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Residents' Perception of Urban Water System-Based Environmental Issues

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Abstract: The present study aims to investigate the level of awareness among residents living around an urban stream regarding the issues arising from the stream and the degree to which they are affected by these problems. To achieve this goal, a face-to-face questionnaire-based survey was conducted with 270 randomly selected individuals using a proportional sampling method. We measured the awareness of residents about the issues arising from the urban stream, as well as their level of impact. The research determined that the inhabitants of the region were aware of and affected by various ecological, socio-cultural, land use, technical engineering, and management issues. The most important problems of which participants were aware included the low water quality, public order problems, the existence of unsafe, unused, and abandoned parts of the city on the stream banks and in the immediate vicinity of the stream, and the presence of a foul odor. Water pollution, public order problems, visual pollution, and the presence of a foul odor were identified as the problems most affecting the participants. Solution recommendations were developed under the five main headings of the identified problems.

Keywords: residents' perception; environmental awareness; urban water systems; environmental issues; Meles Stream

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1. Introduction

Water forms the chief constituent of an ecosystem. Water sources include rivers, lakes, glaciers, rainwater, ground water, etc. [1]. Water is the most vital element among the natural resources and is critical for the survival of all living organisms, including humans, food production, and economic development [2]. Water systems have been a subject of interest throughout history, and they play a significant role in the ecological, social, and cultural dynamics of urban landscapes. They provide a habitat for various species, affect the environmental quality and microclimatic comfort, fulfill the recreational needs of people, and contribute to shaping the urban identity. As such, water systems are important components of urban environments [3]. As humans transitioned to settled life, the importance of water evolved from a mere survival need to a primary factor in determining the location of settlements [4]. This situation has continued in the same way for thousands of years, and the world's most important settlements have always been located on the banks of streams and basins [5].

Urban water systems provide numerous benefits to city residents. Ecologically, these systems play a crucial role in maintaining the vitality of the city. Moreover, they serve as meeting places and social hubs, as well as providing opportunities for recreational activities. However, urban streams present numerous challenges, particularly in developing countries. These water systems are frequently impacted by a range of issues, including water pollution,

channelization, and stream bed invasion. In turn, the compromised condition of these systems poses a direct threat to urban residents, leading to a host of issues for cities.

Urban water is facing increasing pressure from population dynamics, climatic variables, and inefficiencies in the water supply and distribution systems, all of which raise questions about the future availability of water [6]. Urban water systems worldwide are seriously threatened by climate change, population growth, and urbanization: changing weather patterns, increasing anthropogenic activities, and more impervious surfaces lead to the degradation of the environmental quality and the increased risk of urban flooding [7].

Mitigating water pollution and protecting water resources have become urgent tasks for humanity today and are also important components of environmental risk assessment [8].

Water was primarily used for transportation during and after the industrial revolution, and the urban layout and location of functional areas in the city were shaped in this direction [4]. In modern times, however, water resources are facing increasing threats from various factors, such as the growing population, global warming, agricultural practices, industrialization, and urbanization [9]. Urban water supply systems are increasingly burdened because of the increase in population, economic growth, and lifestyle changes. Climate change puts additional pressure on the already stressed "urban water systems" by aggravating the challenges of water scarcity and water quality deterioration [10].

The available water sources throughout the world are becoming depleted, and this problem is aggravated by the rate at which populations are increasing, especially in developing countries [11]. The growth of urban areas brings significant changes in the physical properties of the land surface, increasing the vulnerability of inhabitants, agricultural land, and rural ecological life-supporting systems [12]. In addition, urban activities and related infrastructure alter the natural patterns of streams' physical and chemical conditions [13]. Urban water systems are subject to increasing uncertainty as a result of rapid urbanization and the densification of built-up areas, economic development, changes in climate, and the interconnections with energy and food systems [14].

The areas where pollution poses the greatest threat are typically water basins located in densely populated areas near the city center. The deterioration of these water basins can be attributed to a variety of factors, including incorrect practices in settlement, industrialization, and land use. As a result, the issue of pollution in these areas has become increasingly pressing, requiring immediate action to mitigate its impact on both the natural environment and human health [15].

The Meles Stream, selected as the research area for this study, is subject to the pressures of urbanization, similar to any urban stream in the world. It flows through slums and industrial districts, suffering from pollution, stream bed narrowing, and channeling actions. Over time, the stream has lost its natural characteristics and has become obscured by residential or industrial areas. Consequently, the Meles Stream has become a prime example of the challenges faced by urban streams in developing countries and underscores the urgent need for effective strategies to mitigate the impacts of urbanization on these vital water systems.

To highlight the contribution of this study to the existing literature, it should be noted that only a limited number of studies have been conducted on the Meles Stream and its basin. Previous research has focused on examining the natural, historical, and social infrastructure of the Meles Delta and its surrounding areas, explaining the rehabilitation processes of the delta, identifying existing environmental problems, and introducing planning and design solutions [16–21]. However, no study has investigated the awareness of residents living in the vicinity of the Meles Stream of the environmental problems and their level of exposure to these problems.

This research addresses the following questions:

- Are the participants aware of the ecological, socio-cultural, land use, technical engineering, and management problems?
- Are participants affected by the ecological, socio-cultural, land use, technical engineering, and management problems?

- Do participants' awareness of these problems (ecological, socio-cultural, land use, technical engineering, and management) and their level of being affected differ according to their educational background?

We believe that our study will provide new insights to both the academic literature and policy makers, helping to identify effective solutions to the environmental challenges facing the Meles Stream and its surrounding areas. Since this research measures both the participants' awareness of these problems and the level to which they are affected by them, its contribution to the literature is important. The starting point of this study is to mobilize stakeholders from various sectors to address the problems associated with an urban stream and to develop practical solutions to these problems through a systematic process management approach. Specifically, the study seeks to determine the level of awareness among citizens living near an urban stream about the environmental challenges caused by the stream, as well as their level of exposure to these challenges. By doing so, the study aims to identify areas where stakeholders can work together to develop sustainable and effective solutions to these challenges, thereby improving the overall quality of life in the surrounding community. In addition, another aim of this study is to draw attention to the importance of groundwater and to emphasize the importance of effective use of groundwater resources in meeting increasing urban needs. In a study conducted in Jordan, sectoral allocation of underground resources was analyzed. It discussed how political and technical challenges can be overcome and proposed effective solutions [22].

2. Materials and Methods

2.1. Definition of the Research Area

The research was conducted in the urban area of İzmir, Turkiye, specifically in the Meles Stream Basin. The study area comprises the neighborhoods that have a physical boundary directly with the Meles Stream and includes a total of 25 neighborhoods within 3 districts: Buca, Karabağlar, and Konak (Figure 1).

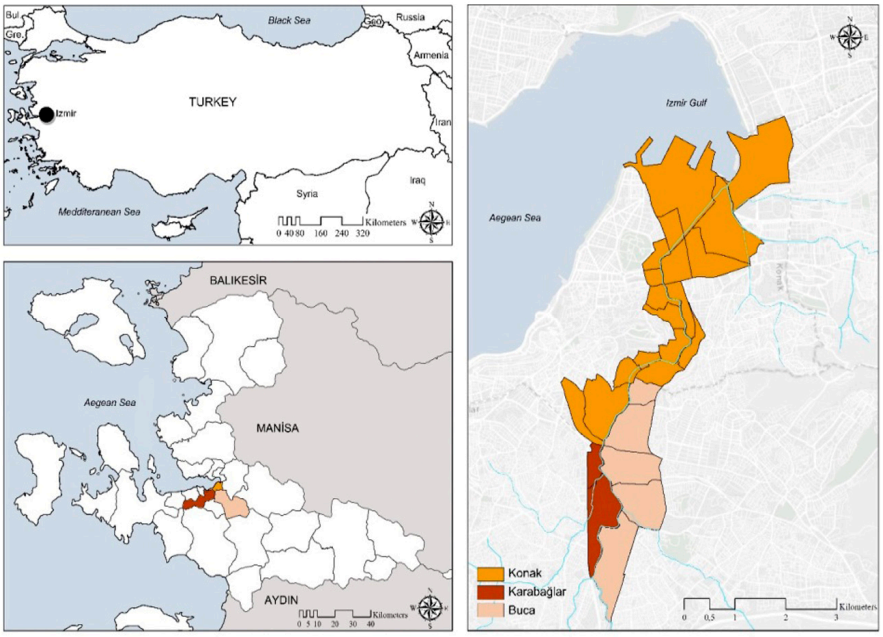


Figure 1. Location and definition of the research area.

The Meles Stream is a historically significant watercourse that flows into the sea in the city center of İzmir. The Meles Stream has been depicted in historical texts with its rushing waters and recreational activities on the shore, and it was associated with Homer, who was referred to as "Melesigenes", the "son of Meles". The cave where he was said to compose his poems was described as being near the source of the stream known as Meles Stream

today [23]. However, at present, there is hardly any trace left of the Meles Stream's once rushing waters. The impact of rapid urbanization in the 20th century had a detrimental effect on the stream and its surroundings, which in turn impacted the city and transformed the region from a point of interest into a problematic area. The existence of slums and industrial areas has had a direct negative impact on Meles Stream, with residents suffering from issues, such as waste disposal, infrastructural deficiencies, abandoned industrial areas, squatting, and inadequate reclamation and maintenance works. The Meles Stream runs between the east and south of the city of İzmir and flows into the Gulf of İzmir through the most densely populated and developed areas of the city; it has completely lost its natural character. The region where the research was conducted has crime and security-related problems due to its disconnection from the city center; the fact that the region is surrounded by highways also affects the social communication and spatial continuity. In addition, the presence of industrial organizations in the vicinity has negative effects on the health and quality of life of the residents living in that region. In this context, not only does the stream negatively affect the lives of the inhabitants of the area, but the fact that this area has become a problem also turns it into a threat to the city.

These problems not only have an adverse impact on public health but also on the environment. Thus, it is imperative to identify the issues affecting the region and propose suitable solutions. The boundaries of this research area were determined by the fact that the area contains historical aqueducts, flows through the slopes of Kadifekale, where İzmir was founded for the second time, and includes the areas where the first slums of İzmir were established; these areas constitute the most important urban transformation areas of İzmir today, and important ring roads (Flying Road, Yeşildere Road) are located within the boundaries of the study area.

2.2. Sample Size

The address-based population registration system data of the Turkish Statistical Institute for 2017 were used, and the total population living in the neighborhoods within the boundaries of the study area was 96,375 [24]. The proportional sample size formula was used to determine the number of people to be surveyed, with a 90% probability and a 5% margin of error as the basis [25,26]. Equation (1) is as follows:

$$n = \frac{Np(1-p)}{(N-1)\sigma 2px + p(1-p)} \quad (1)$$

where:

n = sample size;
p = proportion of households who will be included the sample;
N = number of households in the main population (96,375 people);
σ^2_{px} = variance (90% confidence interval and 5% margin of error);
(1.645 σ_{px} = 0.05, σ_{px} = 0.030395, σ^2_{px} = 0.000924).

The value $p = 0.50$, which gives the largest value in the multiplication of $p(1 - p)$, was accepted to calculate the sample size to be as large as possible. The survey was conducted with a total of 270 people living in these neighborhoods. The surveys were conducted in a total of 25 neighborhoods located within the borders of the research area. The number of people to be interviewed in each neighborhood was determined by considering the ratio of the total number of people living in the neighborhoods. A simple random sampling method was used in the selection of the participants. Then, in order to determine the urban residents' level of awareness and the impact of environmental issues, a face-to-face survey was conducted.

The survey aimed to identify how these problems, which were classified under five main headings, are perceived by the people living in the region. Thus, the awareness of the identified problems of the local people living in this region, their level of knowledge about the causes of the problems, and their level of being affected by the problems were determined.

2.3. Ethics Statement

This study, which was carried out between 2019 and 2020, was reviewed and approved by the Ege University Scientific Research Projects Coordination Unit. When the project was initiated, the Ege University Scientific Research Projects Coordination Unit did not have to obtain an ethics committee certificate for human research. The survey participants were invited to take part in a research study. They were first fully informed as to the intent and purpose of the study. The participants were included in the study after they were informed about the questionnaire.

The following text was read to the surveyed participants before they started the survey: "Participation in this study is completely voluntary. You have the right not to participate in the study or to withdraw from the study at any time after participation. Your response will be interpreted as consent to participate in the study. Do not be under any pressure or suggestion from anyone while answering the questions on the forms given to you. Personal information obtained from these forms will be kept completely confidential and will only be used for research purposes".

The consent procedure was carried out face-to-face. In this regard, informed consent was not obtained. The data were obtained by conducting a face-to-face survey with participants in 2020.

2.4. Analytical Framework

In research previously conducted by us in the same region [21], ecological, socio-cultural, land use, technical engineering, and management problems were identified as the five main headings with the participation of experts using the Delphi method. The problems determined in [21] were used to prepare the questionnaire form for the urban surveys. Once the preparation of the survey form was completed, a trial survey was conducted. Then, a face-to-face survey was conducted to determine how these five problems were evaluated by the urban people living in the region. The following types of questions were included in the questionnaire form:

Questions to define the user profile;
Questions to determine awareness of the problems;
Questions to determine the level of being affected by the problems;
Questions for a general evaluation (open-ended questions).

As a result of the survey, the profile of the residents was revealed, and the awareness of the residents regarding the issues and their level of being affected by them were identified. Finally, conclusions and recommendations were developed.

Statements revealing the awareness of the city residents and their level of being affected by the problems, classified as ecological, socio-cultural, land use, technical engineering, and management, were presented; whether they agreed with each statement/whether they were affected or not was evaluated using a Likert scale (1: not at all aware, 2: slightly aware, 3: somewhat aware, 4: moderately aware, and 5: extremely aware; 1: no effect, 2: minor effect, 3: neutral, 4: moderate effect, and 5: major effect). The answers given by the city residents to these problems are presented in tables, using descriptive statistics (frequency distribution, mean, minimum, maximum, standard deviation, and percentage distribution).

It was thought that the different demographic characteristics of the participants might affect their awareness and level of being affected by the problems. This study analyzed the level of the participants' awareness and level of being affected by problems according to gender, age, education, and income. However, significant results were not obtained for the variables of gender, age, and income. Significant results were found in terms of the participants' level of awareness, according to their level of education. In a study conducted in Jordan, textbooks were analyzed to understand how the education system acts as a platform for disseminating information on the water situation, its causes, and the possible solutions. It was concluded that education is important in raising awareness [27]. In this study, the results related to the level of education were included. It is critical to understand the perspectives, awareness, and levels of being affected of urban residents with varying

levels of education. As a result, it was statistically tested whether the participants differed in terms of their awareness of these problems, as well as whether their level of being affected was based on their educational status (0–5 years, 6–8 years, 9–11 years, and 12 years and above). The Kolmogorov–Smirnov and normal distribution tests were used first for continuous variables [28]. All of the variables studied did not have a normal distribution. Hence, the Kruskal–Wallis test was used. The Kruskal–Wallis test determines whether more than two identical or similar populations have a similar distribution [26,29–31].

The analytical framework of this research is shown in Figure 2.

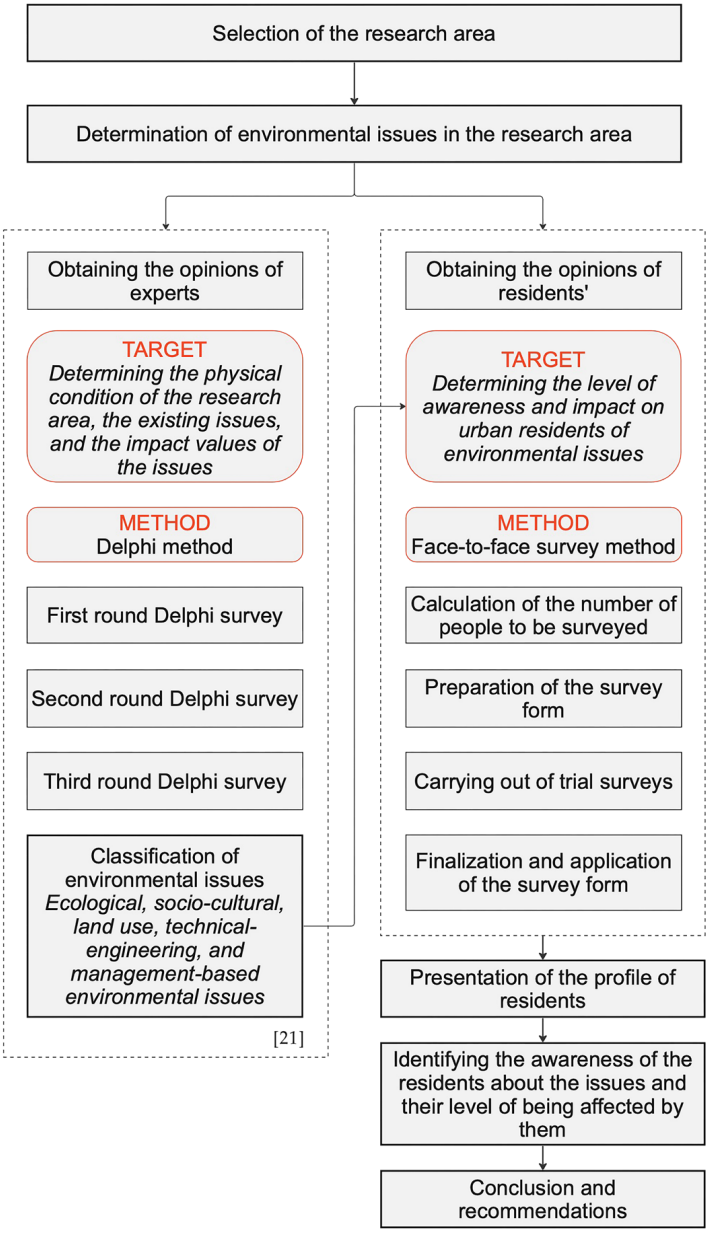


Figure 2. Methodology of the research.

3. Results and Discussion

3.1. Profile of the Participants

Among the participants, 50.7% of them were women, 54.1% were married, and 54.4% were working. The average age of the participants was 40 years. Among the participants, 50.3% of them were between 30 and 49 years old, and 23.3% were 50 years old and over. The average education period of the participants was about 10 years, and 44.1% of them had received education at the primary level. More than half of the participants (65.6%)

had a monthly total income of TRY 4000 or less. The rate of participants with a monthly income of more than TRY 5001 was only 8.1%. The participants had a minimum income of TRY 1500/month, a maximum of TRY 7000/month, and an average of TRY 3925/month. Among the participants, 57% of them stated that they had resided in İzmir since birth, and 48.9% of them stated that they had resided in the same neighborhood since birth (Table 1).

Table 1. Demographic characteristics of the participants.

Demographic Characteristics	Class	General	
		Number	%
Gender	Female	137	50.7
	Male	133	49.3
Age	Under 30	71	26.3
	30–39	63	23.3
	40–49	73	27.0
	50–59	34	12.6
	60+	29	10.7
	Min: 18, max: 78, mean: 39.76, standard deviation: 13.86		
Educational Level	Under 5 years	64	23.7
	6–8 years	55	20.4
	9–11 years	92	34.0
	12 years+	59	21.9
	Min: 0, max: 18, mean: 9.76, standard deviation: 3.56		
Working Status	Employed	147	54.4
	Unemployed	123	45.6
Household Income *	3000 TRY/month and under	65	24.1
	3001–4000 TRY/month	112	41.5
	4001–5000 TRY/month	71	26.3
	5001 TRY/month and above	22	8.1
	Min:1500 TRY, max: 7000 TRY, mean: 3925 TRY, standard deviation: 1023.63 TRY		
Length of Residence in İzmir	0–5 years	13	4.8
	6–10 years	14	5.2
	11–15 years	14	5.2
	16 years+	75	27.8
	Since birth	154	57.0
Length of Residence in the Neighborhood	0–5 years	25	9.3
	6–10 years	28	10.4
	11–15 years	18	6.7
	16 years+	67	24.8
	Since birth	132	48.9

Notes: * Turkish Lira (15.06.2020) USD 1 = 6.8343 TRY.

3.2. The Awareness of the Participants about the Problems and Their Level of Being Affected

Regarding ecological problems, the survey participants expressed their awareness of the issue of low water quality but were uncertain about how much they were affected by it (Table 2).

Table 2. Ecological problems, socio-cultural problems, and land use problems.

	Awareness Average *	Affected Average **
Ecological Problems		
Water pollution	3.43	3.53
Poor water quality	3.60	3.31
Lack of flora and fauna	3.15	2.92
Inability of the stream to create biological diversity	3.14	2.97
Negative effects of water pollution on aquatic organisms and their cycles	3.07	2.69
Decrease in the number of vegetation and animal species	3.11	2.44
Increased risk of soil erosion	2.98	3.01
Socio-Cultural Problems		
The stream and its surroundings do not enable use	3.34	3.10
Public order problems	3.83	3.63
Lack of lighting	3.43	2.96
Encouraging illegal or unlawful use	3.37	3.51
Seen as the source of many problems	3.24	3.16
Considered dangerous	3.80	3.47
Not knowing its value as a water system/underdeveloped awareness of conservation	3.27	3.04
Lack of belonging to the stream and the region in which the stream is located	2.73	2.62
The city has been erased from people's memory	3.04	2.49
The fact that the streams could not be integrated with the city and the daily life of the city	3.08	2.79
Low environmental awareness of people living in the immediate surroundings	3.30	3.10
Behaviors of people living/working nearby that increase the pollution problem	3.45	3.36
Land use problems		
Creating physical pressure on the natural structure of the stream due to industry, residences, etc.	3.01	2.81
The existence of a region with landslide risks in the immediate surrounding of the stream	3.08	3.05
Because the historical structure of the stream and its surroundings have not been protected, it has not been integrated with other historical sites in the city	3.16	2.73
Disconnection of the ecological connection between the Meles Delta and the Meles Stream	3.14	2.38
Lack of continuity of the stream in the city/not being visible	3.10	2.49
Lack of connection between the places along the banks of the Meles Stream	2.94	2.48
Presence of unsafe, unused, and abandoned urban parts of the stream and its immediate surroundings	3.49	3.26
Existence of living quarters and industrial facilities formed as a result of unplanned construction around the stream	3.37	3.12
The problem that the region has turned into an undesirable area	3.23	2.76

Table 2. *Cont.*

	Awareness Average *	Affected Average **
The fact that spatial solutions have not been proposed in the immediate surroundings of the stream that will respond to the increasing number of people in the near future	3.24	2.77
The fact that the stream is not integrated with the planning system of the city	2.77	2.70
The fact that the relationship between the stream system, the central parts of the city, and the Gulf of İzmir could not be established	2.61	2.41

Notes: * 1: Not at all aware, 2: slightly aware, 3: somewhat aware, 4: moderately aware, and 5: extremely aware; ** 1: no effect, 2: minor effect, 3: neutral, 4: moderate effect, 5: major effect.

They were also unsure about their level of awareness and impact related to certain problems, such as the lack of vegetation and fauna, the stream's inability to support biodiversity, and the adverse effects of water pollution on aquatic organisms and their cycles (Table 2).

One of the problems in terms of the socio-cultural dimension, namely public order, was perceived by participants as one that they were both aware of and affected by. Participants in the survey were undecided about their level of awareness about the problem of encouraging illegal or unlawful use; however, they were affected by it. Participants were aware of the problem of the area being considered dangerous; however, they were undecided about the level of being affected by this problem. The participants were undecided about their level of awareness as well as their level of being affected by the other socio-cultural problems (Table 2).

The participants were undecided about their awareness of other problems, such as the "Disconnection of the ecological connection between the Meles Delta and the Meles Stream", "Lack of continuity of the stream in the city/not being visible", "Lack of connection between the places along the banks of the Meles Stream", and "The fact that the relationship between the Stream system, the central parts of the city, and the Gulf of İzmir could not be established"; however, they stated that they thought they were less affected by these problems. The participants were undecided about their awareness of many problems in the land use dimension and their level of being affected by these problems (Table 2).

While participants were undecided about their awareness of the problem of the "Deterioration of the streamflow regime due to the change in the stream bed", which is one of the problems in the technical engineering dimension, they were less affected by this problem. The participants in the survey were undecided about both their awareness of and level of being affected by all the other problems within the technical engineering dimension (Table 3).

Table 3. Technical engineering problems and management problems.

Technical Engineering Problems	Awareness Average *	Affected Average **
Deterioration of the streamflow regime due to the change in the stream bed	2.87	2.27
Enclosing the stream in a concrete canal from place to place/closing and taking it underground	2.72	2.56
Since it is underground in some regions, the water trace cannot be followed, and the linear water system feature weakens	2.84	2.57
Increased risk of flooding/overflowing	2.90	2.89
Interventions to the stream bed negatively affect the urban natural ecosystem	3.10	2.67
Infrastructure problems (such as electricity, drainage, and transportation)	3.23	3.06

Table 3. *Cont.*

Management Problems	Awareness Average *	Affected Average **
Threat of water pollution to public health	3.81	3.56
Existence of buildings that are perceived as unsafe in the immediate surroundings of the stream	3.68	3.55
Existing roadway making access difficult	3.54	3.35
Lack of transportation alternatives	3.60	3.57
Almost no bike and walking paths	3.93	3.69
Insufficient overpasses	4.08	3.68
No stopping, waiting, or parking facilities on the stream coast	3.65	3.09
The fact that the Meles Stream and its coast could not be connected with other open areas of the city	3.34	3.04
Existence of a foul odor	4.14	3.77
Visual pollution	4.03	3.81
Water pollution (garbage, other solid waste, and organic/inorganic materials)	4.01	3.80
Discomfort caused by the density of insects, flies, mosquitoes, and other pests in the area as a result of waste	3.81	3.69
Having a negative impact on the image of the city	3.78	3.60
Existence of visual pollution (due to water, waste, illegal structures, etc.)	3.79	3.26
Insufficient knowledge of important historical heritage sites/lack of re-functioning	2.93	2.63
The fact that while it was the symbol of the city of İzmir in the past, it cannot preserve its historical value today	3.15	2.55
The fact that the Meles Stream, as a natural ecosystem, is not taken as a reference for the future of the city	3.14	2.61
The negative impact of the pollution problems of the stream on residential and business areas	3.43	3.40
The resolution of existing problems, such as pollution/odor/garbage, etc., turns into problems with increasing costs day by day	2.83	2.70
Producing daily solutions for the studies carried out on the stream and its delta	3.37	3.11
Presence of intensive illegal construction and wrong development practices in the stream bed	3.63	3.05
Inadequacy of the measures taken/necessary to fight climate change	2.62	2.37
The problem of buildings used as residences and workplaces in the stream bed	3.14	2.36
Not considering the stream as part of the natural environment	2.79	2.67

Notes: * 1: Not at all aware, 2: slightly aware, 3: somewhat aware, 4: moderately aware, and 5: extremely aware; ** 1: no effect, 2: minor effect, 3: neutral, 4: moderate effect, and 5: major effect.

The participants were aware of the following problems: "Threat of water pollution to public health", "Existence of buildings that are perceived as unsafe in the immediate surroundings of the stream", "Lack of transportation alternatives", "Almost no bike and walking paths", "Insufficient overpasses", "Presence of a foul odor", "Visual pollution", and "Water pollution", and they were affected by these problems. The participants were also aware of the problems of the "Presence of visual pollution" and the "Presence of intensive illegal construction and wrong development practices in the stream bed"; however, they were undecided about their level of being affected (Table 3).

3.3. Participants' Awareness of the Problems Depending on Their Education Level

According to the education level of the participants, the differences between their awareness of ecological, socio-cultural, land use, technical engineering, and management problems and their levels of being affected were determined. Participants in the first and second groups with a low level of education were more aware of the water pollution problem than the participants in the third and fourth groups with a higher education level, and the difference was found to be statistically significant (Table 4).

Table 4. Awareness of the survey participants about the problems, according to their educational level.

	First Group ≤5 years	Second Group 6–8 years	Third Group 9–11 years	Fourth Group 12 years+	General
Ecological Problems					
Water pollution *	3.81	3.58	3.20	3.24	3.43
Poor water quality *	3.95	3.36	3.66	3.34	3.60
Lack of flora and fauna	3.34	2.93	3.20	3.07	3.15
Inability of the stream to create biological diversity	2.87	3.38	3.14	3.20	3.14
Negative effects of water pollution on aquatic organisms and their cycles	2.98	3.31	3.05	2.98	3.07
Decrease in the number of vegetation and animal species	2.97	3.15	3.03	3.37	3.11
Increased risk of soil erosion	3.08	3.11	2.85	2.95	2.98
Socio-Cultural Problems					
The stream and its surroundings do not enable use *	3.19	3.33	3.78	2.81	3.34
Public order problems *	4.02	4.18	3.80	3.32	3.83
Lack of lighting	3.58	3.27	3.36	3.51	3.43
Encouraging illegal or unlawful use *	3.70	3.13	3.32	3.34	3.37
Seen as the source of many problems	3.22	3.29	3.07	3.47	3.24
Considered dangerous *	3.78	3.47	3.78	4.14	3.80
Not knowing its value as a water system/ underdeveloped awareness of conservation **	3.39	3.22	3.40	2.97	3.27
Lack of belonging to the stream and the region in which the stream is located *	2.25	2.78	3.12	2.61	2.73
The city has been erased from people's memory *	2.70	3.33	3.22	2.86	3.04
The fact that the streams could not be integrated with the city and the daily life of the city **	2.75	3.24	3.12	3.24	3.08
Low environmental awareness of people living in the immediate surroundings	3.13	3.64	3.16	3.41	3.30
Behaviors of people living/working nearby that increase the pollution problem *	3.72	3.29	3.30	3.53	3.45
Land Use Problems					
Creating physical pressure on the natural structure of the stream due to industry, residences, etc.	2.80	3.15	3.05	3.03	3.01

Table 4. *Cont.*

	First Group ≤5 years	Second Group 6–8 years	Third Group 9–11 years	Fourth Group 12 years+	General
Existence of a region with landslide risk in the immediate surroundings of the stream	3.03	3.11	3.12	3.03	3.08
Because the historical structure of the stream and its surroundings have not been protected, it has not been integrated with other historical sites in the city **	3.33	3.27	3.11	2.95	3.16
Disconnection of the ecological connection between the Meles Delta and the Meles Stream	2.86	3.24	3.33	3.05	3.14
Lack of continuity of the stream in the city/not being visible	2.95	2.82	3.37	3.08	3.10
Lack of connection between the places along the banks of the Meles Stream	3.05	2.87	2.91	2.93	2.94
Presence of unsafe, unused, and abandoned urban parts of the stream and its immediate surroundings *	3.69	3.15	3.68	3.31	3.49
Existence of living quarters and industrial facilities formed as a result of unplanned construction around the stream	3.59	3.20	3.40	3.22	3.37
The problem that the region has turned into an undesirable area	3.16	3.07	3.43	3.14	3.23
The fact that spatial solutions have not been proposed in the immediate surroundings of the stream that will respond to the increasing number of users in the near future	3.30	3.20	3.25	3.20	3.24
The fact that the stream is not integrated with the planning system of the city	2.73	2.80	2.95	2.49	2.77
The fact that the relationship between the Stream system, the central parts of the city, and the Gulf of İzmir could not be established	2.70	2.24	2.68	2.73	2.61
Technical Engineering Problems					
Deterioration of the streamflow regime due to the change in the stream bed **	2.91	2.58	3.10	2.73	2.87
Enclosing the stream in a concrete canal from place to place/closing and taking it underground *	2.27	2.62	3.08	2.76	2.72
Since it is underground in some regions, the water trace cannot be followed, and the linear water system feature weakens	2.63	2.76	3.02	2.86	2.84
Increased risk of flooding/overflowing *	2.48	3.11	2.92	3.10	2.90
Interventions to the stream bed negatively affect the urban natural ecosystem	2.95	3.15	3.14	3.14	3.10
Infrastructure problems (such as electricity, drainage, and transportation) *	3.37	3.02	3.45	2.92	3.23
Management Problems					
Threat of water pollution to public health *	4.28	3.89	3.66	3.44	3.81
Existence of buildings that are perceived as unsafe in the immediate surroundings of the stream	3.94	3.64	3.48	3.76	3.68

Table 4. *Cont.*

	First Group ≤5 years	Second Group 6–8 years	Third Group 9–11 years	Fourth Group 12 years+	General
Existing roadway making access difficult	3.56	3.35	3.58	3.66	3.54
Lack of transportation alternatives	3.77	3.67	3.46	3.56	3.60
Almost no bike and walking paths	4.28	3.89	3.72	3.92	3.93
Insufficient overpasses *	4.37	3.96	3.87	4.20	4.08
No stopping, waiting, or parking facilities on the stream coast	3.77	3.44	3.63	3.75	3.65
The fact that the Meles Stream and its coast could not be connected with other open areas of the city *	2.86	3.33	3.48	3.66	3.34
Existence of a foul odor *	4.53	4.16	3.95	4.02	4.14
Visual pollution *	4.34	4.11	3.90	3.83	4.03
Water pollution (garbage, other solid waste, and organic/inorganic materials) *	4.23	3.96	3.74	4.22	4.01
Discomfort caused by the density of insects, flies, mosquitoes, and other pests in the area as a result of waste	3.86	3.78	3.84	3.75	3.81
Having a negative impact on the image of the city	3.88	3.89	3.80	3.53	3.78
Existence of visual pollution (due to water, waste, illegal structures, etc.)	3.94	3.78	3.82	3.58	3.79
Insufficient knowledge of important historical heritage sites/lack of re-functioning	2.69	3.04	2.95	3.05	2.93
The fact that while it was the symbol of the city of İzmir in the past, it cannot preserve its historical value today	3.09	3.22	3.30	2.90	3.15
The fact that the Meles Stream, as a natural ecosystem, is not taken as a reference for the future of the city	3.13	2.96	3.17	3.27	3.14
Negative impact of the pollution problems of the stream on residential and business areas *	3.84	3.35	3.45	3.03	3.43
The resolution of existing problems, such as pollution/odor/garbage, etc., turns into problems with increasing costs day by day	2.58	2.67	2.92	3.12	2.83
Producing daily solutions for the studies carried out on the stream and its delta	3.56	3.44	3.26	3.27	3.37
Presence of intensive illegal construction and wrong development practices in the stream bed	3.56	3.65	3.67	3.59	3.63
Inadequacy of the measures taken/necessary to fight climate change *	2.33	2.27	2.73	3.10	2.62
The problem of buildings used as residences and workplaces in the stream bed **	2.91	3.24	3.01	3.51	3.14
Not considering the stream as part of the natural environment **	2.39	2.85	2.97	2.88	2.79

Notes: 1: Not at all aware, 2: slightly aware, 3: somewhat aware, 4: moderately aware, 5: extremely aware; * the difference between groups according to the Kruskal–Wallis test was significant for $p < 0.05$; ** the difference between groups according to the Kruskal–Wallis test was significant for $p < 0.10$.

The participants in group 2 (6–8 years) were more aware of the problem of public order in the socio-cultural dimension. Participants in the fourth group with a higher education level were undecided on the problem of public order. The difference in public order problems between the groups was found to be statistically significant. As education levels rose, people became less aware of the public order problem. Participants with a low level of education (group 1) and participants with a high level of education (group 4) were more aware of the problem of "Behaviors of people living/working nearby that increase the pollution problem" than participants with other education levels (Table 4).

All the participants stated that they were undecided about their awareness of the problems of "Creating physical pressure on the natural structure of the stream due to industry, residences, etc.", "Existence of a region with landslide risk in the immediate surroundings of the stream", "The problem that the region has turned into an undesirable area", and "The fact that spatial solutions have not been proposed in the immediate surroundings of the stream that will respond to the increasing number of people in the near future", which are problems of land use (Table 4).

Participants in the first and third groups were aware of infrastructure problems (such as electricity, drainage, and transportation), which are among the technical engineering problems. Participants in the second and fourth groups were undecided about this problem. The difference in awareness of the infrastructure problem between groups was statistically significant (Table 4).

Participants in the fourth group with a high level of education were undecided about the problem of the "Threat of water pollution to public health", one of the management problems, whereas participants in the other groups were aware of it. As education levels rose, so did the awareness of this problem. With a score of 4.53, the participants in the first group with the lowest education level were quite aware of the problem of the presence of a foul odor, whereas the participants in the other groups were not; there was a significant difference between the groups (Table 4).

Participants from all educational levels were aware of the problem of visual pollution. According to the statistical analysis, the difference in awareness of the problem of visual pollution based on the educational groups was found to be significant. The visual pollution awareness of the participants decreased as their education level rose (Table 4).

Participants with a low level of education (in the first and second groups) were only partially aware of the problem of "The inadequacy of the measures taken/necessary to fight climate change". Participants with higher education levels (in the third and fourth groups) were more aware of this problem. As the education levels of the participants rose, so did their awareness of the problem. The participants in the fourth group with the highest education level had the highest level of awareness about the problem of buildings used as residences and workplaces in the stream bed. Participants in the other groups stated that they were undecided about the problem, and there was a significant difference between the groups (Table 4).

3.4. Participants' Level of Being Affected by the Problems, According to Their Education Level

Participants with 9 to 11 years of education who took the survey were undecided as to whether they were affected by the water pollution problem. However, participants with other levels of education were affected by this problem. The difference in the participants' level of being affected by the water pollution problem according to their education level was found to be statistically significant. Participants in Group 1 with a low level of education stated that the problem of the "Decrease in the number of vegetation and animal species" affected them slightly, whereas participants with higher education levels were undecided about whether this problem affected them (Table 5).

As the level of education increased, the level of being affected by the problem of public order decreased. Participants with a lower education level were more affected by this problem. Participants with less than five years of education were more affected by the problem of encouraging illegal or unlawful use. The average scores of the participants

in the second and third groups affected by this problem were 3.18 and 3.25, respectively. Participants with the highest level of education stated that they were affected by this problem, with a score of 3.58 (Table 5).

Table 5. Participants' level of being affected by the problems, according to their education level.

	First Group	Second Group	Third Group	Fourth Group	General
	≤5 years	6–8 years	9–11 years	12 years+	
Ecological Problems					
Water pollution *	3.92	3.62	3.21	3.54	3.53
Poor water quality *	3.84	2.87	3.30	3.15	3.31
Lack of flora and fauna	3.22	2.76	2.78	2.97	2.92
Inability of the stream to create biological diversity	2.81	3.11	2.90	3.10	2.97
Negative effects of water pollution on aquatic organisms and their cycles	2.81	2.73	2.76	2.42	2.69
Decrease in the number of vegetation and animal species *	1.80	2.55	2.72	2.63	2.44
Increased risk of soil erosion *	2.59	3.33	3.05	3.10	3.01
Socio-Cultural Problems					
The stream and its surroundings do not enable use	3.13	3.18	3.20	2.85	3.10
Public order problems *	3.92	3.76	3.60	3.25	3.63
Lack of lighting	2.95	2.76	3.02	3.05	2.96
Encouraging illegal or unlawful use *	4.11	3.18	3.25	3.58	3.51
Seen as the source of many problems	3.20	3.11	3.00	3.42	3.16
Considered dangerous *	3.75	3.16	3.47	3.44	3.47
Not knowing its value as a water system/underdeveloped awareness of conservation **	3.38	2.73	3.27	2.61	3.04
Lack of belonging to the stream and the region in which the stream is located	2.59	2.65	2.74	2.44	2.62
The city has been erased from people's memory *	2.50	2.45	2.73	2.14	2.49
The fact that the streams could not be integrated with the city and the daily life of the city **	2.61	3.07	2.84	2.64	2.79
Low environmental awareness of people living in the immediate surroundings *	2.50	3.42	3.21	3.31	3.10
Behaviors of people living/working nearby that increase the pollution problem **	3.59	3.16	3.34	3.31	3.36
Land Use Problems					
Creating physical pressure on the natural structure of the stream due to industries, residences, etc.	2.87	2.73	2.88	2.71	2.81
Existence of a region with landslide risk in the immediate surroundings of the stream	2.86	3.07	3.13	3.10	3.05
Because the historical structure of the stream and its surroundings have not been protected, it has not been integrated with other historical sites in the city	2.72	2.87	2.77	2.56	2.73

Table 5. *Cont.*

	First Group	Second Group	Third Group	Fourth Group	General
	≤5 years	6–8 years	9–11 years	12 years+	
Disconnection of the ecological connection between the Meles Delta and the Meles Stream	2.38	2.44	2.45	2.22	2.38
Lack of continuity of the stream in the city/not being visible	2.36	2.31	2.53	2.71	2.49
Lack of connection between the places along the banks of the Meles Stream	2.33	2.40	2.52	2.64	2.48
Presence of unsafe, unused, and abandoned urban parts of the stream and its immediate surroundings	3.27	3.38	3.35	3.00	3.26
Existence of living quarters and industrial facilities formed as a result of unplanned construction around the stream *	3.34	2.87	3.26	2.88	3.12
The problem that the region has turned into an undesirable area	2.55	2.78	2.89	2.78	2.76
The fact that spatial solutions have not been proposed in the immediate surroundings of the stream that will respond to the increasing number of people in the near future **	2.55	2.85	3.03	2.54	2.77
The fact that the stream is not integrated with the planning system of the city *	2.48	2.87	3.00	2.29	2.70
The fact that the relationship between the Stream system, the central parts of the city, and the Gulf of İzmir could not be established **	2.33	2.09	2.57	2.54	2.41
Technical Engineering Problems					
Deterioration of the streamflow regime due to the change in the stream bed	2.19	2.40	2.30	2.17	2.27
Enclosing the stream in a concrete canal from place to place/closing and taking it underground	2.30	2.42	2.80	2.59	2.56
Since it is underground in some regions, the water trace cannot be followed, and the linear water system feature weakens *	2.06	2.51	2.98	2.53	2.57
Increased risk of flooding/overflowing	2.63	2.89	2.91	3.15	2.89
Interventions to the stream bed negatively affect the urban natural ecosystem *	2.28	2.67	2.85	2.83	2.67
Infrastructure problems (such as electricity, drainage, and transportation)	3.02	2.71	3.27	3.12	3.06
Management Problems					
Threat of water pollution to public health *	3.98	3.60	3.39	3.34	3.56
Existence of buildings that are perceived as unsafe in the immediate surroundings of the stream	3.88	3.53	3.33	3.58	3.55
Existing roadway making access difficult	3.19	3.18	3.41	3.58	3.35
Lack of transportation alternatives	3.88	3.24	3.55	3.58	3.57
Almost no bike and walking paths	3.72	3.51	3.73	3.76	3.69
Insufficient overpasses *	4.08	3.36	3.80	3.36	3.68

Table 5. *Cont.*

	First Group	Second Group	Third Group	Fourth Group	General
	≤5 years	6–8 years	9–11 years	12 years+	
No stopping, waiting, or parking facilities on the stream coast	2.94	3.02	3.21	3.14	3.09
The fact that the Meles Stream and its coast could not be connected with other open areas of the city *	2.62	2.89	3.09	3.56	3.04
Existence of a foul odor *	4.16	3.58	3.71	3.64	3.77
Visual pollution *	4.13	3.73	3.58	3.92	3.81
Water pollution (garbage, other solid waste, and organic/inorganic materials) *	4.20	3.53	3.67	3.80	3.80
Discomfort caused by the density of insects, flies, mosquitoes, and other pests in the area as a result of waste *	4.06	3.73	3.66	3.29	3.69
Having a negative impact on the image of the city *	4.12	3.53	3.48	3.29	3.60
Existence of visual pollution (due to water, waste, illegal structures, etc.) *	3.17	2.87	3.40	3.49	3.26
Insufficient knowledge of important historical heritage sites/lack of re-functioning *	2.08	2.60	2.79	2.98	2.63
The fact that while it was the symbol of the city of İzmir in the past, it cannot preserve its historical value today *	2.34	2.51	2.92	2.24	2.55
The fact that the Meles Stream, as a natural ecosystem, is not taken as a reference for the future of the city	2.53	2.58	2.55	2.83	2.61
Negative impact of the pollution problems of the stream on residential and business areas *	3.70	3.07	3.50	3.22	3.40
The resolution of existing problems, such as pollution/odor/garbage, etc., turns into problems with increasing costs day by day *	2.25	2.45	3.14	2.73	2.70
Producing daily solutions for the studies carried out on the stream and its delta **	3.09	2.84	3.12	3.36	3.11
Presence of intensive illegal construction and wrong development practices in the stream bed **	3.33	3.09	2.92	2.92	3.05
Inadequacy of the measures taken/necessary to fight climate change *	2.17	1.73	2.62	2.78	2.37
The problem of buildings used as residences and workplaces in the stream bed *	1.89	2.62	2.55	2.32	2.36
Not considering the stream as part of the natural environment *	2.23	2.64	3.03	2.61	2.67

Notes: 1: No effect, 2: minor effect, 3: neutral, 4: moderate effect, 5: major effect; * the difference between groups according to the Kruskal–Wallis test was significant for $p < 0.05$; ** the difference between groups according to the Kruskal–Wallis test was significant for $p < 0.10$.

Participants of all educational levels expressed uncertainty about whether they were affected by the problems of the "Existence of living quarters and industrial facilities formed as a result of unplanned construction around the stream" and "The fact that spatial solutions have not been proposed in the immediate surroundings of the stream that will respond

to the increasing number of people in the near future", which were investigated in the dimension of space use. The difference in the level of being affected by these problems based on educational groups was significant (Table 5).

The participants with the lowest education level were less affected by the following problems: "Since it is underground in some regions, the water trace cannot be followed, and the linear water system feature weakens" and "Interventions to the stream bed negatively affect the urban natural ecosystem". Participants with lower education levels were undecided whether they were affected by these two problems. The difference according to the education level was significant.

The problem of the "Threat of water pollution to public health" affected the participants with the lowest education level, with a score of 3.98, and the participants in Group 2, with a score of 3.60. Participants in groups 3 and 4 were uncertain whether or not they were affected by this problem. The lack of transportation alternatives affected participants in hroups 1, 3, and 4. Group 2 participants were undecided about whether the lack of transportation alternatives affected them. The presence of a foul odor and visual pollution problems affected participants in the group with the lowest education level more than participants in the other groups. According to the education levels, there was a statistically significant difference between the presence of a foul odor and the level of being affected by visual pollution problems. Participants in groups 1 and 2 were less affected by the "Inadequacy of the measures taken/necessary to fight climate change", while participants with other education levels (groups 3 and 4) were undecided as to whether they were affected by this problem. The difference in the degree to which this problem affected people based on their education level was statistically significant (Table 5).

3.5. Opinions of the Participants about the Study Area and Its Immediate Surroundings

In total, 59.26% of the participants stated that the most important problem of the Meles Stream and its immediate surroundings was pollution/water pollution/odor. This was followed by the flood/overflowing risk (14.44%), the public order problem (7.04%), and the transportation/access problem (5.93%). Only 3.33% of the participants stated that the existence of slums/irregular urbanization was one of the most important problems, while 1.11% stated that infrastructure was a problem. Among the participants in the survey, 8.89% stated that they did not have any information or ideas on this subject.

Among the participants, 30.37% stated that they did not have any project expectations for the Meles Stream and its immediate surroundings. However, 23.33% stated that they have project expectations for maintenance/reclamation, 5.19% for infrastructure, 4.44% for flooding/overflowing, 1.11% for water pollution, and 0.37% for the development of transportation alternatives. On the other hand, 12.59% of the participants emphasized that they have expectations for permanent projects that will solve all the problems related to the Meles Stream and its immediate surroundings.

The participants were asked whether they had any expectations for public institutions and organizations to resolve the Meles Stream's problems. Among the participants, 33.33% stated that they had no expectations, 32.22% expected a permanent solution, 31.85% expected disciplined/continuous/quality service, and 2.59% expected to act together with a common mind.

The participants were asked to evaluate which institutions and organizations could be effective in solving the problems of the Meles Stream and its surroundings, using the Likert scale. Participants stated that İzmir Metropolitan Municipality (İBB), with a score of 3.83, and the General Directorate of İzmir Water and Sewerage Administration (İZSU), with a score of 3.62, could be quite effective in solving these problems. These were followed by Buca Municipality with 3.48 points, Konak Municipality with 3.39 points, and Karabağlar Municipality with 3.34 points. The participants stated that the municipalities of Buca, Konak, and Karabağlar could be moderately effective in solving the problems. Non-governmental Organizations (NGOs) and universities were also seen as institutions

that could be moderately effective in solving the problems of the Meles Stream and its surroundings (Table 6).

Table 6. Institutions and organizations that can be effective in solving the problems in and around the Meles Stream.

	No Effect (1)	Minor Effect (2)	Neutral (3)	Moderate Effect (4)	Major Effect (5)	Average
IBB	8 (%3.0)	17 (%6.3)	38 (%14.1)	156 (%57.8)	51(%18.9)	3.83
IZSU	10 (%3.7)	9 (%3.3)	95 (%35.2)	117 (%43.3)	39 (%14.4)	3.62
Buca Municipality	27 (%10.0)	32 (%11.9)	64 (%23.7)	78 (%28.9)	69 (%25.6)	3.48
Konak Municipality	19 (%7.0)	14 (%5.2)	96 (%35.6)	124 (%45.9)	17 (%6.3)	3.39
Karabağlar Municipality	32 (%11.9)	20 (%7.4)	87 (%32.2)	86 (%31.9)	45 (%16.7)	3.34
NGO	28 (%10.4)	26 (%9.6)	80 (%29.6)	100 (%37.0)	36 (%13.3)	3.33
Universities	46 (%17.0)	15 (%5.6)	98 (%36.3)	88 (%32.6)	23 (%8.5)	3.10

4. Conclusions

The results obtained from the surveys conducted in the city were analyzed and presented in this study, categorized under the headings of ecological, socio-cultural, land use, technical engineering, and management. The study revealed that residents are aware of and are affected by various aspects of these issues. Specifically, residents are affected by the water pollution problem, and they are aware of the low water quality problem. However, participants are uncertain about their level of awareness of and how affected they are by several other ecological problems.

The participants are both aware of and affected by the public order problem, which falls under the socio-cultural category. According to the study, the participants expressed their indecision regarding the problems of land use and technical engineering, which can be attributed to their lack of knowledge about these issues. On the other hand, the participants are aware of and affected by various issues examined under the management heading. These issues have an impact on their quality of life, including the risk of water pollution on public health, the presence of buildings that are considered unsafe in the immediate vicinity of the stream, the inadequate transportation alternatives, the lack of overpasses, and the absence of biking and walking paths.

The stream flowing through the industrial zone where the leather factories are located is faced with the problem of water pollution due to the discharge of industrial wastes and domestic wastes. In order to solve the ecological problems of the Meles Stream, it is necessary to develop projects that can repair the damaged ecological structure. By preventing wastewater flow into the Meles Stream, the water quality should be increased. The increase in water quality will ensure that the stream regains its ecological integrity. The enrichment of the vegetation on the banks of the stream will also be important in terms of reducing the risk of erosion. Measures should be taken to clean the stream beds of wastes and plants that may hinder the flow of water, not to cover the riverbeds, and to move industrial facilities out of the city and away from the riverbanks. It should be ensured that the governorship, municipality, institutions, and non-governmental organizations work on this issue in a coordinated manner.

The Meles Stream and its surroundings are not effectively used as a common living space to meet the socio-cultural needs of the people living here. The potential of this region, which is very important in terms of natural, archaeological, and cultural aspects, has not been fully utilized due to unhealthy urban development. For the people living there, the surroundings of the Meles Stream have a negative identity. This transforming effect, which will begin with the Meles Stream and its surroundings, will have a positive impact on the urban identity of İzmir. It will be important for the development of this region to maintain

the pattern of public places established along the gulf while also creating new social living spaces. In order to increase the awareness of the people living in this region, it is important for various institutions and organizations to organize meetings and to ensure people's participation in the solution to the problems.

This region, through which the stream passes, should have been the center of attraction for the city, but over time it has become a problematic area. In the projects developed for the resolution of existing problems, there is a need to transform the region in an integrated manner with an ecology-based planning approach that takes into account engineering and basic sciences, not piecemeal approaches. The Meles Stream should be integrated with the back areas of the city as soon as possible on the basis of the "Green Infrastructure Strategy" planning approach adopted by the İzmir Metropolitan Municipality. Existing construction plans and approaches should be reviewed in favor of the city and its settlers, and applicable changes should be made when necessary. The redefinition of the idle areas located on the shoreline of the stream and its immediate surroundings and bringing them into urban life is of great importance for the city of İzmir.

Around the world, projects for the restoration of water systems have been developed to increase the connectivity of water systems and cities, improve natural river habitats, protect them from flooding, and create/enhance recreational opportunities along the river, etc. In the realization of the recommendations developed for the research area, previous experiences were utilized, the world agenda was captured, and parallel studies were carried out on global problems. In addition, the fact that the outputs of this project will form a basis for cities experiencing similar problems around the world in the future will increase the scope, relevance, and depth of the issue on a global scale [32–37].

In this study, the participants were aware that the existence of unsafe, unused, and abandoned parts of the city along the coastal line and in the immediate vicinity of the stream poses a problem. For this reason, it should be ensured that the historical texture around the Meles Stream is protected and associated with the city center, i.e., the aqueducts should be restored, and efforts should be made to turn this environment into a natural living center.

The previous topographic features of the stream should be examined, it should be restored to its natural meandering structure, and it should be redesigned in a way that both accommodates the dynamic process of the river system and provides maximum benefit for its users. In order to prevent flooding and flood risk, the existing disaster action plans in this area should be reviewed, and all stakeholders working on this issue should be in collaboration.

Designing the Meles Stream beds in such a way as to integrate environmental, social, and engineering solutions in line with the foresight of green infrastructure systems will contribute to the solution of the problems.

The İzmir Metropolitan Municipality has prepared and continues to prepare strategies, projects, or plans that include multidimensional planning, design, and management issues at various scales and scopes, such as the "Green Infrastructure Strategy", the "Izmirdeniz Project", and the "UPI (Izmir Transportation Master Plan) 2030".

The main purpose of this study, which aims to identify the existing problems and the causes of these problems in the relationship between river–user–city and to propose solutions to the problems, is to raise awareness about water systems.

In this context, making arrangements for the distribution of necessary services between institutions within the borders of metropolitan and other municipalities, considering measures by local governments for visual, solid waste, and air pollution in urban areas, controlling domestic and industrial wastewater with integrated solutions, making it harmless to the environment by using advanced treatment technologies, establishing common treatment facilities at points where businesses are concentrated, and using natural gas energy source in all businesses and residential areas in the region, etc., are solution proposals that are very important in solving the stream's problems.

The suggestions mentioned above, based on the findings obtained in the research area, will firstly be useful in solving the problems specific to the research area, and then they will guide the analysis and evaluation studies of places with similar problems. This is because the protection and improvement of the quality of water resources is only possible by raising awareness on this issue.

Although the recommendations presented in the study seem to be relatively general, they are applicable to many similar examples around the world. Although the causes and diversity of the problems faced by water systems vary, raising awareness is always a useful tool in solving the problems faced by water systems. This makes it possible for academic knowledge to find its place and be applicable in urban management practices on a global scale.

Environmental and visual pollution in İzmir will be reduced to some extent if the suggestions developed for ecological, socio-cultural, land use, technical engineering, and management problems are applied as soon as possible. Some problems caused by unhealthy urbanization will be eliminated, gulf pollution will be avoided, and people living in and around the stream will have a healthier environment.

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