR DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT

In Poland, development management is based on a system of strategic documents which are the basic instruments for guiding the country's development policy (Gawroński, 2010). Strategic documents define the country's development goals and the manner of their implementation. The Development Policy Act of 6 December 2006 (consolidated text, Journal of Laws 2023, item 225) constitutes the legal basis for environmental management. The 2020 amendment to the above Act (Journal of Laws 2020, item 1378) introduced a number of changes with the aim of integrating socio-economic and spatial development programming in strategic documents. The most important changes include provisions aiming to strengthen the role of regional and municipal development strategies and to introduce supra-local development strategies. The Strategy for Responsible Development until 2020 (with an outlook until 2030) (M. P. 2017, item 260) is the medium-term strategy which defines the objectives and directions of social, economic and spatial development in a medium-term perspective. Nine integrated strategies are the main strategic documents in the development management system, including the National Strategy for Regional Development 2030 (M. P. 2019, item 1060) and the State Environmental Policy 2030 – Development Strategy for Environment and Water Management (M. P. 2019, item 794). These strategies combine social, economic and spatial planning based on the existing links between different areas, and they provide a basis for coordinating these activities at lower levels of territorial division. The National Development Concept 2050 is currently under development, and it will define development trends and provide a basis for the preparation of development strategies.

At present, the State Environmental Policy 2030 – Development Strategy for Environment and Water Management (M. P. 2019 item 794) constitutes the basis for all environmental activities. This document also takes into account the objectives and commitments at the international level, including the objectives of the European Union's climate and energy policy until 2030, and the sustainable development objectives formulated in Agenda 2030. The adopted objectives are also determined by the legislative requirements defining environmental quality standards in intervention areas.

The environmental protection programme is an instrument for implementing the environmental protection policy at all levels of territorial division (voivodeship, county, municipality) (Fig. 1). Local authorities are legally obliged to develop an environmental protection programme pursuant to Article 17(1) of the Environmental Protection Act of 27 April 2001 (consolidated text, Journal of Laws 2022, item 2556). Such a programme should take into account the hierarchy of environmental objectives formulated in the strategies, programmes, and programming documents of higher-level territorial units as regards the area covered by the analysis and the documents adopted at the municipal level. The aim of the programme is to improve the condition of the natural environment in municipalities, to minimise the negative impact of pollution on the components

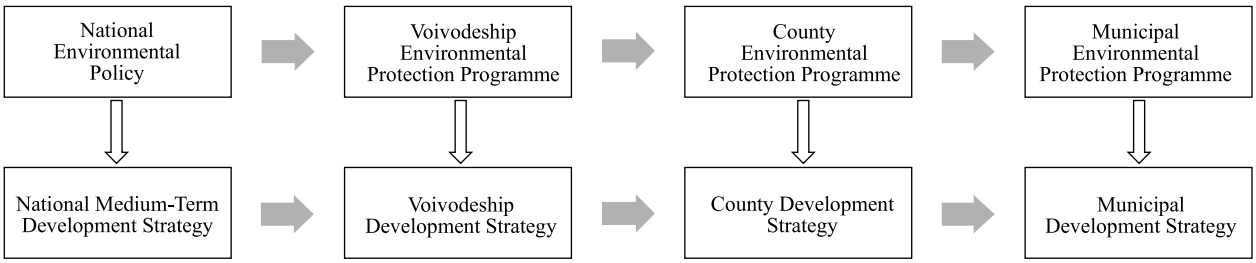

Fig. 1. Strategic planning and environmental management system in Poland
Source: own elaboration.

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of the environment and the environment as a whole, to manage environmental resources rationally, and to protect environmental values. The programme should constitute the basis for the environmental management system by combine all activities and documents on environmental protection and nature conservation at the level of a given territorial unit.

Ukraine has a similar strategic planning system to Poland. On 7 September 2022, Ukraine adopted a law amending selected legislative acts on the foundations of the State Regional Policy and the Policy of Reconstruction of Regions and Territories (No. 2389-IX). This law outlines the main legal, economic, social, environmental and organisational principles of regional state policy as a component of Ukraine's domestic policy. It specifies the main goals in the reconstruction of regions and territories affected by armed aggression against Ukraine. The law formulates a clear mechanism for planning, development and reconstruction of Ukrainian regions and municipalities. It also introduces a three-tier system of strategic planning at the national, regional, and municipal level.

The following legal acts set the formal basis for Ukraine's environmental policy: Decree No. 722/2019 of the President of Ukraine of 30 September 2019 on sustainable development goals in Ukraine until 2030, Regulation of 28 February 2019 on the basic principles (strategy) of Ukraine's national environmental policy until 2030 (No. 16, Article 70), and Decree No. 443 of the Ukrainian Council of Ministers of 21 April 2021 approving the National Environmental Action Plan until 2025.

The Strategy of the National Environmental Policy of Ukraine and the National Action Plan play the key role in the process of developing a consistent vision for the implementation of these founding documents in the area of environmental protection, in particular the development of national and local policies. At the regional level, the Environmental Protection Programme for 2021–2025 was adopted pursuant to Decision No. 72 of the Lviv Regional Council of 23 February 2021. The development of environmental programmes is chaotic at the municipal level. Not all municipalities have departments responsible for environmental issues, and environmental problems are often resolved by general economic departments. In addition, the developed programmes do not always correspond with the development strategies of municipalities as autonomous bodies.

In municipalities, environmental programmes are developed by Departments of Land Resources and the Environment. In many cases, these programmes are created without reference to the municipal strategy. However, according to the adopted law, strategic documents should be aligned. Programme activities that are not included in the strategy are not entitled to funding from regional or state budgets. Therefore, strategies and programmes are being amended in many municipalities.

RESULTS AND DISCUSSION

Strategic documents at the regional level were analysed in the first stage of the study. The objectives related to environmental protection are formulated in the Development Strategy of Lublin Voivodeship and the Development Strategy of Lviv Oblast. These objectives are directly related to countering threats and improving the state of the natural environment (Table 1). The Environmental Protection Programme of Lublin Voivodeship is not directly aligned with the Development Strategy of Lublin Voivodeship, despite the fact that environmental priorities should be consistent with strategic and programme documents. However, in accordance with formal requirements, the environmental protection program takes into account the intervention areas and the objectives resulting from the National Environmental Policy.

The goals, directions, and objectives of the Ukrainian Programme align with Strategic Objective 4 "Clean Environment" of the Lviv Region Development Strategy 2021–2027 and the operational objectives (Table 1). They are also consistent with the Waste Management Strategy of Lviv Oblast until 2030 and the Development Strategy of Mountain Areas in Lviv Oblast for 2018–2022. The environmental situation in Lviv Oblast is influenced by both long-standing

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Table 1. Environmental priorities in the strategic documents of Lublin Voivodeship and Lviv Oblast

Lublin Regional Development Strategy until 2030		Lviv Regional Development Strategy 2021–2027	
Strategic objective 2: Strengthening links and functional systems Operational objective 4.1		**Strategic objective 4 Clean environment**	
		Prevention of water and air pollution	
Operational Objective 2.4.	Protection of environmental assets	Operational Objective 4.2.	Promotion of environmental awareness and development of a comprehensive waste management system
		Operational Objective 4.3.	Preservation of biodiversity and establishment of protected areas
Environmental Protection Programme of Lublin Voivodeship for 2020–2023 with an outlook to 2027 (areas of intervention and objectives)		**Environmental protection programme 2021–2025** (main directions and goals)	
1) Climate and air quality protection: Improving air quality while ensuring energy security in the context of climate change. 2) Noise pollution: Improving the acoustic climate of Lublin Voivodeship. 3) Electromagnetic fields: Protection against electromagnetic fields. 4) Water management: I. Achieving good status of surface and groundwater bodies; II. Protection against water-related extreme events. 5) Water and wastewater management: Achieving rational water and wastewater management. 6) Geological resources: Rational management of geological resources. 7) Soils: Protecting soils from negative anthropogenic impacts, erosion, and adverse climate change. 8) Waste management and waste prevention: Waste management according to the waste hierarchy based on the sustainable development of Lublin Voivodeship. 9) Natural resources: I. Protection of biodiversity and landscape; II. Sustainable management of forests; III. Increasing forest cover. 10) Major accident hazards: Reducing the risk of major accidents and minimising their consequences.		1) Establishment of a nature reserve fund, preservation of biodiversity and landscape diversity. 2) Promotion of environmental awareness. 3) Creation of an environmental monitoring system. 4) Minimising the disposal of untreated and insufficiently treated wastewater to water bodies and improving the quality of surface water in the basins of rivers Dniester, Western Bug, San, and Dnipro. 5) Addressing the main problems associated with the safe collection, storage, disposal, treatment and disposal of municipal, industrial and hazardous solid waste. 6) Land conservation and rational use of land. 7) Protection of ambient air. 8) Promotion of international cooperation in environmental protection. 9) Restoration of environmental balance in areas affected by the operations of mining and chemical companies in Lviv region. 10) Supporting the activities of regional landscape parks.	

Source: own elaboration based on online documents: https://strategia.lubelskie.pl/srwl/2030/srwl.2030.synteza.pdf, https://loda.gov.ua/documents/49999

and current problems. Agricultural practices, forestry and mining, chemical industry, machine engineering, and municipal infrastructure in urban areas have significant impacts on the environment. Under the Development Strategy of Lviv Region until 2027, the main environmental problems that require urgent action include surface water pollution from untreated or inadequately treated wastewater, low levels of environmental awareness, inadequate waste management infrastructure that leads to pollution with industrial and domestic waste, and non-sustainable use of biological resources that contribute to the loss of biodiversity.

In Poland, the investigated region was Lublin Voivodeship, where 22 LAGs have been established. These groups are required to formulate and adopt LDS. An analysis of 62 strategic objectives specified (Table 2) in the LDS revealed that they focus on

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Table 2. Strategic objectives of environmental policies in selected Polish and Ukrainian municipalities

Poland							Ukraine		
Municipal development strategy							Municipal development strategy		
Chodel	**Józefów nad Wisłą**	**Karczmiska**	**Łaziska**	**Opole Lubelskie**	**Poniatowa**	**Wilków**	**Velyki Mosty**	**Sokal**	Radekhiv
Development Strategy of Chodel Municipality for 2015–2023	Development Strategy of Józefów nad Wisłą Municipality for 2016–2023	Development Programme of Karczmiska Municipality for 2015–2022	Development Strategy of Łaziska Municipality for 2016–2020	Development Strategy of Opole Lubelskie Municipality for 2016–2025	Development Strategy of Poniatowa Municipality for 2015–2025	Development Strategy of Wilków Municipality for 2017–2027	Development Strategy of Velyki Mosty Municipality for 2020–2027	Development Strategy of Sokal Municipality until 2027	Development Strategy of Radekhiv Municipality until 2027
CS 3. Improving the standard of living in the municipality	CS 2. Development of technical infrastructure, improved access to housing, and preservation of natural resources	CS 4 Environment and environmental protection	CS 2. Improving municipal infrastructure	CS 4. Low-emission and environmentally-friendly municipality	CS III. Safe and healthy society	1. Improving living conditions through the development of basic technical and social infrastructure	CS 1. Quality of life	CS 2. Improving living conditions	CS 3. Sustainable development of the municipality
CO 3.6. Preservation and enhancement of natural resources	CO 2.6. Implementation of high-standard environmental protection measures		CO 2.2 Expansion of sanitation infrastructure	CO 4.2 Adequate protection of valuable natural areas in the vicinity of nature reserves and the Chodelka Valley […].	3.7 Effective protection and restoration of environmental resources	1.3 Improving the quality of the environment	CO 1.2 Clean environment	CS 2.1. Improving engineering, road, environmental infrastructure and landscape	CS 3.3. Comfortable and safe environment
– Valorisation of natural resources – Construction, modernisation, renovation and provision of infrastructure for the conservation of natural resources	– Development and implementation of an environmental programme – Implementation of environmentally- friendly solutions – Implementation of an environmental education programme for residents	– Investments in renewable energy sources – Asbestos abatement – Promotion of environmental awareness – Construction of domestic wastewater treatment plants		– Development and implementation of a comprehensive programme for the revitalisation of river valleys and nature reserves – Landfill rehabilitation and development	– Creation of a<system for the collection of sorted waste at the source – Raising public awareness of environmental issues		– Improvements in wastewater management, water supply and drainage networks – Improvements in the solid waste management system – Implementation of hydrological measures, sanitary status of rivers and lakes	– Protecting the municipal environment	– Environmental safety

CO – operational objective, CS – strategic objective

Source: own elaboration based on: https://chodel.gmina.pl/, https://gminajozefow.pl/, http://www.karczmiska.pl, https://gminalaziska.pl/, https://opolelubelskie.pl/, http://um.poniatowa.pl/, https://wilkow.e-biuletyn.pl/, https://sokal-rada.gov.ua/, https://radekhiv-miskrada.gov.ua/, https://vmgromada.gov.ua/

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8 main topics (Fig. 2). Under the Rural Development Programme for 2014-2020, the strategies of LAGs in Lublin Voivodeship focused on the development of tourism and entrepreneurship (entrepreneurship – 90%; tourism, recreation – 50%). Environmental protection was the general objective in the LDS of only three LAGs.

Based on the established criteria, seven Polish municipalities belonging to a single LAG under the LEADER Programme in Lublin Voivodeship, and three Ukrainian municipalities belonging to a territorial partnership were selected for detailed analysis (Table 2). The analysis of LDS revealed that none of the strategic objectives were solely dedicated to environment. However, the environmental component is present in each document at the level of operational objectives, with clearly defined tasks for their implementation.

Local Action Groups serve as an additional tool for the development of Polish municipalities (Kołodziejczak & Szczepańska, 2021). Based on the adopted criteria, the "Fruit Trail" LAG in Lublin Voivodeship was selected for detailed analysis (Table 3).

According to the Guidelines for the development of environmental protection programmes in voivodeships, counties, and municipalities (2015), environmental impact assessments encompass 10 areas of future intervention. The operational section formulates the directions and tasks for each intervention area. The relevant documents have been developed by only two municipalities selected for the study. Four programmes developed at voivodeship to municipal level were analysed.

In the analysed documents, most tasks are related to climate protection and air quality (reducing air pollutant emissions and modernizing transport infrastructure). The second significant group of tasks pertains to water management and protection, in particular water and wastewater management, and the expansion and modernisation of infrastructure. Many tasks are related to waste management and waste prevention, mainly rational waste management practices and the expansion of infrastructure for selective waste collection. At the regional level, a notable proportion of the tasks address the management of natural resources within the overall structure of the programmes (Table 4).

An analysis of LDS in Poland and Ukraine revealed that little attention has been given to objectives related to environmental policy. Some strategies lack such objectives, despite the fact that the LDS are the fundamental documents for the development of territorial units (Wiatrak, 2011). However, two objectives in LAG strategies were dedicated to environmental issues. This highlights the importance and effectiveness of LAGs in promoting and implementing environmental policies in municipalities. It should be noted that LAGs are local grassroots movements with a shared potential.

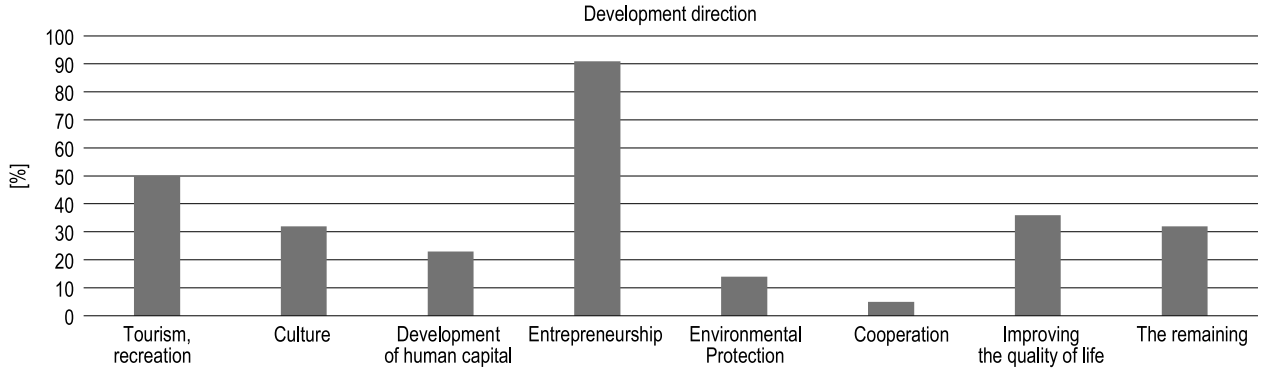

Fig. 2. Development directions in the local strategies of Local Action Groups in Lublin Voivodeship
Source: Kostetska (2022).

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Table 3. Analysis of the strategic objectives of the "Fruit Trail" Local Action Group

	Objectives	Projects
General objective 1	Competitive and innovative fishing and aquaculture	
Specific objectives	1.1 Support for the adaptation and remediation of aquatic environments affected by natural disasters, harmful human and animal activities, and adverse consequences of climate change	1.1.1. Supporting activities to prevent and counteract damage 1.1.2. Supporting measures to reduce emissions of substances that cause climate change 1.1.3. Protection and restoration of the aquatic environment
General objective 4	Raising public awareness about environmental issues, local culture and heritage	
Specific objectives	4.1 Development of social capital and enhancement of local communities' self-organisation capacity in matters relating to culture, the natural environment, and local heritage	4.1.1. Community support for the use of local resources
	4.4 Preservation and sustainable use of cultural, historical, natural, and fishery resources	4.4.2. Creation and adaptation of fisheries heritage sites and education 4.4.3. Support for NGOs and other organisations in the field of education and promotion of fisheries heritage

Source: own elaboration based on (Strategy…, 2015).

Table 4. Areas of intervention in environmental programmes

Areas of intervention	Environmental programme			
	Lublin Voivodeship 2019	Opole county 2021	Karczmiska 2018	Poniatowa municipality 2019
	Number of tasks			
1. Protection of the climate and air quality	23	10	5	5
2. Noise pollution	9	4	4	4
3. Electromagnetic fields	2	2	4	2
4. Water management	14	8	4	1
5. Water and wastewater management	8	7	7	4
7. Soils	10	4	3	6
8. Waste management and waste prevention	15	5	6	4
9. Natural resources	27	7	5	4
10. Major accident hazards	5	2	3	2
Reducing the risk of major accidents and minimising their consequences				

Source: own elaboration based on the analysed environmental programmes.

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Research has demonstrated that LAGs play a significant role as catalysts for rural development (Hadyński & Borucka, 2015; Kołodziejczak, 2011; Wiza, 2021; Zajda et al., 2016), and their strategies can serve as the basis for the future implementation of supra-local development strategies (Koliński & Kołodziejczak, 2021). Projects related to environmental protection and sustainable use of natural resources play a significant role in the strategies of LAGs established in different Polish regions (Czapiewska, 2012; Furmankiewicz & Janc, 2011; Guzal-Dec, 2014; Musiał-Malago' & Marcisz, 2019; Pałka, 2014; Pawłowska et al., 2014). A supra-local development strategy was formally introduced by the amendment to the Development Policy Act (Journal of Laws 2020, item 1378). In Ukraine, a similar system of strategic planning and programming has been introduced after decentralisation (Kostetska, 2021). However, the goals of rural development policy that had been implemented at the beginning of decentralisation and entrenched in the current legislation have not been achieved to date (Davydenko et al., 2022).

Environmental protection programmes should serve as a key instrument in environmental management to coordinate the activities undertaken at the level of voivodeships, counties, and municipalities. These programmes interpret the progress made in the implementation of environmental policies at the regional and local level. Unfortunately, the practical aspects of these programmes and their actual impact on spatial planning and development have not been adequately anchored in legislation. Moreover, the methodological indications and the substantive content of these mandatory documents have been modified over the years (Baran-Zgłobicka, 2017). The analysis demonstrated that the environmental programs introduced at different levels lack consistency. Furthermore, the formal objectives and tasks indicated in these programmes are not directly linked with LDS. Although all documents, including strategies and programmes, contain tasks for implementing investments related to environmental protection, these tasks are not implemented as part of long-term plans, but according to current needs. Most investments receive external support, which establishes a clear connection to the availability of funding. The system for controlling and enforcing the development of local environmental programmes is ineffective, which poses an enormous challenge. Therefore, efforts should be made to strengthen the role of environmental activities in strategic planning.

A supra-local development strategy offers a certain solution to this problem. The analysis of LAGs' development strategies revealed that this is an effective approach, especially when initiated at the grassroots level, because it actively involves members of the local community. Environmental projects are also more effectively implemented by associations of municipalities than individual municipalities. The effectiveness of environmental protection measures can also be increased by incorporating the objectives of the European Green Deal at the supra-local level.

CONCLUSIONS

Ukraine can benefit from Poland's experiences in implementing environmental policies. Some Polish municipalities have been developing documents for consecutive programming periods before the obligation to prepare environmental programmes had been introduced. Polish experiences in aligning local development plans with environmental management may not be flawless, but they provide an opportunity to highlight the system's advantages and disadvantages and propose a new framework that can be implemented in Ukraine to enhance the protection of its natural environment and avoid the mistakes made by the neighbouring countries (Fig. 3).

The proposed recommendations for establishing LAGs in the analysed Ukrainian municipalities aim to harness the local communities' entrepreneurial potential, create jobs, increase revenues for the local budget, and preserve the local culture and lifestyle. Additionally, these recommendations will build a positive image of Ukrainian municipalities and strengthen international cooperation, including as part of cross-border projects.

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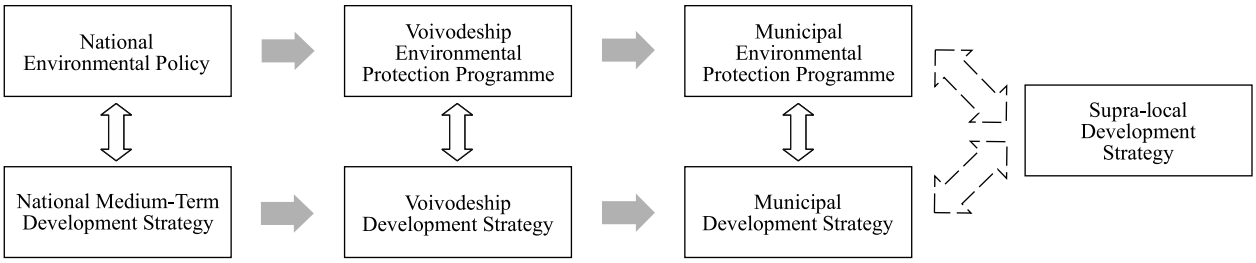

Fig. 3. Proposed planning system in Poland using Local Action Groups as an additional instrument
Source: own elaboration.

Polish LAGs are very active. The inclusion of local communities in the process of creating LDS promotes civic engagement in the implementation of activities and fosters cooperation with local authorities. Ukraine has implemented decentralisation reforms which led to the creation of territorial units. The creation of territorial associations can be a good step towards effective management of rural development and environmental protection policies.

Ukraine became an EU candidate in 2022, and the proposed activities and strategic plans have to meet EU standards. In this context, international cooperation among Polish and Ukrainian LAGs can play a crucial role because these associations can form consortia to exchange experiences at the local level. The study also demonstrated that the Polish LAG model can serve as an additional tool for each community and a valuable opportunity to adopt a similar model in Ukraine.

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IDENTIFYING AND HIERARCHIZING FACTORS THAT AFFECT THE CHOICE OF TRANSPORT ROUTES IN LAND-FERRY TRANSPORT CHAINS

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ABSTRACT

Motives: The choice of a transport route has long been the subject of research because it is regarded as one of the most crucial decisions in transport organizations. However, there is a lack of studies addressing this issue in the context of land-ferry supply chains, where two transport modes have to be integrated. Therefore, analyses of multimodal transport should involve a holistic approach to account not only for seaborne transport, but also for the land leg before and after the ferry trip. This knowledge gap should be urgently addressed due to the importance of land-ferry supply chains in the transport system.
Aim: The aim of this study was to identify and hierarchize factors that determine the choice of a multimodal transport route combining ferry and road transport.
Results: The factors that determine the choice of ferry routes were identified and hierarchized according to their importance as primary, supplementary, and additional routes. The study demonstrated that the cost and time of transport are the main determinants in the decision-making process, with time being marginally more important than cost.

Keywords: transport systems, transport routing, ferry transport, maritime transport, transport management

INTRODUCTION

The ferry transport market on the Baltic Sea has been developing fast (Połom, 2020; Vojdani, 2019). On the Polish market, carriers such as Stena Line, Unity Line, Polferries and TT Line provide regular services between the seaports in Świnoujście, Gdańsk and Gdynia and the Swedish ports in Karlskrona, Ystad, Trelleborg and Nynäshamn (Stenaline; 2023; Studzieniecki & Palmowski, 2021; Polferries, 2023; Ttline; 2023; Unityline, 2023). Ferries that serve those routes are passenger and cargo vessels which in addition to the tourist function play a significant role in cargo transport and constitute key links in sea-land transport chains (Kotowska, 2016). Ferry connections from Gdynia, Gdańsk and Świnoujście play a key role

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in freight deliveries to Scandinavia. Polish sea ferry terminals handle over 500k vehicles a year, and the busiest of them is the one in Świnoujście (see Table 1).

Table 1. Transshipments of trucks and semi-trailers in the analysed ports in 2023

	Świnoujście	Gdynia	Gdańsk
trucks	426,058	98,789	23,501
trailers/semi-trailers	22,790	63,670	5,516

Source: Transport – activity results in 2022, GUS, Warszawa, Szczecin 2023.

Given such a large disparity between the terminals (the Świnoujście ferry terminal handles over four times more vehicles than Gdynia and nearly 20 times more than Gdańsk), a question arises: which factors have an impact on the forwarders or carriers in their decision making when choosing a specific ferry connection, and consequently the particular ferry terminal. A specific feature of ferry transport via Polish seaports is the fact that a considerable part of it is made up by so called "accompanied transport", which means that in the course of the transport process the truck drivers are on board the ferry. Consequently, this kind of transport is additionally subject to regulations covering driving time and rest period limits for drivers (Regulation (EC) 561/2006). Decision-makers must account for this when estimating the time and cost of transport, which, in consequence, affects the choice of the transport route.

The objective of this study was to identify and hierarchize factors that determine the choice of a transport route in circumstances when it is necessary to use more than one transport mode and to combine ferry and road transport (land-ferry transport chain for accompanied transport).

The simple structure of this paper serves the purpose of presenting the research results in a clear manner. The theoretical background for the research is described in Section 2. Section 3 describes the methodology. The research results and discussion are included in Section 4. The conclusions are given in Section 5.

A search of current literature on this subject has shown a lack of research studies regarding factors that have an impact on decisions taken by forwarders or carriers when choosing ferry routes, and take into account the specific nature of accompanied transport. In this regard it is possible to assert that the presented findings fill this research gap.

LITERATURE REVIEW

Due to its unquestionable importance for the world economy, maritime cargo transport has long been the subject of numerous research studies (Christiansen et al., 2007; Heaver, 2002). However, the studies predominantly focus on deep sea transport carried out by specialized cargo ships. In the case of short sea shipping with the use of passenger and cargo ferries, the research interests concerning passenger transport prevail over those related to cargo transport (Banerjee et al., 2020; Fomin & Lovska, 2020; Gan et al., 2017; Kizielewicz et al., 2017; Kizielewicz, 2023). The few studies regarding cargo transport by ferry focus mainly on technical (Urbanyi-Popiołek, 2014) or environmental issues (Pizzol, 2019; Kotowska, 2015). Meanwhile, ferries constitute key links in land-sea transport chains, as well as being important elements of transport systems (Urbanyi-Popiołek, 2021). It is also possible to assert that they meet the conditions for being part of combined transport that is defined as intermodal transport where the major part of the journey is by rail, Inland waterways or sea and any initial and/or final leg carried out by road is as short as possible (Directive, 2016). Combined transport involves two different modes of transport, where one (passive) means of transport is carried by the second (active) one which for this purpose uses an appropriate transport infrastructure and consumes energy (Wiśnicki, 2000). In the case of combined land-sea transport performed by the Baltic ferries, the initial and final legs are by road carriage, whereas the main part of the transport is by sea (Czermański, 2011; Frémont & Franc, 2010).

Each transport process is initiated by the planning stage including i.a. making decisions on choosing the carrier and the route (Filina-Dawidowicz et al., 2022). A number of factors influence such transport

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decisions, however, there is no consensus about their hierarchizing. Cost is commonly considered to be the main determinant. As noted by Jung et al., the cargo transport cost constitutes a considerable share of the logistic costs incurred by enterprises in various industries, which consequently has a significant impact on the price of the products offered by them. Thus, a reduction in transport costs may contribute to increasing their competitiveness (Jung et al., 2019). However, researchers' opinions vary when it comes to the importance of other factors. According to Tiwari et al. (2003), in addition to the cost-effectiveness principle, entities most often follow the reliability principle when making transport decisions. Fanam & Ackerly (2019) are of a similar opinion, pointing to (in addition to the key significance of the cost factor) the importance of the carrier's service quality and their own familiarity with the service offered. Kozieł (2014), in turn, names price and time as the main determinants of transport decisions, considering both of them to be of equal importance. In many sources, factors such as reliability, type of cargo, and service quality are considered significant, though not of key importance (Mangan et al., 2002; Murphy & Hall, 1995).

The issue of choosing a transport route has long been the object of research (Jiang et al., 2020). It is commonly considered to be one of the most important decisions regarding transport organization (Waller et al., 2008). However, the numerous studies on the modelling of cargo transport routes do not take into account the specific nature of ferry transport and the need to integrate two transport modes (Andersson & Ivehammar, 2017; Keshkamat et al., 2009; Weisbrod & Lawson, 2003). Thus, there is a lack of studies relating in this context directly to combined transport, in particular land-ferry transport. Coordination of both transport modes is of key importance and requires in-depth research to address this specific nature. When making decisions on choosing a transport route and a concrete ferry connection, carriers engaged in combined transport must also account for the human factor – the presence of HGV drivers on board the ferry (Hanssen et al., 2020). When travelling on a ferry, drivers are not performing transport activities, nevertheless, they are taking part in the transport process and are subject to the provisions of Regulation 561/2006. When travelling on a ferry, drivers use their "resting time". If the ferry travel time is significantly longer or shorter than the prescribed 9 hours of the daily rest period, this may have a significant impact on transport decisions. In this case, it is necessary to take a holistic approach to account not only for the seaborne transport itself, but also the land leg that needs to be carried out prior to and after the ferry trip (taking into account both the total transport cost and the total transport time, including the required breaks for the driver).

METHODS

An analysis of the existing research literature has shown that the main determinants in choosing transport routes include cost and time. However, as desk research has demonstrated, most sources did not take into account the situations where transport is carried out using more than one transport mode, and, in addition to seaborne transport, also comprises the road leg. The objective of this study was to fill the research gap by identifying and hierarchizing the factors that determine the choice of a transport route when it is necessary to use more than one transport mode and to combine ferry and road transport (land--ferry transport chain for accompanied transport).

To attain this objective, the Multi Case Study (MCS) method was applied (Yin, 2018). as well as qualitative and quantitative research techniques (Fig. 1).

The next step in designing the MCS method was defining the unit of analysis. The research study was based on the analysis of carriage taking place via three Polish ferry terminals: in Świnoujście, Gdynia, and Gdańsk.

The largest of these three is the ferry terminal in Świnoujście, comprising five berths. It serves ferries going to two Swedish ports: Ystad and Trelleborg. From 7 to 11 ferry connections are served daily. There are three carriers operating at the terminal: Polska Żegluga Bałtycka (PŻB), Unity Line, and TT Line.

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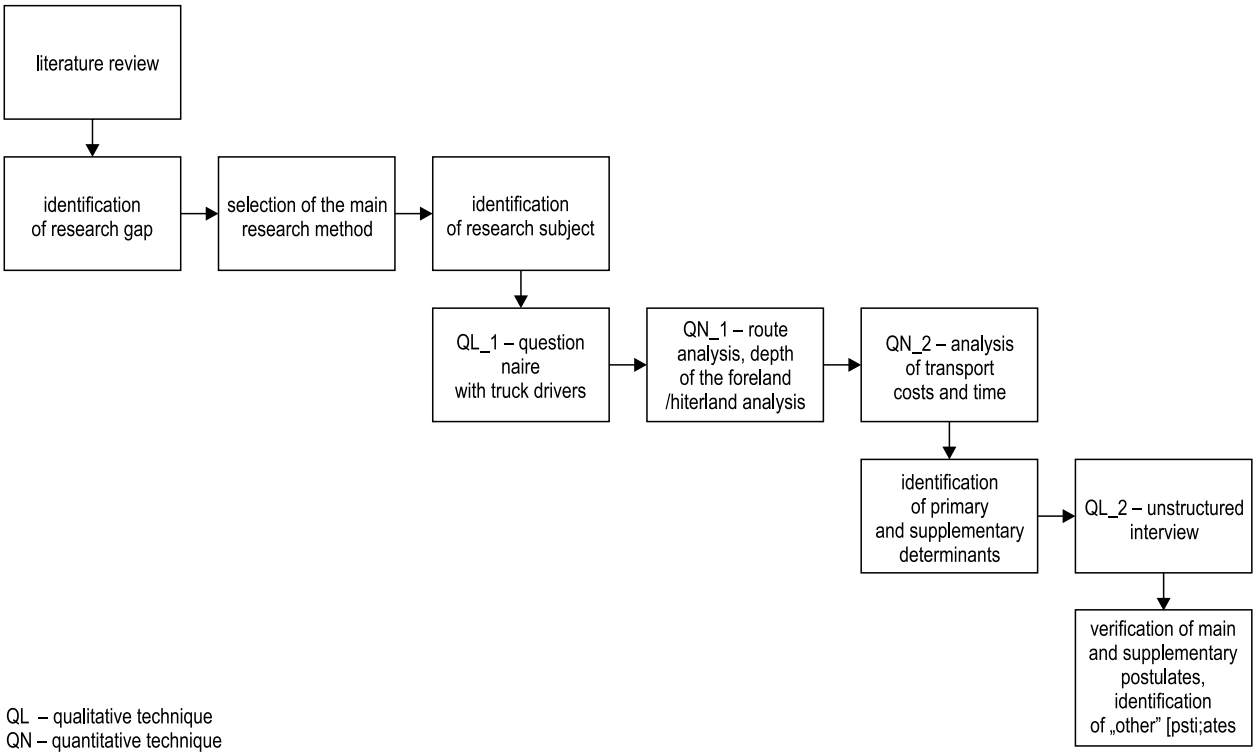

Fig 1. Research method and techniques
Source: Own elaboration based on the conducted research.

In 2021, the ferry terminal handled 6.5m tonnes of ferry cargoes (Eurostat Database).

The ferry terminal in Gdynia serves the connection to Karlskrona in Sweden. There are three connections per day, operated by Stena Line. In 2021, the terminal handled 1.5 m tonnes of ferry cargo.

The third and the smallest of the analysed terminals is the ferry terminal in Gdańsk. It serves one connection per day to Nynashamn in Sweden – the port located nearest to Stockholm. The service is operated by PŻB. The terminal locations are shown in Fig. 2.

In accordance with the MCS method principles, at the first stage of the study the following research questions were formulated:

1. Which routes are chosen by shippers of cargo carried by road accompanied transport (where do the cargoes come from and where are they headed) via Polish ferry terminals?
2. Which factors are decisive in choosing a given ferry connection?

In order to answer Question 1, the study applied the survey research technique.

The main goal of the survey was to collect the primary research material to be the basis for specifying the length of the road link in land-sea transport chains. The research was completed using the personal survey technique (PAPI – Paper and Pencil Interviewing) in September 2022 at the three ferry terminals in Świnoujście, Gdynia, and Gdańsk. The study used one of the non-random sampling methods – the targeted sampling. As a result, a total of 245 drivers were surveyed. The analysis covered responses obtained from 115 drivers from the ferry terminal in Świnoujście, 104 drivers from the ferry terminal in Gdynia, and 26 drivers from the ferry terminal in Gdańsk. As the surveys were held among drivers waiting to board a ferry, they pertained only to the routes headed for Scandinavia.

The drivers answered two questions:

1. Where did you pick up the cargo?
2. Where are you carrying your cargo to?

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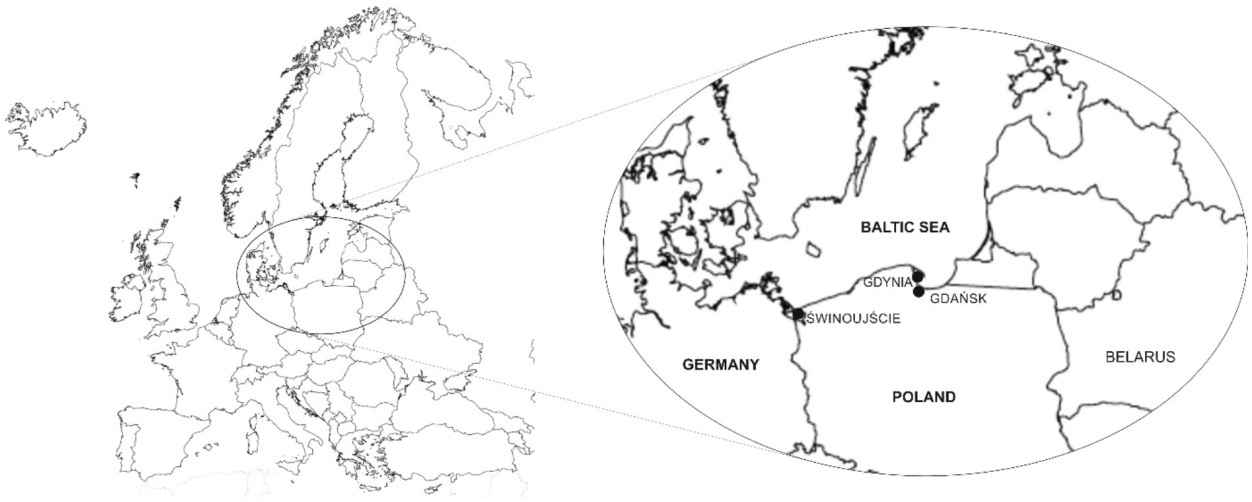

Fig. 2. Locations of the analysed ferry terminals
Source: Own elaboration.

The data were gathered with accuracy to the following spatial aggregation levels:

1. Regarding the place of cargo origin:
   a. for cargoes coming from Poland – the voivodeship (16);
   b. in other cases – the country (9 countries of cargo origin were identified; Belarus, Bulgaria, Czech Republic, Holland, Germany, Slovakia, Ukraine, Hungary, and Italy).
2. Regarding the place of cargo destination:
   a. (D) Denmark;
   b. (N1) South Norway;
   c. (N2) North Norway;
   d. (S1) South Sweden;
   e. (S2) Central Sweden;
   f. (S3) North Sweden;
   g. (F) Finland.

The drivers' responses were then grouped by route. For each route T (x, y, z; where x – place of cargo origin, y – ferry connection used in the cargo carriage, z – place of cargo destination), a number of identified trips was determined.

In order to answer the second research question, at the first stage of the study two primary determinants of choosing a transport route were identified, based on the literature as well as the expertise and experience of the research group:

a. Total transport time;
b. Total transport cost.

Then, as supplementary determinants:

a. shorter transport time in hinterland and foreland;
b. lower transport cost in hinterland and foreland;
c. shorter transport time by ferry;
d. lower transport cost by ferry.

Next, a database was developed. For each route T(x,y,z) the following values were specified:

a. number of trucks carried on the given route (identified based on the surveys);
b. carriage distance in the hinterland – the distance between i) the capital city of the voivodeship of the place of cargo origin and the ferry terminal (for cargoes from Poland) or ii) the distance between the capital city of the country and the ferry terminal (for cargoes from outside Poland);
c. carriage distance in the foreland – the distance between the ferry terminal and the central point of a given region;
d. total carriage distance as the sum of the distances specified in items b and c;
e. mean ferry travel time specified on the basis of the ferry service timetables. Values adopted in the study: 7 h for the Świnoujście – Ystad/Trelleborg route, 10.5 h for the Gdynia–Karlskrona route, and 18 h for the Gdańsk-Nynashamn route;

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f. pre- and on-carriage time – the transport time in the hinterland and foreland, assuming a mean speed of 60 km/h, and the daily rest period required by Regulation EC 561/2006;
g. total carriage time, taking into account: pre- and on-carriage time, mean time of waiting for the ferry, equalling half of the time between ferry departures, but no less than 2 hours (vehicles are required to arrive 2 hours before ferry departure time), ferry travel time;
h. ferry transport cost was specified based on mean rates offered to surveyed road carriers;
i. cost of pre- and on-carriage was established as EUR 1.00 per km;
j. total cost was calculated using the mean cost of 1 km and the offer price for ferry transport (data obtained from direct interviews with road carriers).

The total of 525 hypothetical routes were identified.

For each cargo transport P_i identified in the survey and following route T(x,y,z), it was established whether it met the condition of the lowest total cost or the shortest total transport time in comparison with the other two routes starting at the same pick-up place (x) to the same place of destination (z) via the other two ferry terminals (y), assigning respectively the value of 1 – if the condition was met and 0 if it was not met.

At the second stage of the study, with regard to the cargo transports that did not meet any of the primary determinants, with the use of the same method it was established whether they met the supplementary determinants of choosing the transport route. The research results are presented in a graphic form.

In order to validate the quantitative research results and to specify additional determinants that could not be identified on the basis of the quantitative research, unstructured interviews were held with five experts – representatives of carriers and forwarders from Poland, who specialized in organizing and carrying out transport to and from Scandinavia. The research was carried out in two transport enterprises and three forwarding companies. The selected entities specialize in organizing transport to and from Scandinavia. It should be noted that there are few entities with such experience on the Scandinavian transport market. Most entities did not consent to participating in the research study. The respondents were decision-makers in executive positions, selected for the study on the basis of their business experience of at least fifteen years in the transport industry. In the forwarding companies, the study involved managers of international road transport forwarding departments, whereas in the transport enterprises the interviews were held with managers of international transport departments. In one of the enterprises, there was a department dealing with transport to Scandinavia. All the interviewees participating in the study were asked questions regarding the major factors which they considered crucial when deciding which ferry to use.

RESULTS AND DISCUSSION

The locations of ferry terminals in Poland determine their geographical hinterland. The ferry terminal in Świnoujście is situated in the west of Poland next to the German border. Its geographical hinterland covers the western part of Poland (voivodeships: Zachodniopomorskie, Lubuskie, Wielkopolskie, Dolnośląskie, Opolskie) and West European countries. Gdynia and Gdańsk are located in the central-northern part of Poland. Their geographical hinterland covers 2/3 of Poland's territory (the central and eastern part) as well as the countries of Central and Eastern Europe. However, the survey showed that cargoes gravitate to the Świnoujście terminal much more extensively and from greater distances. As many as 30% (35 of 115) trucks carried cargoes from outside Poland, from countries such as Slovakia, Hungary, Bulgaria, Ukraine and Belarus, for which the closer ferry terminal is the one in Gdynia or Gdańsk (Appendix 1a). A similar situation was observed for the domestic hinterland. As many as 33 of 80 cargo transports coming from the domestic hinterland and served in Świnoujście came from the voivodeships in central and eastern Poland (Table 1, Appendix 1b). A different picture is presented by the ferry terminals in Gdynia

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and Gdańsk, where Polish foreign trade accounts for as much as 95% of the traffic (Appendix 2a). Only 6 out of 130 identified cargo transports were transits from other countries (i.e. Czech Republic, Slovakia and Hungary). Most of the transports related to Polish foreign trade were the ones from central and eastern Poland. Only 15 out of 124 transports came from western Poland (Appendix 2b). It is worth noting that as many as 26 surveyed drivers picked up their cargoes in central and eastern Poland and in the countries of Central and Eastern Europe (Slovakia, Hungary, Ukraine, Belarus, Bulgaria) that were destined for Central and North Sweden, Norway and Finland, and used the ferry service from Świnoujście (Appendix 3). In geographical terms, such transport is unreasonable, those cargoes should gravitate to the ports in Gdynia and Gdańsk (Appendix 4).

The second stage of the research made it possible to identify the most frequently found determinants in choosing a transport route. As many as 158 (65%) of 245 cargo transports met one of the two primary determinants. Out of that 71 (29%) met both determinants: the lowest cost and the shortest time, 49 (20%) met only the shortest time determinant, and 38 (16%) – only the lowest cost determinant (Fig. 3). It is therefore possible to assert that the received findings are convergent with the results of the studies completed by Jung, Tiwari et al., Fanam & Ackerly & Kozieł (Fanam & Ackerly, 2019; Jung et al., 2019; Kozieł, 2014; Tiwari et al., 2003). Nevertheless, our study showed a slight preference for time over cost. This is due to the fact that it is most often the cargo carrier rather than shipper that decides about choosing the route. For road carriers, transport time has a significant impact on total costs, due to the considerable fixed costs of running their business activity (i.e. costs of depreciation of the means of transport, insurance, vehicle maintenance, repair and inspections, administration and drivers' wages), whereas it has no impact on the price of the service offered (offers for cargo shippers depend on the transport distance rather than its duration). Many road carriers are ready to incur a slightly higher cost of transport to shorten the transport time. The saved time may be used to perform another transport order.

However, particular attention should be paid to the transports that did not meet any of the specified primary determinants. There were 87 such transports, accounting for as much as 36% of their total number. In Fig. 3, they are represented by the "Other" category.

Table 2. Distribution of journeys via the examined ferry terminals

Place of cargo destination	Place of cargo pick-up			
	Western Poland and Western Europe[a,b]		Central and eastern Poland, Central and Eastern Europe[c,d]	
	Via Świnoujście	Via Gdynia/Gdańsk	Via Świnoujście	Via Gdynia/Gdańsk
(D) Denmark	1	0	1	0
(F) Finland	1	0	0	0
(N1) South Norway	7	4	1	16
(N2) North Norway	1	2	3	14
(S1) South Sweden	18	2	19	24
(S2) Central Sweden	33	9	15	35
(S3) North Sweden	9	2	6	22
Total	70	19	45	111

a. Dolnośląskie, Lubuskie, Opolskie, Wielkopolskie, Zachodniopomorskie
b. Czech Republic, Holland, Germany, Italy
c. Kujawsko-Pomorskie, Lubelskie, Łódzkie, Małopolskie, Mazowieckie, Podkarpackie, Pomorskie, Śląskie, Warmińsko-Mazurskie, Podlaskie, Świętokrzyskie
d. Belarus, Bulgaria, Slovakia, Ukraine, Hungary
Source: Own study based on the conducted research.

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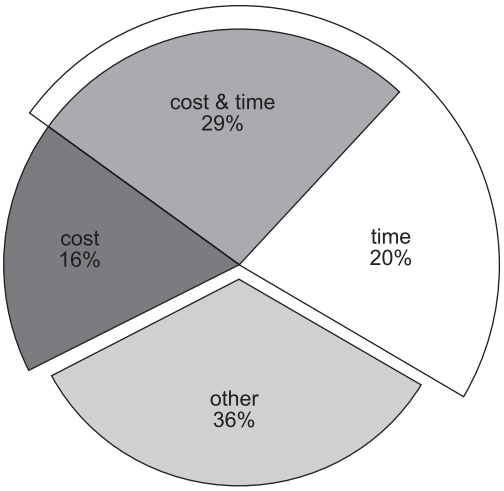

Fig. 3. Percentages of meeting the primary determinants in the whole research sample
Source: Own elaboration based on the conducted research.

With respect to this group, it was checked whether they met the supplementary determinants (Fig. 4). The findings were quite unambiguous. As many as 51 (59%) met the shortest time of ferry transport determinant, 8 (9%) transports met the two determinants of pre- and on-carriage time & cost, and 1 of the pre- and on-carriage cost. 27 transports (i.e. 31%) did not meet any of the identified supplementary determinants. In Fig. 4, these are represented as "Other".

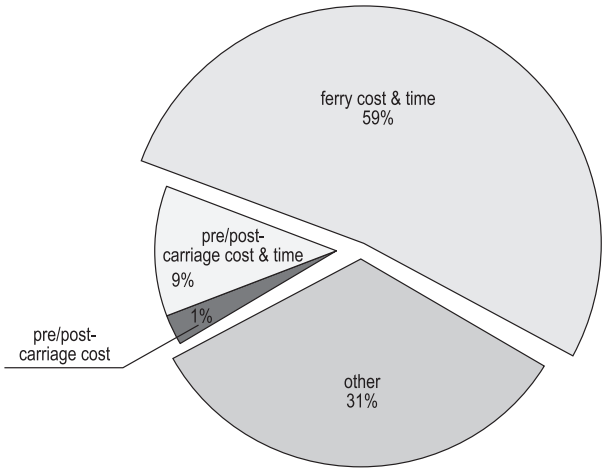

Fig. 4. Percentages of meeting the supplementary determinants within the group that did not meet the primary determinants
Source: Own elaboration based on the conducted research.

The considerable predominance of ferry travel time over the other determinants of choosing the transport route can be attributed to several factors:
– in the analysed case of sea passages starting in Polish seaports only the shortest ferry connection Świnoujście – Ystad/Trelleborg taking 7 hours did not exceed the drivers' shortened daily rest period regulated by Regulation EC 561/2006. The other ferry connections starting in the seaports of Gdynia and Gdańsk did not meet the requirement;
– out of all the analyzed ferry terminals, only the seaport of Świnoujście offers so many loading opportunities. In Świnoujście, up to 11 ferries are served on a daily basis, whereas in Gdynia there are only 2 or 3, and in Gdańsk – just one. As a result, in normal conditions, drivers do not have to wait to board the ferry longer than the required 2 hours, regardless of the time they reach the terminal. The other ferry terminals do not offer such possibilities.

As a result, only the Świnoujście-Ystad/Trelleborg connection ensures the optimum use of the driver's daily rest period during the mandatory sea passage.

However, the completed quantitative research did not explain the carriers' motivations in the case of the 27 cargo transports (over 10% of all the identified transports) which did not meet any of the determinants, either primary or supplementary. In view of the above, an interview with the experts was conducted, which made it possible to explicitly specify the obtained findings. All the respondents agreed that time is an important factor, even though the points of reference shown by the forwarders and carriers were diverse. From the point of view of the forwarders, the transport time was the most crucial, but it did not matter whether the land transport time or sea passage time was shorter. According to the carrier, both factors were equally important due to the need to reach the place of destination at a specified point in time. Additionally, the carriers definitely pointed out the possibility of using the driver's rest period during the sea passage. It was also important for them that the waiting time for the ferry should be as short as possible. The carriers also pointed out that an important determinant of choosing a transport route was the need to arrive "on time". This is due

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to the working time of warehouses/terminals and the designated time slots in which trucks may be handled at the terminal. If a vehicle arrives at the point of destination outside the designated time window, it will not be handled and will have to wait for another available time slot. As for transport costs, the forwarding companies decided that the total cost is the most important, without breaking it down into the ferry crossing cost and the road carriage cost. The carrier, in turn, found the cost of ferry passage more important. The ferry crossing cost depends on the received offer and contract concluded with the ferry operator. This often determines the choice of a specific ferry by the road carrier, even if this is not the first outgoing ferry upon the truck's arrival at the ferry terminal.

The interviewees also indicated that choosing a ferry as a means of transport is most often connected with the nature of the cargo being moved, e.g. in the case of perishable goods the ferry cost is not a significant factor, similarly as in the case of valuable cargoes. On the other hand, the ferry cost will be an issue in the case of low-value cargoes such as e.g. recycled paper bales, where each additional cost factor has a significant impact on the final price of the product.

Having analyzed the obtained responses it is possible to conclude that choosing the way the transport is organized is a question of transport optimization, where time and cost factors are considered to be primary determinants, at the same time taking secondary factors into account.

CONCLUSIONS

The research study aimed to identify and hierarchize factors that determine the choice of a transport route when it is necessary to use more than one transport mode and to combine ferry and road transport (land-ferry transport chain for accompanied transport). The study focused on the Polish market, which has seen significant developments in ferry transportation over recent years.

The research objective has been achieved, and the research process provided an answer to the posed research questions. The research findings have shown that in the case of land-ferry transport there is no geographically assigned hinterland, and the distance

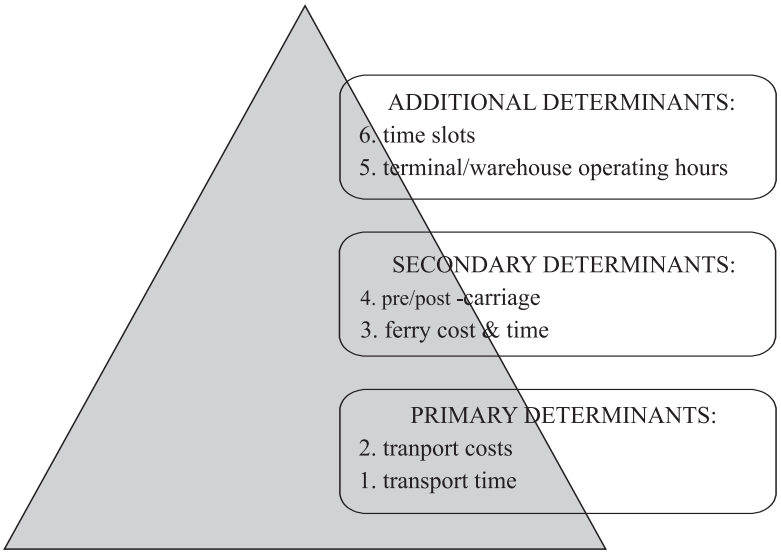

Fig. 5. Hierarchizing the determinants of choosing transport routes in land-ferry transport chains

Source: Own elaboration based on the conducted research.

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to a ferry terminal is not a determinant of choosing a transport route.

The research results made it possible to identify and hierarchize the determinants of choosing a given ferry connection. The determinants were hierarchized according to their importance as primary, supplementary, and additional. The main determinants identified at the first stage of the research are cost and time of transport, with a slight prevalence of time over cost. Thus, the obtained results generally confirm the results of desk research regarding maritime transport in its broad sense. However, the in-depth quantitative research made it possible to identify the supplementary determinants: ferry cost, ferry time, pre- and on-carriage cost, pre- and on-carriage time. The qualitative research, in turn, verified the quantitative research and made it possible to identify additional determinants: terminal/ warehouse working time and designated time slots (Fig. 5).

These factors are characteristic for land-ferry transport chains and have not been identified before. The desk research has shown there are few studies focusing on freight transportation via ferries, especially in the context of combined transport. Most existing studies concentrate on long-distance maritime shipping, while short-distance maritime transportation on ferries has received less attention. In this respect, it is possible to assert that this article fills the theoretical research gap.

By identifying and hierarchizing the factors determining the choice of transport route, the study provides valuable insights for shippers, transport operators, and policymakers involved in planning and optimizing land-sea transport chains. The results of the research can support decision-making processes by helping stakeholders prioritize the factors that have the most significant impact on route selection.

Conflict of interest
None.

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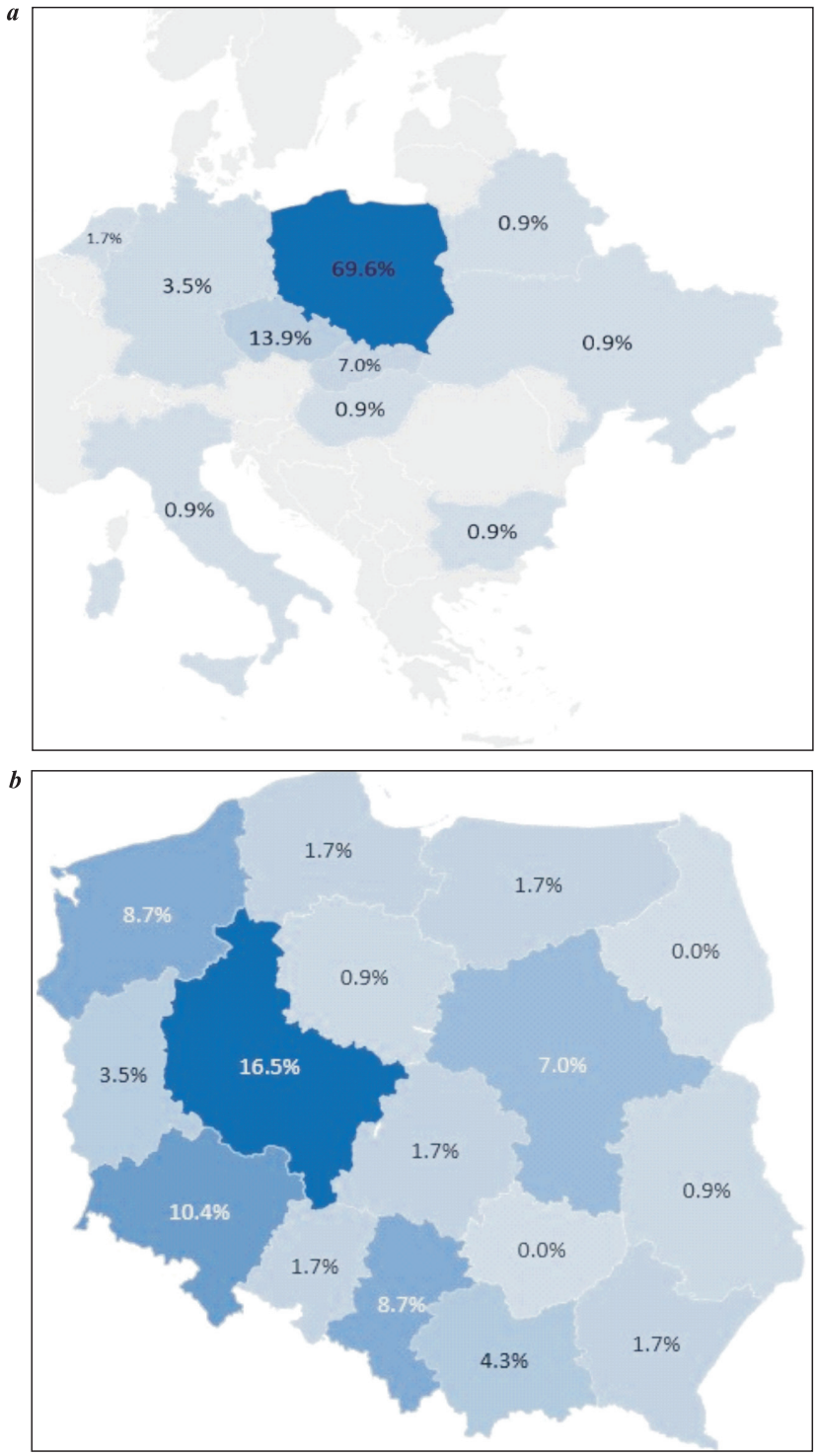
Appendix 1



Foreign and domestic hinterland distribution of Świnoujście ferry terminal
Source: own study.

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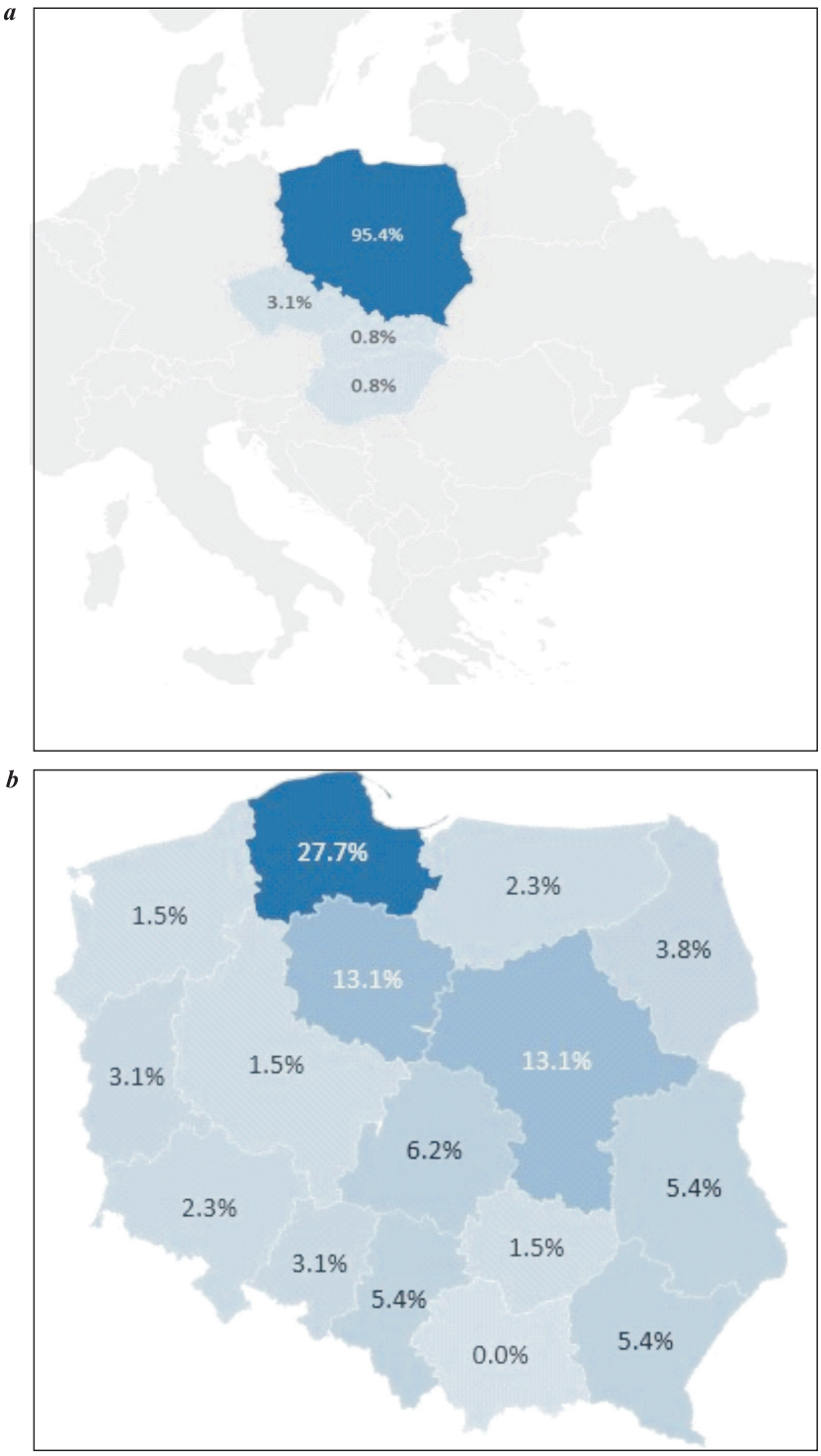
Appendix 2



Foreign and domestic hinterland distribution of Gdynia and Gdańsk ferry terminals
Source: own study.

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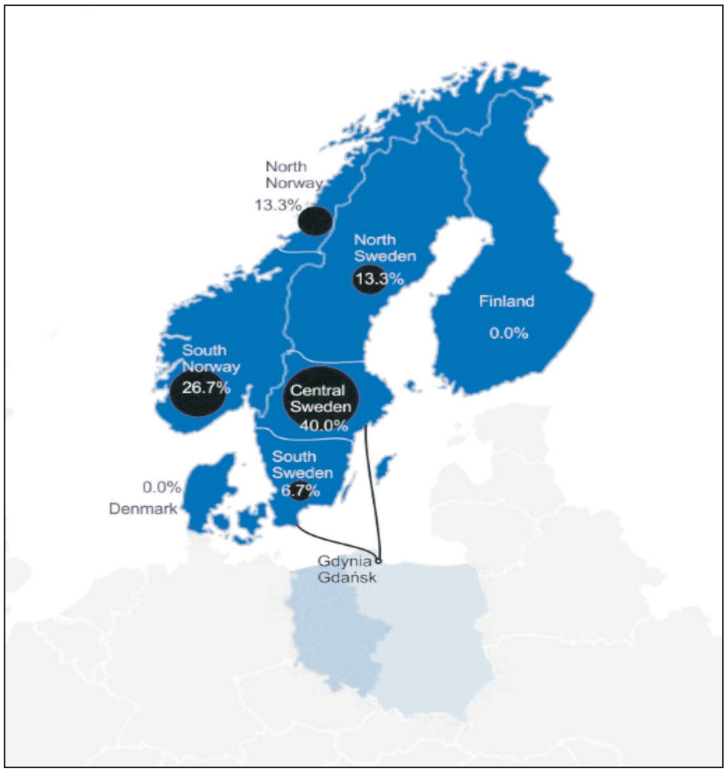
Appendix 3



Foreland distribution of cargo originated from Western Poland and transported via Gdynia and Gdańsk ferry terminals
Source: own study.

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Appendix 4

Foreland distribution of the cargo originated from Eastern Poland and transported vie Świnoujście ferry terminal
Source: own study.

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MICRO-GEOGRAPHIES OF ADMINISTRATION: A WOLF IN SHEEP'S CLOTHING? THE IMPACT OF TRUST ON A STREET-LEVEL APPROACH TO IMMIGRANT INTEGRATION

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ABSTRACT

Increased global migration to welfare states puts pressure on successful integration. Successful integration is broadly associated with entry into the labour market. Therefore, integration is measured through employment. Attempts to increase migrant involvement in the labour market are often made by street-level organisations, where interactions between individuals from the private and/or public sector interact with the migrants. At this microlevel, seemingly innocuous administrative decisions made by individuals working to increase migrant labour integration are often overlooked, yet, as this study shows, have a significant impact on the perceived success of such projects. Using nonparticipant observation, chronological ordering and framework analysis, this paper investigates the dynamics of trust as a critical, yet underplayed dimension of the immigrant integration process within a Swedish street-level organisation. The findings reveal instances of immigrant commodification, exploitation of the project format and lack of cultural awareness, which can disrupt the delicate psychosocial relations at play, without ever being appreciated in official reports. Moreover, the impact of trust further impacts on the micro-geographies of immigrants and the integration process. We conclude that whilst the results of integration efforts should be evaluated at the macro level, the fundamentals of integration are set and often decided upon already at the street level.

Keywords: integration, trust, street-level approach, immigration, nonparticipation observation

INTRODUCTION

Migration is an inherent part of human existence, which can be traced back to Moses leading persecuted Israelites out of Egypt and the Viking invasions of Normandy to the establishment of colonies under the Ancient Greeks and the dispersal of Jews following the rise of the Roman Empire (cf. Fisher, 2013). In the modern era, Europeans travelled to overseas colonies in response to the movement

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of populations experiencing colonial domination, and mass migrations occurred in Europe during and after the two world wars (Lucassen, 2019). Recent decades have witnessed a 'migration crisis' in Europe, fuelled predominantly by political unrest in Africa, South Asia and the Middle East. Beginning in 2011, the surge in migration presented European leaders and policymakers with the greatest challenge. However, the European Union's collective response and the response of its Member States has been criticised for being ad hoc and for focusing on the security of the EU borders rather than the rights of the immigrants.

In this context, the Swedish immigrant integration policy is unique and has been lauded as the 'best' policy in Europe (Migration Integration Policy Index (MIPEX), 2020)[1]. At the same time, its outcomes counterintuitively appear to be amongst the poorest (Eurostat, 2022). In 2004, the outcomes of Swedish labour market integration were deemed 'unfavourable in an international context' by the OECD, and thus worthy of improvement (OECD, 2014). In 2010, new laws were introduced to prioritise labour-market integration for newly arrived immigrants. The most significant change was that the responsibility for migrant integration was placed almost exclusively on the Public Employment Service, which suggests that labour market integration was the most important aspect of integration in Sweden. However, this change also meant that the responsibility had been shifted from the local (municipal) level to the state or national level. As a result, migrant integration became somewhat removed from the street level. Whilst the focus on labour market integration has contributed to Sweden's high MIPEX score, "there remains room for improvement in integration outcomes and recent refugee cohorts still have low employment rates" (OECD, 2014). Thus, Sweden is still an OECD country with the largest gap between immigrant and native-born employment levels. Employment remains higher among the Swedish-born (83.2% for women; 86.9% for men) than among the foreign-born, for whom the overall employment rate was 70.2% (specifically, 63.9% for foreign-born women and 76.4% for foreign-born men) (European Commission, 2022; Eurostat, 2022).

Ager and Strang's *Indicators of Integration* (2004) is widely regarded as a key text in the discussion and definition of integration because it provides a basis for understanding integration as both a policy goal and as a process through which the goal is achieved. This conceptual framework arose from the idea that there is no agreed-upon operational definition of successful integration, particularly where multiple stakeholders are involved (Ager & Strang, 2004). This approach has been applied to both migrant integration (Dymitrow & Brauer, 2014) and the integration of other marginalised societal groups (Feltynowski et al., 2015; Krzysztofik et al., 2017), including those with a pronounced spatial connotation (Dymitrow et al., 2018).

The problems with defining migrant integration have become increasingly relevant in countries such as Sweden, where the responsibility for implementing integration policy falls on national agencies at the macro-level. In turn, scholars have highlighted the importance of connectivity in shaping and aiding the integration process. They also noted that these relationships may be fundamentally unequal with regard to power and resources (Haque, 2010; Ponzo et al., 2013). Furthermore, researchers have argued that there is a disparity between the mechanisms and policy that guide integration at regional, national and international levels, and the measures that are implemented at the local level (Craig, 2015; Penninx, 2009).

This kind of research adopts a *street-level approach* to address the issues of scale and localisation (Brodkin, 2016; Lipsky, 1980). The concept of street-level bureaucracy and the associated approach were first coined in the 1960s by Lipsky who argued that inte-

[1] MIPEX is a unique tool which uses 167 policy indicators on migrant integration to benchmark and score current laws and policies against best practice (MIPEX, 2020). The index measures policies that promote integration in all societies, in both social and civic terms. The eight evaluated policy areas are: labour market mobility; family reunion; education; political participation; permanent residence; access to nationality; anti-discrimination; and health (MIPEX, 2020). Sweden scored 86 (out of 100) points for its integration policy, and 91 points for its policy on labour market mobility.

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gration policy is implemented at the street level by the people (street-level bureaucrats). Therefore, policy outcomes are not only a reflection on the policy itself, but also on the decisions made by individuals who enact them at the street level. The approach has been chosen because it focuses on the interpersonal level, whilst allowing for the exploration of the gap between formal policy provision and measurable outcomes, where trust is a critical dimension of the integration process (cf. Hansson, 2018).

The issue of trust has been employed as the critical dimension in the discussion about the integration process because trust is considered an element of social capital that has a positive impact on an individual's chances of success (Örkény & Székelyi, 2009; Rothstein & Stolle, 2001). Misztal (1996) suggests that trust is one of the most important aspects of social integration. However, research studies analysing trust in the context of migrant integration have overwhelmingly focused on the trust that migrants have towards their 'new' host country state (cf. André, 2014; Gabriel, 2017; Levi & Stoker, 2000 Maxwell, 2010).

Previous studies have suggested that integration policy alone does not affect the acculturation of trust. Researchers have argued that trust is developed through interaction and engagement with the native communities (Dinesen & Hooghe, 2018).

To bridge the existing knowledge gap, this study was undertaken to explore the role of trust in the disparity between integration policy and its actual outcomes. This goal was accomplished with the use of a case study involving a street-level organisation (SLO) that struggles with the integration of immigrants. The SLO approach and methodology provided us with a unique opportunity to critically assess the outcomes of policy implementation over a period of six months through non-participant observation.

The article begins with a theoretical exploration of the concept of integration, both as a measurable outcome and a process, because this difference is often overlooked during policy evaluations. This is portrayed as only one piece of a puzzle, where integration and trust interact at the street level and lead to discrepancies between policy and labour market outcomes in Sweden. Lipsky's (1980) theory of street-level bureaucracy was used to address the challenges of immigrant integration at the local level. A single case study was analysed to shift the focus from the national to the local level. The case study involves the *Green Integration* project which sought to develop immigrant integration by initiating interest in green business development. Non-participant observation of *Green Integration* was conducted over 32 weeks, the entire life cycle of the project. The critical dimension of trust was discussed by analysing three trust relationships between the stakeholders that eventually impact integration at higher levels. The concluding section posits that trust is a critical dimension of immigrant integration, and it suggests that turbulent trust relationships between stakeholders provide a possible explanation for why integration projects fail despite the implementation of an exemplary policy.

THREE PIECES OF THE SAME PUZZLE: INTEGRATION, THE STREET-LEVEL AND TRUST

Integration

Europe has become a destination of choice for many immigrants due to tragic events that took place around the world in recent decades. Europe's economic prosperity, relative political stability and democratic systems of governance are particularly appealing, for both those seeking to work or study and those who are seeking refuge. Most EU states have experienced increased immigration. During 2021, approximately 2.3 million immigrants arrived from non-EU countries, contributing to an estimated figure of 5 immigrants per 1,000 people living in the EU (Eurostat, 2023). In 2022, Sweden was one of the 13 EU states to witness an increase in the number of citizens born in both non-EU and EU countries relative to 2021 (Eurostat, 2023). Given such high numbers, successful integration becomes a priority issue.

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Integration, however, is known to be a chaotic and controversial concept. It is "a word used by many but understood differently by most" (Robinson, 1998, p. 118), with little prospect of the adoption of a unifying definition. Still, integration remains a significant policy goal and a targeted outcome for most governments, projects and organisations working with immigrants (Ager & Strang, 2008). It is also considered a major challenge in the process of successfully addressing interlocking problems of unsustainability caused by cultural contingents (Dymitrow et al., 2019).

These discussions have moved beyond academic debate and have been adopted in widely cited definitions. For instance, the International Organisation for Migration (IOM) (2011) sees integration as: "[the] process by which migrants become accepted into society, both as individuals and as groups… [Integration] refers to a two-way process of adaption by migrants and host societies…[and implies] the consideration of the rights and obligations of migrants and host societies, the access to different kinds of services and the labour market, and the identification and respect for a core set of values that bind migrants and host communities in a common purpose" (IOM, 2011). The EU's Framework of Integration, in turn, defines integration as: "a dynamic, two-way process of mutual accommodation by all immigrant and residents of Member States" (as cited in Carrera & Atger, 2011, p. 4). However, differences of opinion exist even within the definition of immigration as a two-way process. Some scholars place the responsibility equally on both the immigrants and the autochthonous majority (Zapata-Barrero, 2012), whilst others explicitly place the weight of integration on the shoulders of the entire society (Penninx & Garcés Mascareñas, 2016).

In this article, the concept of integration as a two-way process was used to address the gap in knowledge about the 'de facto' process of integration (Penninx et al., 2008), namely to explore and understand how integration operates in practice, rather than to draw assumptions based on public policy.

Integration at the Street-Level

Contemporary research holds that public policy cannot be adequately understood by looking at what is being done in the higher echelons of legislation unless its effects can be assessed "at the street level", namely through the interactions between co-workers and the public they serve (Lipsky, 1980). The "street-level approach" was developed to explore the relative levels of success of the grand social projects initiated in the USA in the 1960s and 1970s which sought to address poverty and build more inclusive and just societies (Brodkin, 2016).

A key research area within this movement involved studies which drew attention to the (then new) fact that a good policy is not enough and that a policy must be translated into action to generate desirable outcomes (Pressman & Wildavsky, 1973). Although early scholars had failed to acknowledge that the bulk of policy implementation was done by lower-level organisations, this area of research was picked up by organisational scholars engaged in policy research. They focused on organisations as entities with internal dynamics, and they were less concerned with what organisations should be doing with policy, but rather what they actually did and why (Brodkin, 2016).

The most seminal contribution to this line of inquiry was Michael Lipsky's book entitled *Street-Level Bureaucracy* (1980). Lipsky had inverted the approach to policy research by recognising that street-level bureaucracies and bureaucrats (SLBs) both delivered and made the policy. SLBs are frontline workers who today work within both traditional government agencies and organisations, including non-profit, for-profit and public/private hybrid organisations (Hupe et al., 2015; Rathgeb Smith, 2003). The diversification of frontline workers reflects attempts to downsize government agencies, and a shift in delivery towards contracting, devolution and outsourcing of policy delivery (Meyers & Vorsager, 2003). As a group, frontline workers enter into regular and direct interactions with citizens and hold power over the services received by the beneficiaries (Tummers & Bekkers, 2014).

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Lipsky (1980) considers two key theoretical contentions within the scope of SLBs as generators of public policy: a) the actions of SLBs actually become or represent the policy through their decision-making for the individual citizen; and b) SLBs can 'make policy' by implementing the required actions at their own discretion. Lipsky suggested that "policy conflict is not only expressed as the contention of interest groups, as we have come to expect. It is also located in the struggles between individual workers and citizens who challenge or submit to client processing" (1980, p. xiii). Because policy is enacted through the decision-making processes of individual stakeholders, each possessing their own motives and objectives, decisions are often fraught with difficulty. Therefore, decisions are often contested by individuals, and it is within these struggles that we can place the concept of trust.

Trust

The issue of trust has been extensively explored in the academic literature (Luhmann, 1979; Mayer et al., 1995; Rotter, 1967). Primarily, the literature on trust analysed the dyadic (interpersonal) relationship (Six, 2005) between two persons at the individual level, where A (the trustor) trusts B (the trustee). Later, trust has come to be viewed as a three-part relation, where A trusts B to do 'something' (Hardin, 1993). This perspective introduces the trustor's discretion into the equation, making trust a dynamic factor that influences the decisions made by SLBs.

Of late, forays into understanding trust have moved away from exploring grand social relations of institutions and social groups towards more hidden aspects of social interactions (Örkény & Székelyi, 2009) Firstly, trust can be interpreted as an integral part of social norms and a central pillar of rational behaviour, decision-making and cooperation between individuals and groups (Hardin, 2002). Secondly, trust is seen as less of a concrete goal and more of a belief in other people, which manifests itself as a positive and optimistic approach to others (Örkény & Székelyi, 2009). Thirdly, trust can be viewed as a generalised notion, where emphasis is placed on the moral aspects of trust.

This study departs from the most influential and commonly cited definitions of trust in the literature and defines trust as "[a] psychological state comprising the intention to accept vulnerability based on positive expectations of the intentions or behaviour of another" (Rousseau et al., 1998, p. 395). However, Lewicki et al. (1998) suggested that commonly cited definitions present a static view of trust and fail to acknowledge the complexity of relationships where both trust and distrust coexist.

The model of trust/distrust proposed by Lewicki et al. (1998) is represented by two intersecting axes, where trust occupies the vertical axis, and distrust – the horizontal axis) (Fig. 1). Both axes range from low to high, creating four archetypal relationships:

1. Low trust/low distrust – low-key casual relationships, normally with no grounds for confidence or concern. Over time, mutual understanding between actors develops quickly, giving rise to the establishment of trust or distrust.
2. High trust/low distrust – only one actor has reason to trust the other actor and no reason to be suspicious. This relationship is characterised by positive experiences, constant interaction and trust based on empathy and identification.
3. Low trust/high distrust – one actor does not have faith in the other actor and plenty of reasons for being mistrustful based on prior experience with that actor.
4. High trust/high distrust – one actor vests extreme trust in the other actor in some respects, but not in others.

Nowadays, trust is also explored in the institutional context, namely as a relationship between two strangers that is forged in the context of a specific interaction. The implication is that individuals intrinsically trust each other based on their position in an institution or because the interaction takes place within a stable institutional context (McKnight & Chervany, 2000). Nooteboom (2007) has argued that institutional trust is localised at a macro-level, namely within the wider communities of nations, regions, industries, or religions. However, this type of trust is built by 'go-betweens' (Nooteboom, 2007) or SLBs (Lipsky, 1980) through street-level interactions.

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CASE STUDY

Sweden has a long history of immigration which peaked in the 2010s. This surge posed several challenges for the country, not only by placing a burden on the welfare system and state-funded healthcare, but also by forcing Swedish citizens to integrate immigrants into their communities. During the refugee crisis of the mid-2010s, Sweden became a refuge for more than 80,000 refugees and asylum seekers, and it took in the highest number of refugees per capita than any other country in Europe in 2015 (Eurostat, 2019). Between 2002 and 2022, the proportion of foreign-born persons residing in Sweden rose to almost 2.15 million. In other words, in 2022, foreign-born citizens made up around 20% of Sweden's population, while the number of citizens with foreign ancestry (having at least one foreign-born parent) was just over 25% (Statista, 2023).

In view of the above, the present study focused on a three-year EU-funded municipal project (2017–2020) in a large Swedish city which sought to address these issues through a different approach. The overarching aim of the project was to create conditions for green business development and innovation by harnessing unused skills, initiatives, and natural resources (green city areas) for the sustainable development of local communities and a low-carbon society (Dymitrow & Ingelhag, 2020). However, this innovative project stirred controversy and attracted considerable criticism from the media, both before and during its course. In essence, the project's focus on urban farming, animal husbandry, cooking, and 'rural development' activities involving unskilled labour from developing countries led to allegations that the proposed measures fostered cultural stereotypes about immigrants, including territorial stigmatisation, resource wasting and local disillusionment (Korn, 2017; Verdicchio, 2017a, 2017b). The ensuing criticism and media frenzy were partly instigated by the manager of the SLO, which is analysed in this study, and the resulting controversy gave rise to the *Green Integration* sub-project (as a form of appeasement).

The *Green Integration* sub-project launched by the SLO was one of the largest Swedish projects that was a part of a wider EU-funded scheme. *Green Integration* was designed as an outreach programme to assist in the integration of newly arrived immigrants by aiding them in creating jobs in the area of 'green business development'. In this study, the personal data of the involved actors were not disclosed to safeguard their professional integrity and the sensitive nature of the discussed relations.

The SLO consisted of a Volunteer Centre (VC), a self-declared multicultural meeting place for residents of all genders, nationalities, religions and sexual orientations. According to the VC staff, approximately 125 people visited the centre at the beginning of the study in autumn 2018. The gender split was approximately 50-50 men and women. Approximately half of the visitors were over 40[2]. Although more than half of the visitors had formal education, their education lasted only two to six years. Only one in five found employment that required some form of training. Only 50% of visitors had a permanent residence permit with the right to live and work in Sweden. The remaining 50% were refugees whose residency applications were being processed. As refugees, they were not entitled to work (legally) or participate in other integration activities, such as free Swedish language training or internships.

Over time, the VC manager became strongly committed to the VC's visitors to integrate immigrants into Swedish society and vested strong trust in the centre's beneficiaries. The manager is considered to be a gatekeeper, and gaining the manager's trust has become a barrier to initiating any systematic integration projects. The *Green Integration* project team comprised representatives from local government agencies, business development platforms and the academia. All actors involved in *Green Integration* are detailed in Table 1.

[2] These are only estimates as the exact data were not provided by the VC, partly because the visitors were unwilling to disclose their personal information in fear that the disclosure would compromise their residency applications and legal status in the country.

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METHODS

In this study, a street-level approach was used to capture the gap between policy provisions and outcomes. Policy analyses, such as MIPEX (2022), are only able to determine the degree of agreement between the policy rhetoric and measurable outcomes (Eurostat, 2022; OECD, 2016). A street-level approach provides the missing information in the middle and explores what happens at the stage of policy implementation. Therefore, this approach fills in the gap between policy and outcome (Brodkin, 2015).

The key objective of street-level analysis is to consider policy implementation through *internal* logic, rather than the logic of command and control (Brodkin, 2008). To achieve this objective, this study relied on non-participant observation in the SLO case study. Non-participant observation enables researchers to analyse both the providers and the recipients in the context of the examined interactions (Brodkin, 2008). Non-participant observation was selected as a data collection method for two key reasons. Firstly, to explore the processes at play and the relationships that exist between stakeholders, with as little interference as possible in the process itself (O'Reilly, 2009). Secondly, to describe the characteristics of such relationships which may be difficult to identify for the stakeholders and may not be evident in self-reporting data collection methods, such as surveys or interviews (Lui & Maitlis, 2012).

Data collection

The data collection process lasted nine months, and it covered the entire life cycle of *Green Integration*. Multiple data sources were combined, including at least 20 hours of observation at formal meetings organised during *Green Integration*, more than 60 interactions and conversations with at least 13 *Green Integration* actors or groups of actors (Table 1), as well as extensive fieldnotes (auxiliary contextual information) during the research process. Therefore, the research followed a multipronged approach which, according to Yin (2009), is appropriate when the goal is to garner insights into the behavioural aspects (from observations) and cognitive dimensions (from guided interactions).

The actors involved in *Green Integration* were the unit of the analysis. The challenge was to explore and extend '*the analysis from an inherently individual level to the organisational level*' (Zaheer et al., 1998, p. 141). *Green Integration* was a project and, consequently, an organisation in its own right (cf. Tahvilzadeh, 2020) despite the fact that it was a temporary and smaller--scale programme in terms of budget, staffing, and objectives.

The research consisted of three phases of data collection. In the first phase, a researcher attended formal *Green Integration* meetings as a passive observer. Non-participation was selected as a research method to reduce the likelihood of the researcher's involvement in changing the behaviour of actors and participants, which is a potential risk during participant observation (Handley, 2008). During these meetings, the researcher collected as much information as possible in the form of extensive fieldnotes.

The second phase of the study (from week 7 of the project) involved observations of interpersonal dynamics. Phase two differed from phase one in that it focused on relationships of trust that were (or were not) present within the project, as well as events or interactions that impacted upon such relationships. This shift was due to events that transpired in week 7 and demonstrated that interpersonal relationships were a critical dimension in need of much closer inspection. For example, there could be clues, such as the extent to which the actors allowed each other to make decisions or work independently. Again, fieldnotes were kept to enable the researchers to both critically reflect upon and contextualise the interactions that occurred.

Conversations with the actors involved in the project were initiated in the third interactive phase of the study. These included both spontaneous interactions and more formalised discussions, such as open questions about interpersonal relationships and processes. Based on the approach proposed by Serva et al. (2005), open-ended questions were framed

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within informal interactions, which enabled the actors to speak freely about how their relationships with other actors had developed. The aim of these interactions was to ascertain the extent to which specific events or behaviours contributed to the development of trust relationships. These interactions were also initiated to confirm or undermine the assumptions formulated based on the observations. Triangulation was achieved by collating documents related to *Green Integration*, such as activity reports that were generated on a weekly basis by the facilitator of the *Green Integration* project ("Sara").

Ethical considerations

During the initial meeting, the SLO's manager ("Ulla") and the *Green Integration* project leader and coordinator ("Malin") agreed on the extent to which the researchers would have access to the SLO. The SLO staff, *Green Integration* actors, and the SLO visitors were made aware that the project was being observed by researchers, whereupon the appropriate introductions were made, and all questions were answered. Furthermore, since the character of data collection changed through the three phases of research, the researchers reintroduced their activities to the SLO staff, *Green Integration* actors and the SLO visitors, and once again sought their consent to continue the project. Pseudonyms were used to maintain the actors' anonymity. The pseudonyms were selected randomly, but remained faithful to the actors' cultural identities (see Table 1 for an overview).

Data analysis

During the first phase of the study, systematicity was achieved by organising the fieldnotes into memos (Barley, 1990; Miles & Huberman, 1994). The observed events were recorded in a chronological order (Mills et al., 2010). In this approach, each event or interaction is regarded as an opportunity to discover underlying themes. The data were also collated in a chronological order to derive meaning from their temporal context relative to events that occurred simultaneously or after the event in question. The second and third interactive phases of the study focused on identifying specific actions that could serve as beacons of organisational culture, for example, the trust dynamics that existed between *Green Integration* actors (cf. Six & Skinner, 2010).

The fieldnotes and memos from informal conversations were coded thematically. For example, codes could include information on whether trust was being built or eroded, whether the actors were present as trustors or trustees, and whether hierarchical relationships of trust were being manifested. This process led to the recognition that small and seemingly insignificant actions at the individual level affected larger actions, and smaller actions were constantly revisited to understand their impact on the relationships between the actors. The documents collected during the research process were not coded in the same manner, but they were used to support the claims made by project team members and to validate the assertions and assumptions made by the researchers in the analysis stage.

RESULTS AND ANALYSIS

As part of the framework analysis, significant trust events were identified, namely interactions or incidents that were deemed to have an impact on a trust relationship. Significant events, including the time of the project at which they occurred and the trust relationships they influenced, are presented in Table 2. Each significant event (as per Table 2) is discussed in detail below.

This section presents an in-depth analysis of the nuanced and seemingly insignificant interactions that took place at the micro-level yet, but exerted a significant influence not only on trust relationships in the *Green Integration* project, but also on the motives and rationale behind the decisions made by project members as trustors and trustees.

A. Project inception – weeks 1–3

Malin visited the SLO to discuss the launch of *Green Integration* with Ulla, despite the fact that Malin had no previous personal involvement with Ulla

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and no formal experience in dealing with migrant integration. A historical relationship had existed between Malin's organisation (the municipality) and Ulla's SLO, and this relationship was characterised by lack of trust on Ulla's behalf. Malin's predecessor was responsible for the events that led to distrust. Malin's predecessor was removed from the project on disciplinary charges, and Malin was thrown into a project that she was not qualified to lead. Despite the above, the interaction was successful, and Ulla granted initial "access" to the migrants. Trust was derived from the fact that project had an academic basis (which was true), rather than the fact that it was a part of a larger EU programme (which was also true), of which Ulla had been highly critical.

B. Miscommunicated group meeting – week 3

Malin arranged a follow-up meeting to discuss the finer details of *Green Integration*. Armin had invited around 50 non-Swedish-speaking visitors from diverse cultural backgrounds to the meeting. The result was chaotic because Malin was not prepared to host such a meeting and no interpreters were present.

The SLO were responsible for inviting participants to the meetings. Therefore, the *Green Integration* team had very little influence over the messages being relayed to the participants. The lack of effective communication was reflected in the questions asked by the participants, which centred around offers of employment, rather than the services offered by *Green Integration*.

Moreover, this seemingly minor event laid the ground for mistrust in communication between the SLO, *Green Integration* and the participants. Given the diversity of languages spoken within the SLO, only one person (Armin) could speak four languages and effectively communicate with other project members and participants. However, Armin's inability to ensure transparency in the translated messages led to confusion and mistrust.

C. the Meeting with an Arabic-speaking group – week 7

Three orientation meetings were held at the beginning of *Green Integration*, each with a different language group. The purpose of each meeting was to share information about green business development and the opportunities offered by *Green Integration*.

The first two meetings (group 1 and group 2) were facilitated by Sara, Hamed (Hamed was the second project member who was tasked with introducing *Green Integration* to the SLO), and an interpreter ("Farah"). Farah was external to the project and the SLO. She offered her services free of charge and had deep knowledge and expertise in the field of integration and business development (she was officially recognised by the municipality for her work in this field).

The first meeting involved Arabic speakers (group 1). Ten participants were present at this meeting: six males (one aged 20-40, four aged 41–60, and one aged 60+) and four females (one aged 20–40, two aged 41–60 and one aged 60+)[3]. The number of questions that were addressed to Hamed suggested that the participants vested greater trust in Hamed than Sara. This difference could be attributed solely to gender, but even more questions were addressed to Farah. Therefore, the trust expressed by group 1 was deemed to be related to the knowledge and ability possessed by Hamed and Farah.

D. Meeting with a Kurdish-speaking group – week 7

The second meeting was organised for Kurdish speakers (group 2). This group consisted of ten males (eight aged 20–40 and two aged 41–60) and five females, (four aged 20–40 and one aged 60+). The meeting followed the same format as the previous one; however, this time Ulla was also present. Again, more questions were addressed to Hamed and Farah

[3] The participants' age was estimated by the researchers because the relevant information was not provided by the SLO or the participants themselves.

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than Sara despite Sara's attempts to identify as a migrant and build bonds with group 2, which was unsuccessful. Persons with a migrant background do not necessarily have shared affinity or experience with other migrants, as the experience of migrants is highly diverse. Therefore, Sara's attempts to identify as "a migrant too" did little to build trust with the migrants, and perhaps only served to signal her lack of cultural sensitivity when dealing with migrants.

The most conspicuous part of the meeting was Ulla's verbal assault of Farah (in front of the participants) for distributing pamphlets to the attendees. The pamphlets contained contact information to the mentoring organisation where Farah was employed. Ulla accused Farah of advertising her own commercial activities[4]. Moreover, Ulla was aware of Farah's dubious history of funding integration activities (redacted) and was suspicious of Farah's motives. Whilst Ulla's response could be regarded as characteristic of a gatekeeper or a matriarch protecting the migrants from Farah's unscrupulous activities, another explanation could be that Ulla was hoping to retain migrants as "customers" who financed the SLO's operations.

E. Gap between meetings – weeks 7–12

Despite attempts to ensure the continuity and consistency of the SLO's activities, it took five weeks to arrange the next meeting, this time with Somali-speaking visitors (group 3). The meeting was held despite Malin's multiple reminders instructing Sara to continue the process of trust-building with the SLO, with reiterative positive interactions. Due to the multitude of these requests, a low trust/low distrust relationship had initially developed between the three parties. Malin had substantial previous positive interactions with Sara to establish high trust or high distrust within the relationship.

F. First report – week 8

An initial report on the meetings with group 1 and group 2 was developed. The internal report focused on the trust relationship with Ulla and placed preliminary findings within a theoretical framework. The report was forwarded to Sara and Malin. This event prompted Sarah to adopt a defiant and resistant attitude. Although Sara acknowledged the report's recommendations, she questioned her role in *Green Integration* and, presumably, the impact that the report would have on her working conditions and environment.

G. Meeting with a Somali-speaking group – week 12

Five weeks after the first group meetings, a further presentation was organised for Somali-speaking participants (group 3). The meeting was attended by nineteen women (three aged 20–40, twelve aged 41–60, and two aged 60+) and five men (all aged 41–60). Again, the meeting was facilitated by Hamed and Sara and followed the same format as the previous meetings. A male interpreter (Yasir) was employed. Yasir provided a one-off service and had no prior knowledge of the SLO, group 3, *Green Integration*, or its team members. The use of a male interpreter had a negative impact on the meeting outcome because most participants were women. The women were mistrustful of the interpreter because in Somali culture, women are discouraged from interacting with strange men in a public setting. The above testifies to Hamed's and Sara's cultural insensitivity because Hamed booked the interpreter and Sara did not question his actions (they shared an office). Thus, Sara trusted Hamed despite his lack of competence or awareness.

[4] Farah was employed in an organisation that offered free business mentoring to migrants, including the newly arrived and those far from the labour market. Therefore, the organisation was deemed relevant (and complimentary) to the *Green Integration* sub-project and the SLO visitors. However, Ulla saw the organisation as competition and its involvement as peddling of commercial activities.

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H. Escalation to management – weeks 12–27

From week 12 onwards, Sara expressed her concern with the management that she felt under pressure to complete work that was beyond her job description. The concern stemmed from an inability to engage the participants. Sara's reaction was perceived by Malin as an attempt to avoid responsibility for the potential failure of *Green Integration*, which made her actions self-servicing and not in the interests of *Green Integration,* its participants or the SLO. This escalation to management broke the trust (if it ever existed) between Sara and Malin. However, the trust between Ulla and Sara remained because Ulla was not aware of the fracture in the relationship between Sara and Malin, and was thus still able to use *Green Integration* and Sara's presence to press her own agenda, namely to increase funding for the SLO.

I. Cancelled group meetings – week 17

From weeks 12 to 17, Sara communicated with Ulla and Armin to arrange further group meetings. There were multiple issues with Armin's availability and Ulla's inability (attributed to her lack of language skills, competence and will) to invite participants to *Green Integration* meetings. Whilst a mutual level of trust may have existed between Armin and Sara, Armin's Armin's inability to ensure transparency in the translated messages led Sara to question what was really being communicated to the participants, and why.

J. Change of engagement tactic – week 20

To prevent the breakdown of the hard-fought relationship between Ulla and Malin, Malin was keen to try a different approach to keep *Green Integration* alive. This was motivated by the lack of communication from group participants, and the problems experienced by Sara in her attempts to arrange subsequent meetings. Malin was acutely aware that Ulla's previous criticism had been aimed at how the projects were launched: promises were made, the migrants were engaged only fleetingly, and they were left abruptly without any contingency planning (cf. Tahvilzadeh, 2020). Therefore, Malin wanted *Green Integration* to succeed, at least in Ulla's eyes, to avoid another media debacle criticising *Green Integration* and putting the spotlight on Malin. This was particularly pertinent to Malin, given the fate of her predecessor who was fired for mismanaging the project.

Malin suggested that Sara attend the SLO weekly for two hours to ensure that *Green Integration* remained visible in the SLO, in hope that consistent action would contribute to trust between Sara, Ulla, and the participants. However, Sara arrived at the SLO at the time the participants were attending obligatory Swedish language lessons; therefore, engagement was not possible. Even though Sara was aware of the mis-scheduling, she continued to come at the same time and spent her time idle.

K. Women's group meeting – weeks 21–24

As part of their engagement with another project, the researchers welcomed a colleague from Africa to observe *Green Integration* in action. The ambition was that an external observer, who had experience with women's groups and labour market integration projects, would be able to provide feedback and suggestions on how to better engage the SLO visitors (cf. Kotze & Dymitrow, 2022).

A meeting was to be organised with women from group 3 (hereinafter referred to as 'group 4' due to changed context). Sara was reluctant to organise this meeting, claiming that she did not understand the reasoning behind it, despite the fact that she had received detailed verbal and written instructions from Malin. As the supervisor, Malin did not expect Sara to question the reasons for changing the activities initiated as part of *Green Integration.* This further eroded Malin's trust in Sara.

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L. Engagement reporting – week 24

To ensure that Sara fully understood her role, Malin asked Sara to develop a weekly action plan detailing her engagement with the SLO visitors. Sara refused, and all paperwork that she completed focused on denouncing her low levels of engagement with participants. By that time, Malin's trust in Sara had completely eroded.

However, recognising that Ulla still had some trust in Sara, Malin allowed Sara to participate in the SLO and *Green Integration*. Without Sara's involvement, however limited, Malin would have had to pull the plug on the project. This would have left Malin as a sitting duck and expecting not only a potential backlash from her employers (the municipality), but also, given previous experiences, a scathing media attack from Ulla. Moreover, given the issues with Malin's predecessor, her position as a substitute project leader in *Green Integration* meant that Malin could not allocate sufficient time to the project. Therefore, she reverted to acting as a coordinator with minimal hands-on duties, leaving Sara to bear the brunt of the workload.

M. Women's group meeting – week 24

Group 4 meeting was attended by twelve women, eleven Somali and one Ethiopian (ten aged 20–40; and two aged 60+). Similarly to the meetings with groups 1–3, an interpreter was needed. Once again, Sara had booked an external male interpreter ("Filsan"). This meeting witnessed the highest level of engagement between Sara and group 4, with both Sara and Filsan sitting in a roundtable format alongside the women throughout the meeting. The high level of trust between Sara and the participants was an anomaly in this case study, given that a male interpreter, Filsan, was present. Filsan's involvement violated cultural norms because Somali women are discouraged from publicly interacting with unrelated men. The above could be attributed to the fact that Hamed did not attend the meeting and that Sara sat with the women (and did not stand in front of them), which shifted the power relations and created a more informal setting in which the women could converse openly. Despite this relative success, Sara was reluctant to continue with the meetings and increase the number of participants. Sara passed off the meeting as her own initiative to Ulla, but did not want to include her "own migrants" from another project in *Green Integration*.

N. Meeting with the gatekeeper – week 25

As part of the *Green Integration* follow-up, Malin visited Ulla to discuss the project and Sara's engagement during her weekly visits. Ulla reflected positively on Sara's weekly visits as she was now able to include *Green Integration* as an ongoing "integration activity" in her monthly report to the local government (who were funding the project based on such activities) without any greater level of engagement from herself or her staff. Ulla also inquired about Sara's duties during the awkwardly timed visiting hours at the SLO. This opinion was compounded by Malin's own observations that Sara was not engaged or productive during her visits.

Throughout the entire project, Ulla seemed content to sit back passively, despite the fact that she was the main culprit behind the scathing criticism of previous migrant integration projects in the area. Although their relationship could not be described as trustworthy, Ulla was happy for Sara and Malin to continue with *Green Integration* because the project would testify to the SLO's success in integrating migrants. Ulla's only active engagement in the project was her aggressive stance towards Farah, despite the fact that Farah arguably offered the only realistic chance for *Green Integration* to change the outcomes for migrants. This demonstrates that Ulla was unable to get over the previous incident, which shattered her trust in Farah, even though it also shattered the success of any subsequent projects.

O. Disbandment of the project – week 35

Due to Sarah's failure to engage with the participants, the absence of new events, lack of meaningful reporting and general distrust, *Green Integration*

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stagnated and eventually self-died. No measurable outcomes for integration were noted, despite the fact that the project had absorbed considerable resources. To our knowledge, none of the observed migrants received a job in "green business development" or any other sector for that matter. The SLO was eventually disbanded in mid-2020 due to insufficient funding and overall lack of efficiency, and this decision was partly accelerated by the onslaught of the COVID-19 pandemic.

DISCUSSION

The definition of generalised trust was used in the description and analysis of the results, whereas this section focuses on three different trust relationships to discuss in detail the extent to which various trust relationships affect the success of immigrant integration in practice. A microscale analysis can provide valuable insights about why a highly lauded integration policy does not always generate measurable outcomes that are held in equally high esteem.

Trust relationship one – Trust between SLOs

The first key trust relationship involved Ulla and external partners or collaborators, such as the wider project team. Within the project team, the trust relationships between Ulla and Sara and between Ulla and Farah had the greatest impact on the success of *Green Integration*. Gatekeepers are individuals who act as mediators between researchers or project teams and participants and who control access to a particular group. Gatekeepers exercise control by exerting or holding positions of power and trust within these communities (Clark, 2010; McAreavey & Das, 2013). They hold power to both allow access to communities and influence their participation. However, they also have a keen interest in ensuring that the granted access and participation do not jeopardise their positions of trust and power within these communities (Clark, 2010).

The issue of gaining access was a recurring theme in the interactions between the *Green Integration* project group and Ulla. Initially, Ulla acted as a traditional gatekeeper by seeking to protect the immigrants from a vulnerable situation (McAreavey & Das, 2013). The vulnerability of the situation stemmed from Ulla's conviction that projects are often fleeting, lack follow-through or follow-up, and provide no clear and tangible outcomes for the immigrant participants (Clark, 2008). However, both the SLO and Sara referred to immigrant groups as 'my immigrants'.

The reasoning behind this ownership claim is that the SLO relies on external funding which is allocated based on the number of immigrants who are registered by the SLO for language training and integration services. Due to funding implications, Ulla was not willing to collaborate with other local SLOs to share knowledge and resources. As an SLB, Ulla chose services that would be offered to 'their' immigrants based on the allocated funds, rather than services that were in the immigrants' best interests. This was further evident in Ulla's treatment of Farah who was a highly skilled and experienced business mentor for the immigrant population, but was verbally abused by Ulla and hounded out of the premises, never to return. Sara was equally possessive of a group of women immigrants from a different project. She prevented this group from meeting other Somali women at the SLO. This possessive attitude was an attempt to demonstrate their abilities and professional skills, and thus justify their position within both *Green Integration* and the wider EU-funded project.

The competition between SLOs and their stakeholders, and Ulla's and Sara's sense of ownership towards 'their' immigrants was related to the acquisition of funds. In this case study, immigrant labour-market integration projects were funded from diverse sources, including the state (municipal or regional councils), government agencies (such as the Public Employment Service) or large external funding bodies (such as the European Social Fund or the European Development Fund), funding is directly related to the interests of the funder (cf. Diedrich & Hellgren, 2018). Therefore, funding is sporadic

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and often directed to specific purposes and specific groups of people. These stringent criteria imply that SLOs are paid per immigrant registered with their organisation, more specifically per person enrolled in Swedish-language lessons at the SLO (Mukhtar et al., 2015).

This funding system has created a competitive environment between SLOs and SLBs whose operations are funded based on the number of immigrants participating in the organised activities. As a result, immigrants become commodified, and SLOs and SLBs become possessive and protective over immigrants as their resource. These competitive and possessive interactions are high in trust as well as high in distrust. A high trust/high distrust relationship is characterised by multifaceted interdependence, where each party holds a separate, but shared objective (Lewicki et al., 1998). In this case study, this is exemplified by SLOs which raise funds by attracting immigrants, whereas an integrated society is the priority goal of all SLOs concerned with immigrants.

Trust relationship two – Trust between *Green Integration* team members

Multiple studies have suggested that trust between project team members and collaboration have a direct impact on a project's success (e.g., Buvik & Rolfson, 2015). Furthermore, studies have shown that the top indicators for team member performance are based on interpersonal relationships (Ibrahim et al., 2015). According to Cooke-Davies (2002), all success factors identified in the literature are rooted in human-related dimensions of a project. Therefore, it is hardly surprising that human-related aspects are central to a project's success, because projects are delivered by people, not processes or systems (cf. Lipsky, 1980). In this study, the human-related aspect of trust was explored as the key and underplayed determinant of *Green Integration*'s success (cf. Gil et al., 2011; Munns, 1995). Given the singular case-study approach and a small project team, the trust relationships established by only one individual, Sara, exerted a much greater influence on the project's success than the relationships built by other team members.

The pushback regarding professional responsibilities was highlighted by Sara's refusal to provide a programme of integration activities at the SLO during her weekly engagements. Although Sarah's refusal did not directly prevent immigrants from accessing integration services, the immigrants were offered fewer services and activities than *Green Integration* had aimed to provide. Therefore, Sara's discretionary decisions were motivated by personal gain, which influenced the way policy recommendations were delivered to the immigrants visiting the SLO. The above could also be interpreted as in the context of employee resilience, where employees make decisions as part of a coping mechanism to deal with their work context (Kuntz et al., 2017; Okojie et al., 2023).

Sara's choice of timing for the weekly engagements was poor, given the number of visitors at the SLO at that time and their engagement in alternative activities. Even though Sara was aware of this fact, the timing was not changed for weeks on end. As a result, the interactions between Sara and SLO visitors were severely reduced. Again, the choices made by the SLB affected the range of services offered to the immigrant visitors. Poor timing, combined with the lack of a structured programme to both inform and encourage participants, can be interpreted as a reactive and one-way response.

It can be argued that Sara's poor service delivery was highly dependent on the relationships between *Green Integration* team members, rather than her relationship with the immigrants themselves. A low trust/high distrust relationship had developed in the last stages of the study. This type of a trust relationship is extremely uncomfortable in an interdependent work environment. Distrust relationships are inherent in any project or work environment, but they should be 'compartmentalised' to promote the emergence of other trust and maintain beneficial stakeholder interactions (Lewicki et al., 1998).

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Trust relationship three – Trust vested by immigrants in the sub-project team

According to Misztal (1996), generalised trust is a critical component of social integration, as well as an important measure of social cohesion (Stolle & Harell, 2012). Given the 'migration crisis' and the resulting multi- or super-diverse societies in Europe, the impact of increasing diversity on social cohesion needs to be discussed. Stolle and Harell (2012) have argued that generalised trust levels are not only lower among immigrants, but that trust also becomes suppressed within the majority populations as they face new diverse environments. Putnam (2007) suggested that at least in the short-term, social solidarity, social capital and social trust will ultimately decrease among citizens within a newly multi- or super-diverse society.

In this case study, Sara's decisions affected the immigrants' trust in the project team at large by limiting the services that were made available to the visitors and the SLO. For example, Sara recruited Yasir, a male interpreter, for group 3 and group 4. This demonstrates a lack of cultural awareness when dealing with gender issues (cf. Kotze et al., 2021). The resulting lack of honesty from the women in group 3 and group 4 further reduced Sara's ability to provide suitable services.

Furthermore, distrust was generated through the perceived actions of the immigrant participants who told Sara and Farah that they had no interest in *Green Integration* and that they attended the meeting only to maintain their living allowance. Such statements undermine the trust relationship between the project team members and the immigrants because they cast doubt on the participants' motives for attending the meeting. These attitudes also prompted team members to question the purpose of *Green Integration*. For instance, Sara expressed her concern that none of the team's efforts would be translated into the overall success of *Green Integration*.

The researchers did not expect the immigrants to participate in *Green Integration* because the Swedish integration policy is non-mandatory, and immigrants are required to attend 'integration activities' only to keep their monthly welfare payments. However, Wiesbrock (2011) noted that although integration activities are not mandatory, they hold financial benefits. Integration activities may not be obligatory in Sweden, but the presence of financial benefits points to the mandatory nature of integration activities in most EU Member States (Wallace Goodman & Wright, 2015).

The above affects the trust and distrust dynamics which are ever-present in organisational relationships. This study demonstrated that the interplay of trust and distrust in *Green Integration* had a greater impact on the project's trajectory than the immigrants themselves. Similar observations have been made in previous research on intra-organisational relationships which revealed that such relationships are plagued by suspicions from the beginning, with stakeholders questioning each other's motives and ambitions within the collaboration (Lewicki et al., 1998). Therefore, the challenge lies in the stakeholders' and project managers' ability to simultaneously manage distrust and build trust within the team, and to ensure that the trust dynamics do not affect the outcome, in this case, for the immigrants.

CONCLUSION

Integration is a complex social process during which newcomers or minorities are incorporated into the social structure of the host society. In the current age of migration, explorations of how to best conduct integration, both to the benefit of host societies and the migrants, remain an important yet unresolved sociological issue. Although research on the role of human agency in integration processes has gained significant attention through literature on values, self-efficacy and citizenship, it has remained in the background in the European context amidst research on systems thinking and complexity science.

The reason for the above is the continued preoccupation with integration as a phenomenon that takes place at the macro level. And while this is true if we see the end results, the fundamentals of integration are set and often decided upon already

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at the street level. Acknowledging the above, this paper delved into a seemingly 'trivial' case of an immigrant integration project in a street-level organisation (SLO). Using methods such as non-participant observation, chronological ordering and framework analysis, we were able to follow the project from inception to disbandment, and provide a different analysis than that provided by the official reports. Instead of integration efforts, our study revealed an array of unfortunate circumstances, where serious deficiencies in ability, benevolence and integrity undermined the delicate trust dynamics at play. In this spectrum, we have identified three areas that warrant further research: immigrant commodification, lack of cultural awareness, and exploitation of the project format, where time pressure, an inherent component of the project format, undermines the establishment of workable professional trust relationships.

We conclude that integration failure is not about the immigrants themselves, but rather about the superstructure of the project, its situatedness within the greater context of integration efforts and, most notably, the personal characteristics of service providers. Instead of integration, we witnessed a scramble for immigrants as commodities, exploitation of the project format for personal gain (idleness, procrastination, routinisation) and a general lack of cultural awareness, all of which undermined the delicate trust relations at play. By recognising that integration is a broader psychosocial process, i.e., more than just a tick-box, it can be concluded that trust and its intricate dynamics seem to be an underplayed dimension of integration. This could be one of the reasons why Sweden is lauded for having the best integration policy in Europe, while exhibiting some of the poorest results. A better understanding of this intricate relationship is essential to garner public support for more critical attitudes to processes that unfold at the street level because this issue – as evidence shows – cannot be left to chance.

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APPENDIX 1

High trust *Characterised by*: hope; faith; confidence; assurance; initiative	• High value congruence • Interdependence is promoted • Opportunities are pursued • New initiatives	• Trust is verified • Relationships are highly segmented and bounded • Opportunities are pursued and downside risks/vulnerabilities are continually monitored
Low trust *Characterised by:* no hope; no faith: no confidence; passivity; hesitance	• Casual acquaintances • Limited interdependence • Bounded, 'arms-length' transactions • Professional courtesy	• Undesirable eventualities are expected and feared • Harmful motives are assumed • Interdependence is managed • Pre-emption. Best offense is good defence • Paranoia
	Low distrust *Characterised by:* no fear; absence of scepticism; absence of cynicism; low monitoring; non-vigilance	**High distrust** *Characterised by:* fear; scepticism; cynicism; weariness and watchfulness; vigilance

Fig. 1. Trust/distrust relationships
Source: Lewicki et al. (1998).

Table 1. Actors involved in the *Green Integration* sub-project

Association	Title (pseudonym)	Description
VC team	Gatekeeper (Ulla)	Manager of the VC and the main gatekeeper in the project (female)
	Staff member (Armin)	Acting deputy manager of the VC (male)
Project team	Team member 1 (Hamed)	Consultant from the local office of a municipal business incubator (male)
	Team member 2 (Sara)	Staff member of an EU-funded project with experience in sustainable food production in the locality (female)
	Team member 3 (Malin)	Project leader and coordinator, liaison to business development
Interpreters	Interpreter 1 (Farah)	Interpreter with past experience working with the gatekeeper and the VC (female)
	Interpreter 2 (Yasir)	External interpreter (male)
	Interpreter 3 (Filsan)	External interpreter (male)
Participants	Group 1	Arabic-speaking participants (male and female)
	Group 2	Kurdish-speaking participants (male and female)
	Group 3	Somali-speaking participants (male and female)
	Group 4	Somali-speaking women (female)
	Participants	Visitors present at the initial (miscommunicated) group meeting (male and female)

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Table 2. Chronological ordering of trust events

	Event	Week	Low trust / low distrust	High trust / low distrust	Low trust / high distrust	High trust / high distrust
A.	Project inception	1-5			Malin-Ulla	
B.	Miscommunicated group meeting	3	participants-Malin	participants-Ulla		
C.	Meeting with an Arabic-speaking group	7	group 1-Farah group 1-Hamed	group 1-Ulla		Malin-Farah
D.	Meeting with a Kurdish-speaking group	7	group 2-Ulla group 2-Farah group 2-Hamed		Malin-Farah	Ulla-Farah
E.	Gap between meetings	7-12	Malin-Sara			
F.	First report	8				
G.	Meeting with a Somali-speaking group	12	group 3-Sara			group 3-Yasir
H.	Escalation to management	12-27				Sara-Malin
I.	Cancelled group meetings	17			Sara-Mohammed	
J.	Change of engagement tactic	20				Malin-Sara
K.	Initiation of women's group meeting	21-24		Ulla-Sara		
L.	Engagement reporting	24				Malin-Sara
M.	Women's group meeting	24			group 4-Sara	
N.	Meeting with the gatekeeper	25			Ulla-Sara Malin-Sara	
O.	Disbandment of project	35	Ulla-Sara		Malin-Sara	

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GENERAL PROBLEMS OF THE CADASTRE SYSTEM – CASE STUDY IN POLAND

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ABSTRACT

Motives: The proper functioning of land administration systems guarantees the security of property rights and property trading rights, which is why many countries worldwide are carrying out continuous research aimed at harmonising and modernising the cadastral system.
Aim: The aim of this article is to show the effects of the implementation of the global concepts of the cadastral system evolution under Polish conditions. This problem is international in nature, and common for a group of central and eastern European countries that underwent a systemic transformation at the end of the 20th century.
Results: As demonstrated in the case study, the cadastral system maintained in Poland is not uniform. There are still many areas where the basic source of information about properties is the materials from the 1960's and 1970's. Nevertheless, the gradually conducted modernisation of the Land and Buildings Registry, which is based on international standards and norms, is slowly leading to the establishment of a full-fledged cadastral system.

Keywords: cadastre modernisation, cadastral data quality, types of errors in cadastral documentation

INTRODUCTION

At the end of the 20th century, cadastral systems were revolutionised. The development of information technology (IT) tools has generated advances in the spatial information technology. The need to implement the principles of sustainable development has resulted in the development of new visions, models, and roles for the cadastre. As reported by Bennet et al. (2010, p. 2): "Innovative concepts and seminal documents including the Multipurpose Cadastre (Williamson, 1985), FIG Statement on the Cadastre (FIG, 1995), The Bogor Declaration (FIG 1996), The Bathurst Declaration (FIG, 1999), Cadastre 2014 (Kaufmann

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& Steudler, 1998), the Core Cadastral Domain Model (van Oosterom et al., 2006), and the Land Management Paradigm (Enemark et al., 2005) radically altered understandings of the cadastre and its potential. Practical implementations can now be seen in the land administration systems of both developed and developing countries". This claim was confirmed by the studies conducted by Lemmen et al. (2013), and Lemmen et al. (2015).

The abundance of applications for the cadastre were also presented by Ting and Williamson (1999) In their studies, they highlighted the role of a multi-purpose cadastre in the development and operation of land administration systems.

In recent years, the concept of a multipurpose cadastre has been aimed at extending the cadastral data dimension from 2D to 3D, or even, as suggested by certain authors, to 4D (Siejka et al., 2014). Therefore, the cadastre of the 21st century should not only be a multi-functional but also a multi-dimensional system for collecting property data (Bydłosz, 2012; Karabin, 2012; Mika, 2018). A similar function of the cadastre was presented at the FIG Congress in 2022, with the emphasis that effective data verification and regular updating are essential in land management (Kocur-Bera & Pietrulińska, 2022). Attention was also drawn to the compatibility of the data contained in the Land and Mortgage Register and the cadastre as a key element confirming the quality of data collected in these systems (Karabin & Łuczyński, 2022).

The cadastre, particularly in south-east European countries, has evolved over many decades under different historical, legal, and technological conditions. The data contained in cadastral documentation can be, and often are, unreliable (Hanus et al., 2018; 2020; 2021). Similar problems occur in neighbouring European countries with the historical roots shared with Poland, such as Slovakia (Muchowa & Juskowa, 2017), Croatia (Tomić et al., 2018), or the Czech Republic (Pesl, 2003). Another problem that aggravates the lack of consistency in the cadastre is the political transformation which took place after the Second World War. This situation applies to most of the Baltic countries (Mika, 2018; Parsova et al., 2012; Pesl & Slaboch, 2002). In Poland, the principles of market economy functioning were restored only after 1989. In accordance with the regulations in force, the role of the cadastre is served by a database functioning under the name of Land and Buildings Registry (status as of 2020). This is a public register which collects descriptive and spatial data on cadastral objects i.e. land parcels, buildings, and premises[1]. Unfortunately, this system does not guarantee the unambiguous identification of cadastral objects in legal terms. Only when combined with the information contained in a separate system that functions in Poland under the name of Land and Mortgage Register[2], it is possible to determine the actual legal and factual status of these objects. These two separate registers are maintained by institutions which are subordinate to two different Ministries. This results in the number of errors and uncertainties as regards the compatibility of cadastral data. Information on cadastral objects is duplicated in both registers and, unfortunately, there are cases of incompatibility of data concerning the same property, which are registered in both systems. An additional problem associated with the mutual exchange of information between these registers is the varied territorial range of data collection. The Land and Buildings Registry collects data within the so-called cadastral unit, which is most often a commune or municipality. As regards the Land and Mortgage Register maintained by District Courts, the area of data collection is the so-called area which most often does not overlap with the administrative boundaries of communes and their subordinate smaller territorial units (the so-called districts, which most often are villages in the case of communes, or districts in the case of cities). This issue was addressed *inter alia* in (Dawidowicz et al., 2014; Hanus et al., 2014; Ilyushina et al., 2018; Maślanka, 2019; Mika, 2017b; 2018; Parsova et al., 2012; Wilkowski & Karabin, 2006). Also, the boundaries of the smallest territorial units registered in both systems, which are at the same time basic cadastral objects, do not

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overlap in the field. As regards the Land and Buildings Registry, the basic object is a land parcel, and for the Land and Mortgage Register, the basic object is a land, building, or premises property. According to Article 9 of Resolution of the Minister of Regional Development and Construction of 29 March 2001 on the Land and Buildings Registry: "A cadastral parcel is a continuous area of land situated within the boundaries of one district, legally homogeneous and separated from the environment with boundary lines". On the other hand, according to Article 46 § 1 of the Civil Code Act of 23 April 1964, "Real estate is part of the earth's surface constituting a separate object of ownership (land), as well as buildings permanently attached to the land or parts of such buildings if, under specific regulations, they constitute an object of ownership separate from the land."

In the last 30 years, there has been a noticeable drive in Poland to modernise the cadastral system by means of successive amendments of regulations in accordance with the global trends in the construction of cadastral systems. The authors who have addressed this issue include (Buśko, 2017; Dawidowicz & Źróbek, 2011; Mika, 2017a). As reported by (Aleksic et al., 2010; Bennett et al., 2010; Hanus et al., 2014; Inan et al., 2010; Kocur-Bera & Frąszczak, 2021; Noszczyk & Hernik, 2019) an efficiently functioning system enables the development of the real estate market while being a source of data for a wide group of users. Above all, it guarantees stability in the real estate market under market economy conditions. The recent amendments to the Land Surveying and Cartographic Law Act of 17 May 1989, were aimed at streamlining the investment and construction processes, and introducing an obligation to establish spatial databases for spatial planning acts. A similar aim guided the update of the Regulation on the Land and Property Register of 27 July 2021. As compared to the previously valid legal act on land register, it was considerably shortened while retaining the most important provisions concerning the functioning of the cadastre. Therefore, the cadastre reforms aim at extending the use of cadastral databases. The concept of a multi-purpose cadastre is based on the assumption that a cadastral register can serve multiple different purposes. It combines the physical, legal, and economic aspects of the cadastre. The physical aspect is closely linked to data on land and buildings. The legal aspect concerns the scope of ownership and the rights to a particular property. The economic aspect governs the issues related to the property value, which, within the meaning of international trends in cadastre construction, is part of the fiscal cadastre. Additionally, a new function of the cadastre, the so-called Green Cadastre, is emerging in scientific papers (Dawidowicz et al., 2020). Green Cadastre assumes the establishment of a uniform system designed to monitor agricultural land in support of agricultural policy.

The aim of this article is to show the effects of the implementation of the global concepts of the cadastral system evolution under Polish conditions. This problem is international in nature, and common for a group of central and eastern European countries that underwent a systemic transformation at the end of the 20th century. As shown by the conducted references review, as of the date of publication of this article, there are no studies on the actual state of the cadastre in these countries. This article is the next step in a scientific discussion on the development of the cadastre in Europe. The research questions posed below relate to Polish conditions but they are universal enough to be used to assess the cadastre in other countries. Does the cadastral data quality in Poland meet global standards? How was Polish cadastre evolving in individual years of the implementation of the assumptions of major cadastre development scenarios worldwide, such as CADASTRE 2014 and CADASTRE 2020? Have the attempts made to modernise the cadastre yielded the expected results? How does the cadastre in Poland function, and what problems does it encounter in the year 2022?

Further part of the article will analyse the vision statement of cadastral systems under Polish conditions.

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ANALYSIS OF THE DEGREE OF IMPLEMENTATION OF GLOBAL TRENDS IN CADASTRE CONSTRUCTION IN POLAND

From the perspective of the subject matter addressed in the study, the following essential documents, legal acts, and implementing provisions, both international and national, were examined: the vision of CADASTRE 2014, the vision of CADASTRE 2020, the INSPIRE Directive, ISO 19152 (LADM), the Land Surveying and Cartographic Law Act, Resolution on the Land and Buildings Registry of 2001, and the Act on spatial data infrastructure.

In the first place, the assumptions of the statements of CADASTRE 2014 were analysed. Due to the need to modernise the cadastre, the International Federation of Surveyors (FIG), via Commission 7, established the Working Group 7.1 at the Congress in 1994. A scope of tasks was defined for them. It was proposed to introduce a cadastral reform along with the procedures for gradual data automation. The cadastral system being modernised was given a new, much more responsible role, laying the foundations for the comprehensive land information system (Kaufmann & Steudler, 1998).

As reported by Kaufmann & Steudler (1998) and Kaufmann (2002), during the research into the current state of cadastral systems, it appeared that the documentation and registers concerning private land were not able to provide sufficient information to be able to present a complete picture of the legal situation of land. In many European countries, the legal sphere has changed noticeably over the last few decades. New regulations have been introduced to ensure prudent use of land and other scarce resources. Based on the research conducted by the author, certain conclusions were drawn as to how cadastral systems should be constructed. Firstly, they need to be a source of reliable and complete information about the legal status of a particular land, with all legal consequences that might have occurred on it. Secondly, through organisations, the information structures along with data models should adapt to the needs of society, which change over time. Thirdly, cadastral systems should operate in a direct and effective manner, using the latest technologies. Fourthly, the costs of the reforms should be borne by society as little as possible. As shown in Fig. 1, Poland in 2002 was at the stage of early implementation of market economy principles, which resulted, in the cadastre (the Land and Buildings Registry in accordance with the principles of the 2001 Resolution), in subsequent attempts being made to modernise the system. These concerned the possibility for transforming the system into a multi-purpose cadastre through further computerisation of data sets by means of analogue map vectorisation. Unfortunately, due to the measures taken and the financial savings, the cadastral data quality deteriorated, as indicated by the analyses provided in studies by (Hanus et al., 2021; Mika, 2018). It follows from these studies that in Poland, as of today,

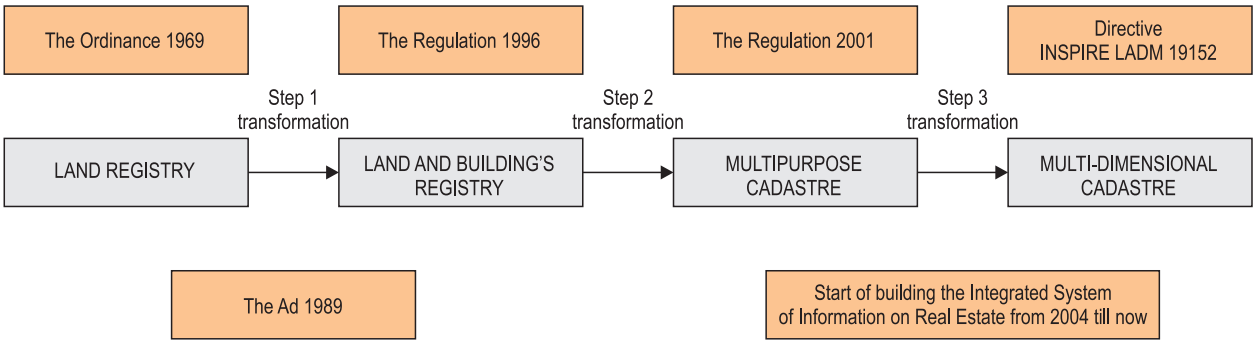

Fig. 1. Stages of cadastre modernisation and the plan of transformation of the multi-purpose (2D) cadastre into the multi-dimensional (3D) cadastre in Poland

Source: own elaboration based on Mika (2018).

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it is not possible to construct a multi-dimensional cadastre due to the poor quality of cadastral data.

The CADASTRE 2014 is characterised by 6 vision statements provided in Table 1.

The possibilities for the introduction of these 6 vision statements of "CADASTRE 2014" in Poland were already examined by Wilkowski (2010) and presented in "Space, Heritage & Future" for the GIS – Forum. The author indicated significant differences in defining the terms of "land parcel" and "land property". The implementation of the CADASTRE 2014 vision statements in Poland would ensure the consistent operation of two registers collecting cadastral data i.e. the Land and Buildings Registry and the Land and Mortgage Register. Unfortunately, the legal complications arising, *inter alia*, from historical factors have been preventing the merger of these institutions to this day. Their actual separate functioning is regulated by the applicable legislation. The rules applicable to the cadastre (Land and

Table 1. The vision statements of the CADASTRE 2014, in the context of changes introduced in Poland by the year 2022

Item	Principle	Commentary	Status as of 2020	Status as of 2022
1	"The CADASTRE 2014 will show the complete legal situation of land, including public rights and limitations!"	This means that the programme under design was intended to provide legal security for governmental institutions, non-governmental institutions, and for natural persons i.e. property owners. In this way, it would be possible to obtain complete documentation on the legal status of all land, including the objects located on it.	NOT IMPLEMENTED	NOT IMPLEMENTED
2	"The division into maps and registers will be abolished!"	Due to the development of information technologies, it will be possible to combine the graphical and descriptive parts of the cadastre by linking land objects directly to the information on them.	PARTIALLY IMPLEMENTED	IMPLEMENTED
3	"Cadastral maps will cease to exist! Long live modelling!"	Thanks to the digital data, IT systems are able to create models of objects, both based on their actual state of affairs and in accordance with the legal situation. This will result in the information storage function being lost by analogue maps which will only serve as a transparent and comprehensive data presentation.	PARTIALLY IMPLEMENTED	IMPLEMENTED
4	"The cadastre on paper will disappear!"	The author claimed that each concept of the cadastre in the world employed information technologies in the implementation of its assumptions. Initially, he believed that only developed countries would be able to follow this particular path. It turned out, however, that developing countries (like Poland) are also striving for modernisation, and do not limit their attempts to traditional methods.	PARTIALLY IMPLEMENTED	PARTIALLY IMPLEMENTED
5	"The CADASTRE 2014 will be highly privatised. The public and private sector will cooperate closely!"	As privatisation affects virtually every area of human activities, it will be no different with cadastral systems. However, the public domain's task will be to care for land ownership titles. Its main task will be to supervise the entire project, and the operational work issues will be carried out by external organisations.	IMPLEMENTED	IMPLEMENTED
6	"The cost of CADASTRE 2014 will be recoverable!"	The development of the cadastre is a long-term investment, which affects the fact that the amortisation period for the costs laid out at the very beginning will be longer as compared with other goods.	NOT IMPLEMENTED	PARTIALLY IMPLEMENTED

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Buildings Registry) are set out in the Land Surveying and Cartographic Law Act and in Regulation on the Land and Buildings Registry of 2001, while those applicable to the Land and Mortgage Register are set out in the Act on land and mortgage registers. The cadastre is maintained by Starosts in Poviat Land Surveying and Cartographic Resources, while the Land and Mortgage Register are maintained by District Courts competent for the place of jurisdiction of a particular property. The data and materials stored in the cadastre are processed by land surveyors. Land and Mortgage Register are created by lawyers. However, it is worth mentioning that until the end of 2022, Land and Mortgage Register have not been established for all properties in Poland. Many properties still have an unregulated legal status. It should be mentioned here that a significant relationship exists between the Land and Buildings Registry and the Land and Mortgage Register. The data on parcels e.g. the location, area, boundaries, and the soil class are the source of information included in Section I-O of the Land and Mortgage Register. The data on the owner of a particular property are imported to the cadastre from Section II of the Land and Mortgage Register. The opinion expressed by Wilkowski in 2010 is, unfortunately, still valid, and in 2020 we can say that the organisation of both registers is not conducive to the rapid implementation of the principles of the second statement of "CADASTRE 2014". It is assumed that in the future, integration between the cadastre and the Land and Mortgage Register will be introduced in order to establish a new system containing information about properties, originating from multiple registers (Integrated Property Information System). As part of the implementation of the third and fourth statement, Wilkowski was of the opinion that in Poland, that state of affairs functioned practically in full. The only inaccuracies result from the diversity of programme tools used for studies in Polish cadastre. They do not ensure full compatibility; therefore, further modernisation work involves eliminating this problem. The number of programme tools is to be reduced, and their specificity unified. Unfortunately, this forecast did not come true, and although in theory, in Poland, the uniformity of land surveying data is obligatory, in practice it is implemented in a diverse tool environment, which repeatedly hinders the land surveyor's work. The fifth statement i.e. that of cooperation between the public and private sector, can also be, according to Wilkowski, considered to have been implemented. The operation pattern is characterised by the supervision on the part of the Land Surveying Service, the works being performed by the private sector i.e. land surveyors being responsible for submitting studies accepted for the resource. The supervision and control are exercised by Starosts who are the "head" of the Poviat Land Surveying Service. In addition, the issues concerning fees and their amounts are governed by regulations. Downloading data and materials from the resources is chargeable. This is the implementation of the sixth statement.

With the completion of the development of the CADASTRE 2014 vision, work began on another modernised vision of the register. Wilkowski and Karabin (2006) analysed the vision statements of CADASTRE 2020 as the future of the cadastral system in Poland. It was prepared for the 23rd Congress of the International Federation of Surveyors, which was held in Munich in October 2006. Research into the state of cadastral systems in certain European countries contributed to a comparative analysis in relation to the situation in Poland. European countries such as Austria, the Netherlands, Germany, and Sweden were taken for comparison. As reported by Wilkowski and Karabin (2006), in the implementation of the transitional model of the CADASTRE 2020, apart from the organisational pattern originating from certain European countries, an important role was played by the previously implemented projects. First of all, these were projects Phare 2000 and Phare 2001, which were mainly involved in the introduction of the IPE system i.e. the Integrating Electronic Platform. The target concept of a cadastral system model i.e. the cadastre after 2020 was mostly based on the methods already employed in the EU Member States and in Norway. The proposed further changes generally concerned the reduction in the costs of maintaining

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two separate systems in Poland i.e. the Land and Buildings Registry and the Land and Mortgage Register. It was estimated that more than half of the information on properties is duplicated in both these systems. The main idea of the target concept was to establish the Central Cadastral Database cooperating with the IPE platform.

In addition, the reform of the cadastral system in Poland involved the implementation of regulations and European standards (ISO 19152 LADM and the INSPIRE Directive of 2007). Figure 2 presents changes in regulations concerning the cadastre on the timeline between 1969 and 2022. It only shows the tendencies towards transforming the Land and Buildings Registry into the cadastre. The change in the register name has not been followed by parallel and effective transformations of the databases, without compromising the quality of cadastral data.

According to Article 2(8) of the Land Surveying and Cartographic Law Act of 17 May 1989 (consolidated text: Journal of Laws of 2019, item 725, as amended), the definition of a cadastre is as follows: "(…) an information system that ensures the collection, updating, and sharing, in a manner uniform for the country, of information on land, buildings and premises, their owners, and on other entities holding or managing these land, buildings or premises (…)". Article 21 of the same Act defines the functions of the data on land and buildings, which are collected in the register. They are crucial for spatial planning, setting tax rates, keeping public statistics, real estate trade, and registering agricultural farms. They also provide the basis for indicating properties in the second public register i.e. the Land and Mortgage Register. The authorities along with other units involved in organisational matters, in cooperation with the Land Surveying and Cartographic Service, perform these specific tasks in order to ensure efficient data exchange between registers. Unfortunately, in practice, many disadvantages of this cooperation can be seen, which was reported by *inter alia* (Hanus et al., 2014; Maślanka, 2018; Pęska, 2014; Przewięźlikowska, 2020), who focused mostly on the analysis of the cases located in Małopolskie Voivodeship.

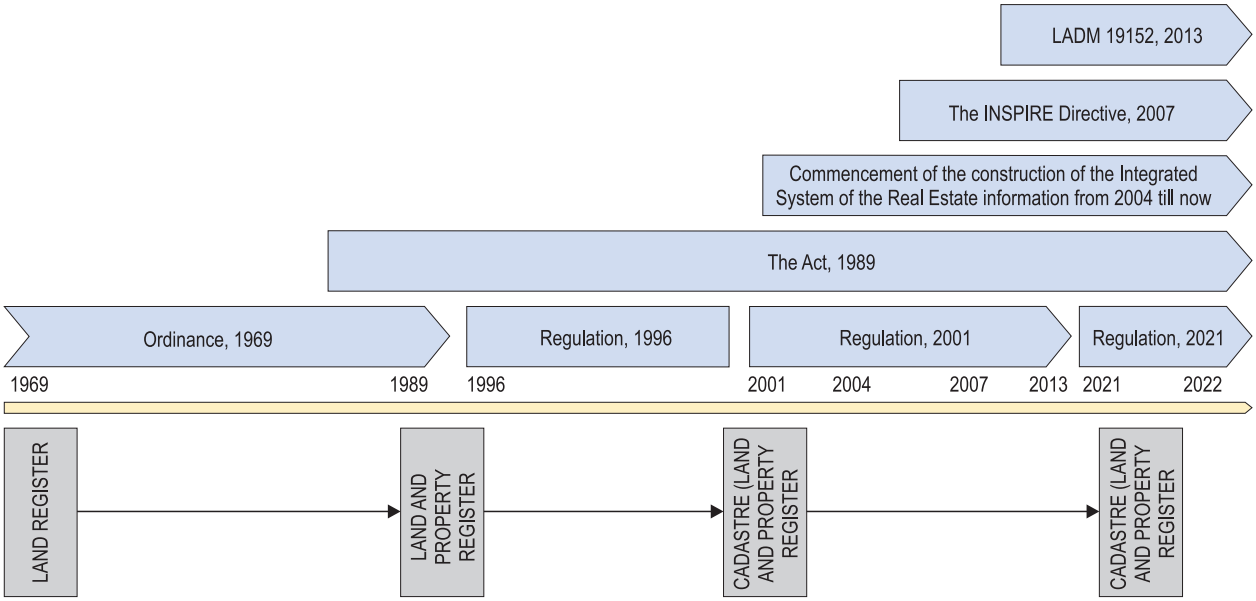

Fig. 2. Selected legal acts on the cadastre in Poland in the recent 50 years
Source: own elaboration based on Mika (2018).

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MATERIALS AND METHODS

The basic research material included the above-analysed source texts of international cadastre construction concepts for the CADASTRE 2014 and CADASTRE 2020. In order to achieve the intended goal, the descriptive and comparative analysis method was employed according to the adopted criteria. The area analyzed is located in two different geographical regions: the Lublin Upland and the Lublin Polesie, as well as two subregions: the Łęczyńsko-Włodawskie Lake District and the Dorohuskie Depression, divided into 6 communes. Detailed research was conducted in two representative *poviats* (administrative units) of Lubelskie Voivodeship. The Łęczyński and Lubartowski Poviats are situated in the central part of the voivodeship. The total area of Łęczyński Poviat is 637 km^2. It is divided into five communes (Cyców, Ludwin, Milejów, Puchaczów, and Spiczyn), and one urban-and-rural commune (Łęczna). Łęczyński Poviat is situated at the interface of two different geographical regions: the Lublin Upland and the Western Polesie, and its two sub-regions: the Łęczyńsko-Włodawskie Lakeland and the Dorohusk Depression. The entire area of the *poviat* is located within the North European Plain, which is the explanation for the plain land used mainly for agricultural purposes. Łęczyński Poviat is characterised by a quite low forestation rate. Forested areas, wooded land and bushland occupy slightly above 15% of the area (including forests 13%). Łęczyński Poviat comprises 117 localities (including 116 villages), divided into 6 communes. In Łęczyński Poviat, individual owners own 76,593 parcels with an average area of 0.65 ha. This, however, varies from commune to commune.

Lubartowski Poviat occupies the area of 1290 km^2 and is divided into 13 communes, including 10 rural communes, 2 urban-and-rural communes, and 1 municipality. The *poviat* is located in the northern part of Lubelskie Voivodeship, and covers an area situated at the interface of three geographical regions: Mazovia, the Lublin Upland, and the Western Polesie. A significant part of the *poviat* is occupied by an undulating moraine plain, Lubartów Upland, a Mazovia mesoregion, and the remaining part by the Łęczyńsko-Włodawskie Lakeland being part of the Western Polesie. The Lubartów Land is a vast plain through which the Wieprz River flows. In Lubartowski Poviat, soils of poor valuation class are found. No soils of class 1 are found there, and the overall area of soils of class 2 is only 13 ha. On the other hand, the class 4 soils and poorer account for 88.5% of the overall area of agricultural land. In Lubartowski Poviat, the area of forested land is 26,233 ha, which accounts for

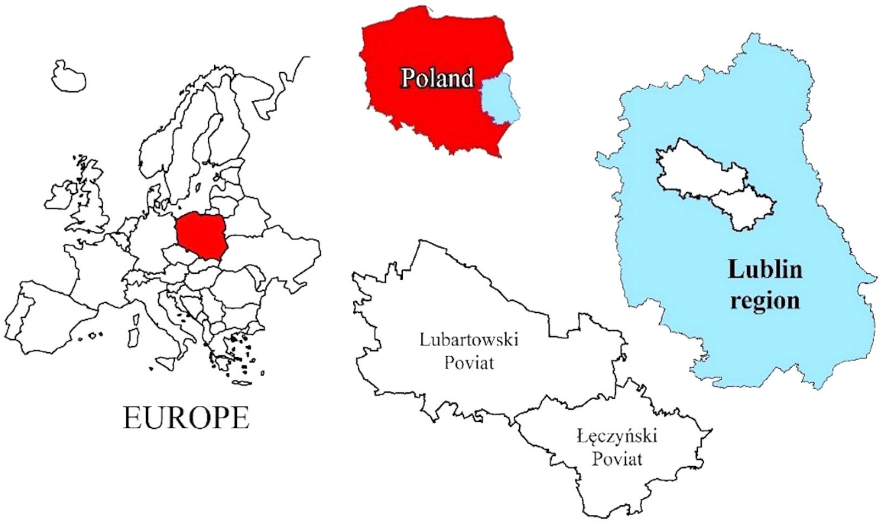

Fig. 3. Spatial location of the research object

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20.3% of the *poviat*'s area. The *poviat* under analysis is divided into 243,824 parcels with an average area of 0.53 ha.

The spatial location of the area under analysis in relation to Europe, Poland, and Lubelskie Voivodeship is shown in Fig. 3.

The research materials included survey statements drawn up based on the data derived from the cadastre. The study was conducted on 20 randomly selected cadastral districts in two *poviats* of Lubelskie Voivodeship. 442 survey statements were analyses, which accounts for 42% of all statement drawn up in the analysed districts in the year 2020. The number of examined cadastral parcels is 1322 (Table 2).

The study revealed eleven error types (Table 3), the frequency of which was analysed in detail.

Table 2. Summary of the data covered by the study

Poviat	District	Area [ha]	Number of survey statements in the district	Number of parcels in the district
		Number of parcels	Number of survey statements examined	Number of parcels examined
1	2	3	4	5
Łęczyński	Rogóźno	790.1940	100	2543
		2543	48	78
	Nadrybie Wieś	572.1273	43	705
		705	12	31
	Jaszczów	669.9708	54	1412
		1412	22	56
	Cyganka	327.0209	15	429
		429	5	50
	Łysołaje	262.9965	222	1194
		1194	53	154
	Turowola	622.0408	55	885
		885	38	52
	Puchaczów	572.1919	47	1900
		1900	18	54
	Ostrówek Podyski	361.4446	10	218
		218	5	15
	Nowy Radzic	340.2286	23	415
		415	8	20
	Jawidz	1376.1878	38	2389
		2389	15	68
Lubartowski	Rozkopaczew	524.5478	69	875
		875	36	121
	Kolechowice	432.0124	20	421
		421	8	20
	Kamionka	635.2145	80	1245
		1245	34	50
	Dębiny	250.2145	30	351
		351	15	25
	Sosnówka	361.2543	38	460
		460	20	58
	Jeziorzany	270.3415	55	728
		728	21	56

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cont. Table 2

1	2	3	4	5
	Klementynów	919.1028	63	2006
		2006	31	123
	Tarło	282.1311	20	683
		683	8	22
	Pałecznica	279.3676	10	342
		342	5	15
	Nowa Wola	572.1254	63	542
		542	40	254
	Total	10420.7151	1055	19743
		19743	442	1322

Table 3. Types of errors in the cadastre

Error designation	Description
T1	discrepancies between archival materials and the current Land and Buildings Registry
T2	errors arising from land consolidations
T3	discrepancies related to the actual existence of public roads in the field, and their absence on maps and in the Land and Buildings Registry
T4	problems related to river shoreline
T5	problem related to the roads constructed on natural persons' parcels
T6	discrepancy between the Land and Buildings Registry and the Land and Mortgage Register
T7	errors in the area of parcels and land in use
T8	errors in parcel numbering
T9	errors in property owners' personal data
T10	failure to disclose the title of property ownership
T11	discrepancy between land in use recorded in the Land and Buildings Registry and the actual field situation

CADASTRE 2020 in practice – a case study

The study demonstrated that there was still no electronic database of the Land and Buildings Registry in certain areas, and that the currently functioning public registers e.g. the cadastre and Land and Mortgage Register were two-dimensional in nature. Moreover, they are affected by errors that have an adverse effect on the cadastral data quality.

One of the major problems that arises in today's cadastre is the discrepancy between archival materials and the current Land and Buildings Registry (T1). Figures 4 and 5 show an analogue principal map of 2009, which showed no cadastral boundaries of the parcel. At the Poviat Centre for Land Surveying and Cartographic Documentation, there was no overlay on the map for the land register itself. After the plotting (digitisation) of boundaries on the principal map during the shift from analogue map to the digital version in 2015, it appeared that the existing buildings had been constructed not in line with designs, and parts of the buildings were located outside their parent parcels. It can be seen very well in parcel No 46/26 or 64, where half of the building is located on a parcel which is a road.

Figure 6 shows another case where a part of the building is located on a parcel not belonging to the building owner. This is parcel No 1665, district of Rozkopaczew, cadastral unit of Ostrów Lubelski, Lubartowski Poviat, Lubelskie Voivodeship. In 2007,

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Fig. 4. A fragment of a principal map as of 09 September 2020. Parcel No 46/26, district of Rogóźno, cadastral unit of Ludwin, Łęczyński Poviat, Lubelskie Voivodeship

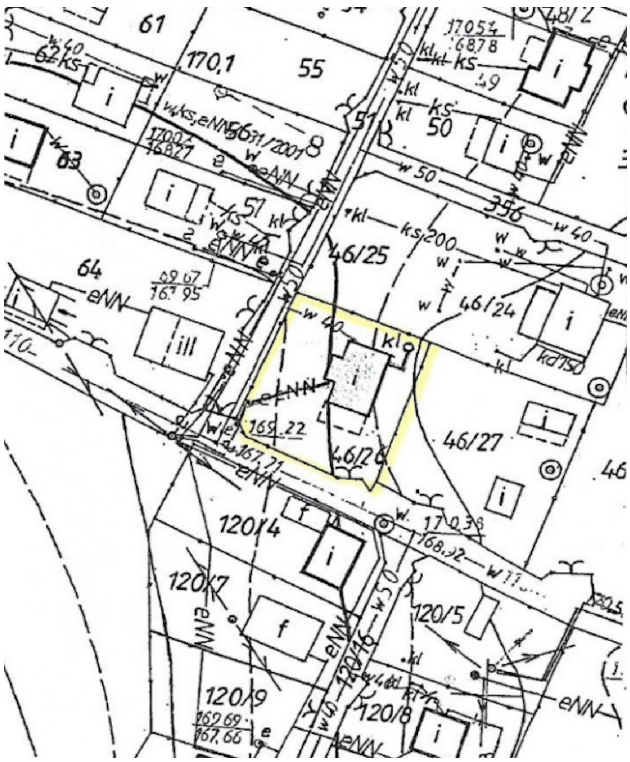

Fig. 5. A fragment of an analogue principal map as of 16 September 2009

Fig. 6. Parcel No 1665 from the geoportal database

in the village of Rozkopacze, land consolidation was conducted (T2). During the consolidation process, a farm building (barn) was located on parcel No 1665. The consolidation for this parcel was conducted based on division diagrams and measures shown on them, which were carried out in 1977. In theory, the consolidation should be laid out on the ground (the course of the boundary crossing the building would be noticeable then), but in this case, this obligation was most certainly not met. The error which emerged in 1977 was repeated during the consolidation in 2007. A part of the building from parcel No 1665 is located on the neighbouring parcel. This error could be rectified in the course of the consolidation procedure. Unfortunately, the parcel owner's failure to take care of the case, and the inaccurate conduct of the consolidation procedure resulted in the situation where the case presented above can only be resolved in court proceedings.

Another emerging problem is the roads which are found in the field but are not recorded in the Land and Buildings Registry (T3). This problem is shown in Fig. 7 (parcel No 215/5, district of Nadrybie Wieś, cadastral unit of Puchaczów, Łęczyński Poviat, Lubelskie Voivodeship). The fragment of the map,

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Fig. 7. Parcel No 215/5, an aerial photograph – geoportal

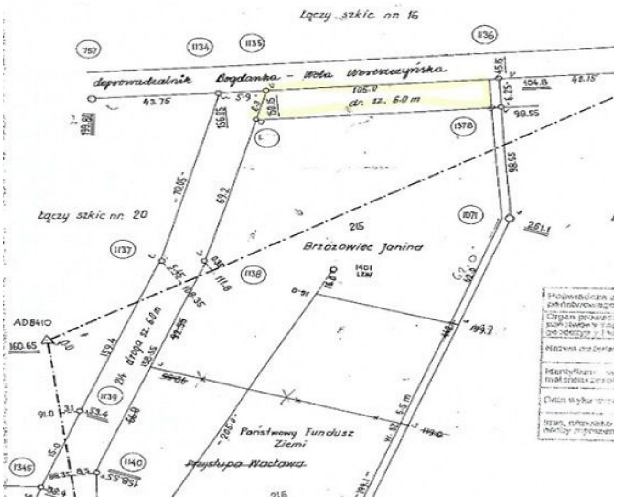

Fig. 9. A fragment of consolidation diagram of 1977, which shows a parcel that is a road with a width of 6.00 m

shown in Fig. 8, contains parcel No 215/5, this is the current situation as of 09 September 2020, "containing" a road which, at the time of the consolidation conducted in 1977 (Fig. 9), was a separate cadastral parcel. Over time, the parcel was absorbed by parcel No 215/5 (Fig. 8). Unfortunately, despite the attempts to find the reasons for this, the authors failed to explain this matter. Physically, in the field, the road still exists, while in the Land and Buildings Registry, such a parcel does not exist.

Another problem is related to the course of the river's shoreline. It is shown in Fig. 10 (parcel No 172/3, district of Jaszczów, commune of Milejów, Łęczyński Poviat). The shoreline of natural watercourses is the property boundary, and the constant changes in the course of the river bed, resulting from natural factors, not only change the boundary of the cadastral parcel but, primarily, change the scope of the property right (T4). The basis for describing the shoreline course is the data demonstrate in the Land and Buildings

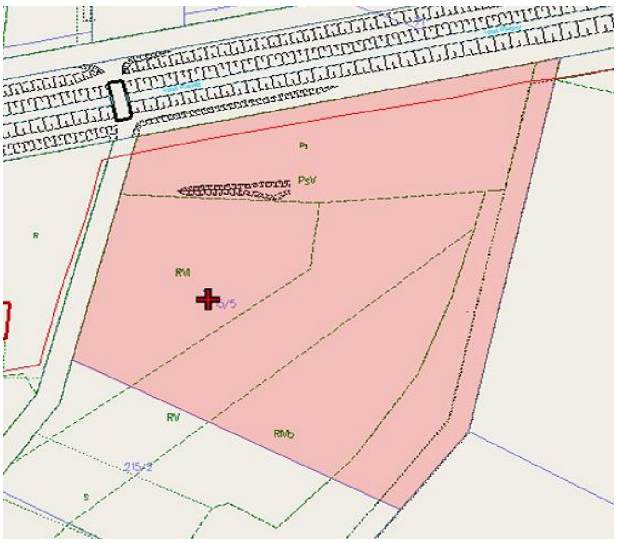

Fig. 8. A fragment of a principal map as of 09 September 2020

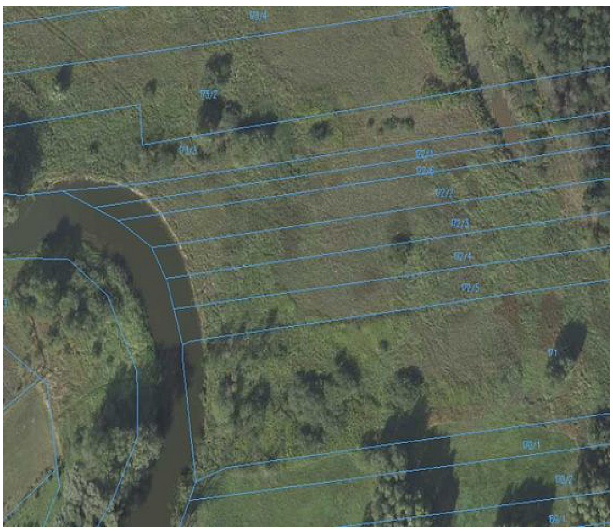

Fig. 10. Parcel No 172/3, an aerial photograph – geoportal

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Registry documentation. The level of quality of the data contained in the Land and Buildings Registry has a significant effect on the quality of the data determining the shoreline course. This problem is well noticeable in Fig. 11 which shows a fragment of a principal map with visible parcel boundaries. However, the actual situation is presented in Fig. 10 where, based on an aerial photograph, one can see the shift of the natural river bed, and the "entering" of the river into the parcels neighbouring with the shoreline.

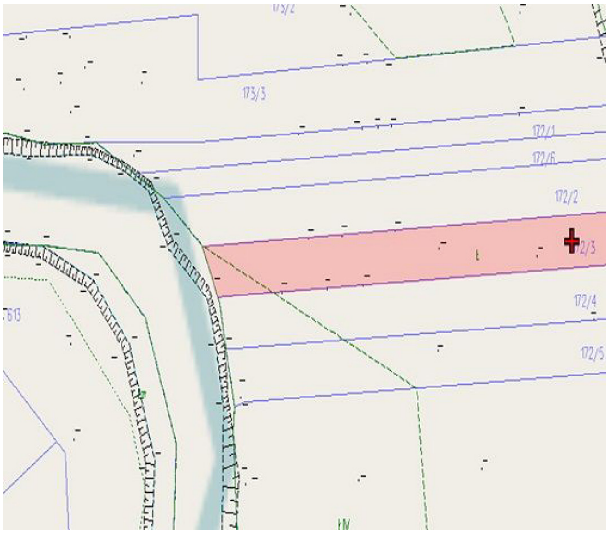

Fig. 11. A fragment of a principal map as of 09 September 2020

In view of multiple problems emerging in the cadastre, attempts are being made to rectify the errors of the past. Figures 12 and 13 show the parcel 290/4 which initially had the number of 290/2. The parcel No 290/2 in question was divided into 3 parcels i.e. 290/3, 290/4, and 290/5 in order to separate from it the part occupied by a public road constructed in the 1970's (T5). The division was conducted based on the provisions of the Act on real estate management and of the Act on detailed rules for the preparation and implementation of investments in public roads.

The proceedings conducted in this way enable the regulation of the state of ownership. Pursuant to Article 73 of the Act of 13 October 1998, the provisions introducing the acts that reform the public administration, the properties remaining, on 31 December 1998, under control of the State

Fig. 12. Parcel No 290/4, an aerial photograph – geoportal

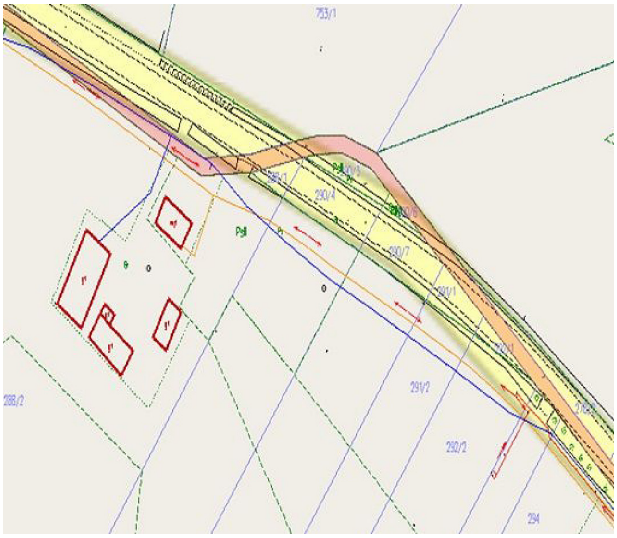

Fig. 13. A fragment of a principal map as of 09 September 2020

Treasury or local government units, not owned by them and occupied for the construction of public roads, on 1 January 1999 they become, by virtue of law, to be owned by the State Treasury or relevant local government units for a compensation. This provision enables the separation, from a parcel being under control of a natural person, of a parcel occupied for the construction of a public road, and the payment of compensation.

The remaining error types i.e. T6-T11 concern the descriptive part of cadastral survey.

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RESULTS AND DISCUSSION

The cadastre is the crucial database for numerous land surveying and legal operations. By definition, it forms the core of tax assessment and spatial planning and contains a lot of relevant land surveying and legal information. Both in Poland and worldwide, work is still underway to improve the data quality and to ensure the safety of using cadastral data. As demonstrated in the case study, in Poland there are still a number of inaccuracies or discrepancies in the data collected in the Land and Buildings Registry. Many areas in the country have no source materials concerning parcels besides the documentation drawn up in the 1960's and 1970's as part of the establishment of the register (Bydłosz, 2012; Dawidowicz & Źróbek, 2018; Karabin, 2012). Table 4 lists the types and number of errors detected in relation to the study area.

The study results showed that each of the districts under study was affected by different error types. 996 errors were recorded for the 1322 parcels examined (Fig. 14). Most errors were noted in the district of Łysołaje in Łęczyński Poviat (154). The fewest errors were found in the district of Pałecznica in Lubartowski Poviat (7).

On the other hand, Fig. 15 shows the distribution of individual error types identified in the area under study.

The most common type of error is the discrepancy between the land in use recorded in the Land and Buildings Registry and the actual field situation (T11). The second error in terms of its frequency in the area under study is an error in the area of parcels and land in use (T7). The reason for the occurrence of such a high number of these two error types is the lack of data updates in the Land and Buildings Registry.

Table 4. Distribution of errors in the area under study

Poviat	District	Type and number of errors detected											Total
		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	
Łęczyński	Rogóźno	42		9			8	6		5	1	7	78
	Nadrybie Wieś	4		11			4	8	2	2			31
	Jaszczów	2			15	5							22
	Cyganka					43	3	4	4	1	4		59
	Łysołaje	6		3	54	15	10	25	4	2	4	31	154
	Turowola		15				4	25		1	5	1	51
	Puchaczów	3		2			17	24		15	3		64
	Ostrówek Podyski		4	1					4				9
	Nowy Radzic	4	5				5	12					26
	Jawidz			2			20	15	21	3	8	42	111
Lubartowski	Rozkopaczew		20	1			15	8			15	17	76
	Kolechowice	10					12	5	2	4	1		34
	Kamionka	5		2		1	5	10	4	1	12		40
	Dębiny		5									15	20
	Sosnówka	11		2		5	8						26
	Jeziorzany	2	4		20					2			28
	Klementynów	1	2						3			51	57
	Tarło	10					4				4		18
	Pałecznica	2				5							7
	Nowa Wola	23		3			20			4	5	30	85
	Total	125	55	36	89	74	135	142	44	40	62	194	996

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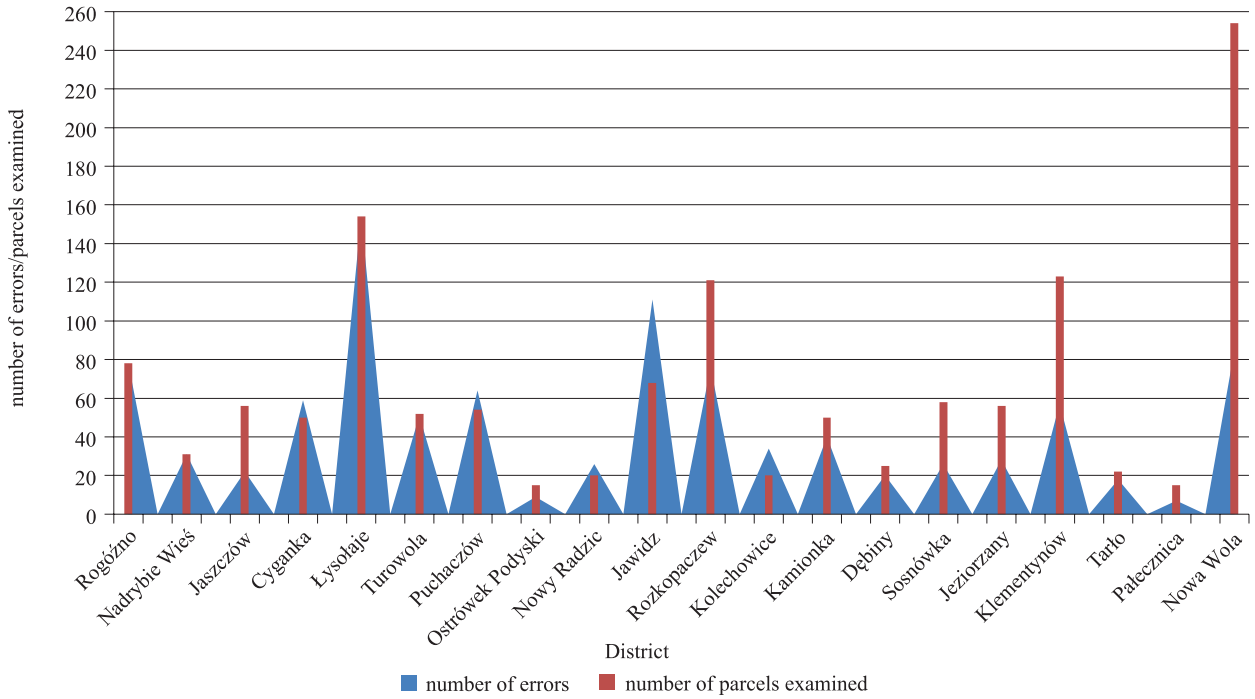

Fig. 14. Distribution of the number of errors in relation to the number of parcels examined

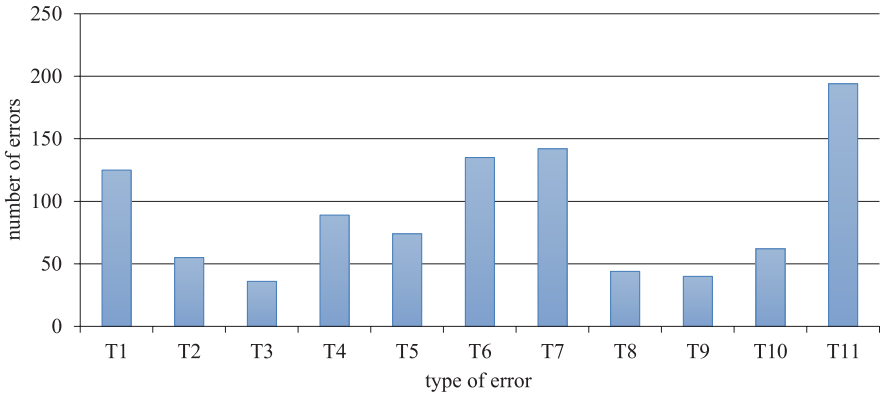

Fig. 15. Number of errors recorded for individual error types

The large scale of the errors detected concerns the discrepancy between the Land and Buildings Registry and the Land and Mortgage Register system (T6). From the perspective of cadastre construction and the reliability of data collected in it, this error should be eliminated in the first place. The consistency of data between these databases guarantees the construction of a reliable cadastral system. Discrepancies between archival materials (cadastral maps) and the Land and Buildings Registry map (T1) were detected in 125 survey statements examined. Problems related to a river shoreline (T4) were demonstrated in 89 survey statements. A problem related to the roads constructed on natural persons' parcels (T5) was demonstrated in 74 survey statements. Moreover, 62 cases of failure to enter titles of property ownership into the register (T10) were noted, which is due to the faulty information flow between the Land and Mortgage Register system and the Land and Buildings Registry. The T2 error type was identified in 55 survey statements. It concerned

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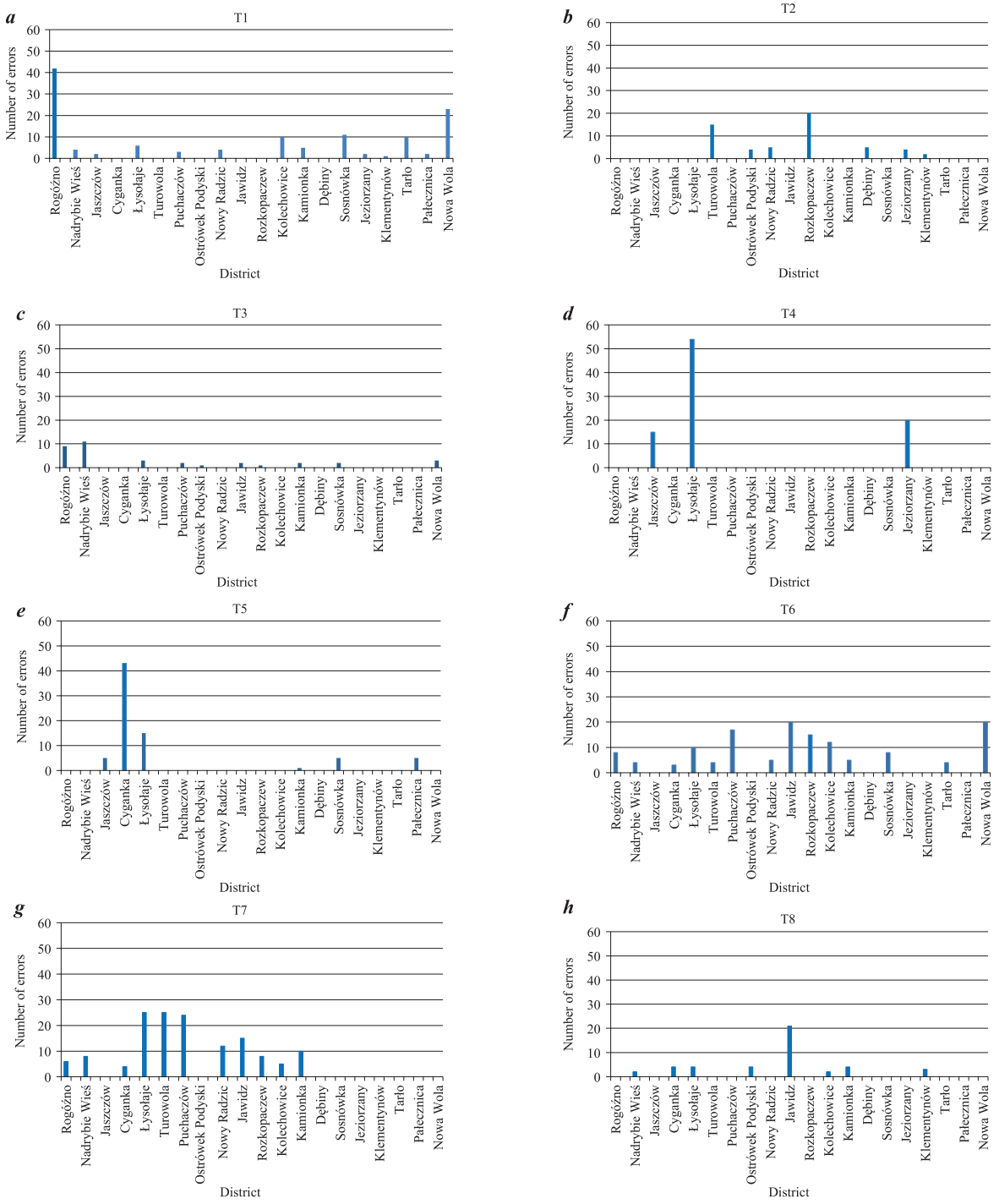

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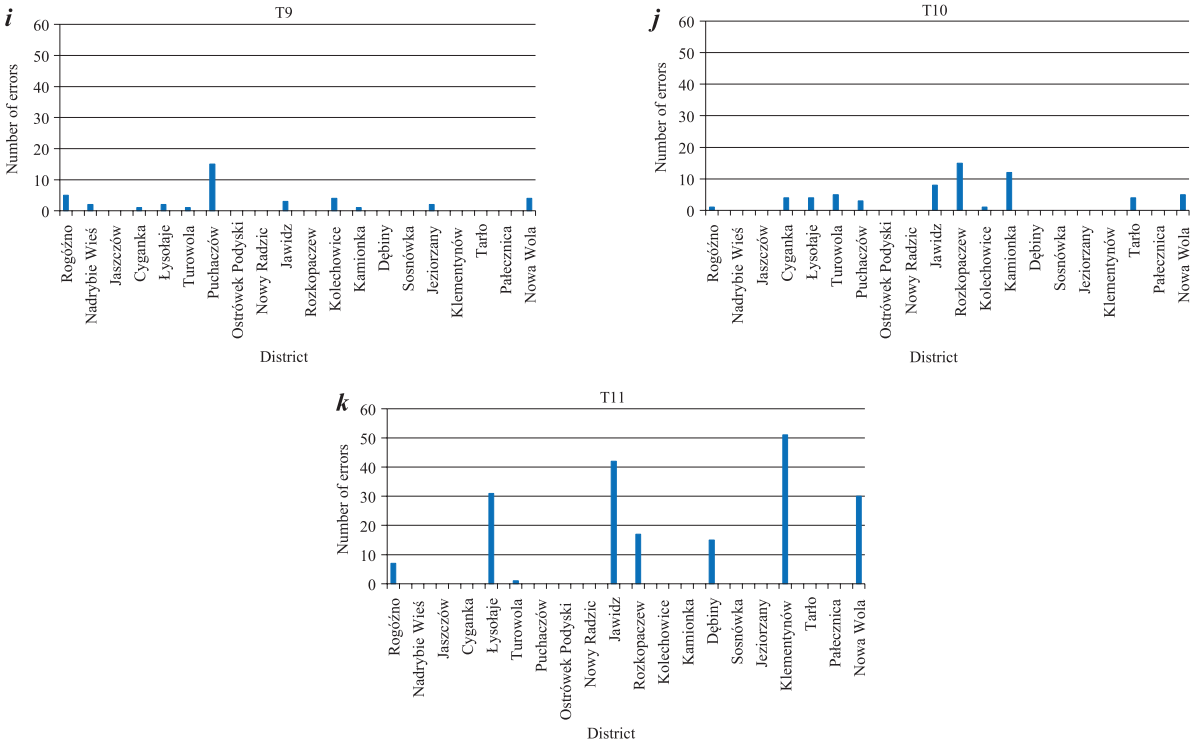

Fig. 16. Distribution of the number of individual error types in the area under study; a) – discrepancies between archival materials and the current Land and Buildings Registry (T1); b) – errors arising from land consolidations (T2); c) – discrepancies related to the actual existence of public roads in the field and their absence on maps and in the Land and Buildings Registry (T3); d) – problems related to river shoreline (T4); e) – problem related to the roads constructed on natural persons' parcels (T5); f) – discrepancy between the Land and Buildings Registry and the Land and Mortgage Register (T6); g) – errors in the area of parcels and land in use (T7); h) – errors in parcel numbering (T8); i) – errors in property owners' personal data (T9); j) – failure to disclose the title of property ownership (T10), k) – discrepancy between land in use recorded in the Land and Buildings Registry and the actual field situation (T11)

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the errors arising from improperly conducted land consolidation procedure. The conducted case study demonstrated the commonly occurring problem of erroneous parcel numbering (T8), primarily due to human errors. Errors concerning property owners' personal data (T9) were demonstrated in 40 cases. The detection of this error type once again proves the inconsistency between the data contained in the Land and Buildings Registry and those in the Land and Mortgage Register. The fewest detected cases concern the discrepancies related to the actual existence of public roads in the field, and their absence on maps and in the Land and Buildings Registry (T3). These cases are a consequence of systemic transformations which took place after the Second World War.

Figure 16 presents the distribution of the number of errors in individual districts in the area under study. The occurrence of the T1 error that indicates a discrepancy between archival materials and the current Land and Buildings Registry was noted in 14 out of 20 districts under study. An analogous situation concerns the errors involving the inconsistency between the factual circumstances (Land and Buildings Registry) and the legal status (Land and Mortgage Register), namely the T6 errors. Therefore, the study results prove that in only 30% of the districts, there is a full data compliance between the land register and the actual field status. A lower degree of error occurrence was noted for error types T3, T7, T9, and T10 which occur in approx. 50% of the districts. Error types T2, T5, T8, and T11 are found in approx. 35% of cases. The error type found in the smallest number of the districts under study is T4 which concerns the discrepancy between the course of river shoreline and the cadastral parcel boundaries, and is attributable to the fact that in the area under study, the river flows through only three districts, namely Jaszczów, Łysołaje, and Jeziorzany. Nonetheless, the number of these particular errors is relatively high, and accounts for almost 10% of all errors.

CONCLUSIONS

The modernisation of the Land and Buildings Registry towards a fully-fledged cadastre, whose principles will be based on international standards and norms, is being carried out in Poland in a slow and inefficient manner. It brings many problems to land surveying contractors through constant reforms of regulations, and in particular their implementation in practice. There is no doubt, however, that these reforms are needed, and that they are on good track. The fact that it is possible to construct a cadastral system in post-Communist countries is evidenced by the experiences of other countries, including Slovakia and the Czech Republic (Hudecova & Kysel, 2019; Muchová & Raškovič, 2020; Muchowa & Juskowa, 2017; Parsova et al., 2012; Pesl, 2003), which, during the Partitions or wars, also had similar experiences that stamped their influence on, *inter alia*, the Register data. The successor states of the Austro-Hungarian Monarchy and also Poland organize regular, joint cadastral conferences at the highest level of departmental authorities, where, among other things, they are discussed in detail about the state of their cadastral systems.

The aim of this article was to show the effects of modernisation of the cadastral system in Poland by implementing international standards and regulations. The conducted case study directly reveals the unsatisfactory status of cadastral data quality, which concerns both the descriptive part and the graphical part of the Land and Buildings Registry documentation.

The study demonstrated that, as regards the implementation of regulations, the status of Polish cadastre is satisfactory. Polish regulations are based on international standards. Unfortunately, their translation into the land surveying practice fails to bring tangible results of the cadastral system improvement.

In the years of cadastre development in Western Europe, there was a difficult period of systemic transformation aimed at restoring private property

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in Poland and other post-Communist countries. The cadastral reforms involved changes in the system name and the scope of cadastral data. Unfortunately, the form of converting analogue maps to digital ones by means of scanning, vectorisation, and digitisation has contributed to the loss of quality, and sometimes even of cartometricity.

How does the cadastre in Poland function, and what problems does it encounter in the year 2020? 996 various error types were detected on 1322 parcels. This shows that 75% of the parcels under study are affected by errors, some of them even by a few error types. Almost every parcel is affected by an error. Most errors concern the discrepancy between the types of land in use recorded in the Land and Buildings Registry and the actual field situation (T11). This is due to the faulty procedure for updating cadastral data. Changes in land in use are not implemented on an ongoing basis. The distribution of errors shows no tendency for errors to be evenly distributed in *poviats* or in districts. This does not change the fact that in cadastral documentation randomly selected for the study, the cadastre functioning is defective. Continued use of data affected by errors will generate further errors.

Based on the study conducted, a general conclusion can be drawn that the identified number of eleven error types represents three major groups of CADASTRE 2020 problem in Poland. The first group includes errors arising from incorrect data processing in order to digitise the resource (T1, T2, and T3). The second group relates to the faulty information flow between the actual status register (Land and Buildings Registry) and the legal status (Land and Mortgage Register) (T6, T9, and T10). The third group includes human negligence errors or systemic errors arising from the lack of relevant regulations (T4, T5, T7, T8, and T11).

Based on the research conducted and the resulting conclusions, the authors of the article believe that they may constitute the first step in the scientific discussion on the condition of the cadastre in a global perspective.

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DIFFERENCES IN THE ENVIRONMENTAL AWARENESS OF THE POLISH POPULATION

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ABSTRACT

Motives: A fundamental tenet of sustainable development (SD) posits that all human endeavors should prioritize ecological safety. This underscores the significance of the knowledge about the ways in which these activities manifest in social attitudes, as an indicator of environmental awareness (EA) levels. Given the relevance of environmental EA, this issue should be examined across diverse communities and social groups, such as urban and rural residents, to catalyze the adoption of SD principles. It is assumed that the concentration of the population and societal structures in urban centers stimulate the development of concepts and solutions that subsequently disseminate to rural areas through urbanization and modernization patterns. Consequently, the potential disparities in EA and pro-environmental behaviors should be analyzed based on community members' place of residence and economic status.
Aim: The objective of this study was to assess differences in EA levels within the Polish population in the context of SD principles, based on demographic and social characteristics, as well as the respondents' place of residence.
Results: The study revealed several connections between attitudes toward sustainability and pro-environmental activities. The identified attitudes were associated with demographic, economic, and spatial factors. The results indicate that EA levels are relatively high among Polish residents, irrespective of spatial distribution. Furthermore, significantly higher levels of EA-related activities were noted among urban dwellers, particularly the young and well-educated. Interestingly, a similar trend was noted among the residents of suburban zones. In contrast, rural inhabitants exhibited lower levels of EA compared to their urban counterparts.

Keywords: sustainable development, pro-environmental behaviour (PEB), environmental awareness, urban-rural

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INTRODUCTION

Sustainable development (SD) stands as a cornerstone principle, asserting that all human activities must prioritize ecological safety. This imperative underscores the need for a profound exploration into the fabric of social attitudes, acting as a barometer for environmental awareness (EA). EA, as a manifestation of collective mindset and accepted norms, plays a pivotal role in shaping how individuals perceive the value of nature and demonstrate respect for the environment.

While the concept of SD is comprehensive, it has encountered criticism for presupposing collective action in the interest of the environment. Nevertheless, understanding EA across diverse social groups, including urban and rural residents, becomes imperative in catalyzing endeavors to imbibe SD principles universally. The pivotal role of urban centers in conceptualizing and disseminating environmentally conscious solutions further raises intriguing questions about the divergence of EA between urban and rural communities. The concentration of population and evolving social structures in cities is presumed to give rise to ideas and innovations, subsequently diffusing to rural areas through the interconnected patterns of urbanization and modernization.

This brings to the forefront an array of inquiries concerning the extent of variation in EA between urban and rural settings. Additionally, an exploration into the differentiation of inhabitants in formally rural areas becomes pertinent, considering their residence in varied spatial contexts, including suburban zones and traditional rural areas. These questions extend to encompass the diversity in EA concerning demographic, social, and economic characteristics.

Therefore, the primary objective of this study is to scrutinize the spectrum of EA within the Polish population in alignment with the principles of SD. This inquiry takes into account not only the demographic and social attributes but also investigates variations based on the respondents' places of residence. By unraveling the intricacies of EA diversity, this study aims to contribute valuable insights into the dynamics of sustainable development within the socio-environmental landscape of Poland. The following research questions were posed:

1. What is the EA of the Polish population as divided between urban–suburban–rural areas?
2. What is the EA of the Polish population considered through socio-economic indicators: gender, age, level of education and economical status?
3. Is the area of living differenting the knowledge of ecological awareness and moreover proenvironmental behaviour?

The above thought process resulted in introducing the following research hypothesis for consideration. According to the area inhabited, there are significant variations in the level of environmental awareness (EA) of Polish society, which affects the variation of EA and PEB. It is assumed that residents of urban areas, especially the young and well-educated, show higher environmental awareness and more excellent pro-environmental activity than residents of rural areas. In addition, there are links between demographic and economic characteristics and the level of EA, which may affect the effectiveness of sustainable development (SD) application activities in Polish society.

LITERATURE REVIEW

Spatial behaviour as well as an individual's approach depend on concepts related to the new ecological paradigm (NEP) (Derdowski et al., 2020; Donmez-Turan & Kiliclar, 2021; Manoli et al., 2019; Topal et al., 2021). It is a paradigm that calls for the formulation of a new ethics sensitive to ecological problems. The ethical principles associated with the old paradigm are not applicable to the main contemporary ethical problems, as most of them concern a threat that is considered contained (Manolis et al., 2021). Thus, the basic and probably most up-to-date concept relating to contemporary EA of society will be that of SD.

The concept of SD can be considered as resulting from a number of legal considerations recommended by global organisations (Lim, 2022; Shi et al., 2019). Throughout the years of dynamic

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socio-economic development, particularly after the Second World War, global organisations such as the United Nations and later the European Union have successfully attempted to introduce a legal framework by which to draw people's attention to the environment (Lim, 2022; Sachs, 1993; Satterthwaite, 1997, Szczepańska & Pietrzyk, 2018; Shi et al., 2019; Redclift, 1993). However, the concept of SD may prove to be a contradiction, as it implies dynamic development while respecting environmental values (Lim, 2022; Skene, 2021). The very notion of 'development' also evokes mixed feelings in the context of environmental degradation in favour of economic benefits (Ziegler, 2021). In addition, the concept of SD is very often wrongly identified with the countries of the former 'poor south' (Fund, 2015). However, this is an illusory assumption, as development problems extend to underdeveloped, intermediate, and highly developed countries. However, at each level of development, the strategic assumptions of the concept itself must be properly interpreted (Kopnina, 2020).

As researchers point out, the strategic goal of SD is difficult to implement because 'there is no general agreement on how the concept should be translated into practice' (Berke & Conroy, 2000; Lim, 2022; Ruggerio, 2021). Furthermore, 'SD is primarily symbolic rhetoric, with competing interests each redefining it to suit their own political agendas, rather than serving as an influential basis for policy development' (Jabareen, 2008). Beatley and Manning (2013) argue that there is a general sense that sustainability is a good thing, but that it still requires definition and elaboration. As a result, this conditions a hindered public perception of pro-environmental behaviour (PEB). However, legislative solutions are gradually influencing the behaviour of individuals. The new reality has prompted society to develop an approach to environmental issues different than before (Irani & Rahnamayiezekavat, 2021; Manoli et al., 2019; Topal et al., 2021; Ziegler, 2021). This social transition is referred to as NEP, which signifies a profound cultural change (Derdowski et al., 2020; Donmez-Turan & Kiliclar, 2021; Manoli et al., 2019; Topal et al., 2021).

The emerging NEP can be characterised in various ways. On the one hand, it can be seen as a holistic view of the world, focusing on the unification of already proven solutions in a pro-environmental context. On the other hand, it depicts the world as an ecosystem in itself, showing the processes of self-regulation and destruction. The cited distinction is the result of the reflections of Arne Naes, who already in the 1970s initiated the modern division used in environmental philosophy. The NEP highlights the need to develop a new pro-environmental ethic, or social sensitivity (Davis & Stroink, 2016; Johnson et al., 2004; Stern et al., 1995).

The whole change taking the form of the NEP in the social dimension can be compared to product life cycle theory derived from Erikson's (1994, 1998) concept (Fig. 1), which compares human behaviour to the relationship of supply and demand in economic science. In his research, he points out that human society interacts though people supporting or blocking each other, thereby influencing the behaviour of individuals. In relation to the concept of SD, this indicates that by systematising society's behaviour in

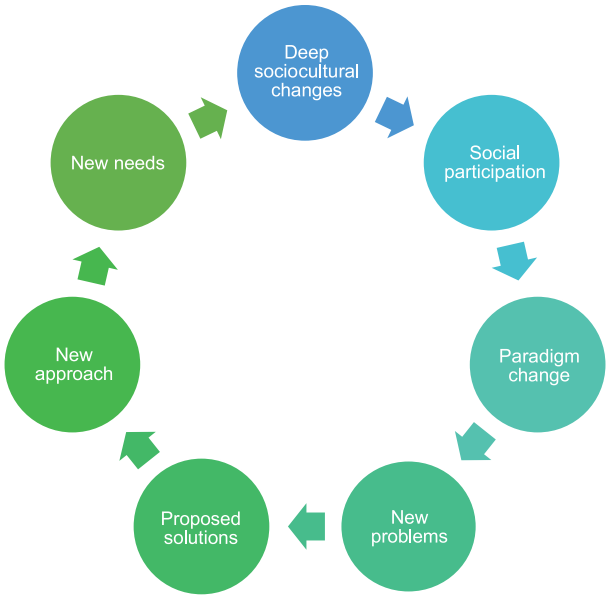

Fig. 1. New ecological paradigm
Source: own adaptation based on Life cycle theory, E.H. Erikson (1994, 1998).

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line with this theory, we can notice an increase in the public's knowledge of the principles of SD.

However, in order for the concepts of SD and the NEP to be successfully integrated into development processes, it is necessary to strengthen EA in each community. EA is the subject of research in many disciplines. While it can be intuitively understood, it is difficult to identify a specific definition of the notion in the literature (Yang et al., 2021); sometimes it is even equated with PEB (Ham et al., 2016). These conceptual deficiencies lead to the fact that terms such as environmental consciousness (Lin & Niu, 2018; Sanchez & Lafuente, 2010;) or ecological awareness (Chodkowska-Miszczuk et al. 2023; Corraliza & Collado, 2019) are also used interchangeably in the literature to describe the mindset and general acceptance of the value of nature and respect for the environment.

As Ham et al. (2016) following Culiberg and Rojšek (2008) point out, 'EA is a predisposition to react to environmental issues in a certain manner'. A slightly different definition is given by Partanen-Hertell et al. (1999) who state that EA 'is defined as a combination of motivation, knowledge and skills'. However, regardless of the definition adopted, research dedicated to EA is important because 'EA has a positive relationship with people's motivation and behavioural intention to engage in PEB' (Arı & Yılmaz, 2017; Yang, 2021). Environmental concern has a positive impact on PEB uptake (Blankenberg & Alhusen, 2019; Schmitt et al., 2018). However, this does not always translate into actual undertaking of PEB (Gifford & Nilsson, 2014). Nevertheless, EA education itself, as demonstrated by Meyer (2015), among others, 'causes individuals to be more concerned with social welfare and to accordingly behave in a more environmentally friendly manner'.

The methodology for measuring EA is also proving problematic. The basic problem of this type of research is to establish how the respondent and the researcher understand the notion in question. The possibility of a different understanding and the very long list of variables may explain the contradictory results obtained (Carlston, 2010; Ham et al., 2016). One of the leading research concepts is to assess respondents' opinions on the environmental issues presented. This, however, requires a combination of many different variables to analyse the results well (Ham et al., 2016).

One of the variables that can determine the level of EA and, indirectly, PEB is the place of residence considered in the context of the urban-rural continuum. According to the concept, place of residence is understood as the type of settlement unit (typical rural areas, suburban zones, cities), which is in line with the examples of unified behaviour of spatially clustered communities (Friedrich et al., 2009; Mokhtarian & Cao, 2008; Szczepańska & Pietrzyk, 2018; Van Raaij & Verhallen, 1983). Huddart-Kennedy et al. (2009) indicate that the dynamic socio-economic changes taking place are having an impact on bridging the gap between the behaviour of rural and urban populations. One such example is the impact of the suburbanisation process. Research by Fortmann and Kusel (1990) or Jones et al. (2003) showed that urban residents who move to rural areas are much more strongly involved in environmental issues than rural residents. These similarities, however, as Huddart-Kennedy et al. (2009) point out, are probably 'an artifact of incomplete measurement tools that may falsely represent empirical differences'. The question of the degree of similarity between urban and rural EA is, therefore, still open. Despite the results of many studies from around the world regarding EA, there is no consensus on the phenomenon in question. This is because EA considered in an urban-rural configuration is characterised by an enormous degree of complexity.

This complexity includes, among other things, the breakdown of society by socio-demographic characteristics. One important variable in measuring EA level is gender. As Zelezny et al. (2000) point out, in the studies they analysed it was women who showed higher levels of EA. The justification is that 'gender differences in environmentalism imply links between socialisation and value' (Zelezny et al., 2000 after Stern et al., 1995). Age, also widely discussed in the literature, may be another variable. However, as Morrison and Beer (2017) prove, it is difficult to indicate exactly whether and to what extent age determines the level of EA. They indicated that of the

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50 cases they analysed, 11 showed older people to be more environmentally concerned, a further 14 pointed to younger people, three studies favoured middle-aged people, and 16 showed no difference in EA in terms of age structure. In contrast, with regard to the education level variable, it should be assumed that an increase in education level commonly correlates with an increase in EA (Vicente-Molina et al., 2013). As Ziadat (2010) argued, people with tertiary education were characterised by higher levels of EA regardless of where they lived. A similar result was obtained by Hoffmann and Muttarak (2020), who highlighted that even 'an additional year of schooling significantly increases the probability of pro-environmental actions, e.g. planting trees, recycling, and proper waste management, by 3.3%'. However, the relationship between EA and the level of education is a complex one and can vary depending on numerous factors. Such a factor is, of course, the economic situation. Many studies directly indicate that high-income earners are characterised by higher levels of EA (Duroy, 2005; Philippssen et al., 2017). In general, however, the variables that may shape the level of EA in different communities still need to be assessed.

The concept of the urban-rural continuum was necessary because the study focused on searching for possible differences between the so-called rural periphery and suburban zones against cities. This concept points out that due to the actual degree of urbanization of individual settlement units, they can be placed on a continuum between the ideal types of the most traditional village and the most modern large city (Wirth, 1938). This urbanization is diagnosed based on a number of social, demographic, cultural, economic, etc. variables (Szczepańska & Gerus-Gościewska, 2017). Thus, it also includes attitudes and behaviours that change among individuals living in particular types of settlement units under the influence of the processes of urbanization, modernization, industrialization or globalization (Halfacree, 2009). Therefore, in the context of PEB, it is reasonable to assume that rural, suburban and urban residents will identify and behave differently. The concept of an Urban-Rural Continuum in the context of PEB is precious, as it provides a basis for spatial considerations embedded in social geography (Dymitrow, 2017, 2019; Halfacree, 2009).

MATERIALS AND METHODS

The research topic determined the data collection method used in the study. A survey was applied to investigate EA; it was conducted using the CAWI technique on a probability sample of 1,082 adult Poles. It was carried out in April 2023. The CAWI (Computer Assisted Web Interview) technique used involves the researcher generating an electronic version of the questionnaire, which the respondent can complete at any time and in any place, provided they have access to a device with an Internet connection. A survey conducted using the CAWI technique also offers additional possibilities, including the use of an extended range of functionalities, the inclusion of detailed instructions for respondents, greater clarity of questions and flexibility of the survey itself, and an increased degree of anonymity (D'Ancona, 2017; Kagerbauer et al., 2013). The benefits associated with the use of this method and the increasingly widespread access to the Internet in Poland mean that over the past decade, almost a third of all research has been carried out using this technique.

An important aspect considered in the study was the sampling based on a probabilistic scheme, i.e. referring to the probability calculus and giving a chance to estimate the possible error. Thus, the sample selected for the study reflected the characteristics of the population and the conclusions obtained from the study can be fully generalised to the population (Chater et al., 2006; Matoušek & Vondrák, 2008). However, it should be added that a probabilistic sampling model can be based on different variables, the most common being gender, age, and place of residence (Babbie, 2015). For this study, quota random sampling was used to increase the representativeness of the sample. Firstly, the percentage of population living in each of the 16 voivodeships (voivodeship – NUTS 2, the administrative region of the 1st order in Poland) was determined (Table 1). Only then, referring

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Table. 1. Data Sample

Amount	Share according to Census 2021	Sample size
Female	0.517	517
Male	0.483	483
18–39	0.349	349
40–65	0.42	420
65+	0.232	232
Countryside	0.404	404
City to 50k	0.237	237
City 50–200k	0.171	171
City 200k +	0.188	303
Dolnośląskie	0.076	76
Kujawsko-pomorskie	0.054	54
Lubelskie	0.055	55
Lubuskie	0.026	26
Łódzkie	0.064	64
Małopolskie	0.089	89
Mazowieckie	0.142	142
Opolskie	0.026	26
Podkarpackie	0.055	55
Podlaskie	0.031	31
Pomorskie	0.061	61
Śląskie	0.117	117
Świętokrzyskie	0.032	32
Warmińsko-mazurskie	0.037	37
Wielkopolskie	0.091	91
Zachodniopomorskie	0.044	44

Source: own elaboration.

to the results of the National Census 2021, was the sample surveyed with the respective shares of each gender, age category, and by place of residence. Thus, the sample included 51.7% of women and 48.3% of men. Furthermore, 34.9% of respondents were aged 18–39, 42.0% aged 40–65 and 23.2% aged over 65. In terms of formal status and size of settlement units, 40.4% of respondents came from rural areas and 59.6% from urban areas, including 23.7% from cities with up to 50,000 inhabitants, 17.1% from cities with between 50,000 and 200,000 inhabitants and 18.8% from cities with more than 200,000 inhabitants.

The collected data were coded in IBM SPSS software (ver. 29), where further analyses and compilations were carried out. The magnitude of the possible statistical error of the results was estimated at three percentage points.

For the purposes of this study, which aimed to determine the differences of EA in rural areas in Poland compared to urban areas, an important distinction was made with regard to formally rural areas. They were divided into typical rural areas and suburban zones. In line with this breakdown, 30.0% of respondents came from typically rural areas, 10.2% from suburban zones, and 59.8% from urban areas (Fig. 2).

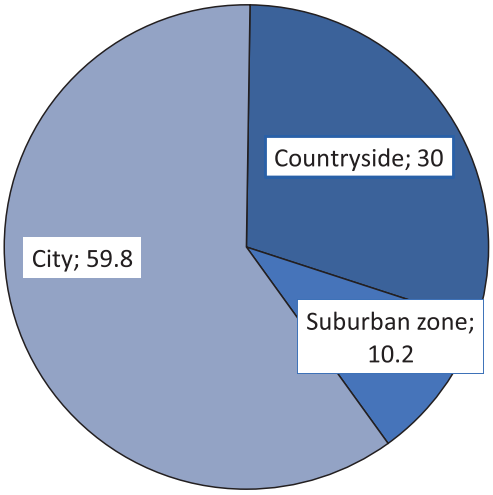

Fig. 2. Structure of respondents by place of residence (%)
Source: own elaboration.

In line with the stated objective, which was to determine the level of EA diversity of the Polish population in the context of the SD principles, the survey was based on a basic question: 'Are you aware of the climate change taking place in recent years?'. Respondents were able to select one of four responses suggested by the authors: 'Yes', 'No', 'I do not see climate change', 'I do not believe in climate change'. The answer to this basic question is a very important aspect for the further analysis of attitudes and the determination of respondents' self-awareness. According to the literature, sheer awareness of the surrounding world and its dynamic changes has a very strong influence on decision-making and actions taken (Ajzen et al., 2011; Lieberman et al.,

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2016; Vazire & Mehl, 2008). The question allowed the authors to measure the degree of scepticism towards climate change without having to ask about actual actions. This is extremely important because, as Poortinga et al. (2011) points out, 'The finding that climate scepticism is rooted in people's core values and worldviews may imply a coherent and encompassing sceptical outlook on climate change'. The question was analysed first in relation to the whole country, and subsequently at lower territorial levels. This allowed us to gather responses from urban residents, the adjacent suburban zones, and typical rural areas.

Once the level of EA was established, the procedure was to measure the real impact on respondents' PEB. The subsequent question: 'How do you evaluate environmental protection efforts?', where the responses included: 'I support environmental protection efforts and reduce my impact on pollution through small changes in my daily life'; 'I think a systemic approach is needed'; 'I think this is one of the reasons why everything is getting more expensive (climate fees, environmental fees)'; 'I am happy to join in all environmental actions'; 'It's not for me, although I don't deny the sense of the activities of other people or organisations'; 'I don't see the point in these activities', helped the authors gain an overview of the approaches to environmental actions in addition to the typical PEB overview. Apart from providing a basic view of respondents' attitudes towards PEB, the answers to the question provided information on the degree of scepticism (Poortinga et al., 2011).

In the sampling itself, as already mentioned, municipalities were selected for the study, both those that fit into typical rural areas and suburban zones. The division into these two categories was made using statistics from the Central Statistical Office. A synthetic index was used here, which considered such variables as the dynamics of population change, the balance of internal migration and the number of housing units completed per 1,000 residents in 1995–2000 (the beginning of suburbanization processes), 2006–2011 (the advancement of suburbanization processes), 2017–2022 (an inevitable extinction and stabilization of the suburbanization process). It was assumed that these characteristics are a distinguishing feature of areas under the influence of suburbanization processes. Using a synthetic indicator made it possible to separate peripheral rural areas from suburban zones and select the sample accordingly. In addition, during the survey, respondents were asked about spatial affiliation (type of settlement unit). In addition, to verify these affiliations, questions were also asked about, among other things, the landscape characteristic of where the respondents live. The survey data, which also included an inquiry about the locality, its size and postal code, made it possible to identify the different types of settlement units based on statistical data from the Central Statistical Office. The use of a synthetic index made it possible, on the one hand, to separate peripheral rural areas from suburban zones and on the other hand, to compare the spatial auto affiliation of the respondents with the actual state of these areas. As it turned out in this investigation, the actual situation, as measured by the synthetic indicator, was in line with the respondents' declarations. It should be noted, however, that the selection of the sample, based on the population structure, considered the division into peripheral rural areas, suburban zones and cities.

RESULTS

The examination of EA in the context of place of residence: urban, suburban, or typical rural areas, as well as additional socio-demographic variables such as gender, age, education, and assessment of material situation, was based on two core questions, which were treated as a differentiator of EA. Respondents were asked whether they were aware of the climate change observed in recent years and how they rated environmental protection measures.

The first issue considered was awareness of the climate change experienced in recent years. As many as 89.6% of the Polish population reported that they are aware of the changes taking place. Only 2.3% of respondents declared that they are not aware

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of these changes, a further 5.5% do not see climate change, and 2.7% do not believe in climate change.

The results obtained were contrasted with socio-demographic data such as the type of settlement unit, gender, age, education, and assessment of the respondents' material situation. As this study focuses specifically on tracing possible differences between urban, suburban, and rural residents, this issue was the starting point for further consideration. As it turned out, in this context, the place of residence, understood as the type of settlement unit, did not significantly influence the results obtained. Among those surveyed, climate awareness was displayed by 89.2% of rural residents, 89.1% of suburban residents, and 89.8% of city dwellers (Table 2). The study's results suggest that awareness of climate change is independent of whether individuals live in urban, suburban or rural areas. This is consistent with the theoretical perspective that SD and NEP must be integrated into all types of communities.

Of the variables selected, quite a large variation was observed in the context of the gender of the respondents (Table 2). While as many as 94.4% of women said they were aware of climate change, the figure for men was 10.0 pp. lower at 84.3%. As many as 3.7% of male respondents were not aware of climate change at the declarative level (in the female group only 1.1%), as many as 8.0% did not see climate change (against only 3.2% of women), and 4.1% did not believe in climate change (women – 1.4%). Differences between men and women were recorded irrespective of where respondents lived (Table 2). The data shows a gender difference in EA, with women showing a higher awareness of climate change. This reflects the literature, which suggests that women may be more concerned about the environment due to different socialization and values.

Some differences regarding the declared awareness of climate change (which was a sign of EA), were registered between respondents of different ages (Table 2). The highest percentage of respondents who confirmed awareness of climate change was among the youngest respondents, i.e. between 18 and 25 years of age, at 92.4%. For those aged 26 to 44, the outcome was 90.0%, with 87.5% for those aged 45 to 59. At the same time, the relationship between awareness of climate change and age was not clear-cut, as in the 60+ age group, the percentage of people who said they were aware of climate change was 89.9%. It should be noted, however, that in the youngest group surveyed there was not a single person who did not believe in climate change (in the other groups it was between 2.5% and 3.3%), while in the group of 45- to 59-year-olds the belief in not seeing climate change was the highest (6.6%, with between 4.5% and 5.7% in the other groups). While the results show that climate change awareness is highest among the youngest respondents, this is not closely related to age, as older respondents also showed high levels of awareness. This suggests that the relationship between age and EA is complex and not linear, reflecting the inconclusive findings in the literature regarding age as a determinant of EA.

Similarly, the respondents' education had some influence on their declared awareness of climate change (Table 3). Certainly, a separate group in this respect were the young people, still in education, all of whom declared that they were aware of climate change. Young people also partly made up the group of people reporting primary education. Here, too, the proportion of those aware of climate change was high at 95.0% (only 5.0% reported that they did not see climate change). In the group of people ranging from vocational education through to secondary and tertiary education, the percentage of people stating that they were aware of climate change was increasingly higher, at 84.5%, 89.1% and 90.7%, respectively. Here, in turn, the proportion of those who consider themselves unaware of climate change would drop with the rising level of education (4.3%, 3.0%, and 1.4%, respectively), as would the proportion of those who do not see climate change (7.8%, 6.1%, 4.5%, respectively). Respondents with higher levels of education showed greater awareness of climate change, which confirms literature studies on which education positively correlates with EA. In addition, the study confirms the position in the literature that while there is a positive relationship between EA and pro-environmental behaviour, this does not always translate into action.

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Table. 2. Answers for question "Do you recently observed the climate change?" (%)

	Gender		Age				Education				Material situation				Residence		
	Female	Male	18 to 25	26 to 44	45 to 59	60 and more	Still learning	Basic	Voca-tional	Sec-ondary	Higher	Bad	Average	Good	Country-side	Suburban zone	City
Yes	94.4	84.3	92.4	90.0	87.5	89.9	100,0	95.0	84.5	89.1	90.7	87.5	88.6	92.1	89.2	89.1	89.8
No	1.1	3.7	2.2	2.5	2.6	1.9	-	-	4.3	3.0	1.4	2.7	3.0	0.9	3.1	1.8	2.0
I don't see climate change	3.2	8.0	5.4	4.5	6.6	5.7	-	5.0	7.8	6.1	4.5	7.1	5.6	4.5	5.8	7.3	4.9
I don't believe in climate change	1.4	4.1	-	3.0	3.3	2.5	-	-	3.4	1.	3.5	2.7	2.8	2.4	1.8	1.8	3.2

Source: Own elaboration based on research data.

Table 3. Answers for question "Are you aware of the climate changes taking place in recent years?" (%)

		Gender			Age				Education						Material situation			
		Female	Male	Total	18 to 25	26 to 44	45 to 59	60 and more	Total	Still learning	Basic	Voca-tional	Secon-dary	Higher	Total	Bad	Average	Good	Total
Countryside	Yes	94.0	84.1	89.2	91.9	89.9	87.3	88.8	89.2	100.0	92.9	81.0	91.4	89.5	89.2	80,0	88.1	96.4	89.2
	No	1.2	5.1	3.1	-	4.7	3.8	1.3	3.1	-	-	5.2	3.6	1.9	3.1	5,0	4.0	-	3.1
	I don't see climate change	3.6	8.3	5.8	8.1	3.9	6.3	7.5	5.8	-	7.1	8.6	5.0	5.7	5.8	12.5	6.0	2.4	5.8
	I don't believe in climate change	1.2	2.5	1.8	-	1.6	2.5	2.5	1.8	-	-	5.2	-	2.9	1.8	2.5	2.0	1.2	1.8
Suburban zone	Yes	94.3	84.2	89.1	88.9	90.7	87.1	88.9	89.1	100.0	100,0	81.8	88.9	89.7	89.1	87.5	90.6	87.8	89.1
	No		3.5	1.8	11.1	-	3.2		1.8	-	-	-	-	3.4	1.8	-	-	4.1	1.8
	I don't see climate change	5.7	8.8	7.3	-	7.0	9.7	7.4	7.3	-	-	18.2	8.3	5.2	7.3	12.5	7.5	6.1	7.3
	I don't believe in climate change		3.5	1.8	-	2.3	-	3.7	1.8	-	-	-	2.8	1.7	1.8	-	1.9	2.0	1.8
City	Yes	94.5	84.4	89.8	93.5	90.0	87.6	90.5	89.8	100.0	100.0	89.4	87.9	91.2	89.8	92.2	88.6	91.4	89.8
	No	1.2	3.0	2.0	2.2	1.7	1.9	2.4	2.0	-	-	4.3	3.0	0.9	2.0	1.6	2.9	0.5	2.0
	I don't see climate change	2.6	7.6	4.9	4.3	4.3	6.2	4.8	4.9	-	-	4.3	6.4	4.0	4.9	3.1	5.2	5.1	4.9
	I don't believe in climate change	1.7	5.0	3.2	-	3.9	4.3	2.4	3.2	-	-	2.1	2.7	4.0	3.2	3.1	3.4	3.0	3.2

Source: Own elaboration based on research data.

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The survey also included a subjective assessment of the respondents' material situation with regard to EA (Table 3). This, too, was associated with respondents' answers, as was gender and partly age and education. This is because the higher the assessment of one's material situation, the higher the percentage of people who said they were aware of climate change over the past years (from 87.5% among those who saw their material situation as poor to 92.1% among those who deemed it good). The assessment of the material situation was also significantly linked to the declaration of not seeing climate change. Among those with a self-proclaimed poor material situation, the proportion of such people was 7.1%, with 5.6% among those with an average material situation, and 4.5% among those with a good material situation.

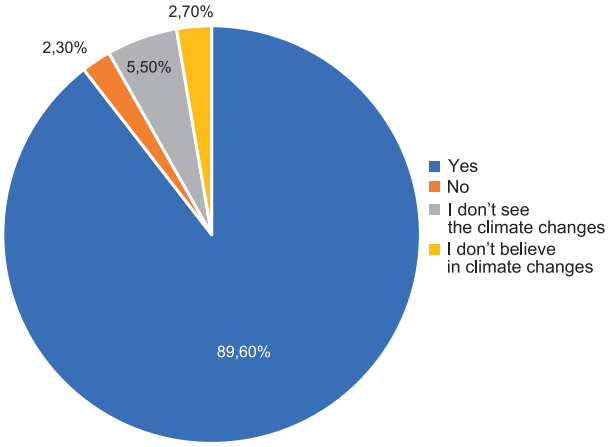

Fig. 3. Structure of answers to the question: 'Are you aware of the climate change observed in the recent years?'
Source: Authors on the basis of a survey (N=1082).

The second issue which underpinned EA concerned the assessment of environmental measures. Respondents were asked about this matter and could choose any number of options from the six available ones. As shown by the survey, most people felt that they supported environmental protection measures and reduced their impact on pollution through small changes in their daily lives (60.8%). At the same time, more than one in two respondents (53.8%) thought that a systemic approach was needed and one in three respondents (36.4%) that this was one of the reasons why everything was getting more expensive (climate fees, environmental fees). One in five respondents (21.9%), were keen to get involved in all environmental actions. Only one in eight respondents (12.8%) said it was not for them and one in twelve (8.1%) saw no point in these activities (Table 4).

According to the assumptions made, these issues were considered by the authors in relation to the place of residence, i.e., urban, suburban, and rural areas. As they were able to show, respondents chose the proposed options quite similarly depending on where they lived. However, for the most commonly selected option, i.e., 'I support environmental protection efforts and reduce my impact on pollution through small changes in my daily life', the difference between rural (54.0%) and urban (63.1%) residents was almost ten percentage points. However, this indication was predominant primarily among residents of the suburban zone (67.3%). A systemic approach was mainly expected by residents of urban areas (58.1%), less frequently in suburban areas (55.5%), and least frequently in rural areas (44.8%). Price increases (climate fees, environmental fees) related to environmental protection measures were first of all highlighted by urban and rural residents (37.1% and 37.0%, respectively), while suburban residents (30.9%) were slightly less concerned. The latter group was the most likely to be involved in all environmental actions (26.4%), closely followed by residents of rural areas (24.1%) and only then urban areas (20.1%). Residents of suburban areas were also the least sceptical about measures to protect the environment (3.6% chose the option 'It's not for me, although I don't deny the sense of the activities of other people or organisations', compared to 12.7% among urban residents and as many as 16.0% in rural areas). In contrast, a simple relationship was observed in the expression of support for the statement: 'I don't see the point in these actions'. The more urbanised the settlement unit was, the less interest there was in this option (ranging from 10.5% in the countryside, through 9.1% in the suburban zone, to 6.8% in the city) (Table 4).

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Table. 4. Multiple-choice question answer for "How do you evaluate environmental protection efforts?" (%)

		Gender		Age				Education					Material situation		
		Female	Male	18 to 25	26 to 44	45 to 59	60 and more	Still learning	Basic	Vocational	Secondary	Higher	Bad	Average	Good
Countryside	1	54.8	52.9	59.5	48.8	48.1	65.0	87.5	64.3	41.4	54.3	56.2	52.5	52.2	58.3
	2	40.5	49.0	43.2	41.9	41.8	52.5	62.5	21.4	34.5	37.9	61.0	45.0	43.8	46.4
	3	36.6	37.6	35.1	31.8	45.6	37.5	37.5	35.7	39.7	35.7	37.1	32.5	38.3	35.7
	4	23.2	24.8	24.3	22.5	21.5	28.7	25.0	21.4	19.0	23.6	27.6	22.5	20.4	33.3
	5	14.9	17.2	5.4	19.4	20.3	11.3	-	21.4	31.0	12.9	12.4	15.0	18.9	9.5
	6	7.1	14.0	8.1	11.6	8.9	11.3	-	7.1	17.2	9.3	9.5	20.0	9.5	8.3
Suburban zone	1	73.6	61.4	66.7	60.5	77.4	66.7	66.7	50,0	45.5	77.8	65.5	50.0	66.0	71.4
	2	52.8	57.9	44.4	55.8	71.0	40.7	33.3	-	63.6	50.0	60.3	50.0	56.6	55.1
	3	24.5	36.8	11.1	32.6	32.3	33.3	-	50,0	27.3	27.8	34.5	50.0	28.3	30.6
	4	30.2	22.8	44.4	27.9	22.6	22.2	66.7	50,0	54.5	13.9	25.9	-	30.2	26.5
	5	5.7	1.8	-	4.7	-	7.4	-	-	9.1	-	5.2	12.5	1.9	4.1
	6	7.5	10.5	11.1	4.7	12.9	11.1	-	50,0	18.2	11.1	5.2	12.5	9.4	8.2
City	1	65.9	59.8	63.0	57.8	59.0	71.9	100.0	50,0	57.4	62.1	64.4	62.5	64.7	60.1
	2	58.7	57.5	56.5	53.0	59.0	63.3	66.7	50,0	55.3	56.4	59.9	59.4	59.7	54.5
	3	35.8	38.5	34.8	41.3	31.7	37.1	33.3	100,0	48.9	34.1	37.1	45.3	35.6	37.4
	4	21.4	18.6	19.6	17.8	16.8	25.2	66.7	-	17.0	23.1	17.9	25.0	19.7	19.2
	5	9.8	15.9	21.7	12.6	14.9	9.0	-	50,0	12.8	14.0	11.2	9.4	13.5	12.1
	6	4.6	9.3	4.3	10.0	7.5	3.3	-	-	6.4	8.3	5.8	9.4	6.5	6.6

1 I support environmental protection efforts and reduce my impact on pollution through small changes in my daily life

2 I think a systemic approach is needed

3 I think this is one of the reasons why everything is getting more expensive (climate fees, environmental fees)

4 I am happy to join in all environmental actions

5 It's not for me, although I don't deny the sense of the activities of other people or organizations

6 I don't see the point in these activities

Source: Own elaboration based on research data.

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With regard to the support for the six proposed options in the context of gender, age, education, and material status assessment, it should be noted that in each of these cases their hierarchy was set similarly. However, some differences became apparent. Referring to the gender of the respondents, it was shown that women were more likely than men to support PEB and reduce their impact on pollution through small changes in their daily lives (63.4% to 57.9%) and more likely to be involved in all environmental actions (22.8% to 21.0%). Men, on the other hand, were more likely to express the opinion that a systemic approach was needed (55.0% to 52.8%), that PEB were the reason why everything was getting more expensive (38.1% to 35.0%), that it was not for them, although they did not question the sense of what other people and institutions were doing (14.8% to 11.0%), and that they did not see the point in these activities (10.9% to 5.7%) (Table 4).

When we look at the age structure of the respondents, it was shown that the highest support for pro-environmental measures was recorded among seniors, i.e., those aged 60 and over. This group was most likely to agree with the statement that they support PEB and reduce their impact on pollution through small changes in their daily lives (69.7%) and are keen to get involved in all environmental actions (25.9%). At the same time, the same age group mainly indicated that they expect a systemic approach (58.7%) and that this is one of the reasons why everything is getting more expensive (climate fees, environmental fees) (36.9%, a similar opinion was held by those aged 26–44 – 37.4%). In contrast, those aged 26–44 and 45–59, i.e. largely of working age, were the most likely of all respondents to say that it was not for them, although they did not deny the point of other people or organisations doing something (14.0% and 14.8%, respectively) and that they did not see the point in these activities (10.0% and 8.5%, respectively) (Table 4).

The proposed statements, reflecting respondents' attitudes towards environmental protection, were also analysed in the context of education. As we have been able to show, support for pro-environmental measures was mainly characteristic of learners, i.e., young people. In this group, as many as 85.7% indicated that they support PEB and reduce their impact on environmental pollution through minor changes in their daily lives (compared to 48.3% of those with vocational education), while as many as 42.9% are keen to get involved in all environmental protection campaigns (this response was least frequently chosen by those with primary education – 20.0%). Systemic measures were mainly expected by those with tertiary education (60.3%) and those in education (57.1%, least often by those with primary education 25.0%). On the other hand, people with primary and vocational education pointed out that PEB is one of the reasons why everything is getting more expensive (climate fees, environmental fees) (50.0% and 42.2%, respectively), that it is not for them, but they do not deny the point of other people or organisations taking actions (25.0% and 21.6%, respectively), and that they do not see the point in these activities (10.0% and 12.9%, respectively). Relatively high support for PEB was also recorded among those with secondary and tertiary education, but in no case was this support as high as among young people still in education (Table 4).

A subjective assessment of the material situation was also identified as a factor possibly related to pro-environmental measures. In the light of the survey, it was shown that the better the assessed material situation, the higher the support for measures to protect the environment and reduce one's impact on pollution through small changes in daily life (good material situation – 61.3%, bad situation – 58.6%). Those with a good financial situation were also more likely to be involved in environmental actions (23.9%). Worse self-assessment favoured responses concerning the need for systemic solutions (54.1% – bad material situation, 52.6% – good material situation), the reason why everything is getting more expensive (41.4% – bad material situation, 36.0% – good material situation), and the lack of sense in pro-environmental measures (13.5% – bad material situation, 7.3% – good material situation) (Table 4).

The study results suggest that better-off individuals are more aware of and take action on environmental issues, which is in line with the literature, which

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assumes a link between higher income levels and more excellent EA.

In conclusion, the study's findings reinforce the theoretical discussions, showing that EA is a multifaceted concept influenced by various socio--demographic factors. However, these factors do not operate in isolation, and their impact on EA and PEB is nuanced and complex, reflecting the complex nature of environmental issues and the need for comprehensive strategies that consider these diversities in EA.

DISCUSSION AND CONCLUSION

Our study provides partial confirmation of Huddart-Kennedy et al.'s (2009) thesis regarding bridging the gap in Environmental Awareness (EA) between urban and rural populations in the context of observed climate change. However, when evaluating personal behavior, our results align with earlier studies indicating that urban residents, particularly the young and well-educated, exhibit higher EA (Arcury & Christianson, 1993; Buttel, 1987; Williamms & Moore, 1991). These findings also resonate with Özden's (2008) research, which highlighted that residents in urban areas tend to have more positive attitudes toward environmental issues than those in villages or smaller towns. Notably, higher EA is observed among both urban and suburban residents. This contradicts the results of Su et al. (2021), who found that rural residents have a stronger role in environmental protection behavior compared to urban residents. However, results from other studies, such as Berenguer et al. (2005), indicated that prominent city residents show higher EA. Rural residents undertake more PEB. According to a study by Berenguer et al. (2005), urban residents show stronger beliefs and concerns about the changing environment. However, rural residents take more action to protect and improve the environment realistically. This confirms the fact of differing attitudes toward environmental issues about where people live.

Age as a variable can be crucial in shaping attitudes, values and habits related to ecology and sustainability. Generational differences in the perception of environmental risks, access to knowledge and specific life experiences can significantly influence environmental behaviour. Therefore, a natural aspect of PEB consideration is precisely to base differentiation on age groups. This poses a challenge since, as the authors of other studies point out, it is not entirely possible to link age to PEB activities undertaken. For example for studies conducted in Canada, age was not reported as a variable in the context of EA (Huddart-Kennedy et al., 2015). As the study's authors point out, this is perhaps because "Young people, who were most concerned about the environment a few decades ago, are now middle-aged, and discussions about the environment have become much more common, to the point that seniors are also paying attention" (Huddart-Kennedy et al., 2015). Such an approach highlights the phenomenon's universalisation process, thus making it challenging to approach analysis conditioned by age groups. Given that the topic of EA has been widely discussed in Poland for a relatively short period, age will likely not significantly affect the level of EA in the future. Currently, environmental topics in Poland affect all age groups to the same degree, making it challenging to divide attitudes into generational approaches specific to particular social groups (Huddart-Kennedy et al., 2015).

In general, our results indicate that higher EA is displayed by young women with higher education and a very good financial situation, aligning with observations from other researchers. Numerous studies globally link gender to the level of EA and awareness of environmental issues, and our study in Poland confirms a similar trend. While the difference is not substantial, it underscores that women are more aware of climate changes and less skeptical about climate change compared to men. This aligns with findings by Sundstrom and McGright (2013), Wehrmeyer and McNeil (2000) and Zelezny et al. (2000), highlighting a prevailing trend of higher EA among women across professional and social groups.

Wehrmeyer and McNeil's (2000) study and the work of Zelezny et al. (2000) suggest that women show higher environmental awareness (EA) than men, reflected in greater awareness of environmental issues

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and less scepticism about climate change. On the other hand, a study by Sundstrom and McGright (2013) highlights that this trend is observed among women across occupational and social groups, indicating a widespread pattern of higher EA in women regardless of their socio-professional position. This research suggests that women, especially those who are young, educated, and financially well-off, tend to have a better understanding of and more excellent responsiveness to climate change and environmental problems. This phenomenon translates into attitudes that are less sceptical of climate change and more committed to environmental action. The aforementioned scientific works – by Sundstrom and McGright (2013), Wehrmeyer and McNeil (2000) and Zelezny et al. (2000) – indicate that the pattern of greater environmental awareness among women is consistent across cultures and societies, emphasizing the importance of gender in the context of pro-environmental attitudes and behaviour.

There are also clear associations between material circumstances and attitudes toward climate issues. The research indicates that the respondent's material situation significantly influences their perception of the climate situation. The slight difference suggests higher EA among those describing their material situation as good or very good. These results align with other studies confirming higher levels of EA and a more determined approach to pro-environmental issues among higher income earners (Kennedy & Corfee-Morlot, 2013; Moser & Kleinhückelkotten, 2018; Satterthwaite, 2007; Tilikidou, 2006). As Tilikidou, 2006 points out, the level of education, social responsibility, and subjective beliefs about one's influence in the political sphere can motivate pro-environmental behaviour, which may be indirectly related to income. People with higher education often have higher incomes, which may translate into their ability to engage in and maintain pro-environmental behaviour.

According to Kennedy et al. (2013), there is a profound injustice in the world between the main contributors to climate change and those most vulnerable to its effects. In terms of income, it is pointed out that it is the high-consumption lifestyles of the rich (and the production systems that meet their demand) that drive climate change, while the primarily low-income groups in low- and middle-income countries, who contribute little to climate change, are the most vulnerable.

A study by Moser & Kleinhückelkotten (2018) noted that while people with higher environmental self-awareness (i.e., who identify with pro-environmental attitudes) appear to be more likely to have pro-environmental behavioural intentions, they paradoxically consume slightly more energy and have a slightly larger carbon footprint than those with lower environmental awareness. It is interesting to note that both environmental impact and environmental self-awareness increase with increasing income. This indicates wealthier individuals may have stronger pro-environmental beliefs and identify with environmental values. However, their lifestyle and related consumption choices may contribute to more significant adverse environmental impacts, described as the "income effect". Higher socioeconomic status is often associated with more excellent consumption opportunities, leading to an increased carbon footprint, even if the individual has environmentally friendly attitudes. This study underscores the need to consider the relationship structure between income and environmental awareness and impact, suggesting that increased consumption associated with higher income may offset pro-environmental motivations.

Pro-environmental behavior is more commonly adopted by individuals who perceive their situation as at least good, while those in average or poor financial situations point to material issues as significant barriers, consistent with findings in other studies (Moser & Kleinhückelkotten, 2018).

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RESTRUCTURING AGRICULTURAL LAND USE IN UKRAINE: DIRECTIONS FOR DEVELOPMENT

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ABSTRACT

The intensity of agricultural land use in Ukraine was analyzed based on soil quality and the values of the land-use intensity (LUI) index and the land-use capacity (LUC) index. In the administrative districts of Cherkasy region, the LUI index ranged from 0.07 to 1.0, and the LUC index ranged from 0.01 ha per 1000 UAH of gross output to 0.19 ha per 1000 UAH, which points to considerable difference in land-use intensity and agricultural land-use capacity. New approaches should be sought to improve the management and use of agricultural land. Functional land use areas should be restructured, in particular, by implementing non-traditional methods of agricultural land use. The results of the study indicate that land-use functions should be modified over an area of 5,343,900 ha, where 2,049,900 ha should be converted to crop rotations for soil protection, 208,000 ha – to protective forest margins; and 2,878,000 ha – to non-traditional forms of agricultural land use.

Motives: The purpose of the article was to propose a methodological approach for assessing the intensity of agricultural land use and to suggest directions for land-use restructuring to improve its ecological status.

Aim: In the proposed methodical approach, the intensity of agricultural land use was assessed with the land-use intensity (LUI) index and the land-use capacity (LUC) index. To reduce plowing and increase land-use intensity, the functions of degraded arable land should be modified over an area of 5,343,900 ha, where 2,049,900 ha should be converted to crop rotations for soil protection, 208,000 ha – to protective forest margins; and 2,878,000 ha – to non-traditional forms of agricultural land use.

Results: The article substantiates the need to modify the functions of arable land over an area of 5,343,900 ha, where 2,049,900 ha should be converted to crop rotations for soil protection, 208,000 ha – to protective forest margins; and 2,878,000 ha – to non-traditional forms of agricultural land use.

Keywords: economics, agricultural land use, land-use planning, soil suitability, functional use

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INTRODUCTION

The Ukrainian land fund is characterized by an extremely high level of development. About 70% of the land fund in Ukraine is agricultural land.

The high level of economic development in the territory of Ukraine determines the intensive impact of anthropogenesis on the surrounding natural environment, including land resources and the structure and character of processes that occur in the field of land use.

The concept of the National Target Program for Land Use and Protection (Concept, 2022) suggests reducing agricultural exploration in Ukraine by 5% and the plowing of the territory by 10%. The plowing of the Ukrainian territory reaches 54%, and the plowing of the Cherkasy region, which was chosen as the base for the investigation, reaches 61% (Tretiak et al., 2022).

Taking into account that arable land is mainly privately owned, restructuring of agricultural land use requires the development of new approaches and methods of organizing land use, economic and land management mechanisms, and tools for agricultural land use ecologization. These approaches and methods of organizing agricultural land use include:

1. Multifunctional approach to land use planning (Tretiak et al., 2021): prioritizing and balancing the stakeholders' needs on a regional, district and territorial communities' scale, taking into account local land use specifics, demand for land and other natural resources, and their quality – to ensure a full range of land benefits and services. Territorial and spatial land use planning helps to determine the types of land use that will maximize the fulfillment of people's needs and preserve soil, water and biodiversity for future generations;
2. Building resilience to external influences: increasing the adaptive capacity of ecosystems through a combination of environmental protection measures, sustainable land use management, and restoration of land and other natural resources (Tretiak et al., 2021). There are many tools and practices to protect the functionality, productivity, and diversity of land and other natural resources that can help minimize the effects of climate change and other impacts, as well as adapt to these effects (Tsyuk et al., 2021);
3. Agricultural activities aimed at optimizing the best possible set of ecosystem services related to food production. It requires a fundamental change of agricultural practices to achieve a wider range of social, environmental, and economic benefits through the land capital management that develops in the process of land use (Tretiak & Lyashynskyy, 2019).

In particular, in order to reduce the plowing of the territory of Ukraine, in addition to the main ways of further possible land use, which are to change according to functional use, it is suggested to include (Tretiak et al., 2022):

1. Arable land with degraded and unproductive soil for use in soil protection and restoration crop rotations;
2. Increasing the area of shelterbelts to reduce the impact of climate change and its erosive effects;
3. Enlargement of area for unconventional agricultural land use.

Such restructuring of agricultural land use is possible only within the territorial and spatial planning of land use development. This planning is a key tool for the formation of multifunctional territories. According to the research of a group of Ukrainian scientists, "territorial and spatial planning performs the functions of regulating land and environmental relations and land use development" (Tretiak et al., 2021). As a regulatory mechanism (at the local, regional, and/or national levels), it should determine the permission for specific agricultural activities; as a development mechanism, it should design tools for land use development to provide services and create infrastructure, preserve land and other natural resources, establish investment incentives, and increase capitalization and ecologization of land use.

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LITERATURE REVIEW

Problems of restructuring and ecological and economic organization of the system of agricultural land use are considered by Ukrainian and foreign scientists. Horlachuk (1999) deals with the problems of land market formation and real estate registration, organization of farm land use, and preservation of soil energy potential. The study by Martyn et al. (2022) identifies ways to improve the mechanism of legal regulation of land consolidation in Ukraine and integrated land management, which will ensure restructuring and improvement of spatial conditions for agriculture, the achievement of more efficient multifunctional use of rural areas, environmental protection, and infrastructure development for further harmonization of legislation. Martyn et al. (2022), Kuryltsiv (2007), note that large-scale destruction of land resources, especially due to soil erosion, and the constantly growing population in the world exacerbate the issue of food supply and lead to the search for new approaches to land use optimization. Stupen and Greschuk (2017) points out that in order to reconcile the environmental and food interests in agricultural land use, it is necessary to change the mechanism of land relations management, the component of which should be the land management of especially valuable lands in agriculture. Tretiak (2021) substantiate the main principles of the concept of modern land management and land use, the introduction of functional land use areas, and the formation of land use resilience to external influences. Khvesyk (2014) proves that economic activity requires the updating of organizational forms and determines the place and role of the financial and economic components in the process of capitalizing on natural resources from the perspective of their profitability. It is also necessary to consider the work of researchers Anh, Bong and Tam (2019), who argue that sustainable land use management deals with current and future areas of the economy, society, culture, and environment and limits the degradation of land and water resources, as well as reduces production costs. Dudzinska (2019), in her research, considers the socio-spatial area of farms as a criterion for choosing a place for the consolidation of agricultural land. Janus and Taszakowski (2018) deal with a regional approach to prioritizing land consolidation that will increase the productivity of agricultural areas. Mika, Len, Oleniacz and Kurowska (2019) suggest an algorithm that enables a detailed assessment of the structure of farms and determines the distribution of land owned by farmers.

Despite the sufficiently thorough level of development of the investigated issues, methodological and methodical problems related, in particular, to the development of new approaches and methods of land use organization, economic and land management mechanisms and tools for the greening of agricultural land use, etc., remain unresolved. The lack of a systematic approach to solving the defined range of problems determines the relevance of the research, its purpose, object and subject.

MATERIALS AND METHODS

The theoretical and methodological basis of the study is the provisions and principles of agricultural land use restructuring and the results of research by domestic and foreign scientists, which reveal the main directions of land use organization, economic and land management mechanisms, and tools for the greening of agricultural land use. Table 1 shows the assessment of the existing level of intensity of agricultural land use in the administrative district of the Cherkasy region and illustrates the level of efficiency of the use of existing agricultural land, taking into account its quality. To assess the level of intensity of land use, the author uses the indicator of land use capacity, which is characterized by the ratio of specific indicators of land area and gross output in monetary terms. The normative indicator of land use capacity is 0.01 and characterizes the highest intensity of land use.

During the research, general scientific and special research methods were used, namely: dialectical – to identify the conditions of agricultural land use, their effectiveness and efficiency; analysis – to highlight the necessity of restructuring agricultural

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Table 1. The assessment of the existing level of intensity of agricultural land use in the administrative district of the Cherkasy region

Districts of the Cherkasy region	Soil quality index*	GP**, UAH ths, const. prices of 2016	Arable land area***, ha	GP per 1 ha, UAH ths.	GP conv, UAH ths./ conv. cadastral ha	Land use intensity index
Cherkasy	41	504810	47904	10.5	13.4	0.12
Chornobai	54	1091041	44849	24.3	23.4	0.21
Chyhyryn	39	374537	93509	4.0	5.3	0.05
Drabiv	60	863063	94198	9.2	7.9	0.07
Horodyshche	46	521094	51952	10.0	11.3	0.10
Kamianka	52	407105	45519	8.9	8.9	0.08
Kaniv	**40**	**4136187**	**47865**	**86.4**	**112.3**	**1.0**
Katerynopil	57	521094	50033	10.4	9.5	0.9
Khrystynivka	58	488526	50090	9.8	8.7	0.08
Korsun-Shevchenkivskyi	43	488526	46655	10.5	12.7	0.11
Lysyanka	51	488526	51414	9.5	9.7	0.09
Mankivka	58	569947	57599	9.9	8.9	0.08
Monastyryshche	59	472242	53203	8.9	7.8	0.07
Shpola	52	716505	81119	8.8	8.8	0.08
Smila	49	569947	52381	10.9	11.5	0.10
Talne	57	635084	70336	9.0	8.2	0.08
Uman	57	911915	106140	8.6	7.8	0.07
Zhashkiv	65	749073	76642	9.8	7.8	0.07
Zolotonosha	54	993336	83285	11.9	11.5	0.10
Zvenyhorodka	46	537379	62698	8.6	9.7	0.09
The entire Cherkasy region	**52**	**16039937**	**1267391**	**12.6**	**12.6**	**0.11**

* *Source*: the calculation is based on the Ukrainian soil assessment data.
** Agriculture in the Cherkasy region in 2019. Department of Statistics in the Cherkasy region. In the comparative prices of 2016, agricultural products are represented.
*** According to the State land cadastre of the Cherkasy region as of January 1st, 2020.

land use; synthesis – to combine different doctrines regarding the use of arable land; structural and functional analysis – to determine the main stages and components of the organization of agricultural land.

RESULTS

Today, land resources are an extremely important structural element of civilization. Global changes in the redistribution and use of land, especially in agriculture, have a number of negative consequences that lead to intensified interstate to limit resources. In the context of globalization, the use of land resources is accompanied by excessive use of nature in agricultural production (Chumachenko et al., 2023).

In order to determine approaches and methods of organizing agricultural land, it is suggested that the level of efficiency of the existing agricultural land use should be assessed, taking into account its quality. This will enable the most accurate estimation of the results of land use. Table 1 presents an assessment of the existing level of intensity of agricultural land use in the administrative districts of the Cherkasy region as of 2019 (2019 indicators most accurately reflect trends in land use) (Agriculture of Cherkasy region, 2020) (Fig. 1).

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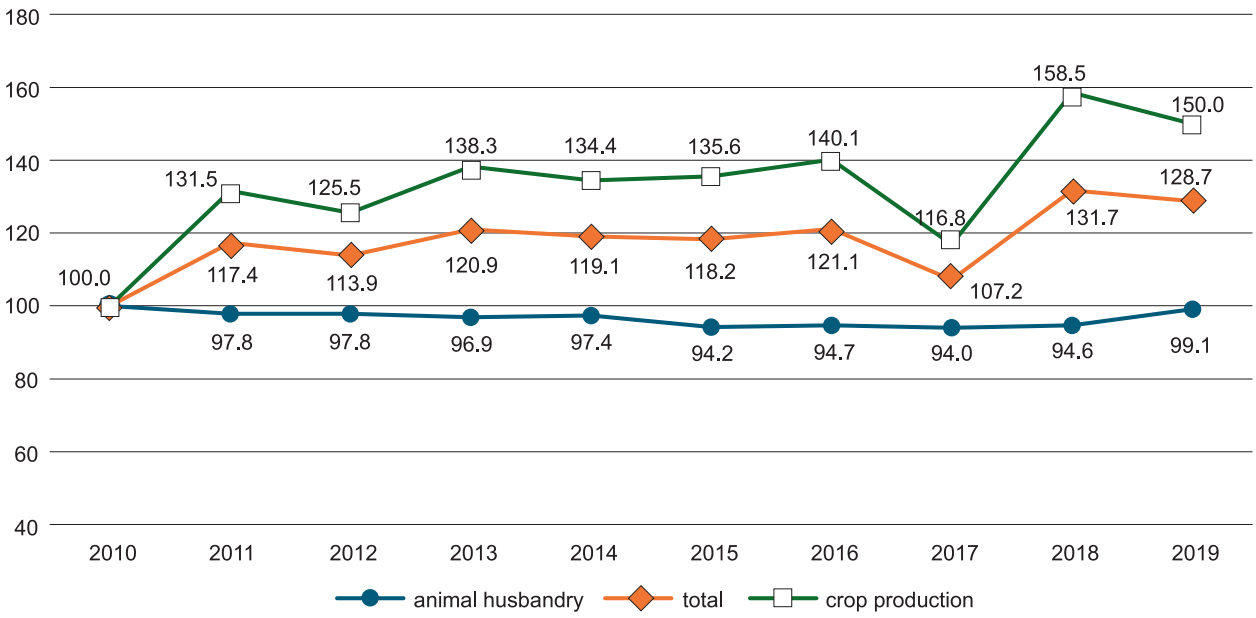

Fig. 1. Trends in agricultural production in the Cherkasy region. The year 2010 is taken as 100% (Agriculture of the Cherkasy region in 2019)

The existing agricultural land use intensity index (LUI) is calculated with the formula:

$$LUI = GP_{conv.exist.} / GP_{conv.norm.}, \quad (1)$$

where:

$GP_{conv.exist.}$ – the value of gross agricultural production per conventionally cadastral hectare of arable land in the existing region, UAH / conventionally cadastral hectare;

$GP_{conv.norm.}$ – the value of gross agricultural production per conventionally cadastral hectare of arable land, which is taken as a standard (the highest among the districts), UAH / conventionally cadastral hectare.

The value of gross agricultural production per conventionally cadastral hectare of arable land is calculated with the formula:

$$GP_{conv.} = GP \times AVG_{region} / AVG_{district}, \quad (2)$$

where:

AVG_{region} – the average-weighted soil quality index in a region;

$AVG_{district}$ – the average-weighted soil quality index in a district.

As shown in Table 1, the existing agricultural land use intensity level – taking into account soil quality index and soil natural fertility in the administrative districts of the Cherkasy region – is very low in comparison to Kaniv district, which is taken as the normative one. The high intensity level of agricultural land use in Kaniv district is confirmed by statistics on the gross agricultural production in 2019 (Fig. 2).

The reason for the striking difference in land use intensity level is the implementation in Kaniv district of a soil-protective and resource-saving agriculture system, which is a component of unconventional agricultural land use. Land use capacity (LUC) is another indicator to confirm the findings about the level of land use intensity. Land use capacity indicates land resource consumption (LR) for the production

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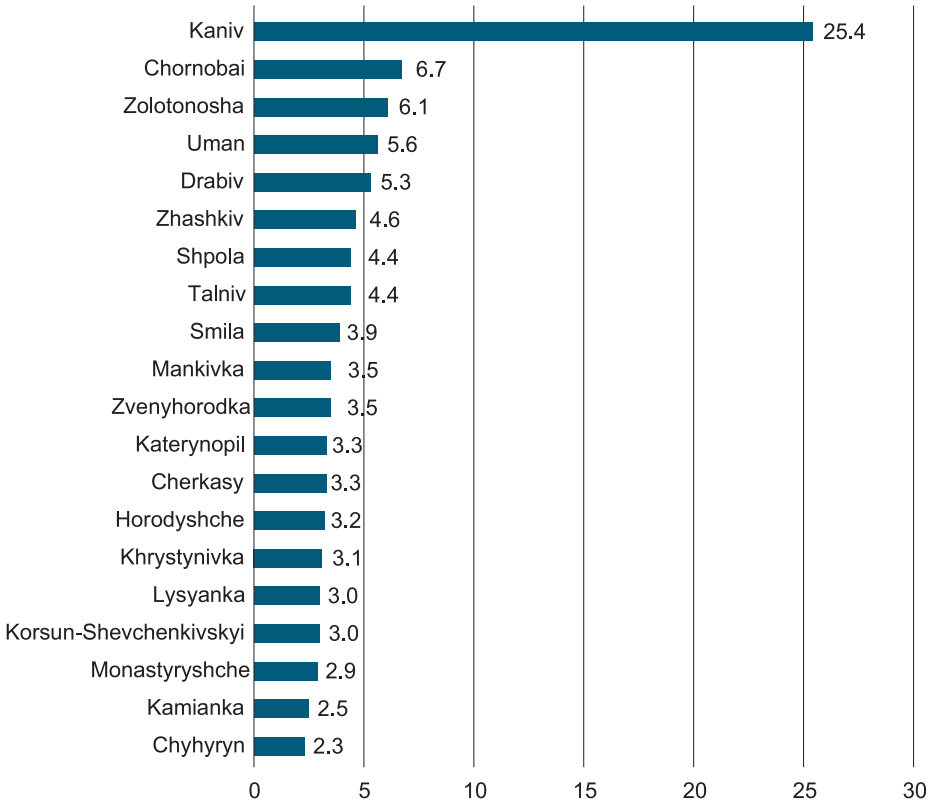

Fig. 2. Ranking of districts of the Cherkasy region by gross agricultural production in 2019 (share in the total amount); Agriculture of the Cherkasy region (2019)

of a specific type of product or all the products in terms of value (GP) and is calculated by the formula:

$$LUC = LR / GP \quad (3)$$

Land use capacity is expressed in terms of the value of land required to produce a unit of output in monetary terms. Table 2 presents an assessment of the existing agricultural land use capacity in the administrative districts of the Cherkasy region.

As shown in Table 2, the existing agricultural land use capacity in the administrative districts of the Cherkasy region is quite high (mostly 10 times higher) compared to the land use capacity in the Kaniv district (0.01 ha per 1000 UAH of GP). Consequently, since the land use capacity ranges from 0.01 to 0.25 hectares per 1000 UAH of GP, agricultural land use in Kaniv district can be described as rational. Its value differs by 25 times. Agricultural land use capacity is calculated taking into account the soil quality index, which ranges from 0.01 to 0.19 hectares per 1000 UAH of GP or – to be more objective – varies by 19 times.

The degree of agricultural land use capacity is influenced by the share of organic agricultural production, which is also a component of unconventional land use. Figure 3 shows the area of land that is suitable for organic farming in Ukraine.

The differentiation of terrestrial ecosystems of Ukraine in terms of ecological and genetic suitability for organic production was carried out as a part of the research program "Agroecological basis for the recreation of soil fertility for organic farming on agricultural landscapes of Ukraine". The soils of Vinnytsia, Ternopil, Khmelnytsky, Chernivtsi, Poltava, Kharkiv, and the Cherkasy are the most suitable for organic farming in Ukraine. But despite the prospects of this approach, the share of agricultural land in the Cherkasy region, where organic technologies are used, is still insignificant

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Table 2. The assessment of the existing agricultural land use capacity in the administrative districts of the Cherkasy region

Districts of the Cherkasy region	GP*, UAH ths., const. prices of 2016	Arable land area**, ha	GP per 1 ha, UAH ths.	LUC, ha per 1000 UAH of GP	GP_{conv}, UAH ths./ conv. cadastral ha	LUC, conv. cadastr. ha per 1000 UAH of GP
Cherkasy	504810	47904	10,5	0,10	13,4	0,07
Chornobai	1091041	44849	24,3	0,04	23,4	0,04
Chyhyryn	374537	93509	4,0	0,25	5,3	0,19
Drabiv	863063	94198	9,2	0,11	7,9	0,13
Horodyshche	521094	51952	10,0	0,10	11,3	0,09
Kamianka	407105	45519	8,9	0,11	8,9	0,11
Kaniv	**4136187**	**47865**	**86,4**	**0,01**	**112,3**	**0,01**
Katerynopil	521094	50033	10,4	0,10	9,5	0,10
Khrystynivka	488526	50090	9,8	0,10	8,7	0,11
Korsun-Shevchenkivskyi	488526	46655	10,5	0,10	12,7	0,08
Lysyanka	488526	51414	9,5	0,11	9,7	0,10
Mankivka	569947	57599	9,9	0,10	8,9	0,11
Monastyryshche	472242	53203	8,9	0,11	7,8	0,12
Shpola	716505	81119	8,8	0,11	8,8	0,12
Smila	569947	52381	10,9	0,09	11,5	0,09
Talne	635084	70336	9,0	0,11	8,2	0,12
Uman	911915	106140	8,6	0,12	7,8	0,13
Zhashkiv	749073	76642	9,8	0,10	7,8	0,13
Zolotonosha	993336	83285	11,9	0,08	11,5	0,09
Zvenyhorodka	537379	62698	8,6	0,12	9,7	0,10
The entire Cherkasy region	**16039937**	**1267391**	**12,6**	**0,08**	**12,6**	**0,08**

* Agriculture in the Cherkasy region in 2019. Department of Statistics in the Cherkasy region. In the comparative prices of 2016, agricultural products are represented.

** According to the State land cadastre of the Cherkasy region as of January 1st, 2020.

and amounts to only 1.6 thousand hectares (about 0.2% of the total agricultural land area).

Considering the effectiveness of unconventional agricultural land use (Tretiak et al., 2022), we suggest the restructuring of the areas of arable land use in regions of Ukraine (Table 3).

Consequently, our research suggests that 5343.9 thousand hectares of arable land are to be changed for functional use: 2049.9 thousand hectares – for soil protection and soil restoration crop rotations; 208.0 thousand hectares – to expand the area under shelterbelts; and 2878.0 thousand hectares – for unconventional agricultural land use. In the Cherkasy region, the area of arable land that needs to be converted to unconventional agricultural land use is 65.7 thousand hectares, or 5.2% of the total arable land.

Production activities in the Cherkasy region are provided by 573 agricultural enterprises, 1401 farms, 94 agricultural cooperatives, and 201 thousand private peasant farms (The state of development, 2023). The development of unconventional agricultural land use will be mainly driven by an increase in the number of family and peasant farms.

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Fig. 3. Map of soils that are suitable for organic farming in Ukraine (The map of lands, 2019)

Table 3. Author's suggestions for restructuring the directions of arable land use in Ukrainian regions to reduce plowing

Region, region	Parameters					
	Existing arable land area, ths. ha	Arable land according to plowing rates, ths. ha	Arable land to be changed by functional use, ths. ha	This includes the following directions		
				soil protection and soil restoration crop rotations, ths. ha	under shelterbelts, ths. ha	unconventional agricultural land use, ths. ha
1	2	3	4	5	6	7
Cherkasy	**1271.9**	**1045.8**	**226.1**	**146.4**	**7.0**	**65.7**
Chernihiv	1477.8	1467.5	10.3	10.3	-	-
Chernivtsi	327.6	297.1	30.5	30.5	-	-
Dnipropetrovsk	2152.6	1596.2	556.4	97.5	21.5	415.9
Donetsk	1654.2	1325.9	328.3	142.2	16.0	154.1
Ivano-Frankivsk	400.6	377.4	23.2	23.2	-	-
Kharkiv	1932.5	1570.9	361.6	90.4	13.0	245.2
Kherson	1784.6	1423.1	361.5	168.0	15.0	163.5
Khmelnytsky	1326.3	1031.5	294.8	141.2	-	153.6
Kirovohrad	1769.0	1229.4	539.6	84.3	27.9	399.5
Kyiv	1320.4	1318.9	1.5	-	1.5	-
Luhansk	1275.9	1267.4	8.5	8.5	8.5	-
Lviv	772.6	768.5	4.1	4.1	-	-

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cont. Table 3

1	2	3	4	5	6	7
Mykolaiv	1703.7	1229.3	474.4	80.4	17.0	360
Odesa	2077.0	1665.7	411.3	215.7	25.0	145.6
Poltava	1816.8	1437.5	379.3	164.5	10.0	194.8
Rivne	658.6	641.6	17	17	-	-
Sumy	1234.7	1167.8	66.9	52.6	-	14.3
The Crimea	1272.2	1272. 2	0.0	-	-	-
Ternopil	852.0	691.2	160.8	91.7	-	69.1
Vinnytsia	1730.4	1324.6	405.8	114.5	9.6	272.1
Volyn	684.6	676.8	7.8	7.8	-	-
Zakarpattia	199.9	117.3	82.6	28.3	-	54.3
Zaporizhzhia	1900.8	1359.2	541.6	296.5	26.0	193.1
Zhytomyr	1143.9	1109.6	34.3	34.3	-	-
Ukraine	**32756.0**	**27412.1**	**5343.9**	2049.9	208.0	2878.0

CONCLUSIONS

In the course of the study of the level of intensity of agricultural land use, the authors have formed the following main opinions.

The assessment of the existing level of intensity of agricultural land use should be carried out taking into account the quality of the soil and the methodical application of the indicators „land use intensity index" (LUI) and „land use capacity" (LUC). Thus, according to the data from the assessment of the current state of land use in the administrative districts of the Cherkasy region, the land use intensity index ranges from 0.07 to 1.0, which indicates a large difference in the level of intensity of land use. A comparison of the level of intensity of land use by the indicator of land use capacity also confirms a large difference in the level of intensity of land use. The land use capacity ranges from 0.01 hectares per 1000 UAH of gross output to 0.19 hectares per 1000 UAH, which indicates a large difference in the level of land use intensity and agricultural land use capacity. The current state of agricultural land use requires the development of new approaches to land use organization. It is suggested to restructure the areas of functional land use, in particular, to implement non-traditional agricultural land use. The article substantiates the necessity of changing the functional use of arable land in the area of 5343.9 thousand hectares, namely: 2049.9 thousand hectares – for use in soil-protective crop rotations; 208.0 thousand ha – for expansion of areas under field protection forest strips; and 2878.0 thousand ha – for non-traditional agricultural land use.

In order to implement measures to reduce arable land in Ukraine, as provided by the Concept of the National Targeted Program for the Use and Protection of Land, it is proposed to restructure the directions for the use of arable land in the regions of Ukraine. To determine possible approaches and methods of agricultural land organization, it is proposed to evaluate the level of efficiency of existing agricultural land use, taking into account their quality, and an assessment of the existing land capacity of agricultural land use is given. A restructuring of the directions of arable land use is proposed, as a result of which arable land with an area of 5343.9 thousand hectares will be subject to a change in functional use and will lead to a decrease in the economic development of the territory of Ukraine.

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Note: the results of this study were presented in another form, such as a poster/abstract at the 3rd International Conference on Water Management and its Surroundings – Theoretical and Practical Aspects.

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THE IMPACT OF TOURIST EXPERIENCE AND SATISFACTION ON REVISIT INTENTION ON THE EXAMPLE OF POLISH TOURISTS IN CROATIA

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ABSTRACT

Motives: To enhance the management of tourism destinations and foster lasting relationships between destinations and tourists, the components contributing to tourist satisfaction should be comprehensively analyzed across diverse social groups.
Aim: It was assumed that the satisfaction derived from a tour affects tourists' intention to revisit a given destination. The main goal of the study was to examine the factors that shape satisfaction and to identify the most significant factors across various tourist groups.
Results: The study involved a survey of 822 Polish tourists visiting Croatia. Based on the results of the cluster analysis, the respondents were divided into three groups according to their opinions on the attributes of Croatia. The variables affecting revisit intention were analyzed with the use of a logistic regression model of the entire sample, taking into account the three clusters. The analysis revealed that high levels of customer satisfaction had a positive influence on revisit intention in the entire sample. The study also demonstrated that the number of visits to Croatia was the least important factor.

Keywords: cluster analysis, logistic regression, revisit intention, Croatia, tourist attributes, tourist satisfaction

INTRODUCTION

Many countries recognize tourism as a tool to attract investment and raise the standard of living in local communities (Jaszczak, 2019). These benefits are usually more noticeable in areas with large tourist resorts (McKercher et al., 2015). Given the diverse economic and social advantages associated with tourism, encompassing both the direct relationship between tourists and destinations and the indirect services involved, it appears imperative to align the efforts of administrative bodies and service-providing companies catering to visitors (Choi & Fu, 2018).

The goal of the tourism industry is to make profits from services offered to tourists, which include arriving in the destination, staying there and using the local offer. Therefore, the task of the industry is to provide tourists with transport, accommodation and attractions at the destination (Bigne et al., 2005).

Croatia, being a Mediterranean country, is on the one hand a beneficiary of tourism, and on the other hand, it is a hostage of the conducted tourism policy,

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foreign trade policy and economic policy (Jelušić, 2017). Despite the efforts to develop inland tourism in Croatia, the coastal region remains the main reception area (Kesar & Čuić, 2017), where 82.9% of all tourist arrivals and 92.8% of all stays take place (Statistical Yearbook…, 2018; Tourism in Seaside…, 2018). According to the WTTC, in 2018 the share of tourism in the global GDP was 10.4%, while the total contribution of tourism to the Croatian GDP was estimated at 24.9% (Croatia – 2019 annual research, 2019). These values clearly show that the main role of entrepreneurs is to maximize economic profit by building consumer–brand relationships. In this case, customer satisfaction is considered to be the most important in achieving the economic goal.

The aim of this article was to attempt to find correlations between an intention to revisit the destination with the achieved level of satisfaction and the number of previous visits. An attempt was also made to determine whether the influencing factors had different significance when different cluster compositions were considered.

Amir et al. (2015) and Tsaur and Huang (2018) suggest that it is necessary to introduce hospitality management strategies and marketing strategies for local authorities and business entities. In particular, preferences and expectations of domestic and foreign tourists should be recognized, with a special emphasis on assessing the accommodation base (An et al., 2019; Bełej, 2021), the gastronomic base (Adam et al., 2015), street safety (Ashton, 2018; Bianchi, 2016), cleanliness of the resort (Alegre & Garau, 2011), entertainment offer (Petrick et al., 2001), the kindness of local residents (Filep et al., 2017; Moal-Ulvoas, 2017), signage for tourist attractions (Vareiro et al., 2019), local means of transport (Masiero & Zoltan, 2013) and the availability of toilets in public places (Matthews et al., 2018).

The empirical approach presented below may contribute to the literature on the tourists' intention to return and satisfaction. Relationships between satisfaction and assessment of tourist attributes were analyzed, taking into account tourists' profiles. The presented study should also contribute to the development of a management strategy, owing to which it will be possible to respond to tourists' needs more effectively and to stimulate their intention to return to a destination.

LITERATURE REVIEW

McKercher et al. (2015) stated that the issues of tourists' satisfaction and their related behavior should be included in the research of regions in the context of tourism. Tourists' satisfaction with the offered goods and services is associated with their emotional perception of these services or goods (González-Rodríguez et al., 2019). Equally important is the role of satisfaction when deciding to re-purchase services (Chen & Chen, 2010; Petrick & Backman, 2002). One should also remember that the services provided to tourists must meet their specific needs.

The image of a destination *de facto* consists of a set of features describing this place. This set is commonly defined as the sum of beliefs, ideas and impressions that people have about the destination (Kotler et al., 1993). The degree of complexity of the destination depends on the elements of the tourist product and the elements forming it (Carvalho et al., 2015). Thanks to this, satisfaction arising from visiting a tourist destination is closely related to the delivery of services expected by the consumer, i.e. a tourist (Ashton, 2018). If the trip is repeated, the level of satisfaction can be judged by its experience. Satisfaction in tourism occurs when the overall rating of the destination is higher than satisfaction with individual elements in the destination (Gnoth, 1994). Satisfaction with the trip results from the quality of tourists' assessment (Bigne et al., 2005). Therefore, the image of the destination is considered a key factor in shaping the level of satisfaction among tourists. This means that a higher level of satisfaction will result from a more positive image (Prayag, 2009). However, it should be noted that it has a temporary character (Oliver, 1999).

Another way to achieve an adequate level of satisfaction is to compare the tourist's initial expectations with the actual state of the offer found

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in a tourist destination. In this situation, the tourist will achieve the expected level of satisfaction when the value of the gained experience will exceed the expected ones (Carlson et al., 2016; Isaac & Eid, 2019).

When attempting to assess satisfaction, one should take into account the features of the destination and the quality of offered services. The individual image of the place consists of three elements: cognitive (Vélez et al., 2019), affective (Smith et al., 2015; Spreng et al., 1996) and holistic. The cognitive element is defined as knowledge, beliefs and assessment of elements of the place (Pike & Ryan, 2004). In turn, the element of the affective image comprises people's emotions and feelings towards the destination (Beerli & Martin, 2004). In order to capture the image of the destination in a better way, it is best to apply the cognitive-affective approach, which has been confirmed by empirical research (Prayag et al., 2018; Vareiro et al., 2019), and which provides more accurate people's assessment of destinations. Some researchers point out strong links between the cognitive, affective and holistic images, emphasizing that the first two are primary to the last one (Kim et al., 2019).

Tourist destinations are areas consisting of cognitive and affective elements, yet affective elements play a greater role (Otto & Ritchie, 1996). The Feelings-as-Information Theory can be used to examine them (Schwarz & Clore, 1996). For people, pleasant feelings are premises for happiness, liking and satisfaction, while unpleasant feelings are perceived as premises for lack of happiness, liking or satisfaction (Schwarz & Clore, 1996). When deciding to go back to a known destination, apart from cognitive processes, people use their feelings as a source of information to form judgments (Schwarz, 2012).

In connection with the above, referring to a review of the literature, Domínguez-Quintero et al., (2019), Lee et al. (2016), Lee et al. (2019), Murphy et al. (2000) and Xu (2010) claim that visiting a tourist destination changes the level of perception affecting expectations. If the expectations are met, it will create a desire to repeat the trip.

The image of a place is a factor that affects strong attachment (Prayag, 2009). Researchers suggest that a more favorable image of a place results in a stronger cognitive attachment to a destination (Liu et al., 2020; Martín et al., 2019; Veasna et al., 2013; Yuksel et al., 2010). However, the same effect should be expected at the affective level (Liu et al., 2020). When one experiences a favorable feeling, a positive affective image of the place is created. Its occurrence will make people more likely to build strong emotional relationships with the destination (Gross & Brown, 2006).

Achieving an adequate level of satisfaction is a prerequisite for gaining tourist loyalty (Dixit et al., 2019; Hall et al., 2017). The relationship itself between the perceived satisfaction and loyalty is positively correlated. Therefore, an inclination to revisit a place depends on the achieved level of satisfaction (Yuksel et al., 2010). The same conclusion was drawn by other researchers (Albayrak & Ceber, 2018; Chen et al., 2016; Scarpi et al., 2019; Tanford & Jung, 2017). It should be remembered that returning visits and loyalty to destinations is not the same. Tourists can be loyal to a destination and yet never return to it.

To sum up the above statements, gaining knowledge about tourists' satisfaction with a destination (and the elements constituting this satisfaction) is necessary for managers and people steering tourism development. They can use it to conduct an active policy of positioning and promoting the represented resorts. In addition, there is information in the literature that shows that different groups of tourists achieve different levels of satisfaction from visiting the same place (Amir et al., 2015; Choi & Fu, 2018; Lee et al., 2019; Matzler et al., 2006; Tynan et al., 2014). Furthermore, in the same group there may be a clear differentiation between satisfaction with participation in the trip and an intention to return to that destination. This means that a separate policy should be pursued for each of the segments affecting satisfaction.

After considering the literature on the subject, the following hypotheses have been formulated:

H1: The diversity in the evaluation of tourist destination attributes is predominantly influenced by factors such as age, gender, education and the employment status of the tourists.

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H2: An intention to return to a destination is positively influenced by satisfaction with the previous visit.
H3: People who have visited a destination more than once more often declare their intention to return.

STUDY METHODS

The research methodology used in the study consisted of independent questionnaires. The study involved 822 tourists from Poland who visited the Croatian coast during the summer tourist season in 2018. It was conducted in coastal towns in Croatia in July and August of that year, with the sample selection being random. To assess the likelihood of tourists' revisits, both their satisfaction with individual elements making up the assessment of the destination and their loyalty to the destination were taken into account.

The questionnaire was prepared in Polish using the knowledge and experience of other researchers from the author's home university. The questionnaire was completed by the respondents themselves, yet in the author's presence who could explain any issues raised at any time.

The survey included 23 questions, most of them in a closed form. They were divided into five main groups. The first part consisted of questions about socio-demographic characteristics (age, gender, level of education and social status). The second part concerned basic information about the trip itself, i.e. duration, type of accommodation, organization, means of transport, aims of the visit, and sources of information about the visited destination. The third part concerned information on the frequency of tourist trips throughout the year in Poland and in general.

The fourth part concerned expressing opinions on the quality of the attributes of the destination and the level of satisfaction with the destination. Nine attributes of the place were considered, taking into account both tangible and intangible elements. A 5-point Likert scale was used to evaluate these attributes, with "1" indicating a very poor rating of the item, while "5" being a very good rating.

Part five contained questions about an intention to return to the destination and a desire to recommend the destination to family and friends. In this part, as in the fourth part, a 5-point Likert scale was used, where the individual marks meant: 1 – strongly disagree, 2 – disagree, 3 – neutral, 4 – agree, 5 – strongly agree.

Then the respondents were asked to provide answers regarding the total number of their tourist arrivals to Croatia.

The SPSS statistical software ver. 26 was used to analyze the data. The following procedure was adopted:

1. Firstly, a non-hierarchical cluster analysis was conducted using the k-means clustering algorithm for 9 items measuring the place attributes. In order to group respondents by their perception of the destination, socio-demographic variables were omitted.
2. Secondly, socio-demographic characteristics were compared with the groups obtained in the cluster analysis from the first step.
3. Step three was to use one-way analysis of variance tests to identify differences between the three clusters in terms of levels of satisfaction, previous visits to Croatia, and intention to return.
4. Logistic regression analysis was performed to analyze variables affecting the likelihood of return.

The application of the method of cluster analysis was preceded by an earlier analysis based on calculations of Kaiser-Meyer-Olkin statistics. The test result was 0.823, i.e. above the recommended value. This confirms that the sample size and the number of variables in the study were adequate. In addition, Cox and Snell and Nagelkerke's pseudo R^2 statistics and the -2 log likelihood were calculated in order to measure the fit of the model to the data.

RESULTS

Tourists' socio-demographic profile

The majority of respondents were women, accounting for 53.9%. The primary demographic consisted of individuals aged 36–45, comprising 40.6% of the participants. In terms of educational

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background, 31.39% had completed secondary education, while 58% possessed higher education. Individuals with primary education constituted the smallest group, making up 4.26% of the respondents. Regarding employment status, the largest group included employed (78.5%) and pupils/students (12.8%), while pensioners formed the least numerous group, representing 0.4%.

Differences between clusters

As already described, the main goal of the article is to examine the level of tourists' satisfaction with a trip to Croatia and to estimate the impact of the level of this satisfaction on their intention to return or to recommend visiting the destination to family and friends. Based on the literature, it was assumed that the analyzed willingness is related to the perceived quality of the destination or its components experienced during the visit (Carvalho et al., 2015).

It is also known that various socio-demographic characteristics of the tourist group influence the varying levels of satisfaction with the place. Considering all of the above, the cluster analysis method was applied first.

In order to minimize variability within clusters and maximize variability between them, a non-hierarchical approach to grouping was used (k-means). This approach was used with three different clusters (n = 3, 4, 5). Then, the obtained results were compared, and a solution based on three clusters was selected for further analysis. This resulted from the largest differences between particular clusters and allowed using the most interpretable results. The comparison of variability within each group was based on average distances of each tourist from the cluster's centroid (Table 1). Data indicate that clusters 1 and 3 have the highest level of divergence, while clusters 2 and 3 show the greatest similarity.

Table 1. Intragroup variability

Cluster	1	2	3
1	–	1.879	3.373
2	1.879	–	1.784
3	3.373	1.784	–

The analysis between clusters was conducted by examining the average scores for 9 items measuring the attributes of tourist coastal areas of Croatia (Table 2). At the same time, an assessment of individual elements in all clusters was disclosed. The obtained results indicate that the share of all components was statistically significant for defining the clusters (p value < 0.01). The attributes that differentiated

Table 2. Perceived attributes of Croatia

	Cluster 1 n = 162 (19.7%)		Cluster 2 n = 382 (46.5%)		Cluster 3 n = 278 (33.8%)		F ratio	Sig.
	Positive (%)**	Average scores	Positive (%)**	Average scores	Positive (%)**	Average scores		
Accommodation base	66.05 (22.22)	3.77	85.60 (43.19)	4.26	98.20 (78.42)	4.76	99.408	0.000*
Gastronomy base	49.38 (8.02)	3.46	74.08 (17.54)	3.90	91.37 (58.27)	4.50	118.083	0.000*
Street safety	48.77 (11.11)	3.39	87.70 (47.64)	4.35	92.45 (69.78)	4.61	139.156	0.000*
Cleanliness of the resort	46.91 (9.26)	3.43	87.70 (32.46)	4.20	94.96 (59.35)	4.54	135.619	0.000*
Entertainment offer	40.74 (8.02)	3.39	65.71 (16.49)	3.79	96.76 (56.83)	4.54	155.619	0.000*
Kindness of local residents	65.43 (14.20)	3.66	96.60 (66.75)	4.63	97.84 (83.81)	4.82	193.184	0.000*
Signage of tourist attractions	54.32 (8.64)	3.57	83.25 (26.44)	4.09	95.32 (74.82)	4.70	164.106	0.000*
Local means of transport	19.14 (1.23)	3.06	27.23 (2.62)	3.27	71.94 (36.33)	4.08	164.136	0.000*
Availability of toilets	18.52 (4.32)	2.82	34.82 (5.50)	3.22	76.26 (33.81)	4.09	142.173	0.000*

* p <0.01

** percentage of respondents who assessed the item positively by answering 4 or 5 (the percentage share of people who answered 5 is presented in brackets)

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individual clusters the most were: "availability of toilets", "entertainment offer" and "local means of transport". The elements that had the least impact on the diversity of clusters were: "kindness of local residents", "cleanliness of the resort" and "street safety".

Based on the results obtained, the estimated clusters can be characterized as follows:

Cluster 1 – this cluster contains 19.7% of the respondents' sample. This group rated the attributes of the Croatian coast the lowest. The highest positively rated was the "gastronomic base" (66.05%), in which case only 22.22% of the respondents rated it as "very good", and "kindness of local residents", which was rated positively by 65.43% members of this cluster (14.2% rated the "kindness of local residents" as "very good"). In this group, the lowest rated were "availability of toilets" and "local means of transport".

In socio-demographic terms, the breakdown by gender in this cluster is the most similar to the result obtained for the entire research sample. This cluster also included the largest number of the youngest and the least educated people compared to other clusters (the most persons with primary education and the least with higher education). The share of persons in education and the unemployed is also higher in this cluster than in the other ones.

Cluster 2 – it contains the largest group of respondents, amounting to 46.5% of subjects. Similarly to the respondents from cluster 3, these respondents positively assessed the attributes of the Croatian coast. However, the percentage of respondents who rated the attributes as "very good" is significantly lower than of those rating positively, especially in the case of "signage of tourist attractions" and "the gastronomic base".

The demographic profile of tourists classified to this cluster is characterized by the highest percentage of males (this is the only cluster in which the number of men is higher than the number of women). In this group, the highest percentage of people with higher education and the smallest percentage of people with vocational education were recorded in comparison with other clusters.

Cluster 3 – members of this cluster constitute 33.8% of the study sample. These respondents are the most convinced of the positive aspect of the features describing Croatia. The lowest rated elements in this group are "local means of transport", which were rated as "good" or "very good" by 71.94% of the respondents and the "availability of toilets" with a positive assessment in 76.26% of the respondents' sample. The highest rated elements include the "accommodation base", which was rated positively by 98.2% of the respondents from this cluster (78.42% evaluate it as very good) and "kindness of local residents", which was positively assessed by 97.84% of the respondents.

The demographic profile of tourists belonging to this cluster is characterized by the highest percentage of women. This group has the lowest percentage of people with primary and secondary education. 80.6% of the tourists assigned to this cluster are employed, and this is the largest percentage among all clusters. Tourists in the described cluster have the lowest share of the unemployed among all three clusters.

Considering H1, regarding the perception of the place attributes, relying on the clusters found, it has to be concluded that we are confronted with tourists endowed of different visit motivations and socio-demographic profiles.

Intention to return

In order to analyze the variables affecting the likelihood of returning to a tourist destination, a logistic regression analysis was performed. Conducting a logistic analysis gives an opportunity to estimate the probability of occurrence of an event (e.g. intention to return) using variables considered explanatory.

As a result of the literature review (Antón et al., 2014; Chen & Chen, 2010; Petrick & Backman, 2002), the chosen variables include the satisfaction level and the past experience of visiting the destination.

The average level of satisfaction with the nine attributes of the destination was assumed as the level of satisfaction among tourists. In turn, the number of previous and the current visit to Croatia was the value of previous experience of visiting the destination (Lam & Hsu, 2006).

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Table 3. Satisfaction, number of visits, intention to return and recommendations broken down by clusters

	Cluster 1 n = 162 (19.7%)		Cluster 2 n = 382 (46.5%)		Cluster 3 n = 278 (33.8%)		F ratio	Sig.
	Positive (%)**	Average scores	Positive (%)**	Average scores	Positive (%)**	Average scores		
Satisfaction	-	3.39	-	3.97	-	4.51	128.039	0.000*
Number of visits to Croatia	-	2.15	-	2.26	-	2.31	1039.011	0.000*
Intention to return	16.67 (3.70)	2.97	60.73 (21.20)	3.79	88.85 (38.85)	4.28	605.741	0.000*
Recommendation to family and friends	42.59 (7.41)	3.37	73.56 (33.77)	4.07	93.53 (58.27)	4.52	423.762	0.000*

* $p < 0.01$
** percentage of respondents who assessed the item positively by answering 4 or 5 (the percentage share of people who answered 5 is in brackets)

To determine the intention to return to the destination, a Likert 5-point scale was used, in line with Ashton (2018), Murphy et al. (2000). Given the main purpose of the article, which is to determine the impact of independent variables on an increase in the likelihood of returning to a tourist destination, these variables had to be dichotomous. The obtained results were transformed according to the scheme: 1 – yes (earlier 5 and 4) and 0 – no (earlier 3, 2 and 1).

A means test was performed before logistic regression. This served to determine significant differences in the achieved levels of satisfaction, previous experiences with visiting the destination, an intention to return to the destination and an intention to recommend the destination to family and friends. The results of the analysis are presented in Table 3. In line with the previous analysis, differences were found in various clusters.

In the logistic regression model, the model parameters were estimated using the maximum likelihood method. Cox and Snell and Nagelkerke's pseudo R^2 statistics and the -2 times log likelihood were used to measure the fit of the model. The results for the total research sample are presented in Table 4.

Table 4. Correctness of the fit of the model to the data for the total sample

	Total sample
Cox and Snell R^2	0.304
Nagelkerke R^2	0.413
-2 times log likelihood	797.178

Cox and Snell and Nagelkerke's pseudo R^2 statistics are at a reasonable level values of 0.304 and 0.413. It should be remembered, however, that their interpretation should be careful, because none of the statistics explains variance in the same way as the R^2 coefficient in the linear regression model.

Table 5 contains the results of the analysis for the entire population of respondents. The estimated parameter values indicate that satisfaction plays a significant role in motivating tourists to visit this country again. This variable has a significant impact on return intentions at the 99% confidence interval.

Table 5. Correlation between the explanatory variables and the intention to return to the destination in the whole sample

	Estimated parameters
Constant	-14.193*
Satisfaction	3.702*
Number of visits to Croatia	-0.044

* $p < 0.01$

Based on the entire sample of respondents, only H2 can be accepted. In other words, it can be said that the likelihood of a return visit to the destination is positively correlated with the tourists' satisfaction.

An analysis was also carried out for each of the previously defined tourist clusters. From the analysis of Table 6, it can be concluded that Cox and Snell and Nagelkerke's pseudo R^2 statistics are higher in cluster 2 than for other clusters. At the same time,

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pseudo-R2 values within clusters are lower than those obtained for the total sample of respondents, which proves a lower coherence of the model.

Table 6. The correctness of the fit of the model to the data in individual clusters

	Cluster 1	Cluster 2	Cluster 3
Cox and Snell R^2	0.059	0.088	0.057
Nagelkerke R-	0.099	0.119	0.113
-2 times log likelihood	136.139	476.557	178.195

Table 7 shows the results of estimated parameters for different clusters. The results indicate that the impact of the variables of satisfaction and the number of visits to Croatia on the intention to return varies between groups. The estimated parameter related to satisfaction is significant at the 99% confidence interval in cluster 2 and 3 and at the 95% confidence interval in cluster 1. The parameter of the number of visits to Croatia is significant at the 90% confidence interval only in cluster 2.

Table 7. The relationship between the explanatory variables and the intention to return to the destination in individual clusters

	Cluster 1	Cluster 2	Cluster 3
Constant	-11.865*	-13.214*	4.791*
Satisfaction	2.861**	3.533*	3.847*
Number of visits to Croatia	0.152	0.082***	0.086

* p <0.01; ** p< 0.05; *** p<0.1

Based on the above results, it should be stated that the estimated parameters have different significance for each cluster. In the case of clusters 1 and 2, the level of satisfaction has this significance. This allows H2 to be accepted. However, in the case of cluster 2, the level of satisfaction and the number of visits to Croatia are significant. This allows H2 and H3 to be accepted.

As mentioned, the composition of the group plays a role in the achieved level of satisfaction. Intention to return to Croatia among people from cluster 1 was affected by the level of satisfaction with a 95% confidence interval. In cluster 2, satisfaction, as the main factor, was an element deciding about an intention to return at a 99% confidence interval, and the number of visits to Croatia at a 90% confidence interval. In cluster 3, only the level of satisfaction proved significant with a 99% confidence interval.

While interpreting the obtained empirical results, one should agree that the intention to return to the destination mainly results from experience (Chen & Chen, 2010; Petrick & Backman, 2002) and to a lesser extent from the number of visits (Petrick et al., 2001).

CONCLUSIONS

The main purpose of the article was to examine elements determining an intention to return to Croatia. These were such elements as satisfaction obtained from the visit to the destination and the experience gained during the visits calculated as the total sum of visits to Croatia. It was also examined how various groups of tourists, different in terms of socio-demographic characteristics, differently perceive the attributes of Croatia and achieve different levels of satisfaction with participation in a tourist trip. This justified examining factors affecting the level of satisfaction in individual groups.

The study uses the method of cluster analysis. Three clusters were identified. The first of them contained 19.7% of the respondents' sample, and it was characterized by the presence of people who rated the attributes of Croatia the least. The second cluster included 46.5% of the respondents, while the third one comprised 33.8% of the respondents assessing Croatia's attributes the highest. After analyzing the attributes, it was found, despite the lack of homogeneity of assessments, that the level of satisfaction of visitors to Croatia should be considered quite high.

Then, logistic regression analysis was performed. Its purpose was to capture the variables that affect the likelihood of a return to Croatia. Data from the entire sample and clusters identified at an earlier stage were used for the analysis. The analysis of the entire sample allowed concluding that not all the elements included in the study played a decisive role in motivating tourists to return to the destination. It turned out that, generally, the number of visits

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to Croatia was not a decisive factor in re-selection of a destination, while satisfaction was such an element.

After analyzing individual groups of tourists, it was found with logistic regression models that the impact of satisfaction and the number of visits to Croatia are different in individual clusters. In the first cluster of people who rated the attributes of Croatia the lowest, it was found that satisfaction was an important factor at the 95% confidence interval. In the second cluster, both analyzed factors turned out to be significant for the intention to return to the destination. Satisfaction was a significant factor at the 99% confidence interval, while the number of visits to Croatia at the 90% confidence interval. In the third cluster, as in the first one, satisfaction was the factor determining the intention to return to Croatia at the 99% confidence interval. This means that the number of visits to Croatia is the least important element among those analyzed.

The results of the study allow drawing interesting conclusions for practitioners and they constitute starting points for further research. Insight of service providers into tourists' expectations has been ensured.

The empirical evidence obtained in the study should be taken into account when managing, planning and promoting Croatia. The obtained results give rise to new questions. Firstly, one should consider whether creating an offer at the destination should be planned for people who rate the attributes of this place the lowest in order to encourage them to repeat the visit. On the other hand, it is worth focusing on new tourists who have not yet visited Croatia, because those who rated it lowest have already formulated their opinions.

Simultaneously, it cannot be suggested that Croatia's attributes are presented in a way that causes misunderstandings arising from unrealistic expectations among potential visitors, as this can lead to frustration and a categorical lack of an intention to revisit.

It is possible that the set of experiences offered at the destination is not satisfactory enough for visitors. Authorities should think about how to enliven and enhance the destination offer to increase the co-creation of experiences among tourists.

Tourists visiting Croatia for the first or the subsequent time may perceive the offered services differently. Therefore, it is necessary to develop different marketing strategies tailored to tourists.

The obtained empirical results prove that loyalty and intention to return are not the same. Loyalty to a destination can be expressed by a wish to recommend the destination to family and friends. This issue has not been sufficiently presented in the article, so it opens a possibility of exploration in future studies.

The main limitation in the presented research results was polling of only Polish tourists, who in 2018 were only the fifth most numerous group of tourists, thus limiting a possibility to extrapolate the conclusions to the entire tourist population. Due to the organization, the whole survey was conducted by one interviewer, which made it impossible to conduct the survey simultaneously in all destinations throughout the whole period. These limitations resulted from budgetary restrictions.

Nevertheless, the applied methodology was appropriate, as conducting the study on the streets and in an individual way allowed drawing conclusions that would otherwise be difficult to obtain.

Further research will take into account a greater diversification of tourists according to their country origin and a different region of destination. This will help to obtain more complete knowledge about tourists' expectations towards the tourism offer of Croatia.

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CONTENTS