MANAGEMENT
2025, Vol. 29, No. 1
www.management-poland.com
DOI: 10.58691/man/203273

MARTA DAROŃ

Social knowledge and information management in the field of urban intelligent transportation

Abstract

Research background and purpose: Urban Intelligent Transportation (UIT) systems are integral to modern city mobility, yet societal awareness and knowledge of these solutions remain underexplored. This study investigates the level of knowledge and recognition of UIT among residents of selected European countries and examines the role of municipal authorities in disseminating relevant information. The purpose of the study was to investigate the level of knowledge and acceptance of innovative solutions in the field of intelligent urban transportation among society.

Design/methodology/approach: A survey using the CAWI method was conducted in Poland, Turkey, and other European countries. A total of 572 responses were collected and analyzed using statistical methods, including logistic regression, to identify key determinants of UIT knowledge. The study also evaluated respondents' perceptions of local government actions in UIT communication.

Findings: The results indicate that 58% of respondents are familiar with the term UIT, but only 40.9% recognize UIT solutions in their cities. Significant differences were found across countries, with Poland exhibiting the lowest recognition rates. Demographic factors, including professional activity and mode of transport, significantly influence awareness levels, whereas age and gender do not. The study also highlights a strong expectation for municipal authorities to enhance their communication efforts, particularly in Poland, where 90% of respondents demand more UIT-related information.

Value added and limitations: This study provides empirical insights into the societal perception of UIT, emphasizing the need for targeted awareness campaigns. It offers recommendations for city authorities to improve UIT communication strategies. However, the study is limited by sample representation disparities between countries and the self-reported nature of responses. Future research should extend the geographic scope and incorporate qualitative methods to deepen the analysis.

Keywords: *transport management, urban intelligent transportation, social knowledge*

JEL Classification: D83, L91, M38, O18

Received: 2024-08-27; **Revised:** 2025-02-03; **Accepted:** 2025-03-24

Marta Daroń ✉
Management Faculty, Czestochowa University of Technology, Poland;
email: marta.daron@pcz.pl
ORCID: 0000-0002-5000-0573

1. Introduction

In recent years, there has been a growing need for mobility, driven by economic development, changes in societal wealth levels, and the increase in the number of vehicles moving around urban and suburban areas (Yannis & Chaziris, 2022). Unfortunately, the existing transport infrastructure cannot always meet expectations in terms of road traffic capacity (Bucsky & Juhász, 2022). Additionally, newly designed communication routes do not solve this problem in the long term and eventually also become inefficient. There are also problems related to the spatial distribution of new infrastructure, especially in highly urbanized areas. The omnipresent congestion causes many negative side effects that local governments have to deal with. To mitigate the negative effects of increased transport in urban areas, the concept of intelligent solutions in the field of urban logistics was created (Cederstav et al. 2023; Kujawski & Dudek, 2021). Solutions in this area should focus on ensuring better regulation and optimization of vehicle movement in urban areas, especially in their centers, and should consequently ensure efficiently functioning transport and contribute to the reduction of negative environmental effects caused by road traffic.

Designing solutions for sustainable urban logistics is a very complex process. Although there are a significant number of simulation, optimization, or heuristic models (Xia et al. 2022; Xu et al. 2023; Belbachir, 2019), it is not possible to identify a single reference model in this area. A significant number of emerging urban logistics models remain theoretical and are not verified by practical application. Therefore, it seems reasonable to design solutions for a sustainable urban logistics plan, including urban intelligent transport (UIT), based on an analysis of the need to implement them, taking into account the assessment of the current state of the city's functioning. It should be noted that the city's logistics system consists of: flows of people (individual and collective), flows of cargo (flows of production, consumption, waste, and returns), and flows of information (subsystems for collecting and processing information about the needs of residents and their assessment of the current state, subsystems for monitoring and controlling vehicle traffic, supporting logistics decisions, and researching and shaping the communication behavior of residents) (Głębocki, 2024; Yin et al. 2023).

In fact, traffic planning and research presented in publications mainly concern passenger transport, with particular emphasis on the problem of congestion in the main arteries of city centers. However, the review of intelligent solutions in urban transport presented below will cover both individual and public traffic. Based on the literature review on UIT, it is stated that there is a lack of research on the awareness of traffic participants regarding these solutions. Therefore, the aim of this study was to examine the level of knowledge of UIT term and whether intelligent solutions are noticed by society. The research was conducted in selected European countries with access to UIT technology. To achieve this aim, the following research hypotheses were adopted:

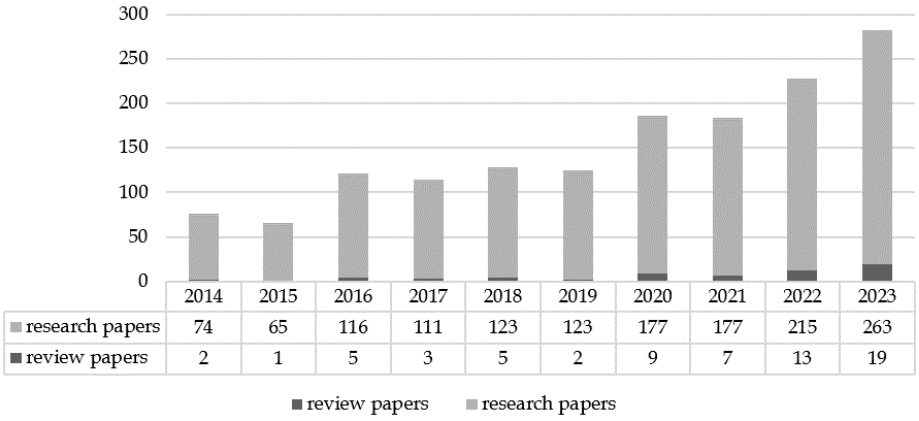
Hypothesis I: Society notices and accepts existing solutions in the scope of UIT but does not know the concept of UIT.

Hypothesis II: It is possible to indicate to city authorities the target groups to which information activities concerning UIT can be directed.

2. Literature review

The theoretical and empirical considerations undertaken in the article focused on the interpretation of the UIT issue from the perspective of society using these types of solutions. Considering the current challenges faced by city authorities in managing UIT systems, an attempt to indicate the directions of changes from the perspective of traffic participants seems all the more necessary.

The literature review was based on the ScienceDirect database. The search term "urban intelligent transportation" was entered, specifying that the term "urban" should appear in the field "Title, abstract, or author-specified keywords." Analyzing the publications in the form of scientific articles on UIT in the ScienceDirect database, which were published after 2014 (the last decade), a clear upward trend in their number can be observed in the last decade (Fig. 1). In 2014, 76 papers were published in this area, while in 2023, this number increased to 282. A particularly significant jump in the number of publications occurred between 2015 and 2016, where the number of publications almost doubled.



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
research papers	74	65	116	111	123	123	177	177	215	263
review papers	2	1	5	3	5	2	9	7	13	19

Figure 1. **Number of papers with UIT term between 2014-2023**

Source: own study

Searching for UIT publications within the specified time frame resulted in finding nearly 1,500 scientific papers. Many of them did not have publicly accessible full versions. Therefore, the literature review was limited to those publications that are available as Open Source. The number of these publications is provided in Table 1.

Table 1. **The number of UIT publications in the ScienceDirect database from 2014 to 2023**

year	open access publication	review papers	research papers
2014	45	0	45
2015	23	1	22
2016	62	2	60
2017	56	0	56
2018	34	2	32
2019	32	0	32
2020	55	4	51
2021	48	2	46
2022	79	10	69
2023	101	10	91
Sum	612	40	572

Source: own study

In summary, between 2014 and 2024, an overall upward trend in the number of publications related to intelligent urban transportation was observed. A particularly dynamic increase occurred between 2021 and 2023, both in the total number of publications and in the number of review papers and research articles. Due to the large number of scientific papers found in the system, it was decided to limit the literature review to the period covering articles from 2020 onwards. Out of over 280 publications, around 60 were selected for analysis, which, after a preliminary review, were considered the most relevant for the subject of this study. After verifying the full texts, approximately half of them were ultimately used for this study.

UIT involves integrating advanced technologies with transportation systems in urban areas to increase efficiency, safety, and sustainability. This literature review discusses the latest research on urban traffic management, analyzing the methodologies used, the

areas studied, and the strengths and weaknesses of individual publications. Based on the analysis of selected publications, several important areas for this topic were identified: data analysis and urban traffic management, the use of AI technologies (including neural networks) and IoT, evolutionary algorithms, and optimization methods for improving passenger and public traffic.

In the field of data analysis and urban traffic management, interesting research is presented by Hou et al. (2021). They emphasize the importance of appropriate data sets for traffic forecast accuracy. According to these authors, the introduction of a new data set, including bidirectional traffic data and weather information, significantly improves forecast results. Similarly, Zheng and co-authors present the WDA-GCN model, which uses a convolutional network and an attention mechanism, achieving a prediction accuracy of 81.03% (Zheng et al. 2022). Liu et al. in their work (2020) presented the EvoTSC traffic signal system based on evolutionary algorithms, which optimizes signaling in large urban networks, improving traffic efficiency. Other studies also present various systems for improving urban traffic, such as a routing solution that helps avoid congestion and increase transportation capacity in large cities (Minh et al. 2022), or the FCM algorithm with particle swarm optimization for recognizing traffic patterns, enabling better management of urban highways (Liu, 2020). In the area of urban traffic management, there is a visible need for further research on solutions integrating various data sources and modern technologies, as confirmed by authors like Ouallane et al. (2022).

In the area of AI and IoT technologies, attention is drawn to studies on dynamic urban traffic prediction models that allow for accurate forecasting of traffic density and travel time in urban road networks (Xia et al. 2022; Xu et al. 2023). There are also works related to mobile crowd sensing, which enables dynamic traffic management and reduces fuel consumption and travel time (Ali et al. 2021; Tay et al. 2023), as well as studies on eco-navigation systems for electric vehicles, improving traffic management efficiency (Chen et al. 2023; He et al. 2023), and safety (Liu et al. 2020; Minh et al. 2022).

Additionally, the scientific literature includes studies on evolutionary algorithms and optimization methods. For example, Liu et al. (2020) presented a traffic signal system in their work. The authors noted that this system significantly reduces computational costs and improves traffic efficiency. Other authors also use optimization methods. For instance, Tu et al. (2020) conducted an analysis on the planning of electric vehicle traffic, considering travel time and energy consumption constraints.

Other authors, such as Sobral et al. (2020), deal with urban traffic analysis and decision support, presenting guidelines for integrating and visualizing ITS data, which help support decisions made by urban traffic management authorities. Other studies highlight the benefits of using data from city bus monitoring to understand

urban traffic congestion (Almeida et al. 2023). Similarly, Hou et al. (2020) investigated the use of data from city bikes to optimize spatial planning and traffic management. Other authors focus on technological innovations visible to traffic participants in their works. Solutions such as countdown displays at major intersections, public transport stop displays with up-to-date passenger information, and speed monitoring displays are crucial for improving passenger experience and increasing public transport efficiency and safety (Waqar et al. 2023). On the other hand, electronic ticket systems for public transport facilitate the use of urban transportation, increasing passenger convenience and operational efficiency (Pomianowski, 2023). These are currently being analyzed as an effective means of reducing congestion and improving traffic flow. The literature also includes studies on parking meter systems with cashless or remote payment options (Zheng et al. 2022). According to the authors of these studies, these systems are becoming increasingly popular and help manage parking spaces in cities.

In the literature review it was noted a lack of studies on the level of knowledge, acceptance, and usefulness of ITS solutions from the perspective of society. Research in this area is essential to understand how users perceive these technologies and their expectations, which could help in better designing and implementing ITS.

3. Methods

The study on the level of knowledge about UIT solutions was conducted using the CAWI method in three geographic areas – in Poland, Turkey, and other European countries. For this purpose, three language versions (Polish, Turkish, and English) of the online survey questionnaire were prepared. The survey link was shared via social media, and anyone with access to the link could participate in the study. First, the study was conducted in Poland, assuming a target number of over 200 completed questionnaires, which was achieved. Unfortunately, the quantitative assumptions of the study in other countries could not be met, so it was decided to present the results divided into Turkey (second place in the number of collected questionnaires) and other EU countries. This is undoubtedly a significant limitation in the study and the study should be supplemented in the future. Initially, the study was conducted in Poland, and over 400 complete responses were obtained. The same questionnaire was then made available to respondents from other European countries (84 responses from Germany, France, and the Czech Republic, among others) and Turkey (47 responses).

The characteristics of the basic features of the research sample, divided by geographic area, are presented in Table 2.

Table 2. **Characteristics of respondents**

Age	Total		Poland		Other EU countries		Turkey	
	Density	**%**	**Density**	**%**	**Density**	**%**	**Density**	**%**
16-19	29	5	21	5	5	6	3	6
20-25	76	13	33	7	30	36	13	28
26-35	79	14	60	14	13	15	6	13
36-50	303	53	273	62	20	24	10	21
51-65	64	11	39	9	11	13	14	30
66 and more	21	4	15	3	5	6	1	2
Total	572	100	441	100	84	100	47	100
Area	**Total**		**Poland**		**Other EU countries**		**Turkey**	
	Density	**%**	**Density**	**%**	**Density**	**%**	**Density**	**%**
	572	100	441	77	84	15	47	8
Gender	**Total**		**Poland**		**Other EU countries**		**Turkey**	
	Density	**%**	**Density**	**%**	**Density**	**%**	**Density**	**%**
man	211	37	143	32	42	50	26	55
woman	361	63	298	68	42	50	21	45
Total	572	100	441	100	84	100	47	100
Place_of_living	**Total**		**Poland**		**Other EU countries**		**Turkey**	
	Density	**%**	**Density**	**%**	**Density**	**%**	**Density**	**%**
city center	112	20	42	9	47	56	23	49
city	286	50	246	56	24	29	16	34
other	174	30	153	35	13	15	8	17
Total	572	100	441	100	84	100	47	100

Activity	Total		Poland		Other EU countries		Turkey	
	Density	%	Density	%	Density	%	Density	%
student	89	16	47	11	25	30	17	36
employee	259	45	225	51	19	22	15	32
employer	161	28	139	31	15	18	7	15
other	63	11	30	7	25	30	8	17
Total	572	100	441	100	84	100	47	100
Transport_ mode	Total		Poland		Other EU countries		Turkey	
	Density	%	Density	%	Density	%	Density	%
On foot/bike/ scooter/other	22	4	9	2	7	8	6	13
Public transport	149	26	85	19	44	53	20	42
Own transport	401	70	347	79	33	39	21	45
Total	**572**	**100**	**441**	**100**	**84**	**100**	**47**	**100**

Source: own study

As it can be seen, data from a total of 572 respondents were collected for the analysis and verification of the adopted hypotheses. Among respondents, the majority were women, which can be explained by their greater activity on social media, through which the survey link was shared.

The questionnaire consisted of several parts. In the first stage, respondents answered demographic questions related to age, gender, place of residence, and professional activity. Then, depending on their answer to the last question (professional activity), respondents were redirected to the second part of the survey, containing 3 or 5 questions depending on the respondent group (Fig. 2).

The third part contained 19 questions on urban transportation, including UIT, and was the same for all respondents. All questions in this section were closed-ended, mostly single-choice, meaning that respondents could choose one of the provided options. In the first 3 questions, respondents answered yes, no, or don't know. In the fifth question of this part of the survey, multiple-choice answers were possible. In the subsequent questions, an ordinal scale was used with the options: very helpful, useful, useless, or very good, good, mildly bad, very bad. Some questions also included the option of answering "don't know" / "no opinion."

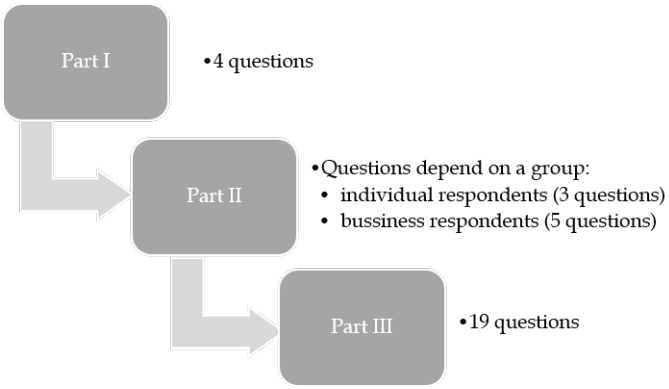


Figure 2. **Questionnaire layout**

Source: own study

For the purposes of this study, selected questions from the described survey were used. Based on the responses, a statistical analysis was conducted, and the hypotheses were verified.

4. Results

In the first step, to conduct the analysis aimed at verifying Hypothesis I, the frequency of responses to the question related to respondents' knowledge of the term UIT was examined. The results are presented in Table 3.

Table 3. **Knowing intelligent/smart transport term**

Area	Answer	N	%
Poland	yes	249	56.5
	no	192	43.5
Other EU countries	yes	48	57.1
	no	36	42.9
Turkey	yes	35	74.5
	no	12	25.5
Total	yes	332	58.0
	no	240	42.0

Source: own study

The analysis of the responses shows that 58% of all respondents have already encountered the term "intelligent/smart transport." In particular, in Turkey, 74.5% of respondents are familiar with the term, suggesting that terminological awareness is particularly high among respondents from this area.

Next, the results of responses to the subsequent question—public awareness of existing UIT solutions—were examined. Respondents were asked whether they noticed UIT solutions in the large city where they most often stay. The frequency of responses in this area, also broken down by the respondents' region, is presented in Table 4.

Table 4. **UIT solutions existence – respondents' perspective**

	Poland		Other EU countries		Turkey		Total	
	N	%	N	%	N	%	N	%
yes	162	36.7	40	47.6	32	68.1	234	40.9
no	45	10.2	11	13.1	6	12.8	62	10.8
don't know	234	53.1	33	39.3	9	19.1	276	48.3

Source: own study

The survey results indicate that awareness of UIT solutions is highest in Turkey, where 68.1% of respondents know and notice these solutions in their city. In other EU countries, this percentage is much lower—47.6% of respondents notice these solutions, while in Poland, only 36.7%. Thus, respondents from Poland have the highest level of unawareness about the existence of UIT solutions, with 53.1% responding "I don't know."

Comparing the results in Tables 3 and 4, it can be stated that while the majority of respondents know the term "intelligent/smart transport" (58%), a smaller percentage notice the actual existence of these solutions in their cities (40.9%). Therefore, in the context of Hypothesis I, which assumes that society notices and accepts existing UIT solutions but does not know the concept of UIT, the results suggest the opposite situation. Namely, more respondents declare familiarity with the term than notice the actual implementation of such solutions in practice in their city. This indicates a potential gap between theoretical knowledge and practical experience regarding intelligent transportation systems. While the level of respondents' awareness of the term UIT and the existing solutions in their immediate surroundings is quite high, it is not satisfactory. Therefore, it would be reasonable to conduct informational or educational campaigns in Poland and continue promotional activities in other EU countries and Turkey for targeted social groups.

Therefore, the next step is to verify Hypothesis II of this study regarding the possibility of advising municipal authorities on the target groups for promoting UIT.

An analysis was also conducted to understand which demographic and behavioral factors influence the awareness of the term "intelligent/smart transport" among respondents. A logistic regression model was used to analyze the impact of demographic and behavioral variables on the awareness of the term "intelligent/smart transport." Logistic regression is appropriate for modeling the relationship between a dichotomous dependent variable and a set of independent variables. The data collected in the study were cleaned of missing values and coded appropriately, as described below. To achieve the research aim, the following auxiliary hypotheses were adopted:

H1: The age of respondents significantly impacts the awareness of the term UIT.
H2: The area of residence significantly impacts the awareness of the term UIT.
H3: The gender of respondents significantly impacts the awareness of the term UIT.
H4: The place of residence significantly impacts the awareness of the term UIT.
H5: Professional activity significantly impacts the awareness of the term UIT.
H6: The mode of transportation significantly impacts the awareness of the term UIT.

First, the variables used in the model were defined. The dependent variable (X0) was the awareness of the term UIT (assigned 1 if the respondent knew the term and 0 if not). The independent variables (x1-x6) in this case were:

- x_1 - age (0 for 10-19 years, 1 for 20-25 years, 2 for 26-35 years, 3 for 36-50 years, 4 for 51-65 years and 5 for 66+ years),
- x_2 - area of residence (1 for Poland, 2 for EU countries other than Poland, 3 for Turkey),
- x_3 - gender (0 for male, 1 for female),
- x_4 - place of residence (0 for city center, 1 for city, 2 for other),
- x_5 - professional activity (0 for student, 1 for employee, 2 for employer, 3 for other),
- x_6 - most frequently chosen mode of transportation (1 for walking and other non-mechanized means, 2 for public transport, 3 for own road vehicle).

The independent variables (x_1 – x_6) were used to predict the dependent variable X0. The logistic regression model can be written in the form of an equation that describes the relationship between the independent variables and the dependent variable. For this model, the equation will look as follows:

$$\text{logit}\,(p) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6,$$

where:

- logit (p) is a a logarithm odds (log-odds) that ppp (the probability that the respondent has heard of the term UIT) is equal to 1,
- β_0 is an intercept (constant),
- $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$, are the regression coefficients for the individual independent variables.

The results of the analysis are presented in Table 5.

Table 5. **Odds Ratio results**

Variable	Odds Ratio	Dev. std.	Z value	P>|z|	95% Cl lower	95% Cl upper
Const	-1.4787	0.644	-2.297	0.022	-2.74	-0.217
Age	0.0264	0.095	0.278	0.781	-0.159	0.212
Area	0.4506	0.174	2.586	0.01	0.109	0.792
Gender	-0.1235	0.185	-0.668	0.504	-0.486	0.239
Place of living	-0.1629	0,134	-1.214	0.225	-0.426	0.1
Activity	-0.3485	0.118	-2.942	0.003	-0.581	-0.116
Transport mode	0.7099	0.18	3.942	0	0.357	1.063

Source: own study

Considering the above coefficients, the model for the analyzed example will take the following form:

$$\text{logit}(p) = -1.48 + 0.03x_1 + 0.45x_2 - 0.12x_3 - 0.16x_4 - 0.35x_5 + 0.71x_6$$

Regarding Hypothesis H1, which assumes that the age of respondents significantly impacts the awareness of the term "intelligent/smart transport," it can be stated that β_1 is 0.0264, and this result is not statistically significant ($p = 0.781$). This means that age does not significantly affect the awareness of the term UIT. Therefore, Hypothesis H1 should be rejected. On the other hand, the coefficient β_2 for the variable x_2 (Area) is 0.4506 and is statistically significant ($p = 0.010$). This means that respondents from EU countries (excluding Poland) and Turkey have greater log-odds awareness of the term compared to respondents from Poland. Therefore, there is no basis to reject Hypothesis H2: The area of residence significantly impacts the awareness of the term "intelligent/smart transport." However, Hypothesis H3 should be rejected, as the coefficient β_3 for the variable x_3 (gender) is 0.12 and is not statistically significant ($p = 0.504$). This means that gender does not significantly affect the awareness of the term UIT. The same applies to Hypothesis H4. The coefficient for place of residence (Place of living) is -0.1629 and is not statistically significant ($p = 0.225$). This means that the place of residence does not significantly affect the awareness of the term "intelligent/smart transport." Therefore, Hypothesis H4 should be rejected. On the other hand, regarding the impact of professional activity on the awareness of the term UIT, the coefficient is -0.3485 and is statistically significant ($p = 0.003$). This means

that employees and employers have lower log-odds awareness of the term compared to students. Therefore, there is no basis to reject Hypothesis H5. The same applies to Hypothesis H6 - the coefficient β_6 at the level of 0.71 is considered as statistically significant ($p < 0.001$). Therefore, there is no basis to reject this hypothesis. This means that people using public transport or other means of transportation (walking, cycling, scooter) have greater awareness of the term UIT compared to those using their own transport.

In the next step of the study, respondents' opinions regarding the necessity for municipal authorities to provide information about UIT to society (Table 6), the evaluation of information activities on UIT (Table 7), and the information channels used by respondents to seek information about local transport (Table 8) were also analyzed.

As can be seen from the results in Table 6, the majority of respondents believe that information about UIT should be provided by municipal authorities. In Poland, as many as 90% of respondents expressed this opinion, compared to 67.9% in other EU countries and 59.6% in Turkey. This suggests that there is a very strong expectation for informational activities from municipal authorities in Poland. Overall, 84.3% of all respondents indicate the need for information about UIT, highlighting the importance of this issue at an international level.

Table 6. **The need of information about UIT solutions**

	Poland		Other EU countries		Turkey		Total	
	N	%	N	%	N	%	N	%
yes	397	90.0	57	67.9	28	59.6	482	84.3
no	17	3.9	8	9.5	8	17.0	33	5.8
don't know	27	6.1	19	22.6	11	23.4	57	10.0

Source: own study

As it can be seen in Table 7, the evaluation of municipal authorities' actions in informing about UIT is more varied. In Poland, the largest group of respondents (44.4%) rated these actions as average, while 25.9% had no opinion on the matter. Only 14.3% considered the actions good, and 15.4% considered them bad. In other EU countries, the ratings are more evenly distributed: 29.8% rated the actions as good, 29.8% as bad, and 23.8% as average. In Turkey, the ratings are more critical - 42.6% of respondents rated the actions as bad, only 27.7% as good, and 21.3% as average.

Table 7. **Urban authority assessment**

	Poland		Other EU countries		Turkey	
	N	%	N	%	N	%
bad	68	15.4	25	29.8	20	42.6
middly	196	44.4	20	23.8	10	21.3
good	63	14.3	25	29.8	13	27.7
don't know	114	25.9	14	16.7	4	8.5

Source: own study

Next, the results of respondents' answers regarding their search for information about the current state of the transportation system in their immediate vicinity were examined (results presented in Table 8). Here, it is important, that respondents had the option to select multiple answers.

Table 8. **Source of local transport information**

	Internet	Information from other people	Local radios	Local newspapers	Other	I don't need such information
Poland	88%	26%	22%	9%	1%	37%
Other EU countries	33%	18%	4%	12%	2%	48%
Turkey	36%	13%	4%	15%	9%	68%
Total	75%	24%	18%	10%	2%	41%

Source: own study

The analysis of the results shows that the Internet is the primary source of information for respondents. In Poland, as many as 88% of respondents indicated that they use the Internet to obtain information about the state of the transportation system. This is significantly higher compared to other EU countries (33%) and Turkey (36%). This indicates a strong reliance on digital sources of information among Polish respondents. Information from other people is the second most frequently chosen source, although much less popular than the Internet. In Poland, 26% of respondents obtain information from others, while in other EU countries and Turkey, this percentage is 18% and 13%, respectively. Local radios and newspapers are less popular sources of information. In Poland, 22% of respondents use local radio stations, while 9% use local newspapers. In

other EU countries, the respective values are 4% and 12%, and in Turkey, 4% and 15%. This indicates relatively low use of traditional media to obtain information about the state of transport. In the category of "other" sources of information (such as posters and information in public transport vehicles and at stops), regional differences are also noticeable. Meanwhile, a fairly large group of respondents declare that they do not seek such information at all (37% in Poland, 48% in other EU countries, and as many as 68% in Turkey).

5. Discussion

The analysis showed that 58% of respondents are familiar with the term "intelligent/smart transport," with the highest terminological awareness in Turkey (74.5%) and the lowest in Poland (56.5%). Nevertheless, only 40.9% of respondents notice the existence of UIT solutions in their city, with the highest awareness of these solutions in Turkey (68.1%) and the lowest in Poland (36.7%). These results suggest that, contrary to the hypothesis that society notices and accepts existing UIT solutions but does not know the term UIT, the situation is the opposite. More respondents declare familiarity with the term UIT than notice the implementation of such solutions in practice, indicating a gap between theoretical knowledge and practical experience regarding intelligent transportation systems.

The logistic regression analysis aimed at understanding which demographic and behavioral factors influence the awareness of the term "intelligent/smart transport" yielded significant findings. Age (H1), gender (H3), and place of residence (H4) do not significantly impact UIT awareness. In contrast, the area of residence (H2), professional activity (H5), and mode of transport (H6) significantly influence this awareness. Respondents from EU countries (excluding Poland) and Turkey show greater awareness of the term UIT compared to respondents from Poland. Employees and employers have lower log-odds awareness of the term compared to students, and people using public transport or other means of transport have greater awareness of the term UIT compared to those using their own vehicles.

In relation to hypothesis II, the results confirm the possibility of informing city authorities about the target groups in order to improve communication about UIT, which may in the long run help to raise the level of public assessment of the activities of these authorities. In light of these findings, the promotional campaign regarding UIT should be intensified among residents of Poland, where awareness of UIT solutions is the lowest. Additionally, the campaign should target employees and employers who show lower awareness of the term UIT, as well as individuals using their own road vehicles, to promote the benefits of intelligent transportation systems and encourage the use of more sustainable means of transport.

Moreover, the results presented in Table 6 suggest a widespread need and expectation for municipal authorities to inform the public about UIT, especially in Poland. However, the evaluations of these authorities' actions are mixed (Table 7), indicating a clear need for improvement, particularly in Turkey, where most respondents rate these actions negatively. Therefore, municipal information campaigns regarding UIT should be more intensive, especially in areas where evaluations are the lowest. The campaign should include various media. However, the Internet is the dominant source of information about the state of the transportation system, suggesting that informational campaigns on transport should be intensively conducted through digital channels. Information from other people also plays an important role, highlighting the importance of social networks and word of mouth. Traditional media, such as radios and newspapers, are less significant, although still used in some EU countries and Turkey. The diversity of other sources of information in Turkey indicates the need to tailor communication strategies to local specifics.

6. Conclusion

The study examined the level of public knowledge and recognition of Urban Intelligent Transportation (UIT) solutions across selected European countries, with a particular focus on the role of municipal authorities in disseminating information. Presented results underline the importance of well-structured, targeted information campaigns to enhance public engagement with UIT solutions. Future research should address the study's limitations by expanding the geographic scope and incorporating qualitative methods to explore public attitudes and behavioral responses in greater depth. Strengthening municipal communication strategies can ultimately support the broader adoption and acceptance of UIT, contributing to more efficient and sustainable urban transport systems. It should be noted that the presented results are part of a broader study prepared in the first version for respondents from Poland. No specific UIT solution was examined, but various, most frequently used in large cities. Therefore, for example, in the assessment of these solutions, an ordinal scale was used, not models of assessment of a given technology, which can be a limitation of the study.

References

Ali, A., Qureshi, M. A., Shiraz, M., & Shamim, A. (2021). Mobile crowd sensing based dynamic traffic efficiency framework for urban traffic congestion control. *Sustainable Computing: Informatics and Systems, 32*, 100608. https://doi.org/10.1016/j.suscom.2021.100608

Almeida, A., Brás, S., Sargento, S., & Oliveira, I. (2023). Exploring bus tracking data to characterize urban traffic congestion. *Journal of Urban Mobility, 4*, 100065. https://doi.org/10.1016/j.urbmob.2023.100065

Belbachir, A., El Fallah-Seghrouchni, A., Casals, A., & Pasin, M. (2019). Smart mobility using multi-agent system. *Procedia Computer Science, 151*, 447-454. https://doi.org/10.1016/j.procs.2019.04.061

Bucsky, P., & Juhász, M. (2022). Long-term evidence on induced traffic: A case study on the relationship between road traffic and capacity of Budapest bridges. *Transportation Research Part A: Policy and Practice, 157*, 244-257. https://doi.org/10.1016/j.tra.2022.01.018

Cederstav, F., Wandel, S., Segerborg-Fick, A., Rylander, D., Asp, T., & Ranäng, S. (2023). High capacity city transport with intelligent access - A Swedish case study of transporting excavated material. *Transportation Research Procedia, 72*, 712-718. https://doi.org/10.1016/j.trpro.2023.11.459

Chen, J., Hu, M., & Shi, C. (2023). Development of eco-routing guidance for connected electric vehicles in urban traffic systems. *Physica A: Statistical Mechanics and its Applications, 618*, 128718. https://doi.org/10.1016/j.physa.2023.128718

Głębocki, K. (2024). Smart city strategic planning: Are there social grounds in medium-sized Polish cities? *Polish Journal of Management Studies, 29*(1), 132-143. https://doi.org/10.17512/pjms.2024.29.1.08

He, R., Xiao, Y., Lu, X., Zhang, S., & Liu, Y. (2023). ST-3DGMR: Spatio-temporal 3D grouped multiscale ResNet network for region-based urban traffic flow prediction. *Information Sciences, 624*, 68-93. https://doi.org/10.1016/j.ins.2022.12.066

Hou, Q., Li, W., Zhang, X., Fang, Y., Duan, Y., Zhang, L., & Liu, W. (2020). Intelligent urban planning on smart city blocks based on bicycle travel data sensing. *Computer Communications, 153*, 26-33. https://doi.org/10.1016/j.comcom.2020.01.066

Hou, Y., Chen, J., & Wen, S. (2021). The effect of the dataset on evaluating urban traffic prediction. *Alexandria Engineering Journal, 60*(1), 597-613. https://doi.org/10.1016/j.aej.2020.09.038

Kujawski, A., & Dudek, T. (2021). Analysis and visualization of data obtained from camera mounted on unmanned aerial vehicle used in areas of urban transport. *Sustainable Cities and Society, 72*, 103004. https://doi.org/10.1016/j.scs.2021.103004

Liu, W., Gong, Y., Chen, W., & Zhang, J. (2020). EvoTSC: An evolutionary computation-based traffic signal controller for large-scale urban transportation networks. *Applied Soft Computing, 97*, 106640. https://doi.org/10.1016/j.asoc.2020.106640

Liu, Z., Jia, H., & Wang, Y. (2020). Urban expressway parallel pattern recognition based on intelligent IoT data processing for smart city. *Computer Communications, 155*, 40-47. https://doi.org/10.1016/j.comcom.2020.03.014

Minh, Q. T., Tan, P. D., Le Hoang, H. N., & Nhat, M. N. (2022). Effective traffic routing for urban transportation capacity and safety enhancement. *IATSS Research, 46*(4), 574-585. https://doi.org/10.1016/j.iatssr.2022.10.001

Ouallane, A., Bakali, A., Bahnasse, A., Broumi, S., & Talea, M. (2022). Fusion of engineering insights and emerging trends: Intelligent urban traffic management system. *Information Fusion, 88*, 218-248. https://doi.org/10.1016/j.inffus.2022.07.020

Pomianowski, A. (2023). The use of smartphone applications when buying public transport and paid parking zone tickets on the example of Szczecin. *Procedia Computer Science, 225*, 2449-2456. https://doi.org/10.1016/j.procs.2023.10.236

Sobral, T., Galvão, T., & Borges, J. (2020). An ontology-based approach to knowledge-assisted integration and visualization of urban mobility data. *Expert Systems with Applications, 150*, 113260. https://doi.org/10.1016/j.eswa.2020.113260

Tay, L., Lim, J. M., Liang, S., & Tay, Y. H. (2023). Urban traffic volume estimation using intelligent transportation system crowdsourced data. *Engineering Applications of Artificial Intelligence, 126*, 107064. https://doi.org/10.1016/j.engappai.2023.107064

Tu, Q., Cheng, L., Yuan, T., Cheng, Y., & Li, M. (2020). The constrained reliable shortest path problem for electric vehicles in the urban transportation network. *Journal of Cleaner Production, 261*, 121130. https://doi.org/10.1016/j.jclepro.2020.121130

Waqar, A., Alshehri, A. H., Alanazi, F., Alotaibi, S., & Almujibah, H. R. (2023). Evaluation of challenges to the adoption of intelligent transportation system for urban smart mobility. *Research in Transportation Business & Management, 51,* 101060. https://doi.org/10.1016/j.rtbm.2023.101060

Xia, D., Zheng, L., Tang, Y., Cai, X., & Sun, D. (2022). Dynamic traffic prediction for urban road network with the interpretable model. *Physica A: Statistical Mechanics and its Applications, 605,* 128051. https://doi.org/10.1016/j.physa.2022.128051

Xu, Y., Cai, X., Wang, E., Liu, W., Yang, Y., & Yang, F. (2023). Dynamic traffic correlations based spatio-temporal graph convolutional network for urban traffic prediction. *Information Sciences, 621*, 580-595. https://doi.org/10.1016/j.ins.2022.11.086

Yannis, G., & Chaziris, A. (2022). Transport System and Infrastructure. *Transportation Research Procedia, 60,* 6-11. https://doi.org/10.1016/j.trpro.2021.12.002

Yin, G., Huang, Z., Yang, L., Ben-Elia, E., Xu, L., Scheuer, B., & Liu, Y. (2023). How to quantify the travel ratio of urban public transport at a high spatial resolution? A nowel computational framework with geospatial big data. *International Journal of Applied Earth Observation and Geoinformation, 118,* 103245, https://doi.org/ 10.1016/j.jag.2023.103245

Zheng, Y., Wang, S., Dong, C., Li, W., Zheng, W., & Yu, J. (2022). Urban road traffic flow prediction: A graph convolutional network embedded with wavelet decomposition and attention mechanism. *Physica A: Statistical Mechanics and its Applications, 608*, 128274. https://doi.org/ 10.1016/j.physa.2022.128274