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EFFECT OF WATER FEATURES ON THE MICROCLIMATE OF RESIDENTIAL PROJECTS IN A HOT-ARID CLIMATE: A COMPARATIVE ANALYSIS

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ABSTRACT

This paper investigated the effect of water features on thermal comfort in a central open space of a residential project in a hot-arid climate. A crowded urbanized area in Baghdad was chosen as a case study a city. The methodology relied on a simulation method using ENVI-met 4.4.5 software to create a model of a residential project and obtain the levels of the predicted mean vote as well as four parameters associated with it. These parameters included, air temperature, mean radiant temperature, horizontal wind speed, and relative humidity. For the purpose of comparative analysis, four types of surfaces were modelled, a surface with a water feature, a vegetated surface, a concrete surface, and a combination of green and blue surfaces. The simulation results showed that a water feature can significantly decrease the levels of the predicted mean vote (PMV) index. It was even more effective than a vegetated surface in increasing thermal comfort levels in the microclimate of a residential project in a hot-arid climate.

Keywords: water feature, vegetated surface, residential projects, thermal comfort, ENVI-met, hot-arid climate

INTRODUCTION

The presence of water in its various forms plays an important role in enhancing the quality of the physical environment, and the socio-economic environment during the expansion process in cities (Bindu & Mohamed, 2016). This process is one of the most important reasons behind the change in the land cover which could cause the phenomenon of urban heat island (UHI) (Hyader & Hassan, 2020). According to the results of previous literature on UHI, one of the factors affecting this phenomenon is the mineralization of cities and the reduction of evaporation from urban green surfaces due to the replacement of vegetation cover with concrete and asphalt (Ballout et al., 2015). Therefore, the addition and inclusion of vegetation and water bodies within the urban fabric can improve thermal comfort. Trees act as a source of moisture, a temperature regulator, and an effective barrier that protects against sun radiation, wind (Hassan et al., 2019). In addition to plants, and tree shade, the effects of UHI can be

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minimized by evaporation from water bodies (rivers, lakes, ponds, etc.) which have higher evaporation rate as compared to vegetation and can thus enhance outdoor comfort and reduce energy consumption (Manteghi et al., 2016; Syafii et al., 2017).

Literatures on the importance of water features in the mitigation of UHI effects are few. A number of them argued that the presence of water bodies is the strongest cooling element in cities on hot summer days (Manteghi et al., 2015). In general, the high availability of water enhances evaporation, especially during the daytime, which leads to a decrease in air temperature in areas over or near water bodies (Du et al., 2016). It is believed that water bodies are the best absorbers of radiation, but on the other hand, their thermal response is limited due to the high heat capacity of water (Manteghi et al., 2015). This is because, it takes about three times the heat to raise one unit of water volume compared to soil, and thus, planners and architects tend to include water features in their designs (Manteghi et al., 2015). In previous research on water bodies concerning thermal comfort, it was found that there is a difference of 1 to 3°C between a river and an urban canyon inside the city on a hot day in Japan (Syafii et al., 2017). It was also found that a small river in the United Kingdom can reduce the temperature by approximately 1°C when the temperatures are higher than 20°C (Syafii et al., 2017). A small urban lake in Singapore, which has a hot and humid climate, led to a decrease of 1.3°C between the near and far regions of it (Ichinose, 2017). Moreover, a pond in Fukuoka in Japan has a 3°C effect extending up to 400 meters, and the effect of the Ota River in Hiroshima reaches 5°C above the river and it spreads 100 meters on the banks of the river, and another research revealed that the pond, which has an area of 4 square meters, is able to reduce the temperature of its surroundings (Robitu et al., 2004). However, the climatic effects of a water body depend on the direction and speed of the prevailing winds, the area of the water surface, and the design of the areas surrounding water bodies (Syafii et al., 2017).

For instance, when relatively small bodies of water are evenly distributed over an urban area, the reduction in temperature is more than that of one body of water of the same total volume (Gunawardena, 2017). The shape of water features is also important in distributing the cooling effect. The simpler or more regular shapes provide higher efficiency than the irregular shapes (Lee et al., 2016; Gunawardena, 2017; Mostofa & Manteghi, 2019) and the local thermal effect of water is higher during the daytime on hot days as compared to nighttime, especially at the end of summer, it may not have any effect (Gunawardena, 2017). Nonetheless, green spaces can also be used to reduce temperatures in hot climates through the reduction in radiation exchange on the surface of the earth. Field studies support the theory that the lack of plants in a city can lead to higher temperatures and increase the impact of UHI in the built environment. Given the positive effect of plants, designers must understand the interaction between the basic components (climate, buildings, plants) to reduce temperatures (Duarte et al., 2015). Vegetation affects the balance of thermal energy in cities, directly and indirectly. Directly by reducing air temperatures near the ground surface. It also modifies it indirectly by reducing the transfer of heat to occupied places, and thus reducing mechanical cooling loads and any thermal emissions from the urban fabric. The most discussed plant-based cooling process is transpiration, in which the water through the plant is evaporated by absorbing energy from solar radiation, which keeps tree leaves and the temperature of the surrounding atmosphere relatively cooler.

A review of previous studies on the effect of water bodies on UHI mentioned above in table 1 indicates that the main way in which blue and green surfaces affect the microclimate is based on evaporation, yet, the cooling effect of blue surfaces is more during the daytime as compared to nighttime. Therefore, both surfaces should be used together and included in future urban growth strategies, especially in countries experiencing high summer temperatures and rapid urbanization (Gunawardena, 2017). Although a large number of scholarly articles have pointed out the advantage of water bodies as the best means of passive cooling, they may not work perfectly

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Table 1. A summary of previous literature on the effect of water features on thermal comfort

Findings	Methodology	Reference
During hot summer day, a waterbody can effectively improve human comfort. Landscaping can improve human comfort	On-site measurements on hot summer days	(Xu et al., 2010)
Due to relatively high humidity, evaporative cooling may not be effective in a hot-humid tropical climate	Field measurements and calculations	(Wong et al., 2012)
The cool island effect of parks was greater than that of the lake	Using on-site measurements and regression analysis	(Li & Yu, 2014)
The larger the water areas, the more positive effects they have with a simplified shape	Using GIS software	(Lee et al., 2016)
The use of vegetation and water features, such as fountains, can improve thermal comfort, thus reduce the heat island. They also have good psychological effect on humans	Using ENVI-met software	(Ballout et al., 2015)
Traditional and innovative techniques using water features can create and improve passive cooling	A review of existing literature on passive cooling techniques	(De Joanna et al., 2016)
The thermal effects of lakes are stronger than the effect of rivers. Vegetation has a positive effect when combined with water features. Also, the geometry of the water body must be simple	Using satellite data of eighteen lakes and three rivers in a ring road in Shanghai, China	(Du et al., 2016)
The larger the water bodies, the greater the cooling effect, especially if it paralleled the direction of the wind. It might increase the absolute humidity, which may negatively affect pedestrians	Creating a miniature model of the urban environment formations with different formations of water bodies	(Syafii et al., 2017)
Centralized water can regulate the microclimate of residential district. Scattered water can improve the uniformity of microclimate. Water should be arranged parallel to prevailing wind direction	Using ENVI-met software	(Jin et al., 2017)
Water evaporation, shading and ventilation can reduce daytime PET of surroundings	Using ENVI-met software	(Cortesão et al., 2018)
Water features (waterfalls, fountains, and water curtains) might increase humidity beyond the comfort level, thus ventilation is necessary to maintain thermal balance	Furthermore, Computational Fluid Dynamics (CFD) is employed to process the data	(Seputra, 2018)
Vegetation, and water bodies improved the thermal environment in hot-dry climates. Yet, provided less cooling in compact urban spaces than in open areas	Reviewing existing literature on the mechanisms and cooling effects of four major mitigation strategies	(Lai et al., 2019)
The temperature is slightly lower near the lake and PET level showed a maximum decrease of 1.44°C	Field Measurements of four sites around Lake Kankaria using hand-held devices	(Gajjar & Devi, 2019)
increasing the size of water body with very simplified shape can have appositive impact on air temperature levels and thus, thermal comfort	Reviewing existing literature on water bodies' cooling effect	(Mostofa & Manteghi, 2019)
Thermal effects of small water bodies can be considered negligible in design practice. Shading, and natural ventilation can make the immediate surroundings of small water bodies cooler	Using ENVI-met 4.1.3 software	(Jacobs et al., 2020)

Source: own preparation.

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in hot and humid regions. Evaporation from water features, such as artificial waterfalls, water curtains, and fountains if applied in a warm humid climate, might increase air humidity beyond the comfort level (Seputra & Wong, 2012).

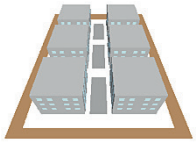
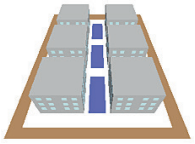
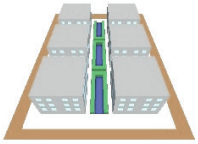
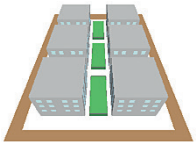
Therefore, the impact of relatively smaller water bodies represented in water features, such as large fountains and swimming pools, needs further research to measure the effect of a water feature upon its thermal condition. In response, this research investigates the impact of water feature's evaporative cooling on outdoor thermal comfort in urban canyons of residential projects, as compared to other surfaces such as a vegetated surface and a concrete pavement, in a hot arid climate. Psychological parameters associated with individual expectations affect thermal comfort. According to Fanger, this thermo-physiological comfort encompasses indexes such as physiological equivalent temperature (PET) and predicted mean vote (PMV) (Fanger, 1970). Here (PMV) is considered the most recognized thermal comfort model. It was developed by Fanger using and empirical studies to define comfort using experimental data about skin temperature obtained in a controlled climate chamber and principles of heat-balance equations. According to de Dear and Brager (1998) the main factors that determine heat loss and heat gain and influence thermal comfort include clothing insulation, air temperature, mean radiant temperature, metabolic rate, wind speed, and relative humidity (Dear & Brager, 1998).

In order to study these parameters and perform a comparative analysis, the methodology of this research relies on ENVI-met 4.4.5 software with an emphasis on the levels of PMV as well as four parameters associated with it. These parameters include air temperature, mean radiant temperature, horizontal wind speed, and relative humidity. The analysis in this software employs Fanger's equations to calculate the PMV of a group of people for a particular combination of the aforementioned parameters. Thermal neutrality is achieved when PMV equals zero, while the recommended limits of PMV to be within the comfort zone is within (-0.5<PMV<+0.5).

METHODOLOGY

In order to investigate the influence of water feature's evaporative cooling on urban canyons in residential projects, ENVI-met 4.4.5 software was used. For the purpose of comparative analysis, four scenarios of simulation modeling were used. See table 2 below for details.

Table 2. Simulation modeling scenarios

Simulation scenarios	Urban canyon surface type	ENVI-met model
Scenario no. 1	A residential project with a central space covered by concrete paving surface.	
Scenario no. 2	A residential project with a central space covered by water features (rectangular swimming pools).	
Scenario no. 3	A residential project with a central space covered by a combination of 50% water features (rectangular swimming pools) and 50% vegetated surfaces (dense hedge 2m).	
Scenario no. 4	A residential project with a central space covered by vegetated surfaces (dense hedge 2m).	

Source: own preparation.

A simple rectangular shape was chosen for the geometry of all proposed surfaces. These surfaces were modeled in a central open space which represents the urban canyon (12 m wide, 72 m long) surrounded by residential buildings (20 m × 20 m each) on both sides. Each of the four types of urban canyons was analyzed in three simulation models in which the urban canyon is flanked by:

– Low-rise residential buildings (3 stories, with a height of 10 m);

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– Mid-rise residential buildings (6 stories, with a height of 18 m);
– High-rise residential buildings (10 stories, with a height of 30 m).

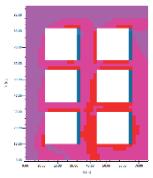
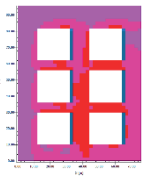
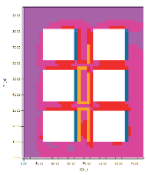
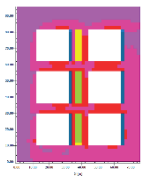
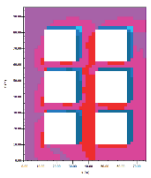
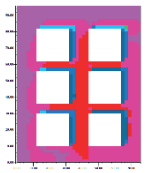
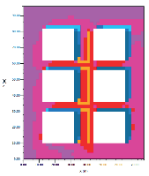
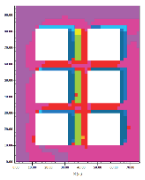
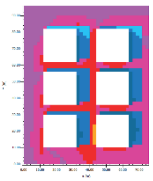
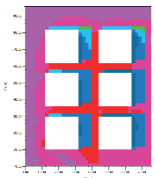
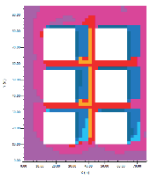
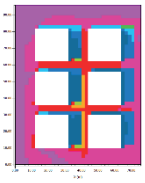
Therefore, the total number of simulations included 12 model output files in ENVI-met. Data were then collected and processed using Biomet which is a post-processor tool used for calculating Indices for human thermal comfort based on the output files. In terms of the location, a crowded urban area was chosen in Baghdad which is known for its hot-arid climate with extremely prolonged hot, dry summers and mild to cool short winters. Summer lasts for nearly 8 months. Therefore, high temperature is a major issue in Baghdad. The average maximum temperature from June through August is as high as 44°C (111°F). Even at night, temperatures in summer are rarely below 24°C (75°F) and the highest could reach up to 52°C (125°F). Humidity is typically under 50% in summer. Therefore, for the purpose of simulation, the temperature was set to range from 23°C to 50°C. One of the hottest days in summer was chosen, the 21st of July.

RESULTS AND DISCUSSION

Table 3 and table 4 below list the results obtained from a comparative analysis of 12 model output files of four types of urban canyons: A concrete surface, a surface containing a water feature, a combination of green and blue surfaces (50% each), and vegetated surface, in terms of PMV and four parameters associated with it in a central open space of three types of residential projects: low-rise, mid-rise, and high-rise buildings.

The levels of PMV for all four types of urban canyons are shown in figure 1. The peak of all four thermal comfort parameters associated with PMV

Table 3. A comparison among four types of surfaces in terms of PMV value

Surface type	Concrete surface Scenario no. 1		Water feature Scenario no. 2		Blue and green surfaces Scenario no. 3		Vegetated surface Scenario no. 4	
	Min	Max	Min	Max	Min	Max	Min	Max
PMV value	6.27	8.19	5.76	7.77	5.81	7.81	5.84	7.84
Low-rise residential buildings 3 stories								
PMV value	6.03	8.02	5.51	7.65	5.56	7.68	5.59	7.71
Mid-rise residential buildings 6 stories								
PMV value	5.81	7.88	5.38	7.57	5.39	7.60	5.45	7.62
High-rise residential buildings 10 stories								

Source: own preparation.

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Table 4. A comparison among four types of surfaces in terms of thermal comfort parameters (air temperature, humidity, mean radiant temperature (MRT), and wind speed) in a central open space of three residential projects: Low-rise, mid-rise, and high-rise

Residential Buildings type	Parameter	Concrete surface Scenario no. 1		Water feature Scenario no. 2		Blue and green surfaces Scenario no. 3		Vegetated surface Scenario no. 4	
		Min	Max	Min	Max	Min	Max	Min	Max
Low-rise buildings (LR) 3 stories	Air temp. (°C)	43.57	45.92	43.58	45.93	43.62	45.93	43.66	45.93
	MRT (°C)	57.25	77.37	50.39	71.95	50.43	72.53	50.90	72.82
	Wind speed (MPF)	0.21	2.05	0.19	2.02	0.19	2.02	0.20	2.02
	Relative humidity %	53.95	57.92	53.97	58.19	53.97	58.12	53.98	58.05
Mid-rise buildings (MR) 6 stories	Air temp. (°C)	43.49	45.92	43.49	45.93	43.52	45.93	43.55	45.93
	MRT (°C)	54.11	75.25	47.80	70.45	48.14	70.90	48.46	71.17
	Wind speed (MPF)	0.03	2.43	0.02	2.40	0.02	2.40	0.02	2.40
	Relative humidity %	53.94	58.23	53.96	58.49	53.97	58.48	53.97	58.42
High-rise buildings (HR) 10 stories	Air temp. (°C)	43.34	45.92	43.35	45.92	43.44	45.93	43.38	45.93
	MRT (°C)	51.82	73.60	46.63	69.52	46.84	69.90	46.82	70.11
	Wind speed (MPF)	0.03	2.91	0.03	2.88	0.03	2.80	0.03	2.88
	Relative humidity %	53.94	58.80	53.96	58.95	53.96	58.71	53.96	59.00

Source: own preparation.

is shown in figures 2, 3, and 4 below. The results can be described as follows:

– In scenario 1, concrete paving was used as a surface for the urban canyon. As compared to other surfaces, it had the highest indices in terms of PMV, and MRT. The results are most significant in the case of low-rise residential buildings and are non-significant in the case of mid-rise and high-rise residential buildings.
– In scenario 2, the concrete paving was replaced by water features (swimming pools). As compared to scenario 1, it caused a decrease in MRT average value of (6.14, 5.55, 4.63) °C, as well as a decrease in PMV level of (0.46, 0.44, 0.37) in the cases of low-rise (LR), mid-rise (MR), and high-rise (HR) buildings, respectively. Yet, there was a slight, nonsignificant increase in relative humidity of about 0.02%. The change in the rest of the analyzed parameters (wind speed and air temperature) was nonsignificant. Nonetheless, it can be stated that this scenario is the best among the four scenarios, and it is most visible in the case of low-rise residential buildings. See figures 2, 3, and 4 below for the average values of analyzed parameters.
– In scenario 3, a combination of green and blue surfaces (50% each) was used. Here, the results are very close to scenario 2 in terms the decrease in MRT. Yet, the PMV level was slightly higher. When compared to scenario 1. There was a decrease of (0.42, 0.4, 0.35) in PMV average level, and a decrease of (6.14, 5.55, 4.63) °C in the average MRT in the cases of low-rise (LR), mid-rise (MR), and high-rise (HR) buildings, respectively.
– In scenario 4, a vegetated surface was used. When compared to scenario 1, there was a decrease of (0.4, 0.37, 0.31) in PMV average level, and a decrease of (5.45, 4.87, 4.24) °C in the average MRT in the cases of low-rise (LR), mid-rise (MR), and high-rise (HR) buildings, respectively. Yet, scenario 4 indicated slightly higher indices when compared to scenarios 2 and 3.

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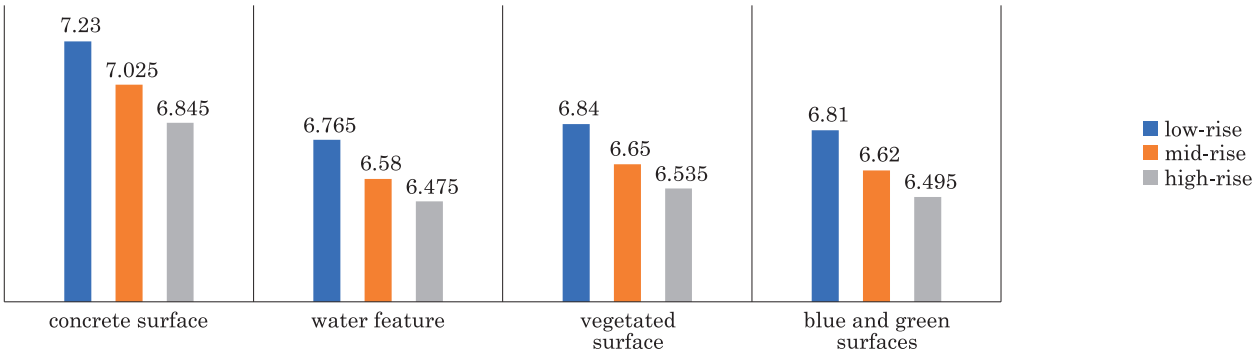

Fig. 1. Average PMV levels of four types of urban canyons flanked by of low-rise, mid-rise, and high-rise residential buildings, respectively
Source: own preparation based on Author.

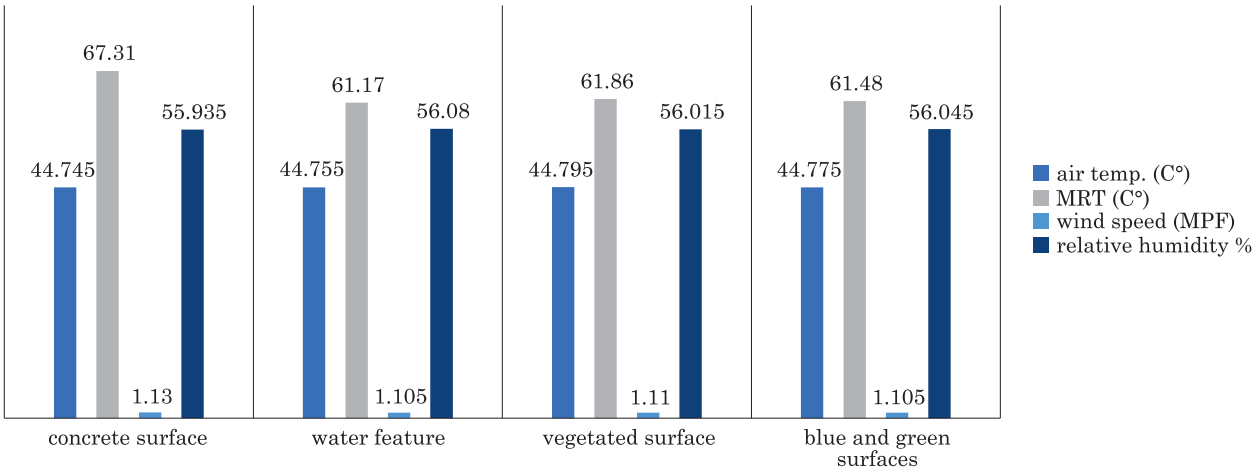

Fig. 2. Average levels of four thermal comfort parameters processed in an urban canyon flanked by low-rise residential buildings
Source: own preparation based on Author.

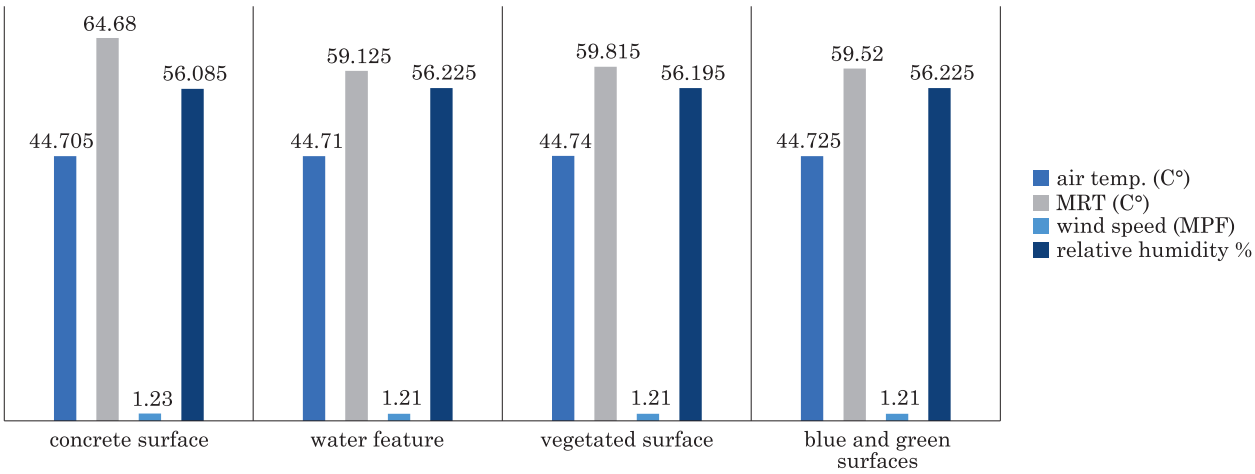

Fig. 3. Average levels of four thermal comfort parameters processed in an urban canyon flanked by mid-rise residential buildings
Source: own preparation based on Author.

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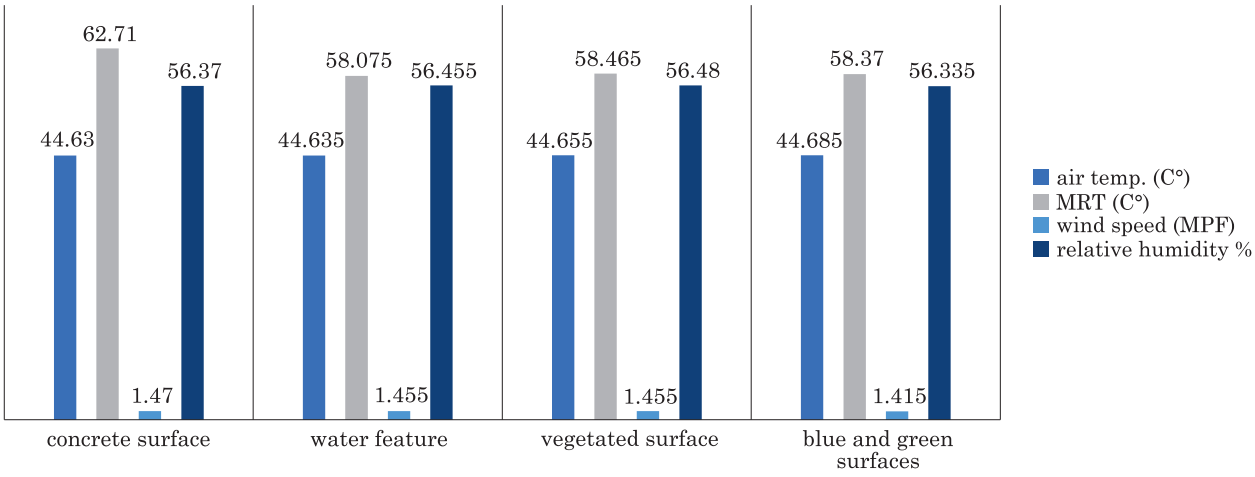

Fig. 4. Average levels of four thermal comfort parameters processed in an urban canyon flanked by high-rise residential buildings
Source: own preparation based on Author

CONCLUSIONS

It was observed that the use of the vegetated surface, as compared to a concrete surface, has improved the level of PMV, yet, when the vegetated surfaces were combined with water features, represented in the rectangular swimming pools, 50% for each type of surfaces, PMV levels showed further improvement. However, the most significant improvement in these levels was obtained in the second scenario in which the central open space in the residential project consisted of swimming pools with no vegetation. These results were most visible in the case of an urban canyon flanked by low-rise residential buildings. Based on the findings, this research recommends replacing paved open spaces within residential projects in a hot-arid climate with water features such as large swimming pools of simple geometric shape. Even though some previous literature suggested that water features might increase humidity levels beyond comfort, the results of this research using ENVI-met indicated that humidity levels slightly increased due to evaporation from the water feature. This increase was nonsignificant and could be considered negligible in designing residential projects. This difference in findings could be because humidity levels can vary according to variables, such as the size and shape of the water feature. This research aimed at measuring the exact influence of relatively small water bodies on the microclimate of urban canyons.

Predicting the thermal sensation of a population using simulation software is an important step in identifying the comfortable conditions in a particular setting during the design process of a residential project. Nonetheless, thermal comfort is a feeling and a state of mind which represents satisfaction with the surrounding thermal environment. Therefore, further research which relies on surveys and on-site measurements in urban canyons of residential districts in hot-arid climate would perhaps be needed to support the findings of this research.

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THE ROLE OF URBAN PRESERVATION TO ACHIEVE SUSTAINABLE URBAN DEVELOPMENT – PRESERVING ERBIL CITADEL AS CASE STUDY

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ABSTRACT

Cities in the world transformed from traditional aspects to sustainable aspects, this transformation need to consider preserving urban heritage as one of the goals of sustainable development agenda 2030. From this view, the research problem appears from the lack of clarity of preserving urban heritage as part of culture and urban sustainability. So, the research aim tries to reach the role of urban preservation to achieve goals of sustainable urban development, and chose Erbil citadel as the first implemented preservation project in Iraq, which adopted 2014 in the world heritage list by UNESCO, which need to integrate preserving urban heritage with sustainable development goals. That will lead to prevent loss of heritage stock, and integrate all goals that contribute to revive the historical buildings in the life of city and society. The research concludes the continuation of this cultural heritage and its effectiveness in completing principles of sustainable development, especially, resettlement of the original inhabitants who removed from it, to be as integrated global model for the traditional human natural and cultural life, and integrated with surrounding urban fabric, instead of their decision to converted citadel as a museum.

Keywords: urban preservation, sustainability, development agenda, urban heritage

INTRODUCTION

Sustainable development is a multi-dimensional policy, integrate six fields of knowledge: political, economic, social, environmental, aesthetic and cultural (Szarek-Iwaniuk, 2021). According to sustainable development agenda, sustainability will be achieved in the world through 17 goals by 2030, sustainable city appears in the goal No. 11 (UNITED NATIONS, 2015; UNDP, 2015), which focus on how to make cities and human settlements inclusive, safe, resilient and sustainable. Urban sustainability depends on three main pillars (social, environment, economic), and they added 'culture' as fourth pillar in Habitat III. So, human heritage considered as part of components of the city and reflect culture of the society, preserving for this urban heritage means sustain the resources of the city, as well as reduce the consumption of built up area.

The United Nation (UN) convention on housing and sustainable urban development 'Habitat III' that take place in capital of Ecuador, submit the New Urban Agenda (NUA), which offer proposals of sustainable development for the next twenty years

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(Cities Alliance, 2015). It is focus on several fields, one of its, cultural diversity as sources of improvement for humans, and supply a vital contribution to sustain cities (UN Habitat III, 2017). The agenda provide an action plan for individuals, groups, organizations and governments, it conjointly seeks to the seventeen sustainable development goals and 169 targets. So, these goals and targets can be achieving over fifteen years in areas of the world (UNITED NATIONS, 2015). The action plan of this agenda depend on: comprehensive development plans, urban management, environmental planning and socio-economic issues (HABITAT III, 2016-1). The main core of this paper appear from recognition of social actors focus on reflecting identity, cultural diversity, and protect heritage, where the research problem appears from the lack of clarity of preserving urban heritage as part of culture and urban sustainability. And the research aim tries to reach the role of urban preservation to achieve goals of sustainable urban development, through the first implemented project in Iraq of historical Erbil citadel preservation.

SUSTAINABLE URBAN HERITAGE

The relationships between culture and heritage empowering the concept of sustainability, along with all other components that make cities more flexible and dynamics. These relationships appear through social and cultural diversity and it's involve the city with more variety and distinction in genus, identity, race, worship, heritage, human products, and collective memory of social group. It needs produce prospects of integration and strong relations, in order to regenerate the spirit of city life (HABITAT III, 2016-1).

Cultural heritage is outlined in strategies of urban development as a result to preserve historical buildings and traditional urban fabric (HABITAT III, 2016-2). It is strengthening identity of societies, and variety of different cultures. As well as emphasis their creative urban products along time, to qualify human needs within contemporary city, which appear through numerous global agreements to documented heritage around the world. There are many challenges faced cultural heritage, such as: the erosion of heritage and cultural identities, shortage of recognition on the function of urban space in reinforcing people's arts, restricted access to cultural facilities and neglecting societal cultural and initiatives of community. So, many approaches acknowledge build on native cultural heritages, which merit professional practice to protect cultural heritage according creative strategies to support experience and appropriate (Duxbury et al., 2016). Therefore, urban cultural strategies and implementations that acknowledge variety within the urban fabric, to reduce critical pressure, safeguard heritage and build safe public places as well as inclusive community neighbourhoods according goals of sustainable development (HABITAT III, 2016-1).

Cultural heritage

Cultural heritage divided to tangible and intangible heritage, it means memorial buildings and sculptures, complexes or historical sites, valuable elements, antiquarian founds, scientific documentations and anthropological references. Heritage can be bridging the gap between multi generations. Therefore, it is resource of social engagement and belonging passion (Chohan & Wai, 2005). The inventive implementation to preserve tangible and intangible heritage, should be combine human activates in the beginning of the comprehensive development plan according sustainable dimensions. The multi range of cultural heritage will facilitate communities which activate citizens, achieve the luxury of decent living for the human being and build safe environment. So that, it is an important field in the comprehensive development plan, land use plan, code of practice, and regional planning policies, in order to take into account their roles determine identity. As well as put action plan in strategies of urban renewal of historical city centres, to secure identity and achieve social cohesion and high level norms for citizens. To reach flexible plans contribute in achieving social identity and human habits, in order to save human cultural heritage (HABITAT III, 2016-2).

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Sustainable heritage preservation

Sustainability will run city resources and turning into reality, to ensure economical use of resources. One of these resources is the protection of heritage and recognize as central to the sustainability. Several urban standards will promote awareness in the protection of cultural heritage through sustainable dimensions (Guzman et al., 2018).

The destruction of urban heritages, especially in historical city centres, will led to immigrate citizens out these centres and cause socio-economic problems (Biegańska et al., 2019), these problems appear in Berlin city centre after post-war reconstruction (Mathey, 2018). So, heritage preservation indicates to save heritage from dangerous urban problems, but when it destroyed, it is difficult to rebuild it. Therefore, preserving sustainable heritage means preserve the preferable values of the important buildings and make balancing with cost, according era spirit and human demand (Chohan & Wai, 2005; (Labadi et al., 2021). This combination between rebuild heritage and human demand appear in the reconstruction of Nuremberg old city after II world war, and especially preservation of old castle as 'the beating heart of the city' (Macdonald, 2009). In order to sustain the resources of the city, as well as reduce the buildings consumption.

METHODOLOGY

In the same direction with "2030 agenda for sustainable development, specifically goal eleven on sustainable cities and target 11.4, the important factor is combining with policy targets to utilize the ability of the objective frameworks for inclusive, safe, resilient and sustainable cities" (HABITAT III, 2016-2; Labadi et al., 2021). The new urban agenda is a good chance to compose cities again, which face many problems and challenges. Cities need to be as dynamic system submit the chance for community to contribute in this composition, to confirm tangible and intangible heritage as part of city layers, as well as, part of sustainable development, in order to provide a chance to change direction from the old vision, to new vision, focusing on people-centred the comprehensive development. Furthermore, conservation of sustainable heritage has the capacity to bridge knowledge gap and solve city problems, according associated with strategies of urban renewal, through rehabilitation, regeneration, redevelopment and improvement of the historical cities (Guzman et al., 2018).

To solve research problem with the lack of clarity of preserving urban heritage of the city as part of culture and urban sustainability, the paper will take benefits from the approach of integrating urban preservation of heritage with sustainable development, to reach the aim of the role of urban preservation and its contribution to achieve goals of sustainable urban development, through the first implemented project of historical Erbil citadel preservation, which adopted 2014 in the World Heritage List (WHL) by UNESCO.

The theoretical approach offers an empirical foundation for monitoring practice (historical Erbil citadel preservation) that enhance the sustainable control of city heritage, within the line of the new development agenda and bridging the gap between theory and practice. Therefore, urban development of Erbil city and preserving citadel will take analytical methodology, which seeks to:

1. Determine the related principles in goals of sustainable development agenda, and study the urban development integration between Erbil city centre and its core of citadel, through multi levels of urban preservation. As well as integrate all goals that contribute to revive the historical buildings in the life of city and society;
2. Prevent loss of heritage stock, and specify the mechanisms of urban preservation of cultural heritage that achieve principles of sustainable development agenda, to enhance cultural identity;
3. Searching for the human activities that increase interaction between peoples, with limited accessibility to these activates which reflect cultural diversity as dominant characteristics at level of tangible and intangible heritage of Erbil citadel;
4. Locating public urban spaces which works as join between citadel and historical city centre, and

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fostering potential energy of culture in the role of public space that enhance social interaction and activate economic resources to support the sense of living place and belongings.

Erbil citadel

Erbil citadel is a reinforced settlement located in Iraq – Kurdistan province – Erbil governorate, on top of an imposed hill created by many civilizations built on it. A continuous wall of high facades from the 19th century reflect the visual effect of castle that dominates Erbil's cityscape. The citadel has a distinctive design from the late Ottoman period. Published historical records document the settlement antiquity corresponds to ancient Arbela, a major political and religious centre in Assyrian civilization, which is belonging to 6000 years BC (https://whc.unesco.org) (Fig. 1). "Erbil citadel located in the city centre. It has semi-circular form with height 30 m. Many civilizations and peoples lived on it, there are 506 houses spread in three districts: Sarai, Takya & Top khana. Its buildings are built according to a distinctive architectural style. Additionally, there is the great mosque and bathtub built in 1775 AD" (Raouf, 2010) (Fig. 1 and 3).

Fig. 1. Preserving heritage inside urban fabric Erbil citadel
Source: own photos, 2013.

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Cultural heritage attraction in Erbil city centre is represented by the citadel and surrounded old parts, which had distinct architectural heritage, with the special value of the citadel as a monument and as one of the ancient cities in the world. The main land use of Erbil citadel was residential buildings, with heights between one and two floors, and only the minaret of mosque appears from the cityscape (Fig. 1). The citadel surrounded by commercial activities, as well as the ancient Bazar as a traditional market. The planning of historical city centre contain citadel with organic urban system, reflect characteristics of traditional cities (Fig. 2). The citadel and surrounded market covers most of the necessary needs of city life and inhabitant's requirements.

Most of Erbil city centre had poor building conditions, caused by the progress of time and lack of maintenance. The city centre suffers from major problems like: neglecting for maintenance especially for the old buildings, bad condition for finishes and paving, severe lack of services and infrastructures, lacks of vitality at night-time, the isolation of the citadel from the traditional fabric by the first ring road, which isolate it and give it the character of a monument more than part of the whole urban fabric of the centre, all that lead for need of new intervention to renewal this urban heritage (Raouf, 2010). In the 2004, Erbil citadel choose as one of the properties inscribed on the world heritage. It is a famous archaeological location that witness dramatic transformation within the past 50 years ago. Because of the lack of interest in this location in ancient time, "Erbil municipality decided to take part in an important project to revitalize the citadel

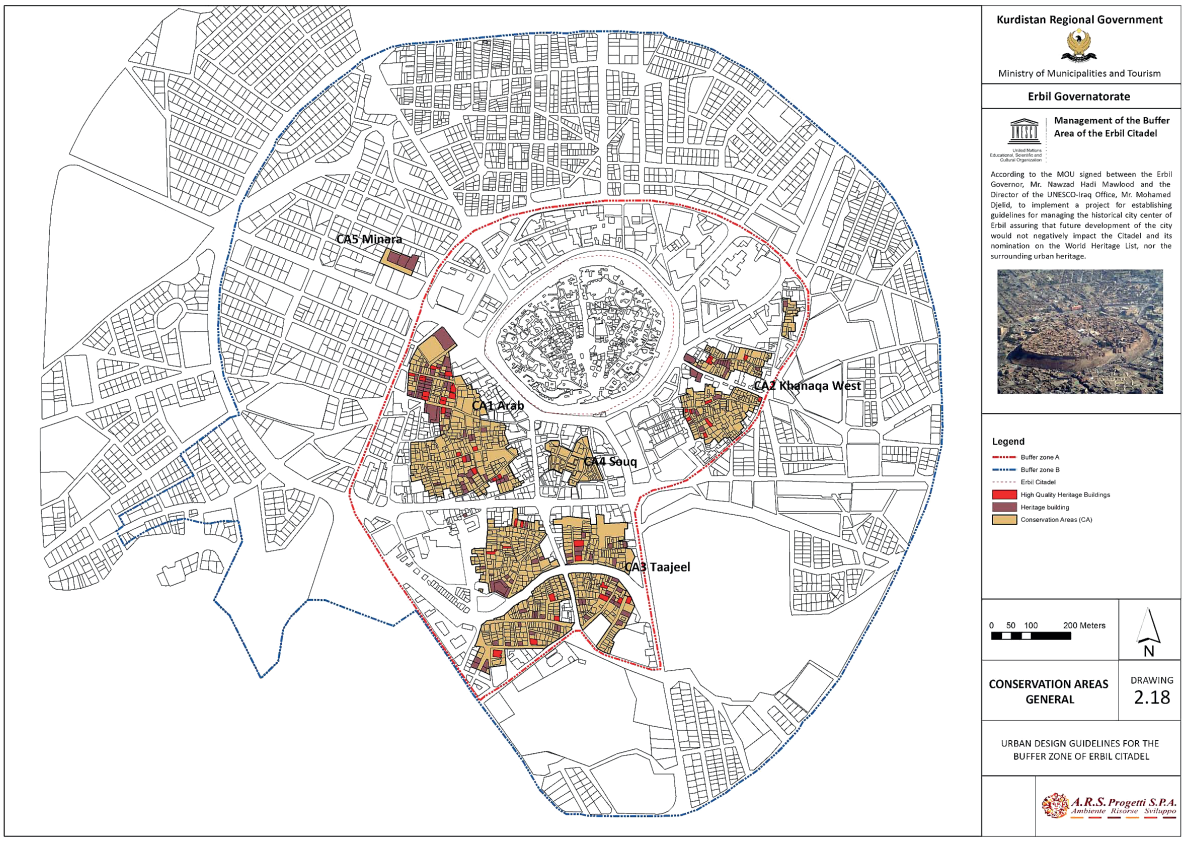

Fig. 2. Erbil city center – Conservation area general
Source: UNESCO (2012).

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(still in progress), organized by the High Commission for Erbil Citadel Revitalization (HCECR) and supervised by UNESCO" (UNESCO, 2012).

In order to make new development plan, "Erbil citadel management plan follows the compilation of two other important documents: The Conservation and Rehabilitation Master Plan (CRMP), and buffer zone guidelines. So, UNESCO and Erbil governorate / HCECR working together on this project" (UNESCO, 2012). These documents have set the basis for the development of the present management plan, which provides strategies for sustainable conservation, rehabilitation and development of the citadel of Erbil.

The properties inside citadel belong to private and public entities, and within the nineteen seventies, public establishments (Erbil municipality, department of antiquities, awkaf) began to get buildings inside citadel in order to preserve its, but, only few interventions happened till 2004. The Erbil municipality declared to empty the location in 2006, and according to decreeing the institution of a (HCECR), to be accountable of making certain that the architectural values and valuable citadel heritage are preserved, reinforced, and revived. This new establishment and development plans, lead to necessary step by the launch of the UNESCO/ HCECR Erbil citadel revitalization project (UNESCO, 2012). In late 2007, the citadel was unoccupied and ready for conservation purposes, as well as implementing Erbil citadel revitalization project adapted by Erbil city master plan 2007.

In order to analysis urban development strategy, the effect of the citadel on the urban growth of the Erbil city must first be clarified, as well as the effect the

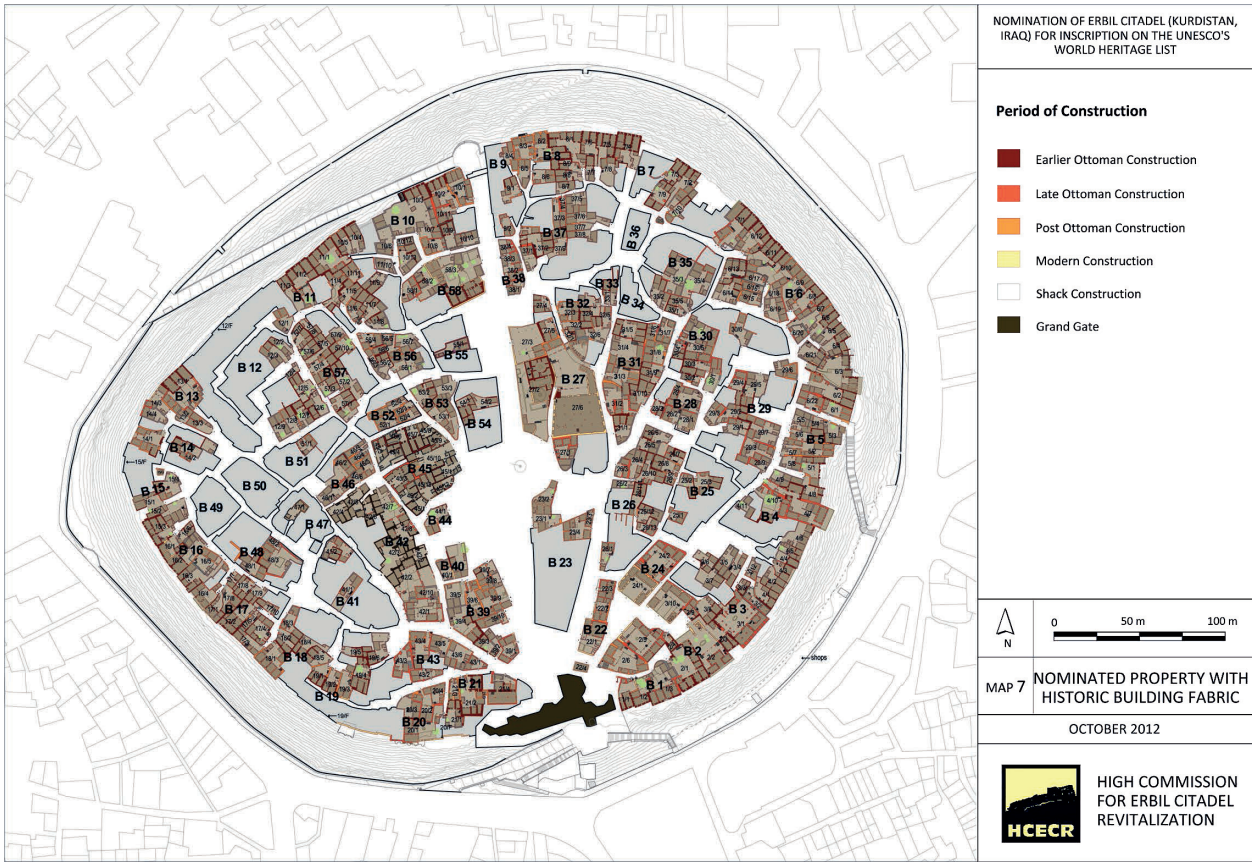

Fig. 3. Erbil citadel – historic building fabric
Source: UNESCO (2012).

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growth of the surrounding urban fabric. The citadel has a great influence on the distribution of uses in the surrounding city centre, as well as the distribution of the first ring road around citadel will lead all growth plan of Erbil city.

Development plan submit many proposals including: conserving significant heritage and important buildings, creating pedestrian routes network, providing a green network of open spaces, restructuring dilapidated areas, maintaining residential uses, maintaining an administrative centre in the city centre of Erbil, developing an aspect of tourism in the city centre, reinforcing and increasing commercial activity, and encouraging new business and financial development. Heritage elements were maintained the citadel, bazaar and traditional urban fabric, and different levels of heritage buildings were identified (Fig. 2). This option conserves the maximum amount of existing urban fabric, including existing landmarks and entrance corridors, thus ensuring the city centre's role as a tourist and cultural destination (Ministry of Municipalities Kurdistan, 2007). The citadel revitalization plan submits the subsequent aspects: protective and rehabilitating thirty percentage of heritage buildings, supply tourist spaces such as (restaurants, cafes and entertainments area), rehabilitation of heritage buildings like traditional bathroom as museum, and rehabilitation of the mosque, organize the traffic system to improve accessibility for all tourist facilities (Fig. 3) (Al-Hinkawi & Alkubaissy, 2016).

RESULT & DISCUSSION

In order to reach research aim, and determine the role of urban preservation and its contribution to achieve goals of sustainable urban development, especially goal 11 on sustainable cities and saving culture heritage, which appear in target 11.4, the applying research methodology and indicators will take Erbil citadel as case study (Table 1), in order to determine these roles through:

1. The related principles in goals of sustainable development agenda, and integration between Erbil city centre and its core of citadel achieve by:
   a. The master plan of Erbil 2007 suggested new activities were proposed in the district, such as museums, multi-purpose halls, etc. This could be a positive sustainable urban factors to develop urban tourism in the district, but it neglected the potentiality of the cultural heritage as main attractions that could be used to develop city centre activities for 24 hours per day, and the possibility of using the traditional buildings as attractions and tourist facilities;
   b. The proposed urban development strategy is based on the idea of highlighting the citadel as a part within a system of open spaces. But locating many huge open spaces around citadel, will make it as monument and isolating it from the city urban fabric and emptying the space inside the citadel from daily life.

   Integrating between sustainable development and cultural heritage of Erbil could be invested as a national and international tourist destination, but it need to provide the good infrastructure of tourist facilities. As well as integrate these goals that contribute to revive the historical buildings in the life of city and society.
2. Prevent loss of heritage stock, and specify the mechanisms of urban preservation to enhance cultural identity, will appear from:
   a. Preserving of Erbil citadel can be benefit from economical resource of cultural heritage attractions by adapting urban strategies like regeneration, rehabilitation and revitalization;
   b. Conservation and restoration of traditional urban fabric, buildings, streets, and open spaces, that could be use with original functions, or adaptive reuse with suitable functions that didn't harm the traditional buildings.

   The strategies of urban renewal depend on the level of the preservation, rehabilitation of the surrounding urban fabric in order to integrating with the citadel and highlighting its role in its formation, in order to activate Erbil cultural heritage and achieve principles of sustainable development agenda.

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Table 1. Appling research methodology and indicators on the experiment of preserving Erbil citadel

Research methodology	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5
	Erbil citadel case study	Erbil citadel case study	Erbil citadel case study	Erbil citadel case study	Erbil citadel case study
Sustainable development agenda	Comprehensive development plans	Urban management	Environmental planning	Socio-economic issues	Collective memory of social group
	Erbil Master Plan (CRMP) Development, Conservation Rehabilitation, and buffer zone guidelines	Collaboration between UNESCO & HCECR, as well as Erbil Municipality, Department of Antiquities & Awkaf	Few interventions happened till 2004, as well as implementing Erbil Citadel Revitalization Project 2007	Economical resource of cultural heritage and adapting urban strategies like regeneration, rehabilitation & revitalization	Some traditional functions & events considered
Challenges faced cultural heritage	The erosion of heritage and cultural identities	Shortage of recognition on the function of urban open spaces in reinforcing people's arts	Restricted access to cultural facilities	Neglecting societal cultural and initiatives of community	Cultural diversity
	Erosion happened when Erbil Municipality declared to empty the location in 2006. In late 2007, the citadel was unoccupied	Providing a green network of open spaces, restructuring dilapidated areas	Weak condition for finishes and paving, services and infrastructures	Neglecting community initiatives for maintenance especially for the old buildings, and lack of vitality at night-time	Isolate the citadel from community & the traditional fabric by the first ring road, and give it the character of a monument more than as part of urban fabric
Comprehansive development of cultural heritage	Facilitate communities	Activate citizens	Achieve the luxury of decent living for the human being	Build safe environment	Support the sense of living place and belongings
	Conserving significant heritage and important buildings	Need to activate Kurdistan citizens & activate residential uses	Create livable places & pedestrian routes network, and develop an aspect of tourism in the city centre	Influence citadel on distribution of uses in the surrounding city centre, and the first ring road lead urban growth	Reinforce and increase traditional residential & commercial activity, and encouraging intangible heritage
Strategies of urban renewal of historical city centres	Secure identity	Achieve social cohesion	High level norms for citizens	Human habits	Flexible plans
	The identity is very clear in citadel, bazaar and traditional urban fabric, and different levels of heritage buildings were identified	This is one of the important point that not considered in the renewal strategies	Ensuring the city centre's role as a tourist and cultural destination, but neglect the citadel as ancient inhabited area	Supply tourist spaces like cafes, restaurants, etc, and adaptive reuse heritage buildings like traditional bathroom as museum & mosque	Conserves most of existing urban fabric, including existing landmarks, entrance corridors and organize the traffic system to improve accessibility for all tourist facilities

Source: own elaboration.

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3. Searching for the human activities that increase interaction between peoples, and maximize accessibility to the main activates, will appear from:
   a. The improve of the existing buildings (inside citadel and outside) to be used as traditional facilities, as well as improve that specific traditional city life of the cultural heritage;
   b. The loss of the urban fabric by demolish the north historical part and built a large commercial complex, in a historic area with modern features, lead to a change the characteristics of the urban fabric surrounding the citadel, as well as isolate urban fabric in which citadel stands out from it.

   Restore the demolished traditional market in the edge of citadel, as well as connect all the pedestrian routs of urban fabric with citadel, will reflect cultural diversity as dominant characteristics at level of tangible and intangible heritage of Erbil citadel.
4. Locating public urban spaces which works as join between citadel and historical city centre, and support the identity, sense of living place and belongings, could be achieve through:
   a. The citadel is a main node of Erbil city centre, its morphology appears from citadel as dominant within a compact, small cells, low rise urban fabric, as well as the main feature in the city scape. This is should be a main factor in the integrated urban development;
   b. The growth plan of Erbil city, shown new dominants nodes and buildings, which cause losing citadel centrality, this will affect the growth and shape of the city centre, and will reduce the importance of the main node of citadel.

   Urban development plan of Erbil submit many aspects emphasized preservation of historical value and identity of the city, but the analysis shown changing the architectural style of the parts surrounding the citadel from traditional to modern, and converting the open areas into outside instead of inside the citadel. These need to adapting and fostering potential energy of culture in the role of public space that enhance social interaction and generate economic resources.

CONCLUSIONS

The preservation of the Erbil citadel as part of the final list of UNESCO, was carried out under the supervision of international organizations and local governments, the development plan and mechanisms for action, apply global standards, and systematic implementation steps. But in some phases is not in line with the criteria of sustainable urban development, when the residents were removed from citadel, and converted citadel into a museum, instead of being an integrated global model for the traditional human natural and cultural life, which lead to isolate it from the rest of the city. So, paper recommended:

Prevent loss of heritage stock, and integrate all goals that contribute to revive the historical buildings in the life of city and society.

Encourage the variety of culture, and specify the dominant characteristics at level of tangible and intangible heritage.

Resettlement of the original inhabitants inside Erbil citadel as sustainable neighbourhood, to bring back traditional life, and use the mechanism of adaptive reuse of some historical buildings to be tourist dwelling or hotels.

The preservation methods need to be on multi levels, not only preserving on tangible heritage of Erbil citadel, but need to preserve of historical urban fabric and urban spaces, as well as intangible heritage and human city life.

Confirm the integration of the citadel with the adjacent urban fabric through the integration of the movement system and pedestrian routes.

The necessity of the continuation of the citadel life by finding activities related to people's daily life in addition to tourist activities and entertainment.

Take into account the architectural values of the urban context of the citadel in the surrounding urban fabric to support the visual harmony and make coherent structure.

Maintenance and rehabilitation of heritage buildings and adaptive reuse in a way that generates benefit to the city and enhances the historical and heritage value.

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Preserving of the buildings and heritage houses inside the citadel and rehabilitating them to suit the tourist activities

Restore of old buildings and cover open spaces in the buffer zone around the citadel, in order to integrate the Erbil citadel and connect it with traditional urban fabric.

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ASSESSMENT OF THE POSSIBILITY OF ESTABLISHING CULTURAL PARKS IN SELECTED RURAL AND SMALL TOWN AREAS IN THE LUBLIN PROVINCE

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ABSTRACT

The study objective was to identify and assess the cultural landscape resources in two counties in the Lublin Province (Poland) – county of Radzyń Podlaski and county of Łęczna – and to examine the public opinion about the establishment of cultural parks within these two counties. The research procedure included an analysis of district-level planning and strategy documents, a SWOT analysis, a field inventory, and a questionnaire survey. This research was preceded by an analysis of the functioning of cultural parks in other regions in Poland. An additional goal of the study was to join the global discussion about cultural parks. The research has shown that the county of Radzyń Podlaski and county of Łęczna have great potential for creating cultural parks. However, it is necessary to improve the public awareness (particularly of local governments and property owners) about the cultural park as a form of protection and the development opportunities related to its establishment e.g. revitalisation, tourism and recreation. System-wide changes in the scope of establishment and functioning of cultural parks are also advisable.

Keywords: cultural landscape, landscape protection, cultural park, Lublin Province

INTRODUCTION

A discussion about cultural parks as a form of protecting cultural heritage in various regions around the world has been going on for several years (e.g. Mascarenhas & Barata, 2005; González, 2013; González & Vázquez, 2014; Roe & Taylor, 2014). Cultural parks as a form of historic monument protection were introduced by the Act on the Protection and Care of Historic Monuments (2003). In particular, they are established to protect the cultural landscape and preserve areas of outstanding landscape with immovable monuments characteristic of the local building and settlement tradition (Art. 16 par. 1 of the Act). The Act regulates the process of establishing cultural parks by districts by way of resolutions (Art. 16 par. 1a-6). At present, more than 40 cultural parks exist in towns and rural areas across Poland (www.nid.pl). The parks comprise monuments of architecture, fortifications, memorial sites, archaeological sites, historical rural and urban layouts, designed complexes of water reservoirs and

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canals in parks as well as historic road networks. Intangible cultural values associated with sites and landscapes are also protected. In one of its reports, the Supreme Audit Office in Poland recognised this form of protection as an instrument for maintaining order in public space even though certain irregularities have been observed in the functioning of cultural parks (NIK, 2017).

Based on analyses carried out in 2005 by the Regional Centre for Research and Documentation of Monuments (abbreviation of the Polish name: ROBiDZ) in Lublin, cultural parks were proposed in 60 areas in the Lublin Province, a peripheral region with a predominantly agricultural character. These are mostly rural areas (46 parks). Unfortunately, no such park has been established so far within urban or rural areas which face numerous developmental problems. What is the reason of this situation? Is it related to the loss of cultural landscape values or an unfavourable attitude of local governments and residents to this form of protection? Already ten years ago, Kałamucka (2008) observed that there was little interest in establishing cultural parks at district level. To a large extent, this results from the lack of awareness of the value of cultural landscape as well as the functions of cultural parks and benefits arising from its establishment. Furthermore, at the stage of delimiting cultural parks in the Lublin Province, it was observed that only a few local planning documents refer to this form protection (Michalska, 2007).

METHODS AND STUDY AREA

The study objective was to identify and assess the cultural landscape resources in two counties in the Lublin Province – county of Radzyń Podlaski and county of Łęczna – and to examine the public opinion about the establishment of cultural parks (CPs) within these two counties. In particular, the study concerned the rural districts of Czemierniki and Wohyń (county of Radzyń Podlaski), Spiczyn (county of Łęczna), the urban-rural district of Łęczna and the urban district of Radzyń Podlaski, representing the rural and small town areas of the Lublin Province (Fig. 1). It should be noted that the Regional Centre for Research and Documentation of Monuments proposed the establishment of at least one such form of protection in each of the districts above, namely Radzyń Podlaski CP (town of Radzyń Podlaski), Wohyń CP (Wohyń district), Suchowola CP (Wohyń district), Czemierniki CP (Czemierniki district), Łęczna CP (town and district of Łęczna), Zawieprzyce CP (Spiczyn district). This factor determined the selection of the two counties as the study area. An additional goal of the study was to join the global discussion about cultural parks. The research procedure included an analysis of district-level planning and strategy documents, a SWOT analysis, a field inventory, and a questionnaire survey. This research was preceded by an analysis of the functioning of cultural parks in other regions in Poland.

The achievement of the study objective required the use of many sources of information and application of various research methods in accordance with the mixed-methods research approach (Creswell & Creswell, 2018). First, these were methods of collecting information concerning cultural parks (review of literature and online sources). The next stage consisted of an analysis of planning and strategy documents and a field observation[1] along with a cultural landscape inventory. A search for provisions related to cultural parks was carried out in the relevant documents. Within the cultural landscape inventory, attention was focused on the cultural markers of landscape, historical functional and spatial links, historical silhouettes and landscape dominants, the degree of preservation of cultural landscape elements, and threats to the landscape. These elements were selected based on other inventory cards (Delimitation of Cultural Parks, 2005; Sałyga-Rzońca et al., 2010; Regulation, 2019). Furthermore, types of landscape were identified based on the typology of the present landscapes of Poland (Chmielewski et al., 2015). This typology is the basis

[1] As Chojnicki (1999, p. 37) observes, "the share of own observations in the preparation of factual material has decreased", but it still plays "a key cognitive role" in geographic studies.

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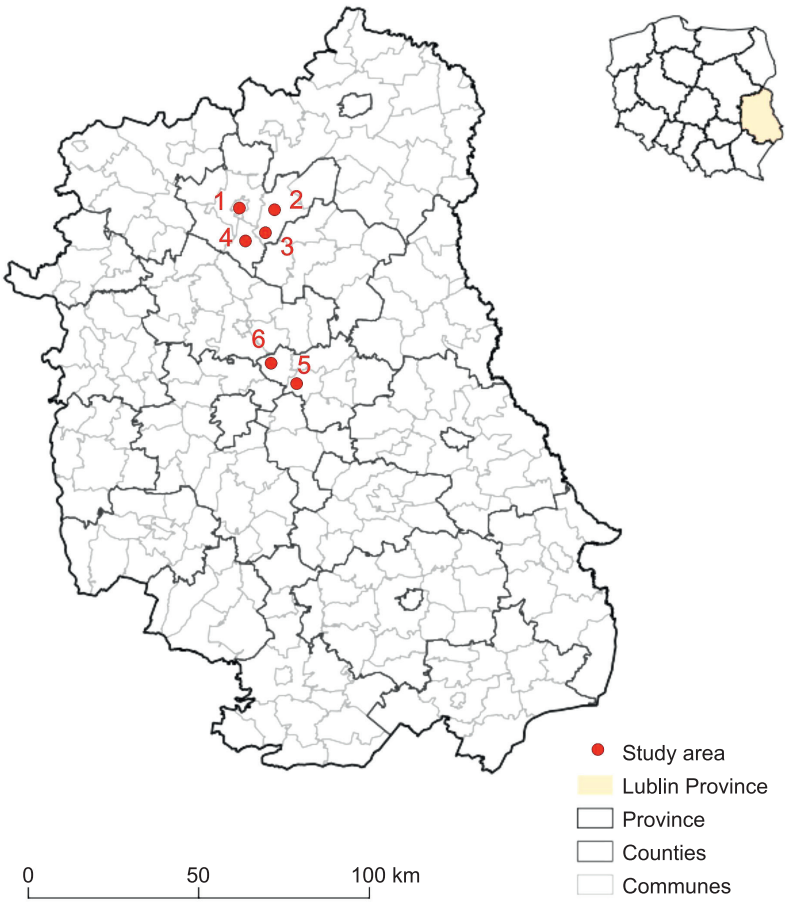

Fig. 1. Location of the study area. 1. Radzyń Podlaski, 2. Wohyń, 3. Suchowola, 4. Czemierniki, 5. Łęczna, 6. Zawieprzyce
Source: own elaboration.

for delimiting and classifying landscapes as part of the landscape audit procedure (Regulation, 2019). The field inventory was enriched with photographic documentation. Based on the stages of the research procedure described above, a SWOT analysis of the particular landscape parks was carried out. This analysis, identifying the strengths, weaknesses, opportunities and threats (existing and potential) is a popular method for determining the directions of spatial development (Bieda & Brzozowska, 2017).

The results of the survey conducted among residents of the districts under study (also local government employees) were used to examine the public awareness about cultural parks. The survey was conducted using the CAWI (Computer Assisted Web Interview) and PAPI (Paper and Pen Personal Interview) methods although using only the latter was initially planned. However, the pandemic restrictions resulted in the need to use the Internet as well. A total of 194 questionnaires were collected (from 112 women and 82 men), most of them from the county of Radzyń Podlaski (N = 126). The survey was conducted separately for each of the counties under study in the years 2020–2021, using similar questionnaires consisting of 9–10 questions. The respondents were asked to rate the attractiveness (including the aesthetic appearance) of the cultural landscape within the area of the proposed cultural park, evaluate the idea of establishing a cultural park in a given area, and justify this rating. In addition, in the case of districts

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in Radzyń Podlaski county, the questionnaire started with questions about the knowledge of cultural parks as a form of protection, while in the case of Łęczna county, the definition of a cultural park as form of protection was provided in the introduction.

Thus, the research had a predominantly qualitative, descriptive, and exploratory character. An important part of this research were case studies based on the analysis of records of available data sources: publications, websites (desk research), and field observations in different regions of Poland. The qualitative research was complemented with quantitative research related to the diagnostic survey and collation of statistical data on pipe organs. Using both types of research was aimed at a comprehensive analysis of the research problem. The approach based on analysing records of the available data sources is a basis for preparing conclusions on the investigated sites and phenomena, subsequently verified during field observations and surveys.

The Lublin Province is on the periphery of the European Union, located by the EU's eastern border. Due to its low level of industrialisation and high unemployment rate, it is one of Poland's poorest regions. However, the region's assets include its high natural, cultural and landscape values. The Lublin Province is cut across by the border between Europe's two primary physical-geographical units: the area of Eastern Europe and area of Western Europe. The east-west oriented, tripartite character of macrorelief is another distinctive feature of the province's natural environment. The Lublin Upland is in the central part of the province, the South Podlasie Lowland and the West Polesie are in the northern and north-eastern part, the hills of Roztocze, separating the Lublin Upland from the Sandomierz Basin, are in the southern part, while the eastern part consists of the Volhynian Polesie, the Volhynian Upland and the Pobuże Basin (Solon et al., 2018). The environmental value of the regions is evidenced by numerous protected areas, some of the country's richest plant communities, and sanctuaries of numerous rare and endangered animals species. The Lublin Province comprises 2 national parks (Poleski and Roztoczański), 85 nature reserves, 17 landscape parks, 17 areas of protected landscape, 7 nature and landscape complexes, 194 areas of ecological land, 23 special bird protection areas, and 100 special habitat protection areas. The province is also is distinguished for its rural and small town cultural landscapes with former Jewish buildings, traditional rural buildings including windmills and water cranes, stork nests as well as palace and park complexes. For centuries, various cultures intermingled with each other here, which has been reflected in the landscape, both its tangible and intangible layer. In the eastern part of the province, within short distances from each other, you can find a Catholic sanctuary (Kodeń), Orthodox monastery (Jabłeczna), Neo-Uniate parish (Kostomłoty), Jewish synagogue (Włodawa) and Muslim cemetery knowns as *mizar* (Lebiedziew). The multicultural mosaic and rich history of the region, along with the richness of its nature, are undoubtedly the region's hallmarks conducive to the development of tourism. The assets mentioned above are complemented by the preserved field patterns as well as rural and urban layouts, even dating back to the Middle Ages.

The county of Radzyń Podlaski lies in the northern part of the province, while the county of Łęczna lies in the central part. According to the Local Data Bank of the Central Statistical Office, the former county had 59,278 residents in 2019, while the latter had 57,331 residents. In both counties, the agricultural function predominates even though the industrial function related to the "Bogdanka" Hard Coal Mine is also significant in the county of Łęczna. According to the regionalisation by Solon et al. (2018), the area of the county of Radzyń Podlaski mostly belongs to the South Podlasie Lowland (mesoregions: the Łuków Plain, the marginal stream valley of the Wieprz, and the Lubartów Heights). The remainder of the county's area is part of the West Polesie (mesoregions: the Łomazy Depression, the Parczew-Kodeń Heights). The county of Łęczna lies within the South Podlasie Lowland (the Lubartów Heights mesoregion), Lublin Upland (the Świdnik Plateau mesoregion), and West Polesie (the Łęczna-Włodawa Lakeland and

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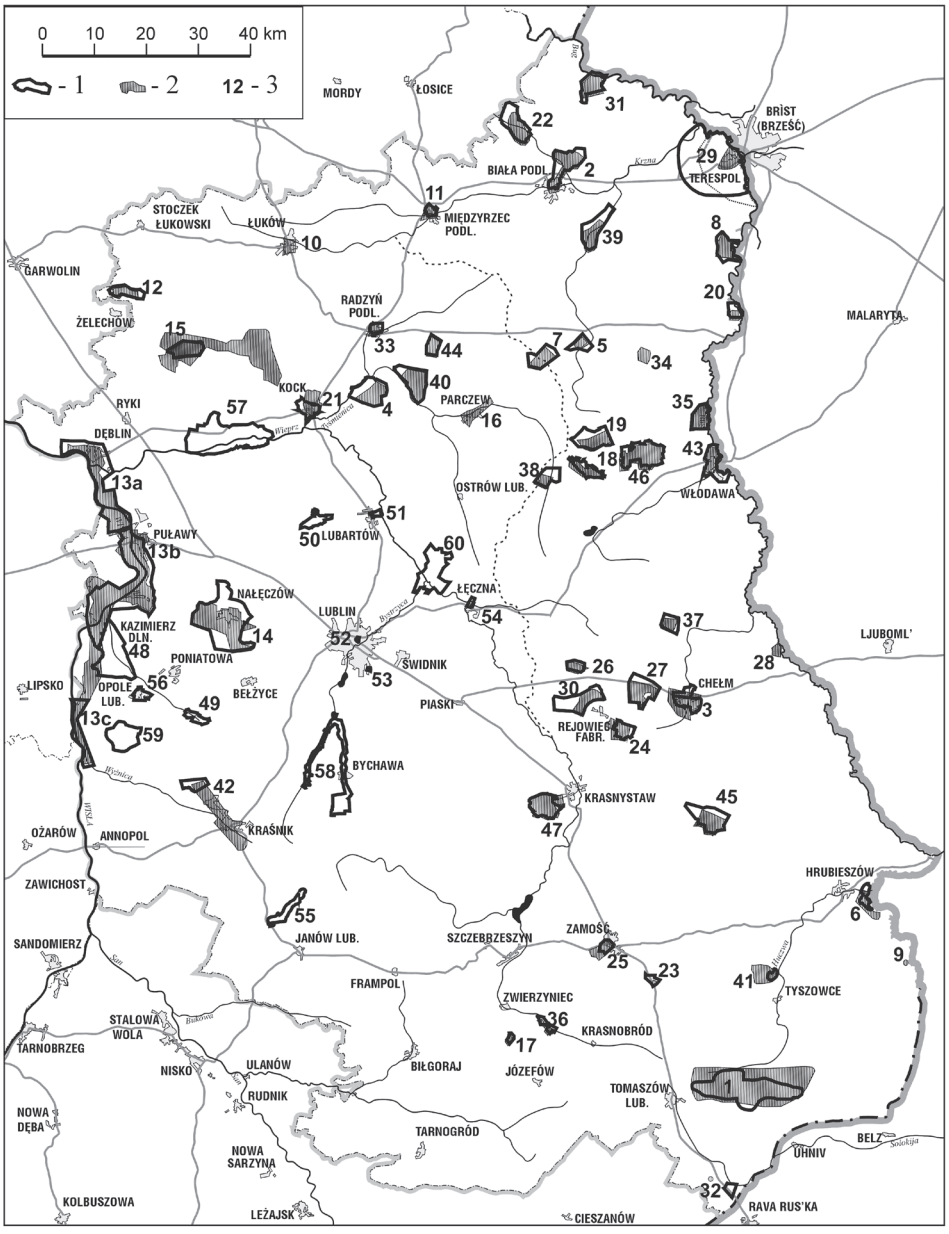

(1) boundaries of parks based on the update from the Regional Centre for Research and Documentation of Monuments in Lublin; (2) range of parks according to the Spatial Development Plan of the Lublin Province; (3) numbers of parks corresponding to the names placed under the figure 1. Archaeological CP of Grzęda Sokalska, 2. Biała Podlaska CP, 3. Chełm CP, 4. Czemierniki CP, 5. Horodyszcze CP, 6. Hrubieszów CP, 7. Jabłoń CP, 8. Kodeń CP, 9. Kryłów CP, 10. Łuków CP, 11. Międzyrzec Podlaski CP, 12. Mysłów CP, 13. Vistula River CP, 14. Nałęczów CP, 15. Okrzeja CP, 16. Parczew CP, 17. Florianka CP, 18. Hola CP, 19. Horostyta CP, 20. Jabłeczna CP, 21. Kock CP, 22. Leśna Podlaska CP, 23. Łabunie CP, 24. Rejowiec CP, 25. Renaissance Locational Foundations of Zamość CP, 26. Siedliszcze CP, 27. Stołpie CP, 28. Świerże CP, 29. Brest Fortress Fortification CP, 30. Pawłów CP, 31. Podlasie CP, 32. South Roztocze CP, 33. Radzyń Podlaski CP, 34. Romanów CP, 35. Różanka CP, 36. Roztocze CP, 37. Sawin CP, 38. Sosnowica CP, 39. Studzianka CP, 40. Suchowola CP, 41. Tyszowce CP, 42. Urzędów CP, 43. Włodawa CP, 44. Wohyń CP, 45. Wojsławice CP, 46. Wyryki CP, 47. Żółkiewka CP, 48. Archaeological Park of the Lower Chodelka River, 49. Chodel CP, 50. Kozłówka CP, 51. Lubartów CP, 52. Lublin Eastern CP, 53. Lublin South CP, 54. Łęczna CP, 55. Modliborzyce CP, 56. Opole Lubelskie CP, 57. Lower Wieprz River CP, 58. Central Bystrzyca River and Kosarzewka River CP, 59. Wrzelowiec CP, 60. Zawieprzyce CP.

Fig. 2. Cultural parks (CPs) in the Lublin Province
Source: Kałamucka (2008).

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the Dorohucza Depression mesoregions). The Gap of the Wieprz River, protected as a landscape park, is also situated here.

Cultural parks in the Lublin Province were already proposed in the Spatial Development Plan for the Lublin Province (abbrev. of the Polish name: PZPWL) from 2002 (Fig. 2, numbers 1–47). The Regional Centre for Research and Documentation of Monuments proposed numerous changes to update the plan. In the case of five cultural parks, i.e. Kryłów, Łuków, Parczew, Romanów and Świerże, it was recommended not to establish them owing to the insufficient value of the cultural and natural landscapes or due to the large transformation of landscape (Delimitation of Cultural Parks, 2005). Areas not included in the plan were also indicated as worthy of protection (Fig. 2, numbers 48–60). The total area of the proposed cultural parks is about 300 km^2, which accounts for 1.2% of the area of the province (Kałamucka, 2008). Most of them are located in the northern part of the region, along the valleys of the Vistula and the Bug, as well as in the Chełm and Zamość area. The proposed parks vary in terms of the level of their cultural value. 23 sites are of supraregional value (including 5 at the European level), 38 are of regional value, and 5 are of local value. Kałamucka (2008) distinguished 7 categories of parks in the Lublin Province based on the subject of protection and cultural value: archaeological parks, fortifications, historic town centres, residences, religious parks, smaller localities with a preserved historic urban layout, harmonious landscape with preserved historic sites of various categories.

In the current PZPWL from 2015, 57 cultural parks were indicated, including all the parks under study in the county of Radzyń Podlaski and Łęczna. The recommended cultural parks have been placed under planning protection primarily based on the functional and compositional protection of buildings (including historic lines of building) and the prohibition of new buildings and structures having an adverse impact on the landscape (e.g. wind farms).

CULTURAL PARKS AS A FORM OF PROTECTION

The concept of cultural parks is related, among other things, to the work of National Park Services (NPS) in the USA and of UNESCO for the preservation of cultural landscapes as an element of heritage[2] as well as the phenomenon of ecomuseums. In recent years, the number of cultural parks around the world has been growing continuously (González, 2013, González & Vázquez, 2014). Cultural parks are established in various ways in different countries. However, it is always a complex process involving local communities aware of the value of the local cultural landscape.

In Poland, the cultural park as a form of cultural landscape protection[3] was introduced by the 23 July 2003 Act on the Protection and Care of Historic Monuments. A cultural park is established pursuant to a resolution of a district council after obtaining an opinion from the province's historic monuments preservation officer (Principles, 2005). A local government that decides to establish a cultural park has to justify the decision and conduct an in-depth analysis of the natural environment and cultural potential. The information on the commencement of work on the establishment of a cultural park is presented in the local media and announced by way of an official notice, in the customary manner, indicating the form and deadline for submitting motions concerning the draft resolution. The recognition by residents that the cultural landscape needs to be protected, and their involvement in the process are important aspects

[2] In 1992, the category of cultural landscape was introduced to the UNESCO Convention system; this category allows taking into account various manifestations of interactions taking place between humans and nature, also in the sphere of religious, artistic, and cultural practices (Luengo & Rössler, 2012).

[3] Cultural landscape is defined in the Act as "the space perceived by people, containing elements of the natural environment as well as the products of human civilisation, historically shaped by natural factors and human activity".

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of establishing a cultural park (Kałamucka, 2008). The resolution specifies the name of the cultural park, its boundaries, protection measures, and restrictions within the park's boundaries. A protection plan is prepared for the cultural park, and a business unit responsible for managing the park can be created. The district where a cultural park has been established is obliged to prepare a local spatial development plan for the area. Pursuant to Art. 17 par. 1 of the Act on the Protection and Care of Historic Monuments (2003), "in a cultural park or within its parts, prohibitions and restrictions can be introduced concerning:

1. Carrying out construction work or industrial, agricultural, breeding, commerce or service-related activity;
2. Changing the way of using immovable historic monuments;
3. Placing signs, boards, advertisements and other items of signage unrelated to the protection of the cultural park, except for traffic signs and signs related to protecting public order and safety, subject to Art. 12 par. 1;

   3a. Rules and conditions of locating small architectural features (street furniture);
4. Waste storage" (Act, 2003, p. 11).

So far, about 40 cultural parks have been created in Poland (Table 1), including 18 parks in rural areas. However, according to a report by Myczkowski et al. (2017), two of them (Osieczek CP in Osieczek, Mary Magdalene Church CP in Łopatki) have already been liquidated. In addition, the functioning of some parks (e.g. in the Jelenia Góra Basin) is under threat (Pawłowska, 2016). The largest number of cultural parks are located in the Kuyavia-Pomerania Province (six parks) and Lower Silesia Province (five parks) (Fig. 3).

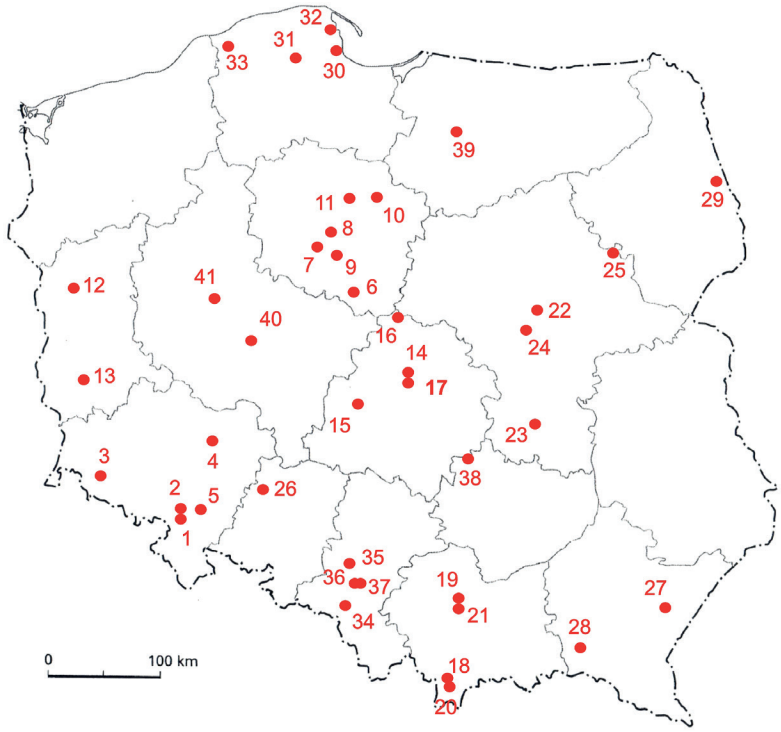

Fig. 3. Location of cultural parks against the administrative divisions of Poland (Numbering of cultural parks as shown in Tab. 1)
Source: own elaboration.

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Table 1. List of cultural parks in Poland

Voivodeship	O.n.	Name	Year of establishment
Dolnośląskie	1.	Fortress Cultural Park in Srebrna Góra	2002
	2.	Kłodzko Fortress Cultural Park	2005
	3.	The Cultural Park of Jelenia Góra Basin	2009
	4.	Cultural Park of the Old Town in Wrocław	2014
	5.	Cultural Park "Castle Hill, Budzówka and Nysa Kłodzka Valley" in Kamieniec Ząbkowicki	2014
Kujawsko-pomorskie	6.	Wietrzychowice Cultural Park	2006
	7.	Kalwaria Pakoska Cultural Park	2008
	8.	"Church of St. Oswald" in Płonkow Cultural Park	2009
	9.	Sarnowo Cultural Park	2010
	10.	Osieczek Cultural Park	2014
	11.	St. Mary Magdalene Church Cultural Park in Łopatki	2014
Lubuskie	12.	Cultural Park „Dolina Trzech Młynów" in Bogdaniec	2006
	13.	Grodzisko in Wicino Cultural Park	2013
Łódzkie	14.	Cultural Park of the Town of Weavers in Zgierz	2003
	15.	Cultural Park of the Castle Hill in Sieradz	2009
	16.	Cultural Park of the ethnographic sub-region of Kutno connected with the romantic poet Józef Bohdan Zaleski	2015
	17.	Piotrkowska Street Cultural Park (in Lodz)	2015
Małopolskie	18.	The Cultural Park of the Zakopane Basin	2006
	19.	The Old Town Cultural Park in Krakow	2010/2011
	20.	Krupówki Cultural Park in Zakopane	2016
	21.	Nowa Huta Cultural Park	2019
Mazowieckie	22.	Ossów Cultural Park "Gate of Battle of Warsaw 1920"	2009
	23.	Old Radom Cultural Park	2011
	24.	Wilanów Cultural Park	2012
	25.	Cultural Park of Cardinal Stefan Wyszyński in Andrzejewo	2016
Opolskie	26.	Cultural Park "Prince's Town Brzeg"	2016
Podkarpackie	27.	Cultural Park of the Old Town Complex and the Complex of the Dominican Fathers in Jarosław	2009
	28.	Krosno Old Town Cultural Park	2019
Podlaskie	29.	Bohoniki Cultural Park	2019
Pomorskie	30.	Gdansk Fortress City Culture Park – Hevelianum Centre	2002/2013
	31.	Cultural Park of the Eight Beatitudes in the village of Sierakowice	2006
	32.	Cultural Park "Seal Hunters Settlement" in Rzucewo	2008
	33.	Cultural Park „Klasztorne Stawy" in Słupsk	2009
Śląskie	34.	Cultural Park of the Jewish Cemetery in Żory	2004
	35.	Cultural Park „Hałda Popłuczkowa" in Tarnowskie Góry	2006
	36.	Cultural Park for the Old Town Area in Bieruń	2016
	37.	Cultural Park for the Dyke Area in Bierun	2016
Świętokrzyskie	38.	Końskie Cultural Park	2005
Warmińsko-mazurskie	39.	Cultural Park of the Warmian Landscape Way Gietrzwałd-Woryty	2009
Wielkopolskie	40.	Mickiewicz Cultural Park	2007
	41.	The Old Town Cultural Park in Poznan	2018

Source: own elaboration based on https://www.nid.pl/pl/Informacje_ogolne/Zabytki_w_Polsce/Parki_kulturowe/Zestawienie_parkow/ (21.06.2021).

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Dworniczak (2016) distinguished the following seven categories within 35 cultural parks (CP) established until the end of 2016:

1. Cultural parks established to protect the cultural landscape of historic old town areas in town/city centres (seven parks);
2. Cultural parks established to protect the cultural landscape of historic building complexes outside town/city centres (four parks);
3. Cultural parks established to protect primarily the cultural landscape of non-urbanised areas (seven parks);
4. Cultural parks established to protect landscapes related to religious worship (four parks);
5. Cultural parks established to protect the cultural landscape of fortified complexes (two parks);
6. Cultural parks established to protect the relic resources of cultural landscape (eight parks);
7. Cultural parks established to protect sites and locations associated with the activity of historic figures and events (two parks).

RESULTS

The counties of Radzyń Podlaski and Łęczna have a wealth of natural, historic and cultural values. The conducted inventory indicates that the richest cultural landscape values occur in three out of four areas designated for the establishment of cultural parks (CPs), namely Czemiernicki CP, Radzyński CP, and Zawieprzycki CP. The following landscape types were distinguished within the parks under study: rural (with a predominance of ribbon-like complexes of small arable fields, meadows and pastures, or with a predominance of built-up areas of rural character), mosaic-like (suburban, with a predominance of former agricultural areas), and urban (localities with a preserved historic layout). The most valuable monuments in the proposed cultural parks include the palace and park complexes in Radzyń Podlaski (Fig. 4), Czemierniki (Fig. 5) and Zawieprzyce (Fig. 6). Historic churches and chapels (mainly Catholic) and historic urban and rural layouts are also of high value.

Fig. 4. Radzyń Podlaski
Source: S. Bernat.

Fig. 5. Czemierniki
Source: S. Bernat.

Fig. 6. Zawieprzyce
Source: S. Bernat.

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The analysis of planning documents showed that provisions on the possibility of establishing cultural parks were included only in the documents prepared for the town of Radzyń Podlaski and the Czemierniki district (Table 2).

The establishment of cultural parks creates opportunities for improving the spatial order and attractiveness of landscape, obtaining external funding, the development of tourism and recreation. Some of the threats are related to the chaotic building development and inadequate development of historic sites held in private hands as well as the potential social conflicts.

The questionnaire survey conducted among residents of Radzyń Podlaski county shows that the cultural park is little known as a tool for cultural landscape protection. Only 27% of the respondents indicated their familiarity with this form of protection, and just a few mentioned specific cultural parks: Old Town CP in Kraków, CP in Zakopane, Wilanów CP. While all the respondents supported the initiative of creating the proposed cultural parks, they found it difficult to provide a justification. They indicated that the establishment of the park would improve the protection of historic buildings and make revitalisation processes more efficient, regulate

Table 2. Strengths and weaknesses of establishing cultural parks in the counties of Radzyń Podlaski and Łęczna

	Strengths	Weaknesses
Radzyń Podlaski CP	presence of numerous historical monuments in a good state of preservation (revitalisation) developed hotel and catering infrastructure provision for a cultural park in the study of conditions	no mention of the cultural park in the local plan
Czemierniki CP	numerous monuments good state of preservation of some monuments (revitalisation) provision for a cultural park in the study of conditions and in the local plan	lack of hotel and catering infrastructure private ownership of the palace and park complex
Suchowola CP	well-preserved composition of the manor layout	location within the palace and park complex of the Hospital for the Mentally Ill – lack of care for the historic values of the facility, difficult access lack of hotel and catering infrastructure lack of provisions in planning and strategic documents
Wohyń CP	presence of multicultural monuments and their good state of preservation (revitalisation)	lack of hotel and catering infrastructure lack of provisions in planning and strategic documents
Łęczna CP	presence of historical buildings and a unique urban layout ongoing revitalisation proximity of Nadwieprzański Park Krajobrazowy (Riverside Landscape Park)	lack of provisions in planning and strategic documents
Zawieprzyce CP	presence of numerous monuments in a good state of preservation buffer zone of the Nadwieprzański Landscape Park functioning of the Zawieprzyce Castle Ensemble location on the John III Sobieski Trail (obtaining funds for trail development)	lack of provisions in planning and strategic documents discontinued revitalisation of the palace and park complex in Kijany and the creation of the Jan III Sobieski Educational and Historical Centre on its premises

Source: own elaboration.

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matters related to aesthetic appearance, help the development of tourism, and improve the visibility of a given locality in the entire province, etc. Some persons were unable to explain their answer, but they supported the establishment of a cultural park.

The survey results for the county of Łęczna indicate that the idea of establishing a park in Zawieprzyce was supported by a majority of residents (52.8%) although opinions were divided in the case of Łęczna. 38.9% of the respondents rated the idea as "very good", 30.6% rated it as "good", 25% "average", while 5.6% thought that establishing a cultural park was a bad idea (Fig. 4). The favourable responses were justified by indicating better opportunities for the continued revitalisation of the Old Town, which would be highly beneficial for the inhabitants of Łęczna because it would improve their quality of life and ensure the development of tourism. In the case of Zawieprzyce, there were opinions saying that such a park should be established to protect the local historic monuments (the palace and park complex in particular) and the picturesque cultural landscape featuring the valley of the Wieprz river. Some respondents indicated that the establishment of a cultural park would help increase the appeal of the area and thus attract tourists. In one of the responses, it was mentioned that events dedicated to history and cultural events could be organised in the cultural park.

DISCUSSION

In the light of the literature, a cultural park is regarded in various regions around the world as a model of the active involvement of the public in the protection and evaluation of cultural landscapes. It is associated with an improvement of the residents' quality of life, preservation of heritage, and sustainable development, particularly in rural areas. The role of cultural parks is also to strengthen identity, social cohesion and economic growth (Bray, 1994). The interpretation of heritage and use of narratives related to heritage fosters the collective awareness of the need for protection, and strengthens the uniqueness of a given location (Daly, 2003). Furthermore, this concept is conducive to a holistic understanding of landscape (overcoming the divisions nature vs. culture, tangible values vs. intangible values), and is a planning instrument for landscape management (Mascarenhas & Barata, 2005).

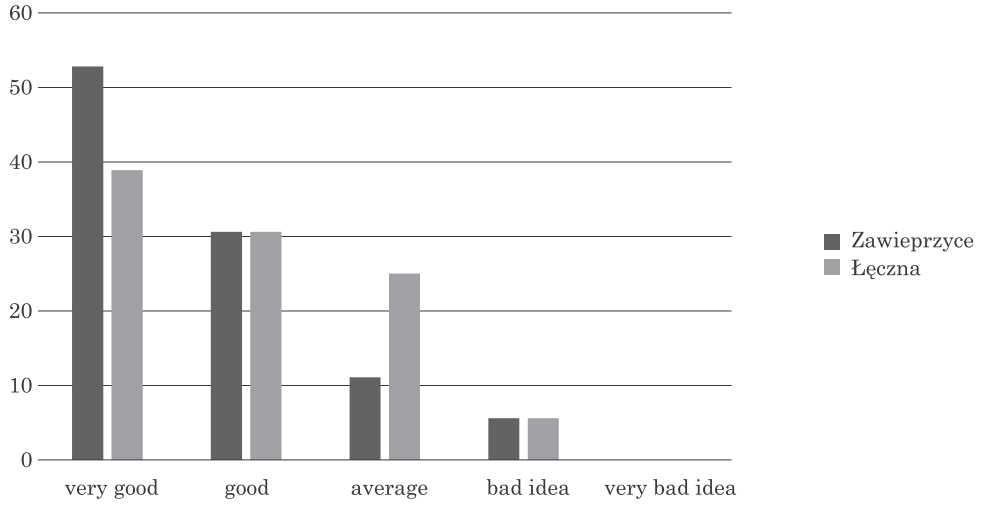

Fig. 4. Evaluation of the idea of establishing cultural parks in the Łęczna County (% of responses)
Source: own elaboration.

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The establishment of cultural parks in Poland faces several challenges. According to administrative law, a cultural park is a special area (Tomczak, 2019). When such a park is established, property owners may receive compensation for the restriction of the use of their property, or they may demand their property to be purchased by way of an agreement if the establishment of the cultural park results in the restriction or impossibility of using their property in the way they had used it previously. Districts can be afraid of the necessity to secure funds to cover the expenses related to the establishment of a park. There are also various lobby groups (particularly investors in the construction industry) that try to block the plans to create cultural parks and call for the liquidation of the existing parks. According to an expert report prepared by Myczkowski (2017), the advantages of the functioning of cultural parks in Poland include the flexibility of this form of protection, availability of "good practices" concerning the establishment and functioning of cultural parks, and the introduction of protection rules laid down in the protection plan and thus significant for local planning. The weaknesses include the organisational and management structure. The formation and functioning of a cultural park is the responsibility of district local governments which do not always have sufficient funds for measures concerning historic monument preservation. Another challenge are the regulations concerning the establishment of a park (the resolution to establish a park may be amended by other resolutions of a district council). The opportunities include the use of the media to promote the protection of cultural landscape and the growing public awareness concerning landscape and historic monument preservation. The establishment of new cultural parks can be threatened by an erroneous interpretation of certain pieces of legislation aimed at protecting natural, historical and cultural values as well as a by social conflicts, e.g. protests of local entrepreneurs (Myczkowski et al., 2017). The analysis of 38 existing cultural parks indicates that only 11 parks have all the required documents, 14 parks have most of the documents, nine parks operate only based on a resolution, while four parks have been completely liquidated. As Żołnierczuk (2019) demonstrates, a clear majority of protection plans for cultural parks does not enable a full protection of cultural landscape. The authors of documents often focus on individual sites while forgetting about their mutual relationships. The most frequent features was the SWOT analysis, but most of them lacked schedules of measures, provisions concerning funding, etc. Therefore, it is advisable to adopt legislation containing elements of protection plans that would have to be included in each document.

Myczkowski et al. (2017) distinguished 4 groups of parks based on the managing entity and activity:
- active parks dedicated to the protection and popularisation of heritage (11 parks);
- active parks dedicated to the protection of space and maintaining spatial order (8 parks);
- existing parks that do not show visible signs of activity (15 parks);
- liquidated parks (4 parks).

Among cultural parks subject to analysis, only 5 parks were found to be an example of the proper establishment and functioning of a cultural park. One of these 5 parks is the Kalwaria Pakoska Cultural Park in Pakość (Kuyavia-Pomerania Province). The revitalisation measures conducted here had a significant influence on the development of tourism (Gotowski & Parzych, 2014). Unfortunately, there is no up-to-date register of parks, which indicates the need to monitor the functioning of parks (Marcinek et al., 2021).

According to Kałamucka (2006), the establishment of cultural parks in areas of outstanding natural, historical and cultural value will be conducive to the creation of effective instruments to protect these values and to the development of tourism in the region. The latter effect was confirmed by Gryszel et al. (2010) who used the example rural areas of the Jelenia Góra Basin. However, the greatest number of cultural parks are established in large towns/cities (within their historic centres) as a form of protection conducive to the control of advertising (Klupsz, 2016) and as a tool useful in conducting revitalisation processes (Myczkowski, 2016; Marcinek et al., 2021).

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However, problems related, for example, to the acoustic dimension occur here as well (Muras, 2020).

As Myczkowski (2018) accurately noted, a cultural park is the most significant manifestation of the local government's responsibility for the area entrusted to its care. It is not merely a collection of prohibitions and orders, but also a recorded diagnosis and forecast for the development of the local cultural landscape. The initiative to establish a cultural park is a choice of the community, but the decision on its establishment is made by the local government. A cultural park offers an opportunity to protect the value and attractiveness of the local landscape, it is a textbook example of a "landscape bank" (Myczkowski, 2007). It is indispensable, however, for district governments to take their tasks in this respect seriously and quickly adopt and approve protection plans, draw up local spatial development plans, and appoint units responsible for managing the parks (Klupsz, 2016). There are concerns about the instability of cultural landscape protection at the local level owing to the possibility of introducing changes and restrictions of protection measures in resolutions, and even of annulling the resolutions establishing cultural parks. This is related to political opportunism, the lack of continuity in the local policies for cultural landscape protection and, frequently, short-sighted surrendering to the lobbying of investors.

As Pawłowska (2016) observed, landscape management in the form of a cultural park does not meet expectations. Although the catalogue of the forms of cultural landscape protection is relatively broad, it is not supported by efficacy, which largely results from the conflict between the natural and cultural values of landscape on the one hand and the social and economic rationale for the location of new investment projects. Furthermore, cultural parks can be viewed as forms of landscape protection that compete with the concurrently introduced forms of nature protection. According to the 24 April 2015 Act on the Amendment of Certain Acts in Relation to Strengthening the Landscape Protection Tools (the so-called Landscape Law), most measures related to landscape protection and planning are linked with the landscape audit carried out for the territory of a particular province. The landscape audit presents the types of landscapes occurring in a given area as well as their characteristics. Furthermore, it indicates the location and boundaries of cultural parks. Regardless of the cultural park as a form of protection, the above-mentioned Landscape Law also governs matters related to the control of advertising (Myczkowski et al., 2017). As Pawłowska (2016) aptly observes, the regulations introduced by the Landscape Law may prove to be more effective with regard to the control of advertising and may lead local governments to adopt landscape resolutions only, instead of implementing a more comprehensive landscape protection plan prepared for cultural parks along with the identification of characteristic features of the cultural landscape. Marcinek et al. (2021) rightly propose linking the initiative to establish a cultural park with the results of the landscape audit and, possibly, the status of a monument of history[4]. The proposed three-level concept of cultural parks is worthy of attention. It consists of district cultural parks, provincial (or regional) priority cultural parks, and national cultural parks linked with the designation as a monument of history. The State consistently supports protection measures under the monument of history category, which can influence the economic condition, competitiveness, and image of districts.

It should also be noted that cultural parks do not have a strong presence in the awareness of local governments and local communities. Therefore, a well-thought-out information and education strategy is needed to convince the public that the creation of a cultural park does not impede growth but instead it channels growth so that it is a continuation of the local tradition while protecting against global cultural degradation.

[4] According to the 23 July 2003 Act on the Protection and Care of Historic Monuments, a monument of history encompasses immovable monuments of particular historical, scientific, and artistic value, established in the popular consciousness and having significant meaning for the cultural heritage of Poland.

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CONCLUSIONS

The establishment of cultural parks in large towns or cities, within their historic centres, is a currently predominant trend in Poland. These actions are primarily aimed at maintaining order in urban space, which is often interpreted as combating illegal advertising and taking care of aesthetic appearance. Such a narrow interpretation of cultural landscape results in a loss of its essence (cf. Klupsz, 2016). Rural and small town landscapes are the most characteristic types of cultural landscape in Poland (particularly in the eastern regions), which results, among other factors, from their large territory, diversity, good condition, and stronger links with nature, history and culture.

The survey conducted in the rural areas of the Lublin Province indicate that, in the case of Radzyń Podlaski county, it would be reasonable to create a cultural park only in Radzyń Podlaski and Czemierniki. Both localities are of outstanding historical and cultural value. The local planning documents contain provisions concerning the possibility of establishing cultural parks. Furthermore, the questionnaire survey results confirmed the viability of establishing cultural parks in the above localities. In the county of Łęczna, on the other hand, the greatest opportunities for establishing a cultural park were identified in Zawieprzyce. However, the local planning documents lack provisions about the proposed cultural park. Most historic sites in the localities analysed are in a good state of repair. The revitalisation and redevelopment measures should be continued, however.

The survey indicates that it is necessary to improve the public awareness (particularly of local governments and property owners) about the cultural park as a form of protection and the development opportunities related to its establishment e.g. revitalisation, tourism and recreation. Although the predominant attitude among residents in the areas under study is favourable to establishing cultural parks, the knowledge about this form of protection is relatively limited. Furthermore, local planning and strategy documents contain few references to cultural parks as a form of protection. Promoting good practices with regard to the functioning of cultural parks in other regions as well as system-wide changes concerning this form of protection could improve the opportunities for establishing cultural parks both within the counties under study and in other areas featuring valuable cultural landscapes.

The problems that emerged during the survey were primarily related to the residents' (especially men's) unwillingness to express their opinion in the questionnaires, and the difficulty in obtaining information on the local governments' position on cultural park initiatives. Another obstacle was the difficult access to some historic sites (held in private hands). Despite the challenges, further research is planned on the possibility of establishing cultural parks in other areas of the Lublin Province.

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PROPOSAL FOR A SOLUTION SUPPORTING A RATIONAL WATER USE IN MULTI-FAMILY RESIDENTIAL BUILDINGS – IMPLEMENTATION IN PROPERTY MANAGEMENT

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ABSTRACT

Motives: Creating a functionality of a software system for managing multi-family residential buildings which could support property managers and encourage households to reduce their water consumption.
Aim: Developing a proposal for a solution supporting a more rational use of water and billing individual households in multi-family buildings for water they use.
Results: The created methodology includes automatic collection and recording of data from water meters in a property management software system, creation of algorithms describing relationships in water meter data, creation of algorithms supporting optimal water use in a property and incorporating the developed solution into the software system. The created algorithms were based on the method of moving average of three consecutive readings which is clear for all users. This enables automatic verification of water use and its visualisation using graphs. The created solution was incorporated into one of the property management software systems used in Poland (IAN24), tested and implemented. The created functionality allows property managers e.g. to estimate future water use, which is important for calculating advance payments towards water bills. It also allows managers to automatically detect various types of anomalies, such as meter failures. In addition, a dynamic method of billing according to the proposed methodology may encourage households to reduce their water consumption and thus reduce the impact for the environment.

Keywords: household water consumption, water resources management, multifamily property, property management, expense forecasting, property management software system

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INTRODUCTION

Continuous social and economic development requires satisfying basic human needs, including supply of water (Sajnóg, 2014). Access to drinking water is a physiological, and therefore a fundamental, need and is the base of the so-called Maslow's hierarchy of needs (1943). Water covers around 70% of the Earth's surface but only about 2.5% of it is fresh water (Yeleliere et al., 2018). Fresh water resources on Earth are estimated at 35 million km^3. The global population is growing fast, and estimates show that with current practices, the world will face a 40% shortfall between forecast demand and available water supply by 2030. Furthermore, climate change will worsen the situation by altering hydrological cycles, making water more unpredictable and increasing the frequency and intensity of floods and droughts (The World Bank, 2017). Thus, water scarcity and weather events (floods and droughts) pose threats to prosperity and in extreme cases contribute to increased instability and exacerbation of conflicts (ONZ Resolution, 2015).

In 2015, the UN General Assembly adopted the Sustainable Development Agenda, which sets out 17 Sustainable Development Goals. Goal six: "Ensure availability and sustainable management of water and sanitation for all" stresses the role of access to adequate amounts of clean water as a prerequisite for sustainable development and the promotion of prosperity (McDonald et al., 2014).

Different countries are unequally affected by the scale of the problem. The World Bank regularly monitors, among other things, the level of the Earth's renewable natural resources, including drinking water. According to the 2017 AQUASTAT report, Iceland is the undisputed world leader in terms of the amount of drinking water per capita (507,000 m^3 per capita), Guyana (348,000 m^3 per capita) and Suriname (176,000 m^3 per capita) rank second and third. For comparison, Poland (ranking at 133rd position among 182 countries) has approx. 1.6 thousand m^3 of drinking water per capita. Accordingly, the management of water resources in different countries, depending on national and regional policies, economic size and the awareness of the inhabitants, takes a variety of forms.

According to the World Bank definition, Water Resources Management (WRM) is the process of planning, developing, and managing water resources, in terms of both water quantity and quality, across all water uses. It includes the institutions, infrastructure, incentives, and information systems that support and guide water management. Water resource management also entails water-related risk management, including floods, drought, and contamination. The complexity of relationships between water and households, economies, and ecosystems, requires integrated management that accounts for the synergies and tradeoffs of water's great number of uses and values (The World Bank, 2017).

LITERATURE REVIEW

In the real estate sector, the literature and business practice have identified three basic functions of property management, each having its specific objectives (Thompson, 2015). To a certain extent, each of these functions covers issues related to the supply of energy and water to a property, the calculation and optimization of their use in order to reduce the expenses incurred by the residents, as well as forecasting their future consumption (Figure 1).

The literature has focused mainly on issues related to energy consumption. To better understand the factors affecting energy consumption in facilities, Griffin and others (Griffin et al., 2014) collected energy and meteorological data covering 22 years for 74 sites located throughout the world. They developed a regression model to predict energy consumption for each site. Ullah and others (2018) proposed a Hidden Markov Model based algorithm to predict energy consumption in residential buildings in South Korea using data collected through smart meters. High prediction accuracy of this model gave the authors confidence to further explore its application in building control systems for achieving better energy efficiency. A prediction methodology for energy consumption in residential buildings based

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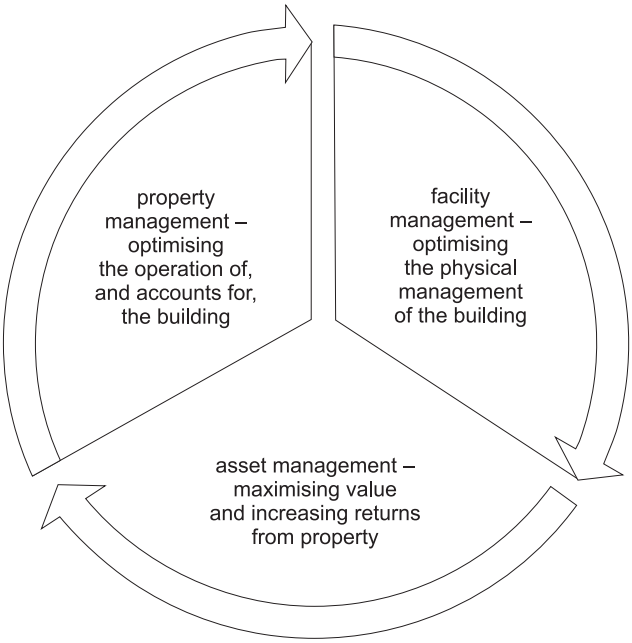

Fig. 1. Basic processes of property management
Source: own preparation based on Thompson (2015).

on deep extreme learning machine was proposed by Fayaz and Kim (2018). The results indicated that in the case of one-week and one-month hourly energy prediction on the given data the performance of deep extreme learning machine was far better than artificial neural network and the adaptive neuro-fuzzy inference system. Ridwana and others (2020) proposed and investigated modelling of building energy consumption by integrating regression analysis and artificial neural network with data classification. The proposed models could potentially be utilized for energy conservation purposes and energy savings in the buildings. Bland and others (2017) introduced the issues related to phase change materials (PCMs) which offer great potential as a latent heat energy storage technique to provide energy efficient systems in new and existing residential buildings. Their study reviewed PCM systems in residential building applications, with focus on their major disadvantages, and concluded with proposals for further development.

Issues related to water consumption, including its forecasting, tend to be addressed in the context of the management of water supply networks. Different types of models are used for water consumption forecasting. Bakker and others (2014) showed that a Heuristic Model and a Transfer/-noise model outperformed a Multiple Linear Regression model when forecasting the one day lead water demand. Mukesh and Adamowski (2015) explored a hybrid wavelet–bootstrap–artificial neural network and also compared its performance with that of standard artificial neural networks (ANN), bootstrap-based ANN and wavelet-based ANN models. Artificial neural networks were also used by Cieżak and others (2015), Romano and Kapelan (2014), Guo and Liu (2018) for forecasting of daily water consumption. As indicated by Somers and Casal (2009), ANNs are efficient in modelling complex linear and non-linear relationships without the need of implicit assumptions. Wałęga and Bergel (2009) evaluated the possibility of forecasting time series of daily household water use in farms with implementation of data mining. To prepare a 10-day water usage forecast, they used the exponential smoothing and the ARIMA method. Al-Zahrani and Abo-Monasar (2015) developed a model to forecast a daily water demand of a city considering meteorological indicators. They demonstrated that time series data need to be combined with other ANN inputs to get a reliable prediction.

In addition, the literature examines various aspects of water consumption by households. Use of water is discussed primarily in the context of its shortage (Klassert et al., 2015) of determinants of residential water demand (Romano et al., 2014), and water consumption pattern and water end-uses in low-income houses (Marinoski, 2014). In turn, Castillo-Martinez and others (2014) describe the results of research in the field of water labels developed to improve the current water billing.

Most of the above-mentioned articles also discuss issues related to management of residential properties in general. Issues related to residential property management are also discussed in some of the recently published papers. Vergara and others (2019) presented the results of an exploratory study about the nature of the management problems in the context of Chilean low-income condominiums. They

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showed the interdependencies between sociocultural, organisational and technical dimensions of the problems specific to the condominiums management and the relevance of the sociocultural variables to performing technical maintenance activities. Huang and Lee (2020) identified possible services that property management companies can provide to elderly residents of apartment complexes in response to changing demographics.

In Poland, the subject of forecasting water consumption is becoming an increasingly important issue in the process of managing residential buildings. This is due to the increase in the prices of water supplied to residential buildings and the resulting growing share of water expenses in household budgets and the need for property managers to collect advance payments towards water bills (2009).

Correct utility billing in a building is an important aspect of work of a residential property manager. Accurate meter data provided as the basis for billing are a guarantee of accurate bills and reduce the risk of complaints. However, water bills usually take into account not only the actual water use, but also the advance payments made by the tenant based on predicted use. Therefore, it was this billing method, which consists of determining average water uses of households and calculating advance payments for water charges on this basis, that was the starting point for creating a functionality which uses a database of archived meter readings and the amounts paid by households for their water usage in previous periods to allow property managers to better match advance payments to the actual demand. The functionality also helps to optimize water consumption through precise control of water expenses.

The aim of this article is to develop a proposal for a solution supporting a more rational consumption of water and billing of households in multi-family buildings. The proposed solution is based on the use of the method of moving average of three consecutive water consumption readings. This method is easy to understand not only for property managers, but also for residents of properties i.e. the persons using water and paying for its use. The created solution was incorporated into one of the software systems used by property managers in Poland, tested and implemented. The functionality enables a prediction of future water consumption, important for calculating advance payments towards water bills, as well as automatic detection of various types of anomalies, such as hydraulic failures, thereby reducing the total water consumption of the property and the corresponding water charges.

METHODOLOGY AND MATERIALS

The functionality supporting a more rational water consumption created for a multi-family property management software was developed in the software environment of the IAN24 property management system. This specific software system is adapted to the management of multi-family residential properties and supports the management process in the area of technical maintenance of the property, organizational, legal, as well as economic and financial services.

When creating the prototype, the method used for testing of the functionality consisted of testing it in the development, then test environment, and ultimately of testing the created prototype with real users. If any errors were detected, the necessary changes were made.

The basic programming language was JAVA, in particular Java EE (Java Enterprise Edition) technology, and a set of accompanying technologies to help create scalable solutions. Data storage was provided by a PostgreSQL database. The user interface was created in JavaServer Faces (JSF) technology using Primefaces framework and support for Omnifaces components. Software development was supported by Bitbucket web hosting, which made it possible to keep a task log and maintain the code in the GIT version control system. Releases of the system, development, test and production instances were run on a dedicated server in a cloud with the possibility to regulate the amount of available resources. Instances were located on the GlassFish application server.

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The methodology of developing the system functionality supporting a more rational water consumption in multi-family residential buildings is illustrated in Table 1.

The software user obtains a financial module for determining the water charges and forecasting the consumption of utilities i.e. of water in the analysed case. With this module, the user can automatically generate the amounts charged for all residential units in the multi-family property. The software leaves the possibility of calculating advance payments manually in cases where the results generated by the automatic model are likely to show excessive errors. Such a case occurs in the event of a change in the manner in which a residential unit is used e.g. in the case of a change of tenant or when the unit is temporarily vacated.

RESULTS

Based on the adopted methodology of developing the functionality supporting a more rational water consumption, new modules were added to the IAN24 software system. At the initial stage of works, an IT tool in the form of an importer was developed to enable automatic collection of data from water meters and its recording in the software system. With this tool, the system allows the user to import data from meters and attribute them to appropriate residential

Table 1. The methodology of developing the system functionality supporting a more rational water consumption

Stage 1.	Automatic collection and recording of data from water meters in the software system
	Automatic collection and recording of water meter readings in the property management software system is carried out based on created algorithms using a data importer. The software system collects the data from a database of meters readings and sends the data to the system server where the readings are attributed to individual households. The report on data import into the software is used to detect and clarify any irregularities.
Stage 2.	Creation of algorithms that describe relationships in data collected from water meters
	Algorithms describing relationships in meter data are created to enable automatic verification of water consumption and visualisation of this data using graphs. The accuracy of water consumption data is verified on the basis of the moving average of 3 consecutive readings. It was assumed that a deviation of up to 30% does not indicate a significant risk of a reading error or irregularity in the operation of the meter. Hence, any deviations above this percentage should be identified and analysed in more detail. This analysis is performed in three steps:
	Step 1. Calculation of the moving average of daily water usage for the previous 7 days. If the difference between a daily water use and the 7-day moving average of the daily water use exceeds 30%, the possibility of a meter failure should be verified. A potential meter malfunction is verified in step 2.
	Step 2. Calculation of the moving average of daily water usage for the previous 30 days. If the difference between the daily water use and the 30-day moving average of daily water use exceeds 30%, the probability of a meter failure is high. The meter failure is finally confirmed or excluded in step 3 below.
	Step 3. The final verification is carried out by comparing the daily water use with the moving average of daily use for the previous 365 days and, if this is not possible, by contacting the owner to explain the reasons for the significant variation in water data. Negative consumption values for any examined period are not allowed.
Stage 3.	Creation of algorithms supporting the optimization of water consumption in a property
	The algorithms created are used for calculating average water uses of individual residential units in a multifamily property and calculating advance payments towards their water use charges. This may contribute to the optimization of water consumption in the property. The water meter readings stored in the software system are the basis for determining the daily, weekly, monthly, quarterly or semi-annual water usage of a given residential unit (depending on the intervals adopted in a given property) to calculate average water uses as the basis for calculating advance payments towards water charges. Based on the calculated average water uses, water charges are automatically calculated for all residential units for their residents to pay in advance.
Stage 4.	Incorporation of the developed solution into the property management software system
	Incorporation of the developed solution enabling automatic collection of readings from meters, analysing the readings and calculating water charges into the software system.

Source: own preparation.

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units, archive readings from removed meters, and upload meter readings from files generated by remote meter reading devices or by the user manually. At the stage of importing data into the software system, the user obtains a tool for efficient previewing and possibly editing the proposed attribution of the data to the information stored in the system. When reading data or archiving meters readings, the system recognizes the meters based on each device's individual number. To attribute a meter to a residential unit, the user can indicate manually the unit to which the meter should be attributed or use automatic attribution by the software system. Any irregularities signalled to the property manager could be subject to clarification to develop of a coherent database based on reports on data import into the system (Fig. 2).

The imported data can be analysed by a system user for all residential units (Fig. 3) or at an individual unit level (Fig. 4) within the selected ranges of readings. This allows the user to initially detect any major deviations that may indicate a reading error, device failure or other failures causing abnormal meter readings. A closer analysis of readings from a particular meter can also be suggested by the software system which indicates a variation of 30% or more compared to the moving average of the last three readings by marking increased use in blue (Fig. 4) and reduced use in green color. Such deviation may be subject to further investigation carried out by the property manager. Normal readings are in standard color (black) and negative values are marked in red. The above rules were established based on property managers' experience and analysis of readings taken daily for a period of 6 months in a property selected for test purposes. The error rate depends on and is proportional to the reading intervals. From the analysis of readings, it can be assumed that the frequency of readings should not be less than once every six months.

Readings from all meters in a multi-family property over a short period of time (less than 1 year) are presented in a graph in Figure 5. In the

Import of meter readings 1 z 55

15

Property	B. no.	Unit no.	Meter type	Main meter	Value of a reading	Date of reading	Meter removal date
Wspólnota Mieszkaniowa Kordeckiego 20	20	1	Licznik główny	240056038	0.27	17/04/2018 09:34:18	
Wspólnota Mieszkaniowa Kordeckiego 20	20	1	Licznik główny	240056074	0.26	17/04/2018 09:33:57	
Wspólnota Mieszkaniowa Kordeckiego 20	20	4	Licznik główny	240055387	0.28	17/04/2018 09:34:09	
Wspólnota Mieszkaniowa Kordeckiego 20	20	5	Licznik główny	240056027	7.55	17/04/2018 09:37:17	
Wspólnota Mieszkaniowa Kordeckiego 20	20	6	Licznik główny	240055788	2.19	17/04/2018 09:35:38	
Wspólnota Mieszkaniowa Kordeckiego 20	20	7	Licznik główny	240055783	5.59	17/04/2018 09:35:37	
Wspólnota Mieszkaniowa Kordeckiego 20	20	8	Licznik główny	240055785	8.66	17/04/2018 09:35:44	

Fig. 2. Report on the import of meter readings in a multifamily property
Source: own preparation.

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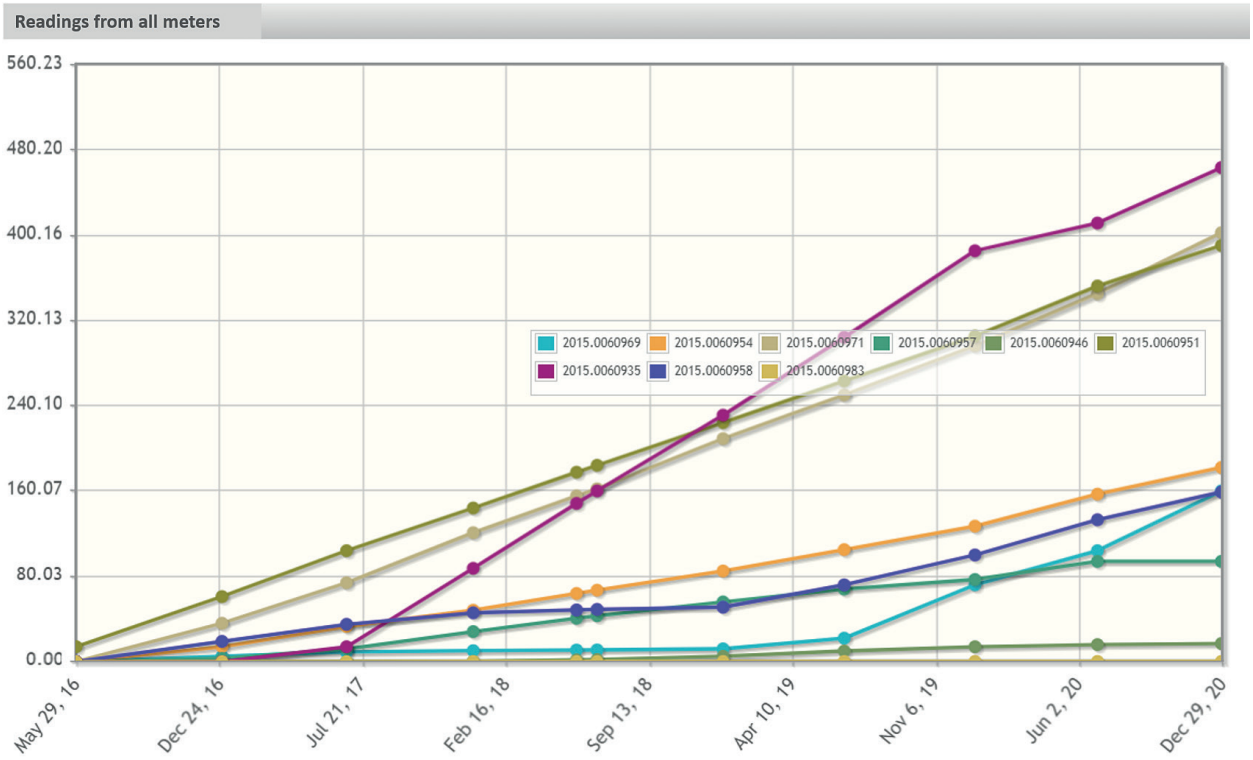

Fig. 3. Readings from all meters in a multi-family building over a long period of time (more than one year)
Source: own preparation.

analysed case, there is a change in the trend of water consumption shown by the meter no. 240056076, which may mean either a reduction in the number of persons living in this unit or illegal tampering with the meter by the its occupiers. Each such case needs to be verified by the property manager.

Verifying the correct functioning of the developed module that enables the analysis of the data uploaded from the meters was performed by:

- checking the meters from which the data were imported;
- checking the calculations of the relationships between readings over time.

Finally, water consumption algorithms were created to calculate average water use and water charges for each residential unit. On the basis of meter readings, the module calculates water consumption in a given period, and then the consumption data are fed to the financial module to calculate average uses and consumption forecasts and to calculate the amount of charges corresponding to a given meter in a residential unit at any given time (there are usually four meters per unit in Poland). For the purpose of the billing process, the developed software functionality enables the user to automatically determine average water use of each unit (average consumption in the current period).

At the same time, the system leaves the possibility to calculate advance payments manually in cases where the results generated by the automatic model are likely to show excessive errors. Such a case occurs in the event of a change in the manner of use of a property e.g. in the case of a change of the tenant or when the residential unit is temporarily vacated.

The correct functioning of the module designed to calculate advance payments for utilities, in particular

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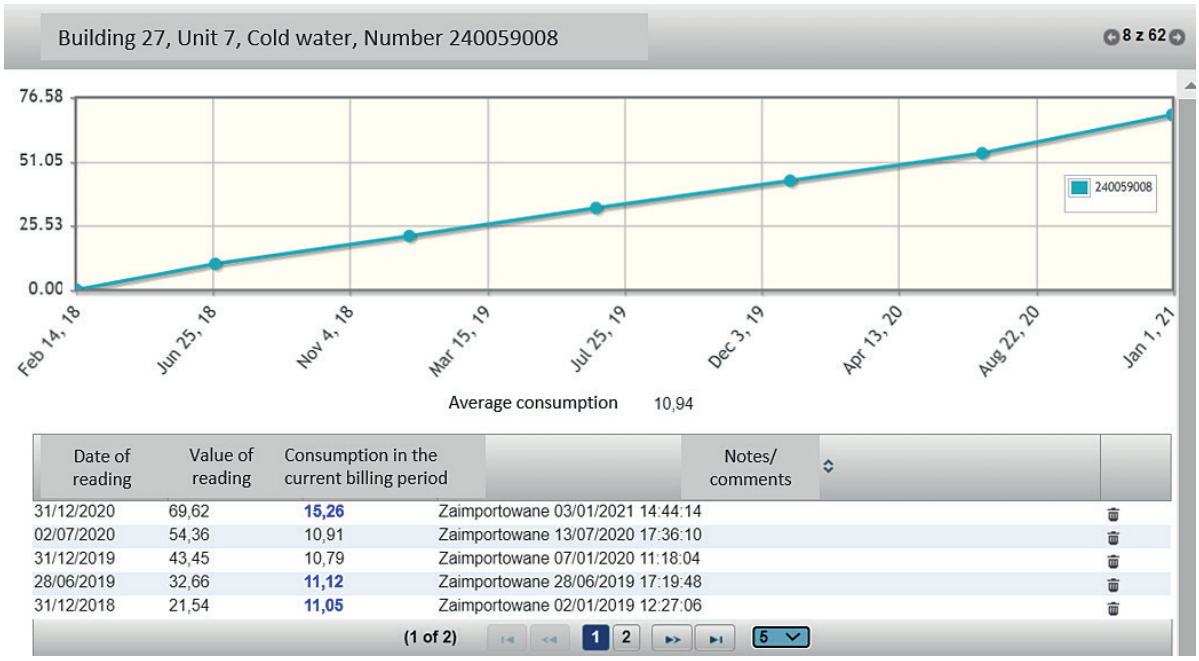

Fig. 4. Graphic visualisation and list of meter readings in a selected residential unit in a multi-family building over a long period of time (more than one year)
Source: own preparation.

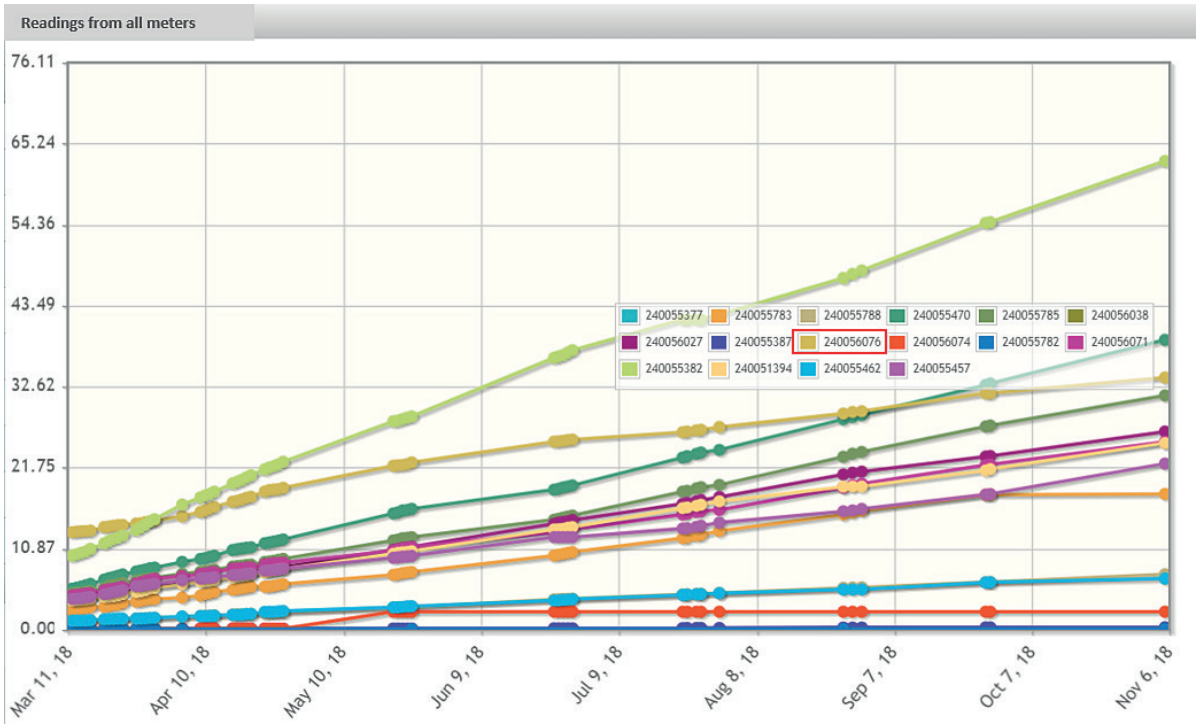

Fig. 5. Readings from all meters in a multi-family building over a short period of time (less than one year)
Source: own preparation.

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water, based on average water uses calculated from verified meter data and on the outstanding balance between the advance payments made and the actual use, was verified in a test in which the following steps were successfully performed:
– verification of advance payments calculated on the basis of average water uses;
– verification of calculations in relation to the actual water consumption and the billed charges.

CONCLUSIONS

The functionality presented in the article created for a software system for managing multi-family residential buildings to support a more rational water consumption, was developed in a four-stage process including: automatic collection and recording of data from water meters in the property management software system, creation of algorithms describing relationships in water meter data, creation of algorithms supporting a more rational water consumption in a property and incorporation of developed solutions into the software system. Key to developing this functionality was the stage of creating algorithms describing the relationships in the data taken from water meters, i.e. illustrating water consumption in specific periods of time. Adopting a moving average of 3 consecutive readings with a deviation of up to 30% appears to be sufficient for the purpose of automatic verification of water consumption in households in a multi-family residential building, assuming that this verification is done in several steps, presented in Table 1. Deviations higher than this percentage threshold should be marked and analysed in more detail to check for a possible reading error, meter malfunction or a hydraulic system failure. Finally, a deviation threshold other than 30% of the three readings' moving average can be adopted after analysing individual cases occurring in a given multi-family residential property. It should be noted that ongoing monitoring of meter readings in multifamily buildings leads to a more rational water consumption in particular due to a more accurate offsetting of advance payments against the actual use and more dynamic calculation of water charges. Due to the occurrence of meter failures or even hydraulic system failures, as well as tampering with meters by some residents to artificially reduce their water charges, verification of meter readings should be one of the important processes in the management of a residential property.

Equally important as the creation of the above-described algorithms was the stage of this functionality's development consisting of creation of algorithms for calculating average water uses and the resulting advance payments towards water charges for individual households. These algorithms are also based on a moving average of three consecutive readings, which is appropriate for reason of its clarity for residents of a property. On the one hand, these algorithms allow a slightly longer period to be taken into account when calculating the advance payments than only the period covered by the last bill and, on the other hand, are not too complicated and thus understandable for the vast majority of residents of the property. The use of more advanced calculation methods allowing a more accurate forecasting of water consumption and thus the water charges, but not easily verifiable by most residents of the property, may lead to allegations of a lack of transparency against the property manager. It should be emphasized that advance payments reflecting trends in water consumption are an important element encouraging a more rational water usage by residents. Automatic calculation of water consumption forecasts for the purpose of determining the amount of advance payments towards water consumption, as well as the dynamic method of billing, according to the proposed methodology, may motivate residents to lower their consumption. Contrary to the currently used method of utility billing, especially the annual one, residents of multifamily properties can quickly see savings in their household budgets if they use water more rationally out of care for their money and the environment.

The created functionality therefore has a pragmatic value. With correct development process, it can be successfully incorporated into any IT system supporting property management.

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Author contributions: authors have given approval to the final version of the article. Authors contributed to this work as follows: T.B., N.S., K.S-M. and S.J. developed the concept and designed the study, T.B. and S.J. collected the data, T.B. and S.J. analysed and interpreted the data, N.S. and T.B. prepared draft of article, T.B., N.S. and K.S-M. revised the article critically for important intellectual content.

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LAND ADMINISTRATION SYSTEM AND GEOPORTAL SERVICE FOR THE NEED OF A FIT-FOR-PURPOSE NATIONAL URBAN GREENERY MANAGEMENT SYSTEM (UGMS). THE CONCEPT FOR THE EU MEMBER STATE OF POLAND

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ABSTRACT

Motives: IT is nowadays an effective tool supporting management in many fields, including management of urban greenery. Only a few cities in Poland have launched a dedicated urban greenery management system (UGMS). The need to provide all cities in the country with such a possibility gave birth to the idea of developing a concept using existing Land Administration System (LAS) infrastructure connected with INSPIRE Geoportal which can provide more than 75% of the information for urban greenery management.
Aim: The main aim of this study was to propose the functional and database concept of a fit-for-purpose urban greenery management system (UGMS) in Poland as a universal tool for different types of urban greenery management bodies (UGMB) and a consistent information platform covering the entire country based on LAS referred to as the Integrated Real Estate Information System (IREIS), and the INSPIRE Geoportal service. The UGMS concept can be implemented in the other Member States of the European Union and other countries that have LAS and SDI like INSPIRE.
Results: This approach develops a cost-effective information system that contains comprehensive information from the existing SDI in Poland and can be used by all Polish cities. The system will provide UGMB with access to data that is required for the performance of their statutory duties. Previous accomplishments, EU recommendations, and national experiences in spatial planning have been taken into account in the design process. In line with the fit-for-purpose concept, the relevant needs were determined during a survey of selected public administration authorities responsible for urban greenery. As a result, the scope of data required to create the UGMS was defined in the context of system functionalities. In addition, potential sources of data for the UMGS and their location in the NSDI were identified.

Keywords: urban greenery, green infrastructure, green information system, urban greenery management system, land administration system, INSPIRE

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INTRODUCTION

Urban greenery should be maintained to protect biodiversity and help cities adapt to a changing climate (Makinde et al., 2021). In Europe, the development of Urban Greenery was particularly influenced by European Commission guidelines and standards (EC, 2012a; 2016) recommending the implementation of consistent green policies and the development of Green Infrastructure (GI). Green information systems should play an important role in the sustainable management of green infrastructure (Pauleit et al., 2017; Nowak et al., 2020). They should be purposefully designed to meet the information needs of all actors who are responsible for urban greenery (UG). However, an analysis of good practices relating to the implementation of GI systems as part of the European GREEN SURGE (GS) project (Pauleit et al., 2019) indicates that despite European Commission guidelines concerning GI systems and the implementation of the European Spatial Data Infrastructure (INSPIRE, 2007), a uniform approach to developing such systems has not been proposed in the European Union or the individual EU Member States. The existing approaches do not cover the territory of entire countries, and the proposed solutions are implemented only locally. In the EU Member States tree risk management is not being regulated at the state level, and instead depends on the decisions made by local municipalities. In consequence, the applied approach to green infrastructure varies between different cities. The above also applies to Poland, where local regulations have been drafted and implemented by selected Polish cities (Biejat, 2017). The existing local information systems contain fragmented databases (Feltynowski et al., 2018; Ślązak, 2017), mainly due to a shortage of funds, insufficient experience in implementing different stages of GI projects, and the lack of economic incentives because the benefits of GI are difficult to assess in financial terms (Kabisch et al., 2016). Since there are no key, nationally standardized regulations for urban greenery maintenance, it is difficult to expect the creation of a nationwide information infrastructure for common use in greenery management.

Therefore, the main aim of this study was to propose the concept of a fit-for-purpose urban greenery management system (UGMS) in Poland as a universal tool for different types of urban greenery management bodies (UGMB) and a consistent information platform with a database and functionalities covering the entire country using information technology (IT) of Land administration system (LAS) integrated with INSPIRE Geoportal service (INSPIRE, 2007) as components of National Spatial Data Infrastructure (NSDI). The UGMS concept can be implemented in the other Member States of the European Union and other countries that have LAS and SDI after adaptation to national information needs. Spatial Data Infrastructure is a global framework of policies and institutional arrangements; therefore, the developed concept can also be used as a reference in non-EU countries. The Polish land administration system (LAS) is referred to as the Integrated Real Estate Information System (IREIS). This approach was adopted to develop a cost-effective system that contains comprehensive information about the existing spatial data infrastructure in Poland and can be used by all Polish cities. The system will provide all users, in particular UGMB, with access to data that is required for the performance of their statutory duties. The UGMS infrastructure should span the entire country to address the lack of cohesive IT tools for urban greenery management, the absence of valid data, and different methods of data collection, and to enable less affluent cities to benefit from the accumulated resources. These goals can be achieved by localizing the UGMS in the LAS environment and using INSPIRE data. The LAS constitutes integrated information infrastructure which is a part of the national spatial data infrastructure (NSDI) and which enables the public administration to perform tasks related to land management. The LAS plays a very important role as a source of reference data for spatial planning, tax assessment, real estate registration in the land register, statistical reports, and real estate management (Williamson et al., 2010). In turn, the Geoportal service constitutes spatial data infrastructure that is open to the public and has been developed under the provisions of the

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INSPIRE Directive (INSPIRE, 2007). The LAS and the INSPIRE Geoportal service are described in detail in subsection *National Spatial Data Infrastructure…* The NSDI comprises public registers and is kept by public administration bodies. Urban greenery constitutes a public resource, and it is also managed by public administration authorities; therefore, the UGMS should be a part of the NSDI. The resulting system could become a national platform for managing UG as well as green spaces outside urban areas. This is a logical approach that will deliver economic (the use of shared infrastructure will decrease development and maintenance costs) as well as environmental benefits (less affluent cities will have access to a greenery management system). A UGMS that is developed based on the LAS and the Geoportal service as a part of the Polish NSDI will create access to large amounts of integrated spatial data.

Literature study covering the last 20 years involving the following keywords – urban greenery/green infrastructure/green spaces information/management systems, urban green spaces maps has shown that there are a lot of studies developing greenery managing systems with new functionalities, including GIS tools e.g. for planning UG (Kulkarni et al., 2017), for mapping urban green spaces (Vatseva et al., 2016), for environmental monitoring (Trubina et al., 2019), and their functions in the absence of spatial data (Łaszkiewicz et al., 2020). However, solutions are lacking for creating a single country UGMS. Hansen et al. (2016) conclude that currently developed greenery management systems in the EU member states are limited in scope and profiled towards solving particular issues at a local scale. They use their own software using publicly available spatial data from selected public records and create their own databases. This is an inefficient approach as it requires significant financial investments and is time-consuming. Furthermore, searching the literature on LAS for urban greenery management or smart urban greenery management also did not identify any scientific proposals for using LAS infrastructure connecting with INSPIRE SDI for UGMS. The most common concepts in current studies are the use of cloud computing, the internet of things (IoT), and artificial intelligence (AI) for smart UGM (Anh, 2021) using GIS and nationally available land use maps. Some smart GIS for UGM uses databases from sensors e.g., for measuring soil moisture for irrigation (Nguyen et al., 2020). So far there is no approach to implement a standardized information technology available to all cities in the country, such as cadastral systems, for the information service of urban greenery management. The proposed concept is innovative not only because it provides a solution for launching the UGMS at a national level, but also because it offers a standardized approach to create fit-for-purpose UGMS. It integrates various types of thematic data for UG management in one access window based on the information technology of the LAS and the provisions of the INSPIRE Directive. The innovative character of the proposed approach to developing a national UGMS was emphasized in subsection Lessons learned… in the context of the European debate on good practices in the process of implementing such systems. The local dimension of such measures and the absence of standard approaches at the national level has also been accentuated by the European GREEN SURGE (GS) project (Pauleit et al., 2019) that aims to develop and evaluate the best practices in urban green infrastructure management.

The proposed concept UMGS will support the management of urban greenery at every stage, from policy-making, through design, material procurement, and implementation, to monitoring, protection, and maintenance. It will enable the development of a uniform system covering all cities in the country, and it will create equal opportunities for developing green infrastructure in all urban areas. This novel approach towards creating a comprehensive national system can support the development of national-level regulations for establishing and operating a UGMS.

The UGMS should not rely on individual information systems because most of the data for UG management is supplied by national spatial databases that are integrated with the LAS and the Geoportal service. Therefore, the following research hypothesis

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was formulated: the Polish NSDI integrating the land administration system, referred to as the Real Estate Information System (IREIS), and the INSPIRE Geoportal service is capable of supplying more than 75% of the data required for UG management in Poland. The proposed approach marks a new direction in the process of developing the UGMS.

MATERIALS AND METHODS

Research organization and methods

An empirical study involving qualitative methods was carried out to achieve the research objective, namely to identify the types of data and the functionalities that are essential in the proposed UGMS. The study relied on an in-depth analysis of the literature, policy documents, legislation, and good practices in the implementation of urban greenery management systems in Europe. Due to considerable differences in the terminology describing urban green spaces in domestic and international literature, the existing definitions were analyzed, and consistent terminology was proposed. Strategic European and domestic documents were reviewed to identify the key EU recommendations on urban planning and the promotion and implementation of green infrastructure and to describe the existing information systems as the sources of the best practices in UG management. In addition, the theoretical concepts relating to spatial data infrastructure (SDI) in Europe and Poland were analyzed to determine the applicability of integrated spatial data in the Geoportal service and the Polish LAS for the needs of the proposed UGMS.

The resulting knowledge was used to describe the main functionalities and features of the proposed UGMS based on general trends in green infrastructure development, the implementation of various information systems in the EU, and the possibilities offered by NSDI. The formulated assumptions were then validated by surveying the employees of public agencies responsible for urban greenery management in five Polish cities (Warszawa, Kraków, Poznań, Gdańsk, and Olsztyn). The selected cities are large urban agglomerations that are situated in different Polish regions, are more affluent than other Polish cities, and have made different progress in the implementation of systems supporting green infrastructure management. In Poland, urban greenery is managed by various entities at different levels of the administrative hierarchy. For the needs of this study, these entities were described collectively as urban greenery management bodies (UGMB). The respondents were UGMB employees (sectoral experts) who were asked to indicate the types of data, tools, and functionalities that would be useful in daily practice. The results of the survey were used to identify the types of spatial data and system functionalities that would most effectively support the operations of UGMB in three general areas of competence: planning, administration, and field operations. In addition, these results were used to select the main (urban greenery) and supplementary (other spatial objects) types of data and essential system functionalities that are best suited for sustainable UG management (detailed information is presented in subsection *Field research*…).

Databases were analyzed in thematic groups to verify the research hypothesis stating the Polish NSDI integrating the land administration system, referred to as the Real Estate Information System (IREIS), and the INSPIRE Geoportal service is capable of supplying more than 75% of the data required for UG management in Poland. The research hypothesis was verified by analyzing the extent to which NSDI resources can cater to the need for spatial data in the proposed UGMS.

The present study did not set out to offer detailed technological or organizational solutions. The study aimed to localize the UGMS database within the Polish land administration system integrated with the INSPIRE Geoportal. The architecture and organization of the UGMS will be described in a future publication.

Research area – survey research

Public administration inspectors (experts) responsible for UG management were surveyed in five Polish cities: Warszawa (3 departments), Kraków, Wrocław, Gdańsk, and Olsztyn (Fig. 1). The survey involved

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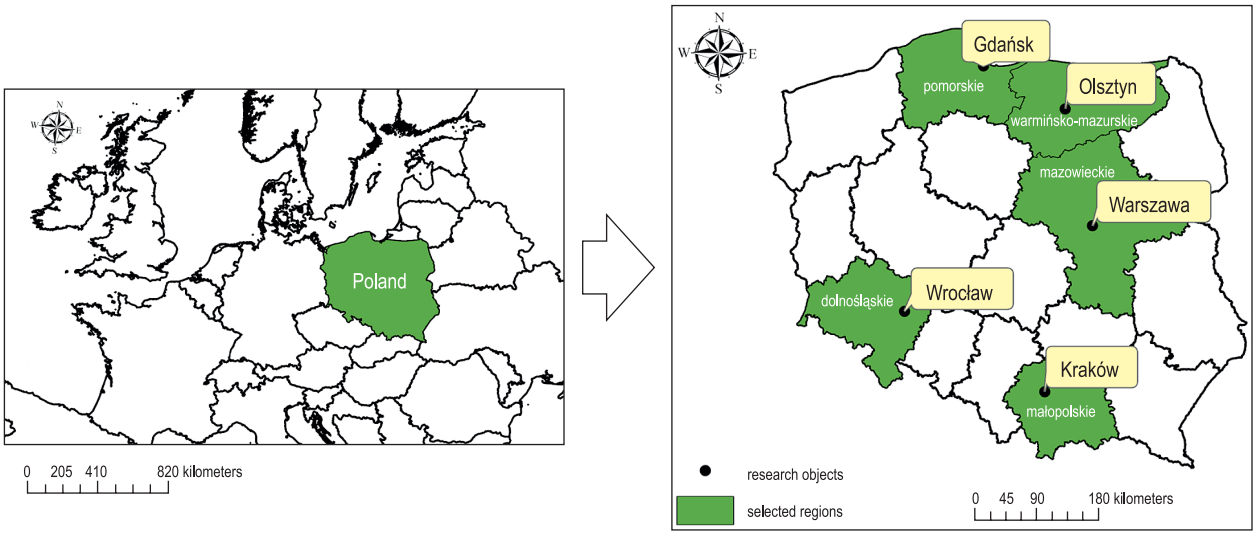

Fig. 1. Polish regions and regional capitals with marked research objects
Source: own elaboration.

the employees of environmental protection departments, urban greenery departments, and city offices in Olsztyn (Olsztyn Road, Greenery and Transport Authority; Department of Urban Planning and Architecture of the Olsztyn City Office; Chief Landscape Architect), Wrocław (Municipal Greenery Authority; Chief Urban Landscape Architect; Department of Urban Greenery; Department of Land Resources; Technical Documentation Department; Investment Department), Kraków (Municipal Greenery Authority), Warszawa (Warszawa Greenery Authority, including three Garden Zone departments; Real Estate Management Department; Green Landscaping Department; Green Infrastructure Department; Water Department; Participatory Budget Department) and Gdańsk (Gdańsk Road and Greenery Authority).

The survey aimed to elicit comprehensive information about urban greenery management at different levels of public administration. The interviews were conducted in public institutions responsible for planning, administering, and managing urban greenery. The cities selected for the study are regional capitals that represent the geographic regions of Poland, and they differ considerably in the implemented solutions and systems for UG management. The selection of research objects was preceded by a detailed analysis of information systems for UG management in these cities.

Survey questionnaires were forwarded by email and post to 50 sectoral experts, 10 in each analyzed city, and completed questionnaires were returned by 34 respondents. The results of the study are presented in subsection *Field research…*

RESULTS

Desk research – Overview of existing studies and documents

The first stage of the study involved a review of the literature, strategic documents, acts of Polish and EU law, and reports from the implementation of modern information systems for urban greenery management. The results were analyzed to create a comprehensive list of data for UMGS and its functionalities. These findings were verified during the expert survey.

Terminology

The present research was undertaken to define the concept of UG management and determine the scope of information required for the effective

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implementation of UMGS. For this purpose, the term "urban greenery" was selected as the main keyword, and "urban green areas" and "green infrastructure" were regarded as related terms that are frequently encountered in the literature and Polish legal acts. In the literature, the term "urban greenery" is often used interchangeably with "urban green areas" (Shashua-Bar & Hoffman, 2000; Morancho, 2003; Ernstson et al., 2008) to denote *urban* land covered by all types of vegetation, including vegetation on private and public grounds, regardless of their size and function, as well as small water bodies such as ponds, lakes or streams ("blue spaces"). The Nature Conservation Act of 16 April 2004 (Article 5.21) (Act, 2004) states that green areas include developed areas with technical infrastructure and functionally related buildings, areas that are covered with greenery and serve public functions, in particular parks, gardens, promenades, boulevards, botanical gardens, zoological gardens, game parks, historical parks, cemeteries, roadside greenery in developed areas, squares, historical fortifications, buildings, storage sites, airports, railway stations and industrial facilities. Green areas also include green walls and municipal forests, as well as tourist and leisure areas. Urban greenery is often incorrectly regarded as synonymous with public areas because Polish urban planning documents focus on the formal and most frequently identified categories of urban greenery (formal urban greenery, FUG) that are managed by the local authorities. In turn, many forms of urban greenery that are found on private land are not formally classified as green spaces (e.g. arable land, grassland, pastures, orchards, brownfields / undeveloped land located within city limits) (Feltynowski et al., 2018). These areas can be referred to as informal urban greenery (IGS). In this study, both formal and informal UG were regarded as components of urban greenery. In the literature, the term "urban greenery" is used synonymously with "urban green areas" (UGA), and both terms will be used interchangeably in this study.

Urban greenery is undoubtedly a fundamental element of urban green infrastructure (GI). Green infrastructure is defined as "a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services" (EC, 2016). This concept incorporates green spaces (or blue spaces if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. In other words, GI denotes successfully tested tools that provide ecological, economic, and social benefits through natural solutions (Benedict & McMahon, 2002). Green infrastructure is a concept that is broadly understood, and it is expected to evolve into a comprehensive approach to fulfilling many integrated functions, from greenery management to the preservation of wild flora and fauna species, recreational areas, ecosystem services such as flood prevention and microclimate control (Pauleit et al., 2017). In Poland, GI is still under development, especially about the division of competencies and responsibilities; therefore, the most urgent task at present is to develop the assumptions for urban greenery management and expand the existing databases to support all GI.

Legal regulations and recommendations in Poland and the EU

European Union documents

The management of green spaces is addressed by numerous policy areas at the European level, and the three most relevant areas are natural resource management, sustainable urban development, and spatial development. Urban greenery is a part of GI, and the following policy documents concerning GI have been adopted by the EU in the context of UG: the Roadmap to a Resource Efficient Europe (EC, 2011a), EU Biodiversity Strategy to 2020 (EC, 2011b), Urban Agenda for the EU – Pact of Amsterdam (Agenda, 2016), Blueprint to Safeguard Europe's Water Resources (EC, 2012b), and Adapting to climate change: towards a European framework for action (EC, 2009). Green infrastructure also refers to the Natura 2000 ecological network of protected areas Directive on the conservation of natural habitats

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and wild fauna and flora (Directive, 1992) and the Directive on the conservation of wild birds (Directive, 2009). The above documents were analyzed, and the following types of data were selected as relevant for UG management: land cover, soil and water conditions, existing infrastructure, land use, protected species and habitats, environmental pollution, and meteorological data. The analyzed documents emphasize the need to collect and exchange information at the level of the EU Member States. Many other documents have been adopted to standardize the approach to improving urban green infrastructure or urban greenery. International conventions, EU regulations, and programs focus on selected elements of green infrastructure. Green infrastructure can deliver numerous benefits and serve different functions, including environmental (biodiversity conservation, climate change adaptation), social (green space planning), and economic (job creation and increased property value). All policy documents recognize the importance of reliable data in GI management. The above documents were examined to identify datasets that are essential for achieving green policy objectives, including land cover (especially green objects), land use, protected areas, valuable species and habitats, the conservation status of natural habitats, and species of European importance, climate, and environmental pollution. These datasets were then verified in an expert survey involving the employees of Polish UGMB.

Polish legal acts and strategies

The concept of Green Infrastructure (GI) is not yet present in Polish legislation, especially in its integrated-strategic approach. However, Polish legal regulations contain references to specific elements of UG. The fragmentation of the relevant regulations and the absence of a clear definition of green infrastructure undoubtedly hinders GI protection. However, specific GI components are protected under other acts and strategic documents; therefore, green infrastructure is not absent from Polish legislation (Neubert et al., 2019).

The most important national strategic document relating to urban greenery and blue spaces are Resolution of the Council of Ministers of 13 December 2011 on the adoption of the National Spatial Development Concept 2030 (Resolution, 2012), Environmental Protection Act of 27 April 2001 (Act, 2001), Nature Conservation Act of 16 April 2004 (Act, 2004), Act on forests of 28 September 1991 (Act, 1991), and the Water Law of 20 July 2017 (Act, 2017). These laws emphasize the importance of land use planning in biodiversity conservation and the protection of valuable natural resources. The following documents were also analyzed in the study: Resolution of the Council of Ministers of 5 February 2013 on the adoption of a Long-Term National Development Strategy – Poland 2030. The Third Wave of Modernity (Resolution, 2013); Resolution of the Council of Ministers of 16 July 2019 on the adoption of the State Environmental Policy 2030 – Development Strategy for the Environment and Water Management (Resolution, 2019); Strategic Adaptation Plan for sectors and areas vulnerable to climate change by 2020 with an outlook to 2030 (Ministry of the Environment, 2013); Resolution of the Council of Ministers of 6 November 2015 adopting the Program for Biodiversity Conservation and Sustainable Use of Its Components and the Action Plan for 2015–2020 (Resolution, 2015). These documents emphasize the importance of protecting and improving the environment, monitoring biodiversity, and working to prevent climate change.

The maintenance and restoration of ecosystem services play an important role in UG establishment. This task requires a system for the valuation and integration of ecosystem services into development strategies, the planning system, and national accounting and reporting systems. Such a system will enable reliable assessment of biodiversity loss, and it will improve communication between different levels of government. The performance of the Polish nature conservation system can be considerably improved through the integration of green infrastructure (Resolution, 2015). The tasks to be performed by the responsible institutions under the Program for Biodiversity Conservation and Sustainable Use of Its

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Components and the Action Plan for 2015–2020 (Resolution, 2015) are presented in Table 1.

An analysis of the above documents indicates that Poland is on the right track towards developing GI and that plans are being made to develop national standards based on EU guidelines, organizational solutions, and divide the relevant responsibilities. To summarize, the above documents indicate that effective GI management requires analyses of long-term climatic and hydrological data (thermal indicators, precipitation, extreme phenomena, air pollution), land use planning studies, flood hazard maps, various nature conservation schemes, ecological corridor maps, and nature monitoring data. The recommendations concerning data collection for planning and managing green areas were taken into account in subsequent stages of the study to identify the types of data that are essential for the development of the UGMS.

Table 1. Key tasks and objectives for the development of Green Infrastructure in Poland

Responsible institution	Tasks
Ministry of Environment	Development of a national catalog of ecosystems and their services with a map of ecosystem distribution
Ministry of Environment	Development of national principles for valuing ecosystem services
Ministry of Environment Ministry of Finance Central Statistical Office	Development of national principles for integrating ecosystem service valuation with accounting and reporting systems
Ministry of Infrastructure and Development	Development of national guidelines to make green infrastructure a standard element of spatial planning and territorial development
Local government entities	Integration of green infrastructure into planning efforts at the local level

Source: own elaboration based on the Program for Biodiversity Conservation and Sustainable Use of Its Components and the Action Plan for 2015–2020 (Resolution, 2015).

Lessons learned – experience from the implementation of the best information systems for urban greenery management in EU member states

Information technology such as databases and Geographic Information Systems (GIS) for comprehensive urban greenery management is still a relatively new phenomenon in Europe. This observation was confirmed by the GREEN SURGE (GS) project (Pauleit et al., 2019) which examined the progress made in GI implementation in 20 European urban areas and identified good practices for GI planning (Davies et al., 2015). The results indicate that all urban areas had defined green space strategies and had developed various tools for their implementation, including the relevant spatial information systems. The key provisions of the strategies introduced by the analyzed cities focused on planning green spaces, most often recreational spaces, and climate change mitigation standards, including adaptation to new climate conditions in future planning of urban GI. The differences in the analyzed green strategies and the relevant information systems resulted mainly from environmental conditions and the funds allocated to the implementation of these policies, which are described below in the example of Barcelona, Berlin, and Kraków. In all surveyed cities, SDI was developed in line with the provisions of the INSPIRE Directive which lays down a general framework for GI development. However, none of the examined European cities had implemented an urban greenery management system that is integrated with the land administration system.

In post-transition EU countries such as Poland, Lithuania, and Slovakia, many cities are struggling with various economic, organizational, and legal problems that are delaying GI development (Davies et al., 2015). However, in some UE cities, considerable progress has been made in urban greenery management, and advanced information technologies have been

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introduced to support the developed management standards. The examples of Barcelona, Berlin, and Kraków point to a strong link between the quality of GI management and information technology. One of the most promising examples that focus strictly on GI development is the Green Infrastructure and Biodiversity Plan 2020 implemented by Barcelona (Spain). Barcelona has developed an information system dedicated to green infrastructure, green spaces, and biodiversity conservation that is consistent with the provisions of the Green Infrastructure Development Program (Barcelona, 2017) whose priory goal is to increase green space per capita. This system called GAVI uses software that interacts with the community through the website (Barcelona City Council, 2011). It integrates a variety of information layers to facilitate urban greenery management e.g. pruning, maintenance, and removal management as well as replacement and risk management. Green spaces in Barcelona were first identified based on the available spatial data, including topographic maps, orthophotos, thematic maps, the normalized differential vegetation index (NDVI), and local plans. Barcelona's GAVI measures and monitors the continuity and accessibility of green areas, their functional complementarity, and their ability to provide social and environmental services, including the planning of green infrastructure as a network of green corridors; assessment of areas identified as recreational spaces with the potential to increase biologically active and permeable surfaces; provision of ecosystem services in green areas on a city-wide scale, and the development of an information system dedicated to green infrastructure, green areas and biodiversity. Unfortunately, Barcelona's Green Information System remains a local initiative, and it has not been implemented in other Spanish cities. The scope of data in Barcelona's GI system was taken into consideration in the process of developing the UGMS database concept.

Berlin has implemented the Green-Space Information System (GRIS). The GRIS has been designed to improve the effectiveness of green space maintenance from the economic point of view and to facilitate data processing for planning and communication with the local authorities and the public. The Biotope Area Factor (BAF) was introduced to determine the proportion of urban areas to be left as green space. This indicator was developed to limit environmental degradation in the inner city and suburban areas and to ensure that sufficient green space exists to provide recreational functions and maintain ecological functions (BGMR & HCU, 2017). The databases in Berlin's system contain information on land cover, including green and blue infrastructure (with particular emphasis on areas that provide ecosystem services, such as forests, parks, vegetable gardens, green roofs), native plant and animal species, and protected areas of high environmental value. Both systems operate independently of the national SDI, and they import and update cadastral reference data within the specified time intervals. The systems cater to the needs of public administration bodies responsible for UG management. They cannot be accessed by other users under a limited license. The databases in Berlin's system should be regarded as a set of good practices for designing the Polish UGMS.

Urban greenery information systems in Poland

Polish cities face many barriers in the process of planning and managing green areas (limited funding, shortage of complete data, reluctance to cooperate) (Feltynowski et al., 2018; Kronenberg et al., 2016). Greenery inventories are usually fragmented and do not cover the entire city (Biejat, 2017). As a result, UG information systems cannot be effectively implemented. However, some progress has been made in recent years, and several large Polish cities have implemented GIS.

The analysis demonstrated that Kraków and Warszawa had implemented two specialist systems each, Gdańsk and Wrocław – one specialist system each, whereas no such systems were available in Olsztyn. In the analyzed group of cities, Kraków had the most advanced green information system (R3Trees) with a detailed and regularly updated inventory of urban greenery data. The system features

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thematic maps illustrating the location of new trees and felling decisions for development projects. This project was largely facilitated by Kraków's UG strategy referred to as Directions for the Development and Management of Green Areas for 2017–2030. Kraków is the only Polish city to have implemented such a strategy. The strategy aims to create new green areas, combine the existing areas into a coherent system, raise UG maintenance standards and improve the management of green areas in Kraków. To establish R3Trees, green areas were identified based on cadastral data for various land use types, information about green areas maintained by the Municipal Greenery Authority, an orthophoto map of Kraków, and field surveys. The system has been designed to perform the following functions: manage and maintain green areas, acquire land for GI development, obtain information about the provisions of the local zoning plan, plan investments, establish nature conservation sites, as well as specific functions such as determining sites where compensation planting is needed. R3Trees is a multifunctional system; however, it is not connected to the IREIS rail service. The system operates in internal mode, and cadastral data are imported periodically, which compromises the timeliness of the gathered information. In addition to cadastral data, R3Trees also relies on orthophoto maps and own data inventory; therefore, only a small percentage of the data available in Poland is used. The main advantage of R3Trees is that it contains an extensive database of inventoried UG data.

Gdańsk has implemented the BAND Tree Planting Bank application (BAND Gdańsk, 2020). Olsztyn has a well-organized spatial information system (MSIPMO Olsztyn, 2020), but it has not introduced any applications that are dedicated exclusively to urban greenery. In Warszawa, efforts are currently being made to develop a tree crown mapping application with detailed information about tree species, their location, and health status. The application will enhance cooperation between public agencies responsible for urban greenery management and green infrastructure development. A tree-felling map has also been developed in a local geoportal as part of the NSDI. The "Greenery" tab in the geoportal contains data layers from the Warszawa Urban Greenery Database developed by the Environmental Protection Department of the City of Warszawa (Warszawa City Hall, 2020). The website of the Warszawa Greenery Authority contains information about trees, new plantings, replacement plantings, tree felling requests, and the relevant approvals (Greenery Board of the City of Warszawa, 2019). This database is an inventory of urban green spaces, in particular roadside greenery, parks, squares, pocket parks, playgrounds, and schools. The ArcZieleń application was created in Warszawa to support the collection and processing of multi-layered information about green areas, and the generation of thematic maps, tabular lists, and graphic lists. The ArcZieleń database contains information about trees (species, dimensions, health status, growing conditions), shrubs, flowerbeds, and lawns. The application contains detailed information about every identified green object. In the future, the application will be expanded to include information about the planned maintenance operations, plant age, and species (Supreme Audit Office, 2017). In Wrocław, the local land administration system features a nature map with information about urban greenery management, greening plans, community initiatives, and environmental protection programs (WSIS, 2019). All green information systems in the surveyed cities rely on data from local information systems. Local systems are not connected to the IREIS rail service.

Other UG information systems in Poland support only selected management tasks, such as the identification of trees and canopies, or public participation (reporting problems in public green spaces) (Czepkiewicz, 2013; Biejat, 2017). Many of these systems cover only selected parts of urban greenery, such as urban and peri-urban forests. Electronic databases of urban trees that are linked to GIS and complete tree inventories facilitate UG planning and management (Tsitsoni et al., 2015).

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National Spatial Data Infrastructure: INSPIRE Geoportal and the Land Administration System in the Polish Integrated Real Estate Information System

A uniform information system for UG management should be confronted with the existing public information systems, in particular with the National Spatial Data Infrastructure (NSDI) which integrates various spatial databases to prevent data duplication and minimize implementation costs. The Polish NSDI conforms to the provisions of the Spatial Information Infrastructure Act (Act, 2010), and it is a part of the Infrastructure for Spatial Information in the European Community (INSPIRE) that had been called into existence by the INSPIRE Directive of the European Parliament and the Council (INSPIRE, 2007). The regulations concerning the development and use of spatial data infrastructure, including spatial data and metadata, services, interoperability of spatial data sets and spatial data services, spatial data sharing, cooperation, and coordination in the field of spatial data infrastructure, have enabled the creation of useful information infrastructure that integrates various databases in Poland and other EU countries. The progress made by Poland in the integration of the databases listed in the annexes to the INSPIRE Direction is presented in Table 2.

Table 2. Implementation of databases in the Polish Geoportal as of 31 December 2020

Annex	No	Theme	Polish Geoportal
1	2	3	4
Annex I	1	Coordinate reference systems	+
	2	Geographical grid systems	+
	3	Geographical names	+
	4	Administrative units	+
	5	Addresses	+
	6	Cadastral parcels	+
	7	Transport networks	+
	8	Hydrography (complex)	+
	9	Protected sites(complex)	+
Annex II	1	Elevation	+
	2	Land cover	+
	3	Orthoimagery	+
	4	Geology	+
Annex III	1	Statistical units	+
	2	Buildings	+
	3	Soil	+
	4	Land use	+
	5	Human health and safety	-
	6	Utility and governmental services	+
	7	Environmental monitoring facilities	+
	8	Production and industrial facilities	-
	9	Agricultural and aquaculture facilities	+
	10	Population distribution – demography	-
	11	Area management/ restriction/regulation zones and reporting units	-
	12	Natural risk zones	-
	13	Atmospheric conditions	+
	14	Meteorological geographical features	-
	15	Oceanographic geographical features	-
	16	Sea regions	+
	17	Bio-geographical regions	-
	18	Habitats and biotopes	-
	19	Species distribution	-
	20	Energy resources	-
	21	Mineral resources	-
Annex I		Sum	9
Annex II			4
Annex III			9
Total			22

Source: own elaboration.

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As shown in Table 2, the Polish Geoportal is a source of spatial data detailed in Annexes 1 and 2 to the INSPIRE Directive (INSPIRE, 2007). The preparation and implementation of Annex 3 data are still in progress. However, even when all data indicated by the INSPIRE Directive have been incorporated, the Geoportal will not guarantee full access to information that is required for UG management. The Geoportal does not contain protected data, including personal data and property rights data, which are kept in the cadaster and the land and mortgage register integrated with the LAS. Protected data are released only for public administration tasks and to persons who have a legal interest in such data. To guarantee effective UG management, access to protected data should be granted based on a license to perform public tasks.

At the national level, protected data can be accessed via the LAS, which is referred to as the Integrated Real Estate Information System (IREIS). The IREIS is the backbone of the NSDI for the

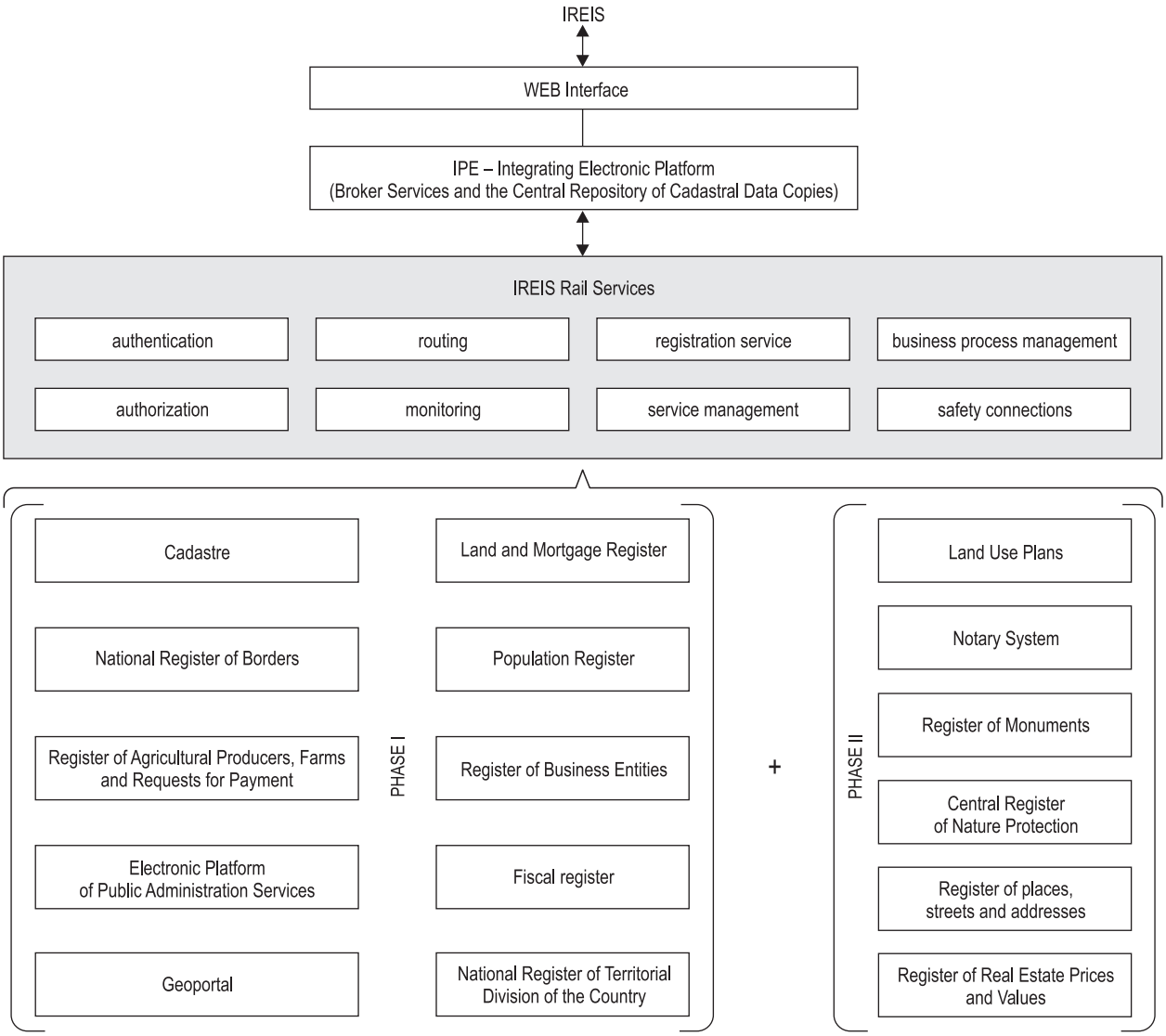

Fig. 2. Functional architecture of the IREIS
Source: own elaboration based on Regulation (2013).

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implementation of sustainable land policies and land management strategies, and it provides comprehensive access to information about spatial objects, land tenure rights, restrictions, and responsibilities (Dawidowicz & Źróbek, 2018). The LAS as a part of the NSDI, and includes institutional arrangements, a legal framework, processes, standards, land information, management and dissemination systems, as well as technologies that support land allocation, land markets, valuation, control of land use, and the creation of equitable interests in land (Williamson et al., 2010). The LAS facilitates the implementation of land policies to fulfill political and social objectives and achieve sustainable development goals (UN-GGIM, 2015). Land administration systems are implemented in different countries to guarantee the harmonization of global data in line with the Land Administration Domain Model (LADM) and ISO standard 19152 (ISO 19152, 2012; Lemmen et al., 2015; Bydłosz, 2015).

The Polish IREIS was introduced under the provisions of the Regulation of the Council of Ministers of 17 January 2013 on the Integrated Real Estate Information System (Regulation, 2013). Successive functionalities are being implemented in stages (Fig. 2). The IREIS aims to integrate the databases of many public registers, including the cadaster, land and mortgage register, fiscal register, land-use plans, population register, central register of nature protection, and others. These registers are integrated to improve data exchange and provide effective information support for other systems, land administration, and economic processes. The IREIS relies on the functional specification of the Integrating Electronic Platform (IPE) for viewing and transferring data between public registers. The functional architecture of the IREIS and IPE is presented in Figure 2. The IREIS is a multi-functional system that can be accessed by the authorities and the public (with limited functionality).

The IREIS is integrated with the Geoportal, and it is the most complete source of data for the UGMS. It contains reference data for address locators as well as the rights, responsibilities, and restrictions (RRR) associated with the use of the property. Public registers have been incorporated into the IREIS via the IPE, and the same approach can be used to integrate the UGMS as a sub-module containing basic data about urban greenery.

Development of a conceptual framework of a fit-for-purpose urban greenery management system (UGMS) in Poland in the context of the database and system functionalities

Initial assumptions regarding the functionalities of the UGMS were developed based on a review of the EU recommendations, Polish legal acts and strategies addressing green infrastructure, including urban greenery, and an analysis of good practices for developing UG management systems in Polish and European cities. A preliminary set of spatial data was identified, and the functionalities of the designed UGMS were described on the assumption that a universal UGMS covering the entire country should meet the following threshold conditions:

1) it should be fit-for-purpose (it should be a comprehensive source of data for UG management) (Dawidowicz et al., 2020);
2) it should reconcile the interests of various entities responsible for urban greenery (the departments responsible for UG management (Planning, Administration, Field Operations) should be able to exchange and view the relevant data and processes);
3) it should account for EU recommendations, local SDI solutions, and the local environment;
4) it should contain data from the existing public registers and information systems in Poland to eliminate redundancy, save time and minimize costs.

The system should cater to the needs of diverse users (public authorities and residents) because participatory management of urban greenery can deliver various benefits, including local needs assessment, identity building, and ecosystem services (Kronenberg et al., 2016). The functional architecture of the UGMS should enable members of the public to report current problems and needs under a local license. The following four principles of green infrastructure

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planning and implementation (Davies et al., 2015) should be taken into account when designing the UGMS database concept:

1) integration – urban greenery should be regarded as a type of infrastructure that is physically and functionally integrated with other urban systems;
2) connectivity – the functional and physical integration of green areas should generate added value;
3) multifunctionality – integrated green infrastructure should deliver ecological, social, and economic benefits;
4) multiscale – different spatial scales within and across city regions should be taken into consideration in urban greenery planning.

Based on the above principles, the proposed system should integrate and process multiple data for the needs of various tasks and functions. The system should be accessible to all interested users under a license, and it should cover all cities in the country. In the future, the system could be expanded to cover rural areas. The only potential limitation is the shortage of funds for inventorying and mapping green areas. The UGMS will constitute a sub-module of the NSDI, and it is economically justified because additional funds will not be required to develop separate infrastructure. The proposed system will contain timely and cohesive data because IREIS resources, in particular cadastral data for all Polish regions, are regularly updated. Therefore, attempts were made to determine the extent to which the technical infrastructure of the Polish LAS (IREIS), which functionally integrates public registers such as the cadaster, land and mortgage register, land use plans, Register of Places, Streets and Addresses, Central Register of Nature Protection, and the Register of Monuments, can be used for UG management. The integration of the INSPIRE Geoportal with the UGMS as a sector-specific sub-module will facilitate the creation of a standardized data model based on ISO 19152 standards for the Land Administration Domain Model (LADM), (ISO 19152, 2012; Bydłosz, 2015). This innovative approach will contribute to the development of a comprehensive information system for UG management as part of the NSDI, and it offers a technological perspective on the evolution of SDI and LAS. This solution closely contributes to the following Sustainable Development Goals (UN-GGIM, 2015): (11) Sustainable Cities and Communities, (13) Climate Action, (15) Life on Land.

A fit-for-purpose UGMS should support UGMB in the process of implementing international standards on the quality and organization of ecosystem services (including ISO 9001 (2015) and ISO 14001 (2015)) as well as the Eco-Management and Audit Scheme (GDOS, 2021) developed by the European Commission to evaluate the environmental performance of businesses and other organizations. The above implies that the UGMS should be consistent with legal regulation and the needs of UGMB.

Based on an analysis of the existing information system, a list of 15 thematic data groups that should be included in the UGMS was identified: urban greenery (basic and supplementary data, including maintenance and management of urban greenery), address data, physical attributes of land parcels, legal status (RRR), land and planning, infrastructure, soil and water conditions, nature conservation sites, protected monuments, climate, environmental pollution and threats, habitats and protected species, technology/machines, market, cooperation, and support. The extent to which the identified thematic data groups cater to the needs of UGMB was determined during an expert survey.

Field research – expert survey to determine data requirements for UG management

The expert survey demonstrated that Polish municipal authorities generally manage urban greenery based on the data published by Statistics Poland, cadastral data, and orthophoto maps from the geodetic and cartographic resources of Polish counties, and, less frequently, the Database of Topographic Objects and the Urban Atlas of 2012. The Urban Atlas is a pan-European repository of land cover data that is coordinated by the European Environment Agency (EEA). It provides extensive information on various

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land use types, including orchards, fallow land, farmland, and private land. The Urban Atlas is not widely used in Poland (Feltynowski et al., 2018), which further accentuates the need for cohesive standards for the development of a fit-for-purpose (FFP) UGMS. The present study was conducted to fill the existing knowledge gap.

Survey questionnaires were forwarded by email and post to 50 sectoral experts, 10 in each analyzed city, and completed questionnaires were returned by 34 respondents. The questionnaire contained open-ended and closed-ended questions relating to daily problems and information needs in urban greenery management. The first four questions were designed to elicit personal data, including the respondents' official titles, competencies, education, and training. The survey revealed differences in the organizational structure of the surveyed institutions and the types of personnel involved in greenery management. Two types of management regimes were identified: centralized management, where the responsible personnel report to a single authority (such as the municipal landscape architect), and distributed management, where urban greenery is managed by numerous civil officers in various organizational units. The relevant posts are determined by the organizational structure of the surveyed institutions and the characteristic features of urban greenery in the analyzed cities. In the surveyed population, 68% of the respondents had a university education and 32% had secondary school education. All respondents were keen on expanding their knowledge and skills by participating in training courses, attending conferences, and enrolling in post-graduate courses. This is a highly satisfactory result which indicates that the surveyed employees are professionals in their respective fields. However, the competencies of the surveyed employees and departments were significantly fragmented. For this reason, the UMGS should integrate all operations relating to UG management by enabling all users to enter data and view the information contributed by other users. Therefore, the UGMS should flexibly adapt to the organizational structure of the responsible authorities, and it should be accessible to suitably authorized personnel.

The fifth question in the survey contained a list of 15 groups of data that were selected based on an analysis of the literature, legal acts, and reports on the implementation of green information systems. The respondents were asked to choose data that would be useful for daily operations relating to UG management. They were also encouraged to add other types of data that were not listed in the questionnaire. The respondents selected groups of data by marking them with an "x". None of the experts proposed additional groups of data, which confirms that the presented information was exhaustive. However, six respondents remarked that UGMB employees would benefit from information relating to tree-based ecosystem services, the responsible (managing) authority, and detailed physical parameters of green objects. These inputs were taken into consideration in the analysis, and they were classified as basic UG data. Due to the fragmentation of competencies and responsibilities relating to UG maintenance, uneven progress in UG development in Polish cities, and a small number of respondents, all responses (regardless of their frequency) were included in the analysis. Therefore, each response was considered relevant in the process of developing the standard database. Regardless of the occupied post and responsibilities, all respondents selected the following groups of data as essential for UG management: urban greenery (basic green object data), address data, physical attributes of land parcels, infrastructure, soil and water conditions, nature conservation sites, protected monuments, climate, environmental pollution and threats, habitats and protected species. The selected data groups are presented in Table 4. The surveyed experts recognized the need for aggregating the data generated by inventories of trees and other green objects, including their location and the accompanying technical infrastructure. Employees responsible for planning operations additionally selected the following types of data: supplementary urban greenery data (maintenance and management of UG), legal status (RRR), land planning, cooperation, and support. Data relating to technology/machines and the market were selected mainly by respondents

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responsible for field operations. As a result, all of the 15 proposed data groups were used in the process of developing the UGMS. The scope of data in each thematic group was determined based on an analysis of public registers, good practices, and the respondents' answers.

The results of the survey were used to define a list of core data for the UGMS (Table 3), including a specification of different types of UG. Supplementary data (Table 4) were compiled with reference data (shown in bold) to validate the research hypothesis stating that the Polish NSDI (IREIS Geoportal) contains sufficient resources to meet the data requirements of an FFP UGMS. Urban greenery management bodies will collect basic UG data and contribute supplementary data for the UGMS.

Table 3. Basic urban greenery data for the UGMS

Trees	
Location / ID	
Tree number (on the map)	
Type of urban green space (park, roadside greenery, residential greenery, green squares, pocket parks, informal urban greenspace)	
Responsible authority (managing authority)	
Species (variety)	
Planting date	
Height (in meters)	
Diameter at breast height (1.30 m)	
Crown width (in meters)	
Tree health (crown damage in %, bark cracking, hurricane damage, broken branches)	
Habitats and protected species (species, types, abundance, hatching time)	
Completed maintenance works (wooden supports for trees, pruning, removal of broken and damaged branches, crown reduced by 20%, replanted trees)	
Maintenance costs (based on the service price list)	
Additional information (breeding sites, follow-up inspections after 1 or 3 years)	
Ecosystem services:	Energy benefits
	Esthetic value and social benefits
	Stormwater benefits
	Air quality control

cont. Table 3

Shrubs
Location / ID
Shrub number (on the map)
Type of urban green space (park, roadside greenery, residential greenery, green squares, pocket parks, informal urban greenspace)
Responsible authority (managing authority)
Species (variety)
Height (in meters)
Habitats and protected species (species, types, abundance, hatching time)
Form: a cluster of shrubs, hedge (length), individual shrubs
Recommendations (replacement of dried shrubs, pruning)
Completed maintenance works (hedge trimming,…)
Maintenance costs (based on the service price list)
Other types of plants (dwarf shrubs, perennial plants)
Location / ID
Plant number (on the map)
Type of urban green space (park, roadside greenery, residential greenery, green squares, pocket parks, informal urban greenspace)
Responsible authority (managing authority)
Species (variety)
Area (m^2)
Habitats and protected species (species, types, abundance, hatching time)
Recommendations (watering, weeding, replacement)
Completed maintenance works (mowing, mulching, watering…)
Grass lawns
Location / ID
Number (on the map)
Type of urban green space (park, roadside greenery, residential greenery, green squares, pocket parks, informal urban greenspace)
Responsible authority (managing authority)
Area (m^2)
Habitats and protected species (species, types, abundance, hatching time)
Recommendations (mowing, repairs)
Completed maintenance works (mowing, repairs)

Source: own elaboration.

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Public registers that can be a potential source of data in each identified group were analyzed in Table 4. Registers integrated with the NSDI are presented in columns, and they are linked with IREIS and INSPIRE infrastructure according to the specification. The IREIS and INSPIRE are a part of the NSDI, but they are operated separately. In the future, dedicated solutions could be developed to link both infrastructures, protect data and create client access licenses. Public registers that are not integrated with the IREIS or INSPIRE are also presented in Table 4. In the future, these registers could be merged with the UGMS by incorporating additional databases into NSDI.

The list in Table 4 indicates that NSDI can be a source of 12 to 14 supplementary data groups for an FFP UGMS. These results validate the research hypothesis and shed new light on future directions for the development of green information systems that can be incorporated into the NSDI rail service, especially the IREIS.

The final two questions in the survey addressed the respondents' current responsibilities, information needs, and expectations concerning UGMS functionalities. The questions were closed-ended, the respondents marked the selected items with an "x", and they could provide additional information. The list of potential UGMB responsibilities was created based on the statutory tasks of selected greenery management units in Warszawa and Kraków (Poland's largest and most highly developed cities) described on their respective websites (ZZW, 2020; ZZM, 2020). The respondents were asked to indicate their professional duties and responsibilities. The relevant information was used to compile a list of UGMB tasks (Table 5. Duties/Tasks). The respondents added the following additional information to the list of duties: planning replacements for the most expensive services, acquisition of funds from other sources, surveying local residents' expectations regarding urban greenery, recommending changes in the existing procedures to eliminate planting defects, analyses of energy benefits, stormwater benefits, esthetic value, and social benefits, air quality control. Based on the identified scope of UGMB duties, UGMS functionalities were developed given the good practices from Barcelona, Berlin, and Kraków. UGMS functionalities and UGMB duties are presented in Table 5. The proposed functionalities were divided into groups of tasks supervised by planning, administration, and field operations bodies (Table 5). System functionalities should be identified separately for different types of management tasks to facilitate access control.

According to the respondents, an urban greenery management system should support tree inventorying at all stages of planning, administration, and management. The designed system should also incorporate analytical, calculation, and prognostic tools that facilitate daily operations. The study revealed that the required UGMS functionalities frequently overlapped. All experts, regardless of their post and scope of duties, thought that the UGMS should support:

- collection and analysis of data concerning green areas;
- monitoring of changes in green areas in the context of adaptation to climate change;
- introduction of green-blue infrastructure solutions to cities;
- identification of ecosystem services provided by trees;
- cooperation between administration units in the management of green areas;
- social participation in the process of creating green areas;
- data analysis for adapting different tree species to changing urban conditions;
- analyses of the benefits provided by trees;
- improvements in the operations and performance of UGMB.

The respondents responsible for planning thought that local citizens' needs should be taken into account in the process of planning urban green spaces and that cohesive standards for urban greenery management should be implemented. They recognized the need for consistent regulations relating to replacement planting in cities. According to the subjects responsible for urban greenery management, unambiguous standards are also needed for handling trees in crises.

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Table 4. Main and supplementary sources of data for the UGMS

No.	Group of supplementary data (data layers)	NSDI		Other registers and information systems (Source/data)	Urban greenery management bodies (UGMB) data
		IREIS (Integrated Real Estate Information System) (Source/data)	**INSPIRE (Source/data)**		
1	2	3	4	5	6
1	**Address data**	**Cadaster:** Number of cadastral plot, **Register of Places, Streets, and Addresses:** Street name and number, building number **National Official Register of the Territorial Division of the Country:** Statistical numbers and unique identifiers of spatial objects in the country: number of cadastral districts, number of the municipality, type of municipality	**Cadaster:** Number of cadastral plot, **Register of Places, Streets, and Addresses:** Street name and number, building number **National Official Register of the Territorial Division of the Country:** Statistical numbers and unique identifiers of spatial objects in the country: number of cadastral districts, number of the municipality, type of municipality	-	Green objects identification number
2	**Physical attributes of land parcels**	**Cadaster:** Area, boundaries	**Basic map/ Situation-height map:** Slope	-	-
3	**Legal status / Rights, Responsibilities, Restrictions**	**Land Register:** Owner, tenant/administrator, documents granting legal title, restrictions in rights **Cadaster:** Distribution of plots **Population Register:** Personal identification number	**Cadaster:** Distribution of plots	-	-
4	**Land Planning**	**Land Use Plans:** Permissible types of land use and management, site functions, restrictions on use	**Land Use Plans:** Permissible types of land use and management, site functions, restrictions on use	**Decisions on the conditions of development and land use:** In the absence of land-use plans, the decisions issued shall specify the conditions of land use and permits	Planting plans, green regeneration plans, green protection, and maintenance plans

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cont. Table 4

1	2	3	4	5	6
5	**Infrastructure**	**Cadaster:** Buildings **Land Use Plans:** Planned infrastructure and public utilities	**Cadaster:** Buildings **Land Use Plans:** Planned infrastructure and public utilities **Geodetic Register of Utility Networks:** Existing infrastructure and public utilities, location of infrastructure networks	-	Small architecture (park benches, arbors, fountains, rubbish bins, statues).
6	**Soil and water conditions**	**Cadaster:** Soil quality class, land use including still and running waters, drainage ditches	**Water cadaster:** water table, watercourses and water bodies, hydrographic classification of Poland, indirectly protected zones, protected water intake zones, **Geology Cadaster** soil and agricultural maps, Soil type, geology **Geodetic Register of Utilities Networks** Existing infrastructure and public utilities, location of infrastructure networks	-	Small ponds
7	**Nature conservation sites**	**Central Register of Nature Conservation Sites:** Nature reserve, protected ecosystem, Nature 2000 area, nature, and landscape conservation site	**Central Register of Nature Conservation Sites:** Nature reserve, protected ecosystem, Nature 2000 area, nature, and landscape conservation site	-	-
8	**Protected monuments**	**Central Register of Monuments, culture park, protected urban area:** Type of monument, Historical small architecture objects such as chapels	**Central Register of Monuments, culture park, protected urban area:** Type of monument, Historical small architecture objects such as chapels	-	-

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cont. Table 4

1	2	3	4	5	6
9	**Climate**	-	**Institute of Meteorology and Water Management – National Research Institute (IMWM) – climate maps:** Average annual temperature, average annual precipitation, humidity, insolation (agricultural climate model – application), extreme weather events (drought, floods, hurricanes)	**Solar atlas:** Sunshine time per day **European Severe Weather Database**	-
10	**Environmental pollution and threats**	-	**State Environmental Monitoring – pollution maps:** Air pollution (e.g. CO_2); soil pollution (e.g. nitrates and Nitrate Vulnerable Zones); radioactive and microbiological threats; artificial water deficit; landscape degradation; air, underground water, surface water, and seawater pollution; water cycle disruptions; changes in land relief; soil erosion; degradation of flora; industrial and municipal waste; noise pollution; pests	-	-
11	**Habitats and protected species**	**Central Register of Nature Conservation Sites:** list of protected species (data from the species lists and monitoring of protected objects)	**Central Register of Nature Conservation Sites:** list of protected species (data from the species lists and monitoring of protected objects) **State Environmental Monitoring (nature monitoring reports):** natural habitats (status and changes occurring within their range, area covered, structure and function); species (status and changes occurring within their range, population size and structure and area and quality of the habitats to which they are associated).	-	Location of occurrence of protected plant and animal species in green areas (in. urban greenery basic data)

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cont. Table 4

1	2	3	4	5	6
12	**Technology/ machines**	-	-	-	Equipment with fixed assets (all available machines and tools for automation of greenery care and protection, year of purchase and production, value, consumption, fuel type.
13	**Market**	**Electronic Platform for Public Administration Services, ePUAP:** Unit prices from public tenders	-	**Price comparison applications:** Prices of plants, prices of plant protection products, prices of small architectural objects, and prices of building materials	Wholesale marketing, retail marketing (prices of seedlings and seeds). Assessment of market situation, trends, forecasts, tenders, etc.
14	**Cooperation and support**	–	–	**Institutions supporting development projects (Marshal's Offices):** Information on open financial or material support programs and training courses, workshops. **A public participation gateway to report problems and comments:** Information on risks and new proposals for solutions in public green space	Social participation (location and type of participation)

Source: own elaboration.

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Table 5. List of UGMS functionalities assigned to different types of tasks urban greenery management bodies (UGMB)

Responsible entity	Duties / tasks	UGMS Functionality
Planning (expert body)	Expenditure planning	Generation of lists of urgent maintenance works
	Expenditure monitoring, planning replacements for the most expensive services	Generation of reports on greenery maintenance costs
	Acquisition of funds from other sources	Generation of reports on the sources of financing for urban greenery
	Monitoring public tenders	Reminders on upcoming public tenders, financial settlements for greenery maintenance services
	Surveying local residents' expectations regarding urban greenery	Generation of reports on participatory greening
	Modifying the list of recommended tree species for urban areas	Generation of reports on tree species damaged by hurricanes
	Modifying the list of recommended tree species for urban areas	Generation of reports on tree species that are most resistant to climate change
	Environmental monitoring/environmental protection plans	Systematic analyses for monitoring urban green areas
	Evaluations of maintenance services and their future consequences	Analyses of tree maintenance services
	Planning replacement plantings	Coordination of replacement plantings
	Expenditure planning, analysis of tree species that require maintenance	Analyses of street tree inventories (range of tasks)
	Recommending changes in municipal regulations	Observance of tree protection laws in urban areas
Administration (regulatory body)	Selection of tree species for planting	Analyses of the number of removed tree species and reasons for removal
	Selection of tree species for replacement plantings	Generation of reports on tree species for replacement plantings
	Monitoring replacement plantings, recommending changes in the existing procedures to eliminate planting defects	Generation of reports on the feasibility of replacement plantings
	Assessment of replacement plantings	Generation of reports on service teams performing replacement plantings
	Analyses of energy benefits, stormwater benefits, esthetic value, and social benefits, air quality control	Generation of reports on ecosystem services
Field operations (executive body)	Planning field operations	Tree safety alerts
		Alerts on upcoming maintenance and planting operations
		Alerts on upcoming greenery development projects
	Coordination of field operations	Inspections of tree and shrub maintenance in a given district

Source: own elaboration.

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DISCUSSION

The study demonstrated that the UGMS should be an integrated system that compiles information about urban greenery, the accompanying facilities, and local policies from various sources in line with the infrastructure planning principles of the GREEN SURGE project, including integration, connectivity, multifunctionality, and multiscale. The UGMS database should be standardized and based on the results of urban greenery inventories. Inventories can be automated by deploying drones. Selected types of data can also be collected by municipal employees responsible for UG maintenance. The relevant information would be collected with the use of a dedicated inventory form (Table 3), and it would be entered into the database as a UGMS sub-module in the IREIS environment. The data collection process should entail minimal effort, and it should rely primarily on the existing sources of information from NSDI. The UGMS should cover urban green spaces that are owned, co-owned, or administered by the city.

The UGMS should contain basic information about the location and requirements of different plant species. The employees should be notified about problems that require urgent intervention as well as upcoming maintenance works. The system should also register the boundaries of different types of urban green areas, such as roadside vegetation, residential, ornamental, and monumental greenery. The information relating to individual UG objects will be gathered within cadastral plots. The objects in each plot will be assigned a unique identifier.

The developed list of UG data (Table 3) includes ecosystem services for trees only, as indicated by the experts. The above could be attributed to the fact that this functionality is easy to implement in the start-up phase. The development of ecosystem services for other UG types requires further research and recommendations. However, the proposed system is flexible, and the database can be easily expanded when the standards for calculating ecosystem services delivered by other UG types are developed. In Poland and other countries, municipal authorities rarely identify and assess ecosystem services as part of standard planning operations. Therefore, workshops and training courses should be organized to raise the employees' and the public's awareness about the ecosystem potential of UG and the impact of climate change on urban green spaces.

The list of supplementary UGMS data (Table 4) is extensive. These data are needed for various tasks, including:

- to determine the demand for public green areas with recreational functions, which is directly related to the urban population and population density, and changes in these parameters over time;
- to determine whether the existing and predicted demand for green areas can be met through the existing municipal resources by analyzing the legal status of land zoned for public green areas;
- to identify areas that should be zoned as green urban areas to protect valuable natural sites, minimizing development pressure, and securing land for future UG development through access to information on the spatial policy. Development projects that encroach on green areas in an uncontrolled manner pose a threat to the continuity and accessibility of urban green spaces;
- to verify the boundaries of plots where new green objects are planted, the plots' legal status, location of underground utilities, soil and water conditions, existing environmental hazards, public procurement of plants in previous years;
- to plan remediation works and select resistant plant species for planting in contaminated areas;
- to plan and perform lawn mowing operations by analyzing the number and parameters of lawn-mowers in stock;
- to determine the local community's needs and expectations regarding urban green spaces by analyzing the results of public consultations.

In terms of functionality, the system should feature tools for spatial and descriptive analyses, statistical tools for reporting, IT tools, and it should generate descriptive (guidelines and recommendations for fieldwork) and cartographic (maps) documents. The proposed UMGS should feature the above

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functionalities to analyze data, generate various reports, including reports on plant tolerance to various urban pressures. The UMGS should support the monitoring of trees in urban green spaces and identify the reasons for tree removal (safety concerns, encroachment upon utility networks, tree decline, tree diseases). By analyzing the collected data, the system would automatically identify potential locations for replacement plantings. The UMGS would also plan and control the expenditures relating to urban greenery maintenance, and it would calculate the value of ecosystem services (such as oxygen production). The proposed system would notify the responsible employees of upcoming maintenance works, and it would generate alerts on hurricanes and other risks that necessitate tree control.

The UGMS will be integrated with the IREIS rail service to guarantee the continuous exchange of data and access to valid reference data stored in the land administration systems, including the cadaster, land registers, land use plans, population register, and other public registers listed in subsection *National Spatial Data Infrastructure*… This solution will compromise the timeliness of data in the INSPIRE Geoportal, but this limitation can be overcome by improving data update frequency standards. The Geoportal does not contain sensitive personal data, and it will not adversely affect the informational capacity of the UGMS.

The UGMS database was designed to support urban greenery, but it can be expanded to include the entire Green Infrastructure. The system will be integrated with IREIS infrastructure; therefore, data can be exchanged between multiple bases that are connected to the IREIS rail service. The integration of the UGMS with the IREIS environment will guarantee the system's structural flexibility.

SUMMARY AND CONCLUSIONS

The proposed system for urban greenery management can support the development of green infrastructure and improve the quality of municipal vegetation. Numerous publications and reports have demonstrated that friendly urban policies can facilitate access to green infrastructure and significantly improve the quality of life in cities (Bieda & Telega, 2021). The present study demonstrated that most of the relevant initiatives in Poland, including comprehensive green information systems, have been undertaken locally, whereas the handful of measures implemented at the national level are limited to a single functionality. This study identified the key functionalities and the scope of data for designing a universal for the entire country and cohesive urban greenery management system that meets the needs and expectations of urban greenery management bodies. The relevant functions and data were identified in detailed analyses based on previous research findings, EU recommendations, national experiences in spatial planning, and current needs. The proposed UGMS contributes to the body of knowledge on urban greenery management. The developed functionalities and categories of essential data can be used to develop a theoretical framework for designing technological solutions in the future.

The results of this study confirmed that urban greenery management bodies need an information system that contains comprehensive information about green and blue infrastructure and is integrated with other public registers and sources of data, including the register of protected areas and monuments, local policies, the cadaster, land registers, address database, and climate services. It is demonstrated in the text that this is possible, thanks to the technological location of the UGMS in the IREIS and INSPIRE infrastructure. The research hypothesis postulates that the Polish land administration system, referred to as the Real Estate Information System (IREIS), and the INSPIRE Geoportal service that are integrated as parts of the NSDI are capable of supplying more than 75% of the data required for UG management in Poland was positively validated.

A universal for the entire country UGMS can be created by relying on IREIS and INSPIRE infrastructure. This approach is consistent with the needs of the Polish UGMB and the infrastructure planning principles of the GREEN SURGE project, including integration, connectivity, multifunctionality,

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and multiscale. The proposed approach is valid from an economic and practical point of view because the IREIS contains complementary and reference spatial data. The UGMS will be connected to the IREIS rail service to create access to regularly updated data and enable efficient data exchange. The UGMS database concept follows the latest trends in green information systems development. The UGMS will be consistent with the fit-for-purpose approach to land administration. Therefore, the research hypothesis was confirmed.

Experts and professionals responsible for urban greenery management were surveyed to ensure that the proposed UGMS reconciles the interests of different decision-makers and accounts for EU recommendations as well as local and climatic factors. The UGMS should address the needs of different users, and it should facilitate communication between the relevant authorities to build local identity and promote ecosystem services. The key functionalities and the required scope of data for the designed system were identified given the allocated responsibilities. The proposed UGMS will provide a cohesive and nation-wide framework for:

- inventorying urban greenery;
- identifying plant species, their requirements, and susceptibility to disease;
- automating field operations by alerting users of upcoming maintenance tasks;
- calculating ecosystem services;
- monitoring changes in urban greenery and improving response times in problematic situations and emergencies;
- generating reports on the planted species, the longevity of different tree species, location of public safety threats.

The proposed database and UGMS functionalities were designed based on an analysis of local (Polish) needs, but the presented solutions can be modified and expanded. In the future, the needs and expectations of UGMB should be surveyed in other countries to develop a universal UGMS that can be applied around the world.

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ATTRACTIVENESS OF CEMETERIES VERSUS SOCIOECONOMIC AND SPATIAL DEVELOPMENT OF NON-METROPOLITAN CITIES IN POLAND

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ABSTRACT

Motives: Societies have developed a variety of services to meet their basic needs. One of them is to deposit and commemorate the bodies of the dead, for which cemeteries are used. Cemeteries and cities are thus interlinked.
Aim: The first aim of the study was to verify whether cemeteries located in secondary cities with a high synthetic measure of socioeconomic development and with sustainable spatial policy on cemetery greenery are more attractive. Second aim was to verify whether attractiveness of cemeteries is related to their age. The study was conducted on a sample of 96 cemeteries located within the administrative boundaries of 10 cities of population between 50 000 and 300 000 inhabitants within city limits, that were representing various NUTS1 regions. Criteria of the cemetery evaluation based on the features of the cemetery were elaborated in terms of location, accessibility and development of the necropolis. Moreover, analysis of the current socioeconomic situation of cities was carried out.
Results: Finally, the mutual correlation of indicators was examined using the Spearman correlation coefficient. The relationship between the cemeteries features, the socioeconomic development, share of municipal cemeteries as well elements considered in study of spatial policy on cemetery greenery in non-metropolitan cities has been noticed. As the result of performed analysis the guidelines on how to increase the attractiveness of cemeteries in non-metropolitan cities were developed.

Keywords: municipal cemetery, NUTS1, synthetic measure of socioeconomic development, urban cemetery evaluation

INTRODUCTION

Main goal of urban development is optimization expressed primarily in balancing the needs of different interest groups and different users, therefore, no municipal services can be marginalized in this process (World Urbanization Prospects, 2018). Historical data support that social functions of cemeteries have played an important role in the formation and development of early cities (Ariés, 1974; Vovelle, 1983; Kolbuszewski, 1996; Bryant, 2003). Nordh and Evensen (2018) have noticed that research focusing on cemeteries as

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urban public green spaces is limited. For example, the subject of cemeteries and its assessment in the aspect of location, accessibility and development of cemeteries and its buffer zone is grossly neglected in the Polish studies. The necessity to conduct research in the field of urban cemeteries is justified by demographic forecasts of the Central Statistical Office in Poland and Eurostat. All demographic forecasts assume a slow increase in deaths due to the fact that the population of the post-war population enters the post-productive age phase (Szukalski, 2016; Eurostat, 2020). The main stimuli that prompted the authors to scrutinize this topic is a lack of central database aggregating information about: number, type, area and current state of cemeteries development in Poland. Meanwhile statistics related to burial but also data about distribution of cemeteries form, are the basis of planning burial investments all around the world (Fisher, 1992; Santarsiero et al., 2000; Croucamp & Richards, 2002; Larkin, 2011; Kjøller, 2012; 2013). Moreover, researchers have found that poor management of cemeteries can cause negative perceptions among local inhabitants (Tudor et al., 2013; Niţă et al., 2014).

First hypothesis states that cities with high synthetic measure of socioeconomic development and sustainable spatial policy on cemetery greenery have more attractive cemeteries. Sustainable spatial policy on cemetery greenery is defined by authors as high share of cemetery greenery per capita, high share of municipal cemeteries and including cemetery greenery into urban greenery system. As far as we know, none have examined the correlation between such urban development indicators and the attractiveness of cemeteries. Cemeteries constitute some of oldest and largest green and open spaces of urban landscape (Laske, 1994; Rogers, 1997; Harnik & Merolli, 2010). With the rapid densification of the city, and the extensive loss of green space, verifying the relationships between cemeteries attractiveness, local spatial policy as well as socioeconomic status of cities and understanding the potential of these sites as multiperspective facilities, complementing the cityscape is critical for the sustainability of the city (Al-Akl et al., 2018).

Second hypothesis states that the attractiveness of a cemetery may be related to its age due to the changing trends in planning practice. Finding such relation may help urban planners to implement some good practices in projecting new burial spaces.

One has to emphasize the fact the flora of cemeteries in Europe has been best studied in Poland (Löki et al., 2019). It is not surprising when taking into account our very rich tradition of designing well integrated cemeteries with cultural landscape (Kolbuszewski, 1996; Czerner & Juszkiewicz, 1995). There is a number of outstanding cemeteries combining art and environment, like Powązki Cemetery in Warsaw, Rakowicki Cemetery in Cracow, Srebrzysko Cemetery in Gdańsk, Central Cemetery in Szczecin, Central Municipal Cemetery in Koszalin, Central Cemetery in Gliwice, as well as Pęksowe Brzysko Cemetery in Zakopane. Large share of greenery in the spatial layout of historic cemeteries has contributed to their attractiveness and timeless character (Długozima, 2011). While big and famous cemeteries in biggest Polish cities (especially national pantheons that have become important tourist destinations) seem to be a frequent subject of many different research (Tanaś, 2008; Dębczak, 2010; Hodor, 2012), there is still little attention paid to 'ordinary' cemeteries located in smaller cities. Are they also attractive? What makes some of them more attractive than the others? Does their attractiveness correspond with development of each city or local urban policy?

The objectives of this study were as follows:

1. To describe selected cities in the terms of socio-economic and spatial development, and spatial indicators related to cemeteries;
2. To define an assessment criteria to evaluate attractiveness of cemeteries;
3. To calculate cemeteries attractiveness index of selected cemeteries;
4. To verify relationship between the attractiveness of cemeteries, their age, sustainable spatial policy on cemetery greenery, share of municipal cemeteries and socioeconomic development of the city.

In the last section, the results were discussed and provided. Authors of this research developed

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the guidelines on how to increase the attractiveness of cemeteries in non-metropolitan cities, which could be useful in master planning of urban burying places.

LITERATURE REVIEW

Cemeteries, apart from fulfilling the basic function of burying the dead, are an integral part of the space and in European (Polish) cultural tradition, they play an important role. Chmielewski (2010), Długozima (2020) include burial to the service infrastructure. Researchers agree with its crucial role in the functioning of local communities (Francis & Kellaher, 2005; Swensenet al., 2016; Grabalov, 2018). Cemeteries are important components of the urban green infrastructure, simply because of their number and the area they cover.

To elaborate the criteria taken into account during the process of analyzing the attractiveness of cemeteries, it was necessary to determine the phenomenon of cemeteries in the aspect of socio-cultural and legislative conditions (regulations demanded by law in Poland). It should be emphasized that cemeteries are facilities dedicated to burial purposes, they have a very wide collection of designations (including: green area, building intended for religious worship and religious activities) (Długozima, 2020). In addition, cemeteries are different from other categories of land use due to their specificity and thus affect the local community, natural environment, spatial structure of the cities and its use. Therefore, cemeteries require an individualized approach in developing the criteria for their assessment. Due to the need to ensure the epidemiological safety, the cemetery must fulfill restrictive requirements in the aspect of location and development. The basic acts regulating the establishment and maintenance of cemeteries in Poland include: the Act of January 31, 1959 on Cemeteries and Burials of the Deceased, Regulation of the Minister of Municipal Economy of August 25, 1959 on determining which areas in terms of sanitation are suitable for cemeteries, Regulation of the Minister of Infrastructure of March 7, 2008 on requirements for cemeteries, graves and other places of burial ofácorpses and remains, the Building Law Act of July 7, 1994, the Act on Nature Conservation of April 16, 2004. According to the Nature Conservation Act cemeteries are classified as green areas. On the basis of research carried out by ecologists, landscape architects and urban planners (Abernathy, 1970; Gilbert, 1991; Laske, 1994; Richter, 1995; Szumański, 2005), it should be stated that cemeteries complement the urban natural system. In addition, sacred places, both the church and the cemetery, have a very high status in the hierarchy of space (Humphrey & Vitebsky, 1997; Harvey, 2006; Cheng, 2013), which is highlighted in Polish Classification of Building Facilities. „Buildings intended for religious worship and religious activities (class 1272) include, among others: cemeteries and related facilities". Due to multidimensional character of cemeteries, especially natural and architectural, integration in the aspect of planning, design and evaluation is needed. The main components of cemeteries evaluation are as follows: location conditions, communication imperative (accessibility), development of the surroundings (buffer zone) and development of its space. Literature review shows that for the proper performance of their functions, cemeteries require a well-thought-out, defined space (Lehrer, 1974; Capels & Senville, 2006). Irrational use of cemeteries space and intensification of historical cemeteries development lead to degradation of composition of the cemetery (Długozima, 2011; Osiekowicz & Podciborski 2013; SAO, 2016; Pilarczyk & Nowak, 2019). Thus, it affects the negative social perception of the cemetery space (Tudor et al., 2013). The Act of 1959 on Cemeteries and Burials of the Deceased indicates that cemeteries are designated and enlarged in the areas specified in local land use plans. The grave cannot be liquidated earlier than 20 years after its foundation and if anyone extends the right to use the grave by paying the fee for the next 20 years, which can be repeated many times. The issues regarding selection of a proper area for the construction of cemetery are regulated by the Regulation of 1959, which indicates that before establishing the cemetery, one should analyze features and conditions of the area taken into account as the place where burials are located.

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The following are analyzed: type of land, water system of the area, terrain, existing plant complexes. Chudak (2012) pointed out that the tradition based on Christianity does not allow entertainment in the vicinity of the necropolis. Locations of service and industrial enterprises emitting abnormal noise, pollution and odors should be avoided, as well as shaping monofunctional funeral districts (Thomas, 1991). This approach corresponds to the recommendations of planners and urban planners, who emphasize the need to organize urban structures in accordance with the criterion of social rationality (Douglass, 1980; Calhoun, 1998; Amin, 2006). In addition, Chudak (2012) recommends the concept of the common good in the aspect of cemetery location. After all, cemeteries are a matter of concern for administrators, owners and local communities (residents, associations, social movements, tourists). Regulation of 2008 indicates that cemeteries should be designed and maintained as a park-based area. It is required that the cemetery is surrounded by a permanent fence with a minimum height of 1.5 m. It was pointed out that the cemetery, apart from the burial area, should also include the areas intended for: isolating and decorative greenery, roads, walking and pedestrian routes, parking spaces, waste collection areas, toilets, water drawing points (wells), morgue, funeral parlor, possibly also a chapel and administrative and economic facilities. Passages between the graves should have a width of no less than 50 cm.

MATERIAL AND METHODS

The research was conducted in 96 cemeteries located within administrative boundaries of 10 non-metropolitan cities from which: 3 are voivodeship capitals (Kielce, Rzeszów, Zielona Góra), 4 are cities of regional significance (Częstochowa, Grudziądz, Tarnów, Słupsk) and 3 are cities of subregional significance (Suwałki, Stargard, Jelenia Góra) (Fig. 1) (The National Spatial Management Concept, 2012). These cities play the role of regional administration pillars as they provide regional functions (especially in social and infrastructural sphere) for territory

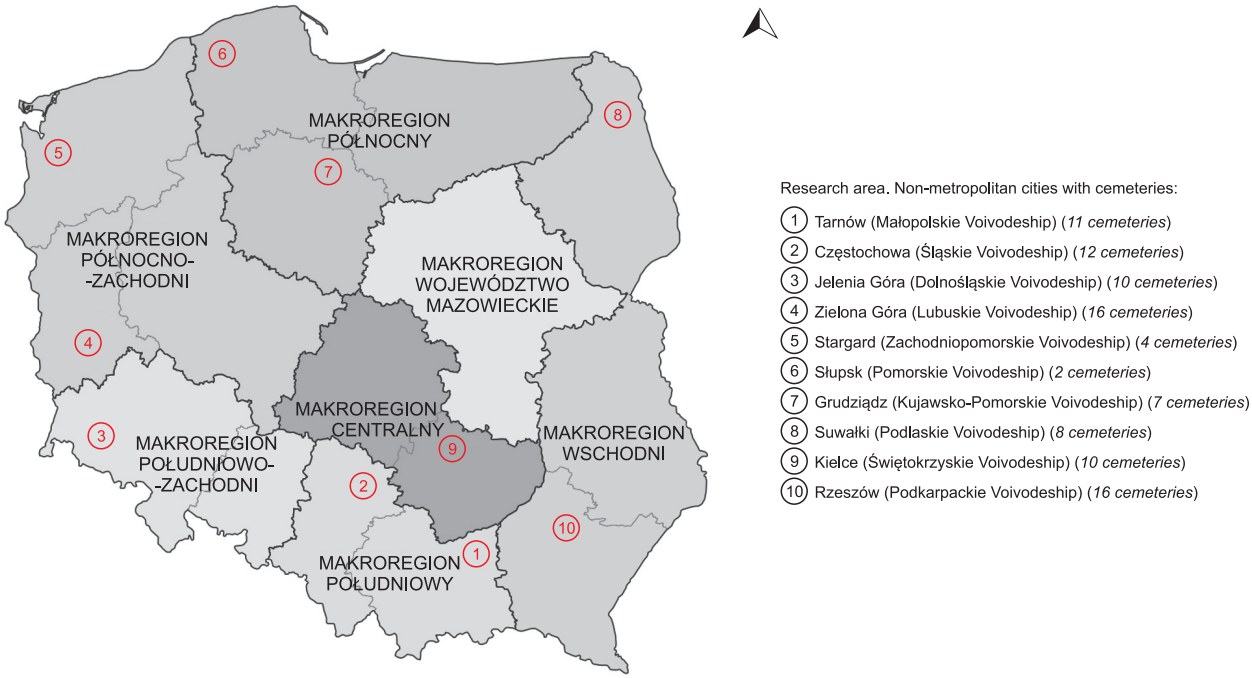

Fig. 1. Research area on the map of Poland, including division into 7 NUTS-1 macro-regions and 16 voivodeships
Source: own preparation based on 'Poland's division into NUTS 1 units' map from https://stat.gov.pl/ (10.04.2021).

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of a size fromat least few poviats to whole voivodeship (voivodeship capitals). Due to suburbanization processes functional urban area (FUA) context was also included in analysis. In order to make research internationally comparable joint Eurostat and OECD delimitation of FUAs was chosen (OECD, 2020).

The process of study went through 4 stages (in accordance to the research objectives):

Phase 1: Characteristics of selected cities in the aspect of spatial policy and socioeconomic development, including spatial indicators related to cemeteries.

Phase 2: Defining criteria assessing the attractiveness of cemeteries.

Phase 3: Calculating cemeteries attractiveness index.

Phase 4: Verification of mutual correlation between analyzed indicators.

Phase 1: Characteristics of selected cities

The characteristics of ten cities constituting a research sample were elaborated based on local spatial policy documents and data provided by the Local Data Bank, National Heritage Board of Poland, local spatial documents (Spatial Development Conditions and Directions Study and local land use plans), local Sanitary and Epidemiological Stations and Polish Funeral Association. These data sources were screened to calculate main spatial indicators:

– area of cemetery greenery per capita,
– area of cemetery greenery included into urban greenery systems,
– area of municipal cemeteries,
– average age of cemeteries in every city.

Demographic data (population, population change, annually number of deaths, change in annual number of deaths) was also collected to include wider background of ten cities constituting a research sample. The synthetic measure of socioeconomic development of every analyzed city was calculated using the SMR statistical method (Malcher & Zielińska-Sitkiewicz, 2017). The indicators that were taken into account were:

1. Population change within 2015–18 – measured for FUA;
2. Number of business entities per 1000 inhabitants – measured for city itself;
3. Number of universities (including out-of-town departments of universities from other cities) measured for FUA.

These three indicators represent three main themes of the Silicon Valley Index (2010), that was created to measure regional and urban socioeconomic development and was successfully used in similar analysis in Poland (Męczyński et al., 2010). They were selected according to the highest degree of mutual Spearman correlation (computed in SPSS statistics) with indicators from other themes. Based on these 3 indicators, using SMR statistical method, the synthetic measure of development was calculated for 10 cities included in the main research (Częstochowa, Słupsk, Stargard, Jelenia Góra, Tarnów, Rzeszów, Kielce, Suwałki, Grudziądz, Zielona Góra).

Phase 2: Defining criteria assessing the attractiveness of cemeteries

Cemeteries differ from other categories of land use due to their specificity and thus affect the local community, natural environment (important component of urban green infrastructure), spatial structure of the cities and its use. Therefore, cemeteries require an individualized approach in developing the criteria for their assessment. Based on the literature review, reports (ASA, 1952; SIFUREP, 2016) and analysis of the law regulations in the aspect of planning cemeteries in Poland – 9 criteria of the evaluation of urban cemeteries with scores (0, 1, 2 points) were elaborated. The selection criteria for assessment of cemeteries were based on the top-down principle, i.e. from general to specific. The general is the context of studied cemeteries (location in the relation to existing functional and spatial structure), after which a specific space is analyzed, i.e. spatial layout of the cemetery. The following criteria were assessed: I) location of the cemetery within the landscape; II) location of the cemetery in relation to the city center; III) location of the cemetery in the urban

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Table 1. Criteria of the cemetery evaluation

Criteria	Scores	Weight (ratio correcting)
1	2	3
I. Location of the cemetery within the landscape. Visibility, ease of identification, attractive location (King et al., 2010; DDC, 2010; Pécsek, 2015)		
poor visibility: cemetery surrounded by buildings, infrastructure; difficult to identify	0	0.048
moderate visibility: cemetery overlooked by a small number of buildings, visible from close range	1	
good visibility: cemetery easily identifiable in city landscape	2	
II. Location of the cemetery in relation to the city center (Lehrer, 1974; Capels & Senville, 2006)		
cemetery located peripherally in relation to the city center (located in low-density, rural clusters)	0	0.113
cemetery located moderate distance from the city center (located in clusters with moderate density of suburban population)	1	
cemetery located non-peripherally in relation to the city center (located in clusters with high population density, urban and downtown character)	2	
III. Location of the cemetery in the urban natural system (Gilbert, 1991; Quinton et al., 2020; Act on Nature Conservation of 16 April, 2004; Abernathy, 1970; Richter, 1995)		
no connections between the cemetery and the system of urban green areas	0	0.024
the cemetery as an area supporting the urban natural system (in the vicinity of green areas)	1	
the cemetery is included in the basic areas of the urban natural system	2	
IV. Location of the cemetery in relation to other religious facilities in the city (Harvey, 2006; Polish Classification of Building Facilities, 1999; Humphrey & Vitebsky, 1997; Cheng, 2013)		
no religious facilities in the vicinity of the cemetery	0	0.073
religious facilities in the immediate vicinity of the cemetery e.g. cemetery, church, small sacred architecture	1	
the cemetery as one of the element of sacred complex	2	
V. Accessibility of the cemetery area. Transport infrastructure (SIFUREP, 2016; Śleszyński, 2014; Komornicki, 2013; Komornicki et al., 2009)		
no public transport access; only private transport	0	0.169
access only to public transport or only to bicycle paths in the vicinity of the cemetery	1	
access to both public transport andbicycle paths in the vicinity of the cemetery	2	
VI. Accessibility of the cemetery area. Frequency of public transport (Śleszyński, 2014; Komornicki, 2013; Komornicki et al., 2009)		
every 1 hour or less	0	0.185
every 31–59 minutes	1	
less than 30 minutes	2	
VII. Program of services in the vicinity of the cemetery (Chudak, 2012; Dian, 2004)		
no services	0	0.065
individual service facilities with monothematic program (industrial, light industrial, retail outlets)	1	
many service facilities with a diverse program (culture, gastronomy, public administration services)	2	

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cont. Table 1

1	2	3
VIII. Cemetery in the urban context (Dian, 2004; Bennett & Davies, 2014; Afla & Reza, 2012; Benmoshé, 2017)		
no connections	0	0.161
moderate connections: urban plan determined the cemetery layout or vice versa (mainly a network of communication routes)	1	
strong connections: cemetery as an important element spatial composition in the city; cemetery as a landmark	2	
IX. Cemetery development. Quality of the cemetery space development, types of infrastructure (law regulations)		
poor development: burial space, communication system, greenery	0	0.161
medium development: burial space, communication system, greenery, park furniture	1	
full development: burial space, communication system, greenery, park furniture	2	

Source: own preparation.

natural system; IV) location of the cemetery in relation to other religious facilities in the city; V) accessibility of the cemetery area (transport infrastructure); VI) accessibility of the cemetery area (frequency of public transport); VII) a program of services in the vicinity of the cemetery; VIII) cemetery in the urban context; IX) cemetery development (Tab. 1).

Phase 3: Calculating cemeteries attractiveness index

After selecting the factors of cemeteries attractiveness, the next step was to calculate the importance of each criterion. For calculation of weights, this study has consulted with 30 experts from the fields of cemetery administration, environmental management and land use planning. Experts have determined which criteria, in their opinion, are the most important and which are less important (weights). The weights add up to 1 (100%). The greater the weight of a criterion, the greater its importance in the final assessment. The maximum number of points that cemetery could score was 2. The analysis of the criteria for the attractiveness of cemeteries was made possible by the use of cartographic materials (topographic maps, aerial photos). Additional, non-cartographic sources of information about the cemeteries were local spatial policy documents: Spatial Development Conditions and Directions Studies and local land use plans. As part of the analytical research, inventories of cemeteries were compiled (general sketches and photographic documentation was prepared). The average ratings for the attractiveness of cemeteries in the analyzed cities created cemeteries attractiveness index.

Phase 4: Verification of mutual correlation between analyzed indicators

In this phase mutual Spearman correlation of achieved spatial indicators, synthetic measure of development and cemeteries attractiveness index in the city was calculated.

RESULTS

Characteristics of the selected cities in the aspect of spatial policy and socioeconomic development

Ten cities included in the main research represent different sizes. The biggest are Częstochowa with 222 200 inhabitants within city limits and 393 180 within its FUA and Rzeszów with 191 564 inhabitants within city limits and 517 628 within its FUA. The smallest one is Stargard with 67 900 inhabitants within city limits and 81 338 within its FUA. They also represent different administrative status. Three of them (Rzeszów, Kielce and Zielona Góra) are voivodeship capitals with poviat status, six (Częstochowa, Słupsk,

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Jelenia Góra, Grudziądz, Suwałki, Tarnów) are cities with poviat status and one (Stargard) is a poviat capital without any special status. It is also important to underline that every analyzed city with poviat status is also a capital for surrounding poviat.

There is a noticeable tendency of increase of the number of deaths in all analyzed cities (Tab. 2). It is symptomatic and should lead the authorities to verify whether resources in the area of burial space are sufficient. The largest percentage of the city's area developed by cemeteries was recorded in Słupsk (0.77%) and Stargard (0.67%), despite the fact that these cities have the smallest number of cemeteries: 2 facilities in Słupsk and 4 facilities in Stargard. In turn, the smallest share of cemeteries in the overall area of the city characterizes Zielona Góra (0.17%) with the most burial sites (16 facilities). On 1 January 2015, the rural commune was incorporated into the city of Zielona Góra. 17 villages were included into the administrative boundaries of the city along with the rural cultural heritage e.g. small rural cemeteries and former Protestant cemeteries (nowadays inactive).

Table 2. Demographic data of analyzed non-metropolitan cities

Item	City (Voivodeship)	Population City	Population FUA	Number of deaths
		2005/2018	2005/2018	2005/2018
1	Tarnów (Małopolskie Voivodeship)	117 560	292 788	1 046
		109 358↓	304245↑	1 142↑
2	Częstochowa (Śląskie Voivodeship)	246 890	415 122	2 758
		222 292↓	393180↓	2 972↑
3	Jelenia Góra (Dolnośląskie Voivodeship)	87 017	141 741	912
		79 686↓	135567↓	1 079 ↑
4	Zielona Góra (Lubuskie Voivodeship)	118 221	209 332	1 000
		140 297↑	211447↑	1 370↑
5	Stargard (Zachodniopomorskie Voivodeship)	70 639	82 288	566
		67 938↓	81338↓	696↑
6	Słupsk (Pomorskie Voivodeship)	98 695	170 981	917
		91 007↓	169759↓	1 021↑
7	Grudziądz (Kujawsko-Pomorskie Voivodeship)	99 578	128 273	988
		95 045↓	126480↓	1 262↑
9	Suwałki (Podlaskie Voivodeship)	69 268	84 897	459
		69 827↑	86771↑	600↑
9	Kielce (Świętokrzyskie Voivodeship)	208 193	397 646	1 704
		195 774↓	393142↓	2 134↑
10	Rzeszów (Podkarpackie Voivodeship)	158 539	491 481	1 141
		191 564↑	517628↑	1 494↑

Source: own preparation based on the Local Data Bank, https://bdl.stat.gov.pl/ (10.04.2021).

Over a half of analyzed cities face up depopulation problems. Highest decline of population between 2005 and 2018 was recorded in Częstochowa FUA (21942 inhabitants). Significant decline was also observed in Jelenia Góra FUA (6174 inhabitants), Kielce (4504 inhabitants), Grudziądz (1793 inhabitants) and Słupsk (1222 inhabitants). Decline in Stargard was lower than 1000 inhabitants. Highest increase of population was recorder in Rzeszów FUA (26147 inhabitants) and Tarnów FUA (11457 inhabitants). Significant increases were also recorded in Zielona Góra FUA (2115 inhabitants) and Suwałki FUA (1874 inhabitants). It's important to notice that population increase in Tarnów FUA has stopped in 2012 when population became stable with tendency to decline. The highest number of business entities per 1000 inhabitants was recorded in Jelenia Góra (over 155), which is an important tourist destination (Eurostat Urban Audit). High numbers can be also found in voivodeship capitals (Kielce, Rzeszów and Zielona Góra), but also in Słupsk (approximately 140). The remaining of analyzed cities recorded much smaller results with the lowest one in Grudziądz (84). The highest number of universities characterized Kielce FUA (18) and Rzeszów FUA (11) that are also important supra-regional academic centers, whereas the lowest number (2) characterized Stargard FUA and surprisingly Zielona Góra FUA, that is considered as a major academic center of Lubuskie voivodeship. However, academic life in this city concentrates mostly in one strong "University of Zielona Góra" with relatively small numbers of students.

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In overall, the highest value of synthetic measure of development was obtained by Rzeszów (0.82). Also the result of Kielce was quite high (0.75). These two cities clearly outperformed the others that obtained scores between 0.59 (Zielona Góra) and 0.40 (Częstochowa) (Tab. 3). These results correspond with a strong concern in public debate that Rzeszów is the best developing non-metropolitan city in Poland, but also confirms the validity of actions taken in recent years by Kielce authorities (such as: creation of new science and technology park and scientific campus of National Office of Measurement Główny Urząd Miar), that were conducted to strengthen Kielce's metropolitan functions.

In the Spatial Development Conditions and Directions Studies (SDCDS) of analyzed cities, little mention was made of cemeteries. In above-mentioned document for all analyzed cities, old cemeteries (especially historic objects) were included as elements of the urban greenery system. In Tarnów, Rzeszów, Jelenia Góra, Stargard, Kielce historic cemeteries are classified as the most valuable green areas. Additionally, the spatial policy documents in Słupsk, Stargard, Grudziądz emphasized the natural importance of these areas. Moreover, in the Study of Kielce, Rzeszów, Tarnów, and Stargard old cemeteries are defined as elements of cultural landscape possessing tourist values.

Moreover, the SDCDS of Częstochowa, Kielce, and Stargard includes a general description of the cities' cemeteries.

Zielona Góra is the only city among the analyzed ones with the Strategy for the Development of Green Areas. As a part of this document, the expert team for the revitalization of green areas in the city conducted a SWOT analysis, in which the presence of historical cemeteries was considered as one of the strengths. There are also guidelines for planning cemetery greenery within the city.

In the case of Stargard, information on cemeteries is provided by the City State Report (2019).

Based on the planning documents entries, three proposed directions for the functioning of cemeteries with respect to the city's natural system can be identified (Fig. 2):

1. Cemetery as a green enclave;
2. Cemetery as an element of city's natural system;
3. Cemetery as an element of green corridor.

Type 1. Cemetery as a green enclave: this solution refers to historical cemeteries, which along with urbanization were surrounded by built-up areas. Such a location imposes a park program on these

Table 3. Values of development indicators in analyzed cities

City	Population change (2005–2018)	Number of business entities per 1000 inhabitants (2018)	All universities (2018)	Synthetic measure of development
	(FUA)	(City itself)	(FUA)	
Rzeszów	26147	139,4729699	11	0,819666681
Kielce	-4504	140,9839917	18	0,69031735
Tarnów	11457	103,9317086	9	0,627941009
Zielona Góra	2115	139,3213986	2	0,559002871
Słupsk	-1222	135,7788445	3	0,554383558
Jelenia Góra	-6174	155,4227479	3	0,535465936
Stargard	-950	115,3993347	2	0,501998022
Suwałki	1874	99,7608375	1	0,457739644
Grudziądz	-1793	84,29691199	5	0,446039642
Częstochowa	-21942	118,37583	6	0,42134482

Source: own preparation based on the Local Data Bank, https://bdl.stat.gov.pl/ (10.04.2021).

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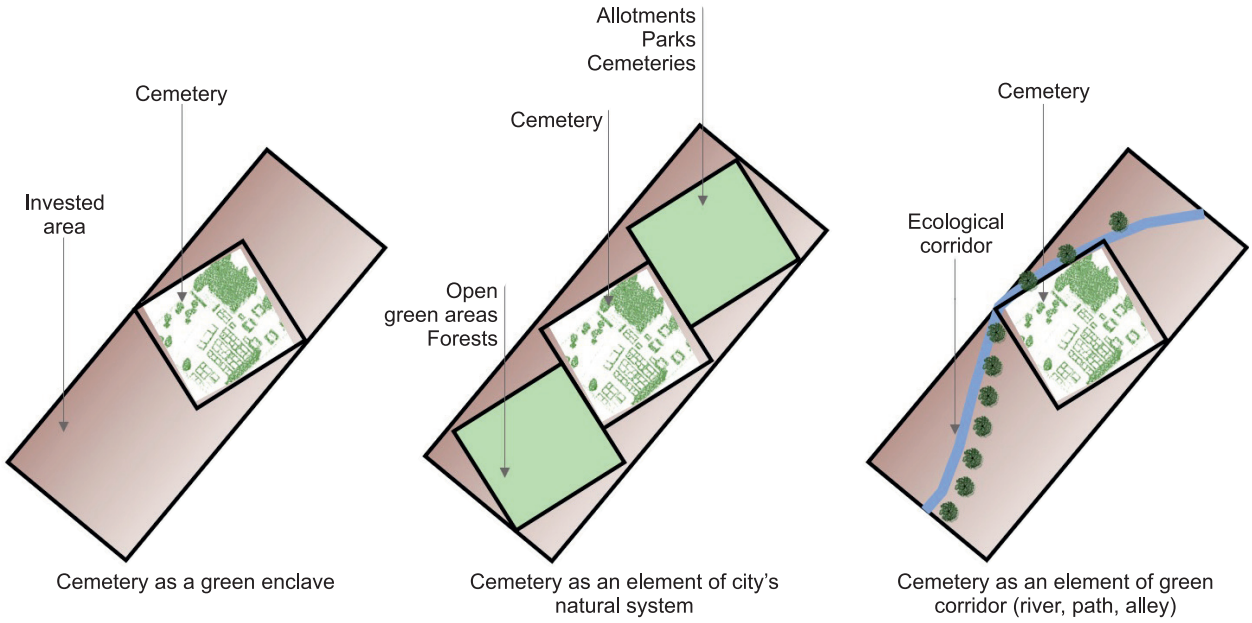

Fig. 2. Cemeteries in city's natural system
Source: own preparation.

areas, which is reflected in the provisions of planning and strategic documents (e.g. Saint Roch Cemetery in Częstochowa, the park cemetery at the at the Holy Cross Elevation Church in Jelenia Góra). The cemeteries located in the open areas are also identified as the "green islands" in the functional and spatial structure of the cities (provided that the trees are included in their development), enriching the landscape of the area (e.g. municipal cemeteries in Cmentarna Street in Kielce).

Type 2. Cemetery as an element of city's natural system: this category refers to modern cemeteries located in the direct vicinity of green areas classified in the SDCDS as "ZL" i.e. forests (e.g. the communal cemetery in Suwałki), "ZD" i.e. allotment gardens (e.g. the communal cemetery in Stargard), "ZC" i.e. cemeteries in the vicinity of the historical burial sites (e.g. new communal cemetery in Częstochowa and Zielona Góra). This category also includes historical cemeteries, around which other green areas of recreational character (city park, city-forest park, stadium, allotment gardens) were aggregated and developed, e.g. Grudziądz and Kielce.

Type 3. Cemetery as an element of green corridor: this category refers to historical cemeteries which are "green islands" and at the same time constitute one of the elements of development in the vicinity of watercourses, e.g. the Old Cemetery in Rzeszów included in the nature trail along the Wisłok River and the Old Cemetery in Tarnów on the Wątok River which, apart from the sepulchral object, include green areas of high natural value.

This excerpt from spatial documents shows that in Poland authorities are inclined to cover the issue of old cemeteries while at the same time the modern ones are omitted, which results from lack of present-day Polish cemetery art. Spatial development conditions and directions studies for Grudziądz and Częstochowa, where a lot of attention is paid to the contemporary cemeteries, are unique.

Cemeteries attractiveness index of selected cities

In order to compare the quality and attractiveness of cemeteries in non-metropolitan cities, the index of the cemetery greenery per 1inhabitant (in m^2) was

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used, based on the American Planning Association (APA) and Association for Public Service Excellence (ASPE). This indicator shows that the largest area of cemeteries can be found in: Stargard (6.9 m^2) and Jelenia Góra (4.8 m^2), and the smallest in Kielce (2.4 m^2), Tarnów (2.7 m^2) and Rzeszów (2.8 m^2) (Tab. 4).

Cemeteries are an important component of city's green areas in the structure of Suwałki, Stargard, Tarnów, Rzeszów and Kielce.

The highest total score of attractiveness was obtained by cemeteries in Słupsk, Suwałki, Jelenia Góra and Kielce. In turn, the lowest score was obtained by cemeteries in Grudziądz and Zielona Góra (Tab. 5).

The following features were rated the highest: development of cemeteries and its location in relation to transportation infrastructure (availability) (these two features have the greatest impact on the attractiveness of cemeteries). Most of the researched cemeteries fulfill legal requirements in the aspect

Table 4. General data on the non-metropolitan cities analyzed

City	Area [ha]	Number of cemeteries	Total area of cemeteries [ha]	% of Total	Area of greenery [ha]	% of cemeteries in greenery	Cemetery greenery/1 inhabitant [m^2]
Tarnów	7238	11	29.39	0.41	241.84	13.69	2.7
Częstochowa	15971	12	65.45	0.41	736.36	7.10	2.9
Jelenia Góra	10922	10	38.20	0.35	702.2	4.46	4.8
Zielona Góra	27832	16	48.12	0.17	889.41	1.42	3.4
Stargard	4808	4	47.27	0.98	219.02	21.58	6.9
Słupsk	4315	2	33.10	0.77	431.66	10.54	3.6
Grudziądz	5776	7	27.77	0.48	326.42	5.61	2.9
Suwałki	6551	8	25.55	0.39	132.18	21.94	3.7
Kielce	10965	10	46.22	0.42	371.14	12.81	2.4
Rzeszów	12041	16	53.35	0.44	406.15	13.1	2.8

Source: own preparation based on the Local Data Bank, https://bdl.stat.gov.pl/ (10.04.2021).

Table 5. Results of the evaluation of cemetery attractiveness in non-metropolitan cities. M – municipal cemetery, D – denominational cemetery, W – war cemetery

City	Average attractiveness	The highest score		The lowest score	
		Cemetery name	Score	Cemetery name	Score
Tarnów	1.100	Old cemetery (M)	1.668	War cemetery no. 200 Chyszów (W)	0.555
Częstochowa	0.906	Cemetery Complex of Saint Roch (D)	1.611	Stradom cemetery (M)	0.257
Jelenia Góra	1.142	Park Cemetery at the Holy Cross Elevation Church (D)	1.837	Sobieszów cemetery (M)	0.460
Zielona Góra	0.799	New cemetery near Wrocławska Street (M)	1.377	Sucha cemetery (D)	0.306
Stargard	1.007	Old cemetery (M)	1.490	International War Cemetery (W)	0.652
Słupsk	1.289	Old cemetery (M)	1.829	Western Cemetery (M)	0.749
Grudziądz	0.792	Cemetery Complex (D)	1.490	War and Garrison Cemetery (W)	0.467
Suwałki	1.170	Multi-religious cemetery complex (D)	1.611	Zastawie cemetery (D)	0.185
Kielce	1.108	Cemetery Complex near Kwasa Street (M)	1.603	Cemetery of Soviet POW's (W)	0.137
Rzeszów	1.053	Old Cemetery near Targowa Street (D)	1.829	Matysówka parish cemetery (D)	0.322

Source: own preparation.

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of spatial arrangement (i.e. fence, legible burial ground, circulation route, entrance, parking facility, water intakes). There is the obligation in Polish law to build a funeral parlor or chapel in contemporary cemetery. In the researched non-metropolitan cities, there were cemeteries without above-mentioned facilities identified, e.g. Zastawie parish cemetery in Suwałki, Stradom and Mirów municipal cemeteries and Gnaszyn parish cemetery in Częstochowa. Despite the legislative intention that "the cemetery should be arranged and maintained as a park-based area", many of the cemeteries in non-metropolitan cities are without tall greenery (e.g. Zastawie cemetery in Suwałki, enlarged municipal cemeteries in Kielce Cedzyna or Suwałki) and benches or lighting (basic park furniture).

Correlation between analyzed indicators

Output were divided into 4 main categories to facilitate the determination of classes of cemeteries attractiveness: I. Very high; II. High; III. Average; IV. Low (Tab. 6).

It was found relationship between cemeteries attractiveness and spatial policy. Facilities classified with very high and high attractiveness are included in planning documents. Situated in downtown clusters, due to the preserved old trees, they are green islands and treated as an important element of the city's natural system.

No statistically significant correlations between cemeteries attractiveness index and other indicators has been found. However it was found that some criteria that make up cemeteries attractiveness index have statistically significant correlations with some spatial indicators (Appendix 1, Appendix 2).

1. Accessibility of cemetery by transport infrastructure (criterion V) has statistically significant correlation with area of cemeteries included in city greenery system;
2. Program of services in the vicinity of the cemetery (criterion VII) and cemetery development stage (criterion IX) have statistically significant correlation with area share of municipal cemeteries;
3. Visibility of cemetery in urban landscape (criterion I) has statistically significant correlation with cemetery's age.

Table 6. Classes of cemeteries attractiveness

Classes of cemeteries attractiveness		Partitiones (scores)	Attributes of attractiveness	Examples
I	Very high	$1.500 \leq x \leq 2.000$	Cemetery as landmark in urban landscape (good visibility, good connection with urban structure), full development (cemetery as a park), good availability	Old Cemetery near Targowa Street, Rzeszów Pobitno Cemetery, Rzeszów Old Cemetery, Słupsk Park Cemetery at the Holy Cross Elevation Church, Jelenia Góra
II	High	$1.000 \leq x < 1.500$	Full development, good availability, moderate connections with urban landscape, cemetery situated near monofunctional areas, communication nodes (outgoing and incoming roads)	Krzyż Cemetery, Tarnów Mościce Cemetery, Tarnów New Municipal Cemetery, Zielona Góra Cemetery near Sudecka Street, Jelenia Góra Staromieście Cemetery, Rzeszów New Municipal Cemetery, Częstochowa
III	Average	$0.500 \leq x < 1.000$	Peripheral location (low availability, low visibility), medium development, situated in the vicinity of green areas	Kobylanka Cemetery, Grudziądz Municipal Cemetery near Reja Street, Suwałki Bzianka Cemetery, Rzeszów
IV	Low	$0.000 \leq x < 0.500$	Peripheral location (low availability, low visibility), poor development, warehouses, industrial facilities in the cemetery buffer zone	Stradom Cemetery, Częstochowa Sucha Cemetery, Zielona Góra Budziwój Cemetery, Rzeszów

Source: own preparation.

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Fig. 3. Graphic presentation of classes of cemetery attractiveness, on the example of Old Cemetery in Rzeszów (class I), new municipal cemetery in Częstochowa (class II), municipal cemetery in Suwałki (class III), parish cemetery Zastawie (class IV)

Source: own preparation based on https://polska.e-mapa.net/ (02.05.2021).

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Table 7. Synthetic measure, spatial development policy and cemeteries attractiveness – results

City	Synthetic measure	Average attractiveness of cemeteries	Cemeteries in spatial policy documents
Tarnów	0,627941009	1.100	
Częstochowa	0,42134482	0.906	
Jelenia Góra	0,535465936	1.142	
Zielona Góra	0,559002871	0.799	
Stargard	0,501998022	1.007	
Słupsk	0,554383558	1.289	
Grudziądz	0,446039642	0.792	
Suwałki	0,457739644	1.170	
Kielce	0,69031735	1.108	
Rzeszów	0,819666681	1.053	

the document emphasizes:

 the natural value of the cemetery, including facilities in the local ecological network;

 historic values of the cemetery, postulating conservation protection;

 list and description of cemeteries in the city;

 feasibility study in the aspect of cemeteries expansion (burial needs) taking into account contemporary burial culture

Source: own preparation.

It's important to add that mutual correlation between cemeteries age and attractiveness criteria was examined only for those 60 cemeteries (representing every analyzed city) whose year of establishment was precisely known and it was made for individual notes of each cemetery not for city's average note as for other indicators.

Establishment of old necropolis in analyzed non-metropolitan cities is connected with the decline in using the church cemeteries which occurred in Rzeczpospolita in the second half of the 18th century. In the beginning of the 19th century, establishing cemeteries outside of city limits was a common practice throughout Europe. Cemeteries founded in the 18th and 19th centuries as "*extra muros*" facilities had a vast space, which was arranged as a park-based area or a garden-based area (Curl, 1980; Etlin, 1984; Linden-Ward, 2007). Nowadays these cemeteries are attractive public parks and gardens as a result of the city boundaries extension (Rogers, 1997; Harnik & Merolli, 2010; Uslu, 2010; Swensen et al., 2016). Cemeteries established in the second half of the 20th century are characterized by the lowest attractiveness index. Given the solemn and dignified nature, cemeteries typically keep a low profile and do not promote their significant role. Due to the state policy aimed at secularizing the society and limiting the zones of public influence of the Roman Catholic Church, as well as large shortages in the field of burial space, a decision was made to establish municipal cemeteries by means of small financial outlays, which determined the quality of cemeteries (Rogowska, 2014). Part of the reason for this low profile may be that cemetery operators are often guided by a philosophy of service that leads to the situation where large burial surfaces devoid of plants create a monotonous and depressing impression. In turn, the average attractiveness index is found in cemeteries established after 2001. They constitute large-scale urban investments equipped with cubature buildings, small architecture, technical and communication infrastructure. However, due to restrictive sanitary and hydrological requirements, they are located on the outskirts of cities (difficult accessibility), without any connection with the urban context (new cemetery does not create a spatial composition with other sacred objects in the non-metropolitan city).

It is significant that in all researched non-metropolitan cities, new burial investments (built

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from 1989 to 2019) are municipal ones. It appears that the share of communal cemeteries increases, which is associated with progressing secularization and problems related to cemetery management noticed in the Supreme Audit Office report (2016) (church authorities are increasingly deciding to transfer the administration of the cemetery to local governments).

Moreover, the research showed the problem with identifying a specific number of cemeteries in each non-metropolitan city, which results from the lack of a coherent definition of cemeteries in Poland. There is also a problem with classification of inactive cemeteries; in spatial policy documents (local land use plans and spatial development conditions and directions studies), the cemetery area is classified as „ZC" (cemetery), „ZP" (park) or „US" (religious services). Such discrepancies may be one of the factors determining the low attractiveness of cemeteries.

GUIDELINES. HOW TO IMPROVE THE ATTRACTIVENESS OF URBAN CEMETERIES?

Guidelines have been developed to improve the quality and attractiveness of cemeteries in urban context and to strengthen the role of cemeteries in documents as an important element of green infrastructure. The authors developed recommendations that are universal and can be implemented to other urban cemeteries.

Nordh and Evensen (2018, p. 80) pointed out that "Cemeteries are green spaces, but in planning documents, they are assigned a limited number of environmental qualities. Cemeteries are publicly accessible spaces, but treated as private spaces in municipal plans". Because of the multi-perspective character of cemeteries, space and its important role in shaping cityscape, especially as a part of green urban areas (Długozima & Kosiacka-Beck, 2020; Yilmaz et al., 2018; van Leeuwen et al., 2010; Haq, 2011). That is why cemeteries should be included in the concept of green infrastructure in the respective municipalities. According to the principles of integrated planning, spatial policy should take into account cemeteries, not only by listing them, but also by identification, characterization, valorization. Cemeteries should be treated as an important element of the city's structure.

In this aspect, the analyzed as well as other non-metropolitan cities, could follow the spatial policy assumptions for Łódź, where the City Urban Planning Department proposed a multisectoral project "The Green Ring of Tradition and Culture". A concept to protect the most valuable areas and objectives – parks, cemeteries, allotment gardens, university campus surrounding the city centre with its main street. "The Green Ring of Tradition and Culture" including cemeteries could be one of the basic elements of the spatial structure of the city in the project of the SCDSD, ensure sustainable development and improve the city's identity and attractiveness (Müller et al., 2005).

In the analyzed non-metropolitan cities, active and inactive cemeteries coexist, some of them are the testimony of multicultural (e.g. Evangelical and Jewish cemeteries) and dramatic (war cemeteries) history of Polish land. These inactive facilities are often devastated and are invisible in the urban landscape. Therefore, to ensure optimal development of cities, it is necessary to pay more attention to cemeteries in spatial policy.

A cemetery's primary function is to provide a physical space for the memorialization and final resting place of the deceased. It plays an important role in social infrastructure.

The use of a multi-criteria method of assessing the attractiveness of objects may be useful in spatial planning. By selecting attractive objects, it is possible to plan cultural and bicycle trails and include cemeteries in their program what would make them an element of ecosystem services.

On the other hand, the identification of unattractive cemeteries allows preparation of a strategy to improve the quality of their functioning.

The currently conducted works on national law on spatial planning and development, as well as the works on the national law on cemeteries and the burying of the deceased, constitute an excellent excuse to standardize the nomenclature and propose

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a legal definition for a cemetery trying to include both the historic and ecosystem values of objects in this definition. It's also important to mandatory include cemeteries as city green infrastructure as well as to maintain them as park layouts, so that they constitute an attractive cultural space, while supplying the city's greenery system.

The current trends that have been observed in many European cities suggest an increasing degradation in the general quality of existing urban green spaces. That is why cemeteries should be assigned in spatial policy documents as green areas. It ensures the development of green spaces. Such strategy will contribute to integrate existing cemeteries into a coherent natural system.

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Appendix 1. Values of correlations between analyzed cityscale indicators. (Statistically significant correlations are marked on red)

Criteria ma king up cemeteries attractiveness index									Area of cemeteries included in city greenery system	Cemetery greenery indicator per capita [m^2]	Synthetic measure of development	Area share of municipal cemeteries	Criteria ma king up cemeteries attractiveness index
I	II	III	IV	V	VI	VII	VIII	IX					
1,000000	0,042946	0,276079	0,352767	0,118015	-0,006135	0,055048	-0,021539	-0,009259	0,244659	0,328227	-0,403687	-0,077641	I
0,042946	1,000000	0,323171	0,289634	0,074080	0,317073	0,145897	0,431195	0,012270	0,231004	-0,317073	0,601826	-0,228412	II
0,276079	0,323171	1,000000	0,332317	-0,259279	0,353659	0,455929	0,425078	-0,003068	-0,072949	0,210366	0,085107	0,123466	III
0,352767	0,289634	0,332317	1,000000	0,074080	-0,103659	0,012158	0,623856	-0,337430	-0,133739	0,250000	-0,231004	-0,246932	IV
0,118015	0,074080	-0,259279	0,074080	1,000000	0,419785	0,172328	-0,015481	-0,018634	0,867795	0,117293	-0,018464	-0,093750	V
-0,006135	0,317073	0,353659	-0,103659	0,419785	1,000000	0,595747	0,143732	-0,276079	0,565352	0,262195	0,188451	0,012347	VI
0,055048	0,145897	0,455929	0,012158	0,172328	0,595747	1,000000	0,353665	0,403687	0,163636	0,303953	0,454545	0,738549	VII
-0,021539	0,431195	0,425078	0,623856	-0,015481	0,143732	0,353665	1,000000	-0,067693	-0,189028	-0,067279	0,140247	-0,030961	VIII
-0,009259	0,012270	-0,003068	-0,337430	-0,018634	-0,276079	0,403687	-0,067693	1,000000	-0,030582	-0,168715	0,562715	0,776412	IX
0,244659	0,231004	-0,072949	-0,133739	0,867795	0,565352	0,163636	-0,189028	-0,030582	1,000000	-0,072949	0,103030	-0,178483	Area of cemeteries included in city greenery system
0,328227	-0,317073	0,210366	0,250000	0,117293	0,262195	0,303953	-0,067279	-0,168715	-0,072949	1,000000	-0,486324	0,240759	Cemetery greenery indicator per capita [m^2]
-0,403687	0,601826	0,085107	-0,231004	-0,018464	0,188451	0,454545	0,140247	0,562715	0,103030	-0,486324	1,000000	0,443129	Synthetic measure of development
-0,077641	-0,228412	0,123466	-0,246932	-0,093750	0,012347	0,738549	-0,030961	0,776412	-0,178483	0,240759	0,443129	1,000000	Area share of municipal cemeteries

Source: own preparation.

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Appendix 2. Value of correlation between each criteria of attractiveness of individual cemeteries and their age (statistically significant correlations are marked on red).

Criteria of attractiveness of individual cemeteries									Age of cemetery		
I	II	III	IV	V	VI	VII	VIII	IX			
1,000000	-0,182311	-0,646809	-0,083241	-0,265645	-0,164650	-0,361180	-0,409873	-0,456179	0,281764	I	Criteria of attractiveness of individual cemeteries
-0,182311	1,000000	0,127717	0,033087	0,519885	0,188966	0,335068	0,385990	0,413416	0,082601	II	
-0,646809	0,127717	1,000000	0,136184	0,160489	0,243257	0,515261	0,457319	0,352117	-0,193498	III	
-0,083241	0,033087	0,136184	1,000000	0,184997	0,001167	0,170034	0,170063	0,130176	0,112223	IV	
-0,265645	0,519885	0,160489	0,184997	1,000000	0,211765	0,313971	0,346754	0,478631	-0,002195	V	
-0,164650	0,188966	0,243257	0,001167	0,211765	1,000000	0,547880	0,428985	0,049573	0,027844	VI	
-0,361180	0,335068	0,515261	0,170034	0,313971	0,547880	1,000000	0,667087	0,254326	0,098839	VII	
-0,409873	0,385990	0,457319	0,170063	0,346754	0,428985	0,667087	1,000000	0,372452	0,159212	VIII	
-0,456179	0,413416	0,352117	0,130176	0,478631	0,049573	0,254326	0,372452	1,000000	-0,092541	IX	
0,281764	0,082601	-0,193498	0,112223	-0,002195	0,027844	0,098839	0,159212	-0,092541	1,000000	Age of cemetery	

Source: own preparation.

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CURRENT PROBLEMS AND CHALLENGES OF AGRICULTURE IN THE REPUBLIC OF BELARUS

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ABSTRACT

The work aims to discuss current problems and challenges for agriculture in the Republic of Belarus. The effects of the COVID-19 pandemic and the socio-economic processes initiated in 2020 somewhat worsened the situation in the agricultural sector, and the existing problems deepened and reasserted themselves. The methods of statistical comparative analysis used in the study together with the construction of dynamic series, which reflect changes in the phenomenon over time, allowed for the identification of certain trends and regularities characteristic of Belarusian agriculture. On the other hand, dialectical analysis made it possible to identify the sources of the main obstacles to effective functioning. The study concludes that the reform of the agricultural system is of key importance for the future performance of Belarusian agriculture. The lack of a uniform approach to the development of the separate spheres of the agro-industrial complex (rus. *агропромышленный комплекс, далее – АПК*) leads to significant disproportions in their effectiveness. On the other hand, the lack of diversification of buyers on the market of agricultural products leads to a significant dependence of Belarusian producers on the market conditions of the Russian Federation. An attempt to create large cluster formations should be accompanied by appropriate justification and calculation of potential opportunities and threats.

Keywords: agriculture, current problems, production, economic conditions, market, management, labour resources

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INTRODUCTION

Agriculture and the agro-industrial complex AIC (rus. *агропромышленный комплекс, далее – АПК*)[1] are an integral part of the national economy of Belarus. Increasing the production of agricultural products and foodstuffs is correlated with the need to ensure food security and increasing the country's export potential.

In this context, it should be noted that the concept of AIC is similar to the classical definition of "agribusiness" by J. Davis and R. Goldberg presented in the work of "A Concept of Agribusiness. Division of Research" (Davis & Goldberg, 1957).

However, this applies only to the definition, since its interpretation and practicality are different. For example, J. Davis and R. Goldberg note that responsibility for the development of agriculture should be maximally shifted from the government to the private sector of the economy and the state should only provide appropriate assistance in scientific and technical research and development. In the Republic of Belarus in 2019, the structure of agricultural products by categories of farms in value terms was as follows: agricultural organizations – 79.8%, peasant (farm) farms – 2.7, households – 17.5%.

The strategic goal of the national food security of the Republic of Belarus till 2030 is to increase the level of supply for the population and the availability of high-quality food for adequate nutrition and a healthy lifestyle through the sustainable development of competitive agricultural production, as well as to create socio-economic conditions for maintaining the consumption of basic food products at a rational level (On the doctrine of national food security of the Republic of Belarus until 2030). In the European Union countries, the agricultural sector is also mentioned as an element of co-creating energy security (production of biofuels) (de Gorter at al., 2013; Wright, 2014; Hamulczuk, 2016).

In the process of achieving the above-mentioned goal, the Belarusian agro-industrial complex is undergoing quite systematic development, but an evaluation of its economic results exposes low effectiveness of agrarian reforms and calls for the need to correct the existing direction of development.

The current situation of Belarusian agriculture is partly due to the changes taking place in this sector. Structural changes are an ambiguous concept because they can be analyzed in many respects. It was most generally presented by Balmann (1997), who considered structural changes in a broad sense as an answer to the question: who produces what, in what amounts and with what means? The answer to this question requires specification of the criteria for the division of the sector. The most important ones are the size of farms, ownership and control over resources, legal form, degree of integration within the sector, technologies and production systems used, the level of specialization and the level of intensity (Zimmermann et al., 2007; Wąs, 2005). Regardless of the division criteria used, it can be seen that the characteristics of the entire sector are the result of changes in the structure of its basic units, which are farms (Wąs & Małażewska, 2012).

According to the authors, the most urgent problems in the functioning of Belarusian agriculture are the following:

[1] The agro-industrial complex (агропромышленный комплекс, далее – АПК) is the largest cross-industry complex, bringing together several sectors of the economy focused on the production and processing of agricultural raw materials and obtaining products from these raw materials that reach the end consumer. The main task of the agro-industrial complex is to supply the population of the country with food, and the industry with raw materials. The economic effect is achieved thanks to the favorable location and cooperation of enterprises.

(I) The main link of the agro-industrial complex is agriculture, which includes crop production, animal husbandry, farms, personal auxiliary plots, etc.

(II) Industries and services that provide agriculture with means of production and material resources: construction and repair of tractors, agricultural machinery and equipment, production of mineral fertilizers, plant protection chemicals, fodder and microbiological industries.

(III) Industries involved in the processing of agricultural raw materials: food industry, primary processing of raw materials for light industry.

(IV) Infrastructure block – industries dealing with the purchase of agricultural raw materials, transport, storage, trade in consumer goods, training of human resources for agriculture, construction in agricultural sectors.

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– excessive centralization of the management of the activities of various spheres of the agro-industrial complex, limited production, and financial independence of economic entities;
– lack of large-scale diversification of agricultural product markets in the environment of intensifying international relations;
– incompatibility of the created conditions for managing the agro-industrial complex with the requirements of stimulating the growth of socio-economic efficiency;
– low potential of human resources in agriculture and ineffective use of human capital.

The research so far does not address the above-mentioned problem comprehensively, therefore the aim of the work is to discuss the current problems and challenges for the agriculture of the Republic of Belarus.

RESEARCH DATA AND METHODS

The article contains the structure of problematic aspects according to differentiated features that significantly affect the productivity of agriculture. The research is based on the data of the National Statistical Committee of the Republic of Belarus, materials of scientific works on similar topics. The following research methods were selected: analysis, synthesis, comparison, analogy method, etc. The identified current problems allow a deeper understanding of the essence of ongoing processes and final results in agriculture of the Republic of Belarus.

ANALYSIS AND INTERPRETATION OF THE RESULTS

Centralized management and planning

The development of agriculture in Belarus is determined by the state policy and respective programs. Since 2005, the country adopted several basic documents regulating the agricultural sector. There are, among others, "State program for revitalization and rural development for 2005–2010", "State program for sustainable development of rural areas for 2011–2015" and "State program for the development of agribusiness in the Republic of Belarus for 2016–2020".

Each of the programs has a strict structure, contains a list of sub-programs, and has specific forecasted indicators of agricultural functioning broken down into sectors, types of products, territorial features, and others. The existing order of forecasting the development of the agro-industrial complex is basically such as the practice in the Soviet times, when the results of branches and individual enterprises were based not on economic and socio-economic efficiency indicators, but primarily on technical efficiency indicators. In practice, this is expressed in the strict achievement of the planned production volume without considering the relevant socio-economic, natural-climatic, political, and technical-technological factors (market conditions, price level, efficiency, investment climate, domestic market needs, export / import of products, the level of technology development, etc.).

As Galbraith notes, the structure of GDP is created not by the entire society, but only by those who produce goods and services (Galbraith, 2008). As in the case of agricultural production, the production volume implementation plan is passed on to specific enterprises (without considering economic, natural, technological, social, and other aspects of economic management), and economic losses from its implementation are also borne by them. On the one hand, agricultural production is increasing due to intensive and extensive factors, while on the other hand, the obligations of agricultural organizations are increasing.

After a detailed study of the above-mentioned state programs, a justified question arises with regards to the advisability of precise (detailed) and long-term planning of individual indicators (the volume of agricultural production, production in individual spheres of the agro-industrial complex, etc.). Some economists note that long-term forecasting is rather impractical as it is impossible to accurately predict technical, technological, and other innovations, consumer and investor reactions, fluctuations in export and import

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expectations, etc. (Taleb, 2019). In the conditions of a market economy, it is a strategic planning of development directions that facilitate the implementation of a sustainable development policy.

The analysis of the planned agricultural development parameters for 2005–2020 showed that almost all plans and assumptions were not achieved due to several stochastic reasons (African swine fever, the world crisis in 2008–2009, financial crises in 2011 in Belarus and 2014 in the Russian Federation, unfavorable natural and climatic conditions, "trade wars", the COVID-19 pandemic, etc.) (Table 1).

The most ambitious production targets were in the State Program for Sustainable Rural Development for 2010–2015, but after the financial crisis of 2011 and the subsequent over-saturation of the domestic market with domestic food, the parameters of the next program were lowered. Thus, the State Program for the Development of Agricultural Business in the Republic of Belarus for 2015–2020, some parameters are lower by 20–25%. This program also took into account a number of factors affecting the reasonable amount of agricultural production: production in households and peasant (farm) households, problems of export supplies ("milk" and "sugar" trade wars), population decline, changes in the rations of the population and others.

It should be noted that the "State program for the development of agribusiness in the Republic of Belarus for 2016–2020" (2016) already lists various types of risk and summarizes that as a result, by 2020, the risk of insufficient plant and animal production is estimated at approximately 20% and 40% of the production level achieved in 2015, respectively. In fact, it is a potential "official justification" for not achieving the planned results.

It is necessary to realize that agricultural organizations, as well as peasant farms and private auxiliary plots, will actively develop the production of those products that ensure the highest profitability. As in the countries of Western Europe and North America, the price factor will be used primarily to stabilize and control the production volume.

Table 1. Comparative analysis of selected data of government programs

Selected data of the State Program for Revitalization and Rural Development for 2005–2010		
	Plan for 2010	Fact 2010
Grain production, thousand tons	8 400	6 988
Sugar beet production, thousand tons	3 810	3 773
Potato production, thousand tons	9 000	7 831
Milk production, thousand tons	6 500	6 624
Meat production, thousand tons	1 440	1 400
The level of profitability of agricultural production, %	18–20	9.4
Average monthly salary, USD	320–360	285
Selected data of the State Program for Sustainable Development of Rural Areas for 2011–2015		
	Plan for 2015	Fact 2015
Grain production, thousand tons	12 000	8 657
Sugar beet production, thousand tons	5 500	3 300
Potato production, thousand tons	7 750	5 995
Milk production, thousand tons	10 700	7 047
Meat production, thousand tons	2 000	1 661
The level of profitability of sales, %	10.5	1.1
Average monthly salary, USD	600	280
Export of agricultural products, USD billion	7.2	4.5
Selected data of the State Program for the Development of Agricultural Business in the Republic of Belarus for 2015–2020		
	Plan for 2019	Fact 2019
Grain production, thousand tons	9 710	7 331
Sugar beet production, thousand tons	4 902	4 927
Potato production, thousand tons	5 913	6 105
Milk production, thousand tons	8 685	7 394
Meat production, thousand tons	1 863	1 725
The level of profitability of sales, %	9.0	4.6
Export of agricultural products, USD billion	6.0	5.5

Source: own work based on State programs for the development in the Republic of Belarus.

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In the domestic agricultural economy (AIC) the principle of "complementary equilibrium" is often applied, the essence of which is that the profitability (loss) of some products is regulated by purchase prices based on the relation to profitability (loss) of other products that have technological commonality. For example, the production of livestock and fattening cattle is an artificially sustained loss-making activity, and milk is highly profitable. From a technological point of view, the production of these two types of products is inextricably linked. First, this is to prevent the autonomy of enterprises in trade in certain types of products (especially export) and uncontrolled changes in prices on the market (Hrydziushka, 2020).

The wrong choice of performance indicators of producers of goods leads to the orientation of production to natural indicators, which is manifested in a decrease in resource efficiency and a decrease in the efficiency of the enterprise and the entire industry. The increase in physical production is not always accompanied by an increase in the production efficiency, and in some cases, it manifests itself in excessive stockpiling, freezing assets and reduced capital turnover.

Diversification of agricultural product markets

At the current stage of development of the agro-industrial complex, the level of self-sufficiency in the main types of agricultural products, raw materials and food is rapidly increasing, and for some products it has exceeded domestic demand several times (Dayneko et al., 2018). The Russian Federation is the traditional and main export destination for Belarusian food. The level of food self-sufficiency of the Russian Federation is increasing rapidly, but no effective measures are taken to diversify exports of products, which will inevitably lead to overproduction of domestic agricultural products and food collapse in the foreseeable future (except for possible environmental and climate changes in importing countries, post COVID-19 pandemic crisis and other unforeseen circumstances).

Currently, the Republic of Belarus participates in regional and international trade and economic processes caused by the progressing globalization of the world economy (COVID-19 pandemic, increasing tensions in international relations with several countries) to a very limited extent. The Russian Federation remains the main trade and economic partner of the Republic of Belarus in terms of both economic and political conditions (Table 2).

Table 2. Export and import of goods of the Republic of Belarus, USD million

	2000	2005	2010	2015	2019
Export of goods					
Total	7 326.4	15 979.3	25 283.5	26 660.4	32 955.1
including. the Russian Federation	3 710.1	5 715.8	9 953.6	10 398.4	13 685.8
Import of goods					
Total	8 646.2	16 708.1	34 884.4	30 291.5	39 476.7
incl. the Russian Federation	5 604.7	10 118.2	18 080.6	17 143.2	22 016.4

Source: own work based on Statistical Yearbook of the Republic of Belarus – Foreign Trade of the Republic of Belarus (2020).

The data in Table 2 serve as a kind of additional indicator, indicating that trade relations between Belarus and the Russian Federation are often determined by the political relations of the countries. Between 2010 and 2015, relations between the states were strained and together with the financial crisis, formed a synergistic effect of the decline in the performance of trade relations.

In the Russian Federation, however, there is a lobby for the interests of both individual sectors of the national economy and individual integrated entities (holdings, concerns). The protectionism of Russian state authorities towards domestic commodity producers has a negative impact on the financial condition of Belarusian exporters of agricultural and food products. Specifically, it is manifested in temporary bans and sanctions imposed on the import of Belarusian products to the Russian Federation.

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In this respect, Belarusian producers of goods must resort to a certain list of measures to eliminate the claims made. These are, among others, complaints regarding the quality of products and the origin of raw materials, complaints regarding the compliance of production, storage and sale of products, veterinary and sanitary-hygienic conditions and other activities that significantly affect both the cost of products (conducting additional tests and controls) and the selling price (directly lowering the price), as well as the sales volume in general (product spoilage, sanctions, prohibitions). In 2012–2020, Belarusian producers of agricultural products and food were regularly subject to restrictive measures by the Russian Federation, expressed in the above-mentioned forms. Of course, the existence of such restrictive measures cannot be compatible with the main goal of creating a common agricultural market for the federal states: using the advantages and characteristics of the territorial division of labor, international trade, specialization and cooperation in production to achieve common strategic and current economic interests.

The state authorities of the Russian Federation cannot abruptly limit the import of Belarusian products because, it should be noticed, that agricultural policy ought to be aimed primarily at ensuring the maximum supply of food for the population, and only then at supporting the stability of domestic agriculture and creating conditions for strengthening the competitive share of domestic agriculture producers of goods in the international division of labor. The import of Belarusian products contributes to the formation of a competitive environment on the Russian market, the improvement of the assortment of food products, and the satisfaction of the population's needs with food products, at the same time leading to a situation that destabilizes domestic production and drives Russian goods out of the market.

The need to solve this problem requires the development of a mechanism ensuring maximum external benefits for Belarusian producers and suppliers at minimum internal costs, as well as containing reasonable economic freedom for export-import operations.

To maintain the export orientation of the Belarusian agro-industrial complex (AIC), it is necessary to significantly diversify the markets of food products by expanding the geography of supplies and reducing the influence of the Russian Federation on the financial situation of Belarusian producers of agricultural products and food products. The analysis of the Russian state agricultural programs suggests that the Russian Federation in the coming years will significantly increase agricultural production and fully satisfy domestic demand for it, and the commercial approach to the implementation of the programs and the availability of resources will allow Russian producers to gain additional competitive advantages (Hrybau, 2021).

ECONOMIC CONDITIONS

Some Belarusian economists believe that agriculture and the entire agro-industrial complex (AIC) operate under market conditions. It is impossible to straightforwardly agree with it and it is appropriate at this point to share the opinion of Gusakov, who notes that in order for the sphere of AIC – the branch of agriculture and agro-industrial enterprises – to shift to the principles of self-sufficiency and self-financing, a completely different comprehensive organization of agriculture is also necessary – on the principles of a market economy, and, above all, legal and economic regulations. It should also be a completely different practice which is based on a market-oriented strategy and policy. What is more, since Belarus still has a traditional system of centralized state regulation (management) of the agro-industrial complex, the means and methods of state preferential support for agricultural production should also be appropriate (Gusakov, 2020).

The further development of the agro-industrial complex should be based on a sustainable strategy that in various spheres should not differ from the traditional centralized system to the market system and vice versa. Thus, in agriculture, as the central sphere of the AIC, elements of the traditional system prevail, while in other spheres market mechanisms

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and levers dominate, which is the main destabilizing element in relations between partners and creates conditions for disproportionate prices of products and disproportionate distribution of profits between branches. The combination of two different systems negatively affects the efficiency of the complex as a whole. Presently, in our opinion, it is particularly urgent to create a uniform policy for the functioning of the agro-industrial complex in order to prevent further divergence of the economic and technological components of various spheres. The processing, marketing and storage enterprises of agricultural products are highly profitable and efficient, unlike agricultural enterprises.

It should be noted that the existing market situation in the countries of Western Europe and North America is also often very ambiguous and contradictory. Therefore, Galbraith explains that market relationships must be modified by certain planning, e.g., From an economist's perspective, planning is to replace prices and the market as the mechanism that determines what products will be produced with an authoritative decision that determines what will be produced and consumed and at what prices (Galbraith, 2008).

The market mechanism, according to Lagodich, is replaced by vertical integration when the company becomes a supplier of raw materials and (or) a seller of manufactured products. In the case of vertical integration, raw materials and products are "transferred" within the organization, and not purchased from third parties (Lagodich, 2015).

In the analyzed model, in practice, there may be a situation in which there will be an oligopoly on the market as a form of imperfect competition. For example, in Belarus, such a situation was observed in the sugar market for several years, where silent agreements between enterprises led to an unjustified increase in prices on the domestic market and to dumping on the foreign market.

Another significant threat to the emergence of a large cluster formation is the social burden (Galbraith, 2008). A large state-owned enterprise is not necessarily highly productive in the long run, and profit maximization will no longer be in the focus, because a "social security cushion" can be used in the event of an unprofitable business. Namely, to demonstrate the high social importance of the enterprise for the region, point to the city-forming role of the organization, announce mass layoffs, unemployment in the region, etc. In this context, the firm manipulates government authorities forcing them to provide preferential loans, subsidies, and debt restructuring, while in the long term to prolong the functioning of the organization.

It is well known that the minimum influence of an organization on the price exists only when the share of each company is minimal, or the market is rigidly determined by legal acts. In the Belarusian economy, however, there is a situation in which small and unprofitable (insolvent) enterprises become, in a directive manner, branches or parts of larger and more profitable enterprises. This method does not increase the efficiency of the industry or the entire economy, and, statistically, only reduces the number of unprofitable organizations. Accounting measures of loss restructuring, and administrative consolidation applied are flawed and, above all, ineffective.

The state repeatedly made unsuccessful attempts to solve the problem of the insolvency of agricultural organizations. The problem was not resolved because the financial repair task was seen primarily as a financial problem – a debt restructuring problem. It is necessary to radically change the organizational and economic management mechanism, and above all, to broadly apply the mechanisms of transferring land and other resources into the hands of efficient economic operators – owners and users. Quite an effective way to transfer the property to private ownership is, for example, by auction held under mandatory requirements and conditions. One of the solutions could be to create conditions for a wider inflow of foreign capital in the form of foreign direct investment (FDI) (Kisiel & Graszkiewicz, 2018). Concurrently, investment barriers for enterprises in the region of Central and Eastern Europe are exposed. There are problems related to the complexity and instability of the tax system, excessive bureaucracy, high labor costs, instability and low quality of law, and high taxes (Oleksiuk, 2017).

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Personnel potential (Human Resources)

In agricultural production, the economic efficiency of individual farms depends both on the qualifications of employees and the level of employment. The constant introduction of innovative approaches in the organization and management of production requires not only a higher level of training, but also the availability of personnel as such.

The shaping of human resources in agricultural organizations is based on demographic and socio-economic processes that have developed mainly in rural areas. In 2010, the rural population amounted to 2,358.8 thousand, and in 2019 it decreased by nearly 10% (by 245.4 thousand people). The number of people employed in agriculture (agriculture, forestry, and fishing) in 2010 was 494.5 thousand, and in 2019 – 332.6 thousand, therefore, it decreased by 32.7% (Statistical Yearbook of the Republic of Belarus, 2020). The main direction of ensuring the human resource capacity of agricultural organizations is the increase in the number of young people and the renewal of human resources. However, in the years 2014–2019 the situation was reversed. People in mature and pre-retirement age had the largest share in the human resources structure. In 2014, the share of employees under 40 was around 40%, and in 2019 – 36.2%, the number of employees over 55 is also significantly increasing. Migration processes to the EU countries, especially to Poland, play an important role here. According to the data of the Ministry of the Family and Social Policy, 74,473 work permits and 207,744 declarations on entrusting work to a foreigner were issued to Belarusian citizens in 2018–2020 (Information about employment of foreigners in Poland, 2021)[2]. Another direction of migration of Belarusian citizens are the Commonwealth of Independent States and Ukraine (Hrybau et al., 2020). However, in most of the EU countries, along with the increase in labor productivity in agriculture, the demand for labor decreased (Wąs & Małażewska, 2012).

To consolidate human resources in rural areas, it is necessary to improve material incentives for productive work. Wages are the decisive factor influencing the choice of employment by employees. The level of wages in agriculture did not increase above 74% of the national average in 2010–2019. In the analyzed period, the increase in nominal wages in agriculture in relation to the national average was only 3.3%, which negatively affected the attraction and retention of specialists in this industry (Hrybau, 2021).

In market economy countries, the problem of mutual interconnection of the economic interests of owners and hired workers and the increase in the efficiency of economic activity is solved by involcing workers in the process of reproduction not only as the labor force, but also as owners of the means of production (Baehr, 1993; Surdykowska, 1996). In accordance with the legal acts in force in the Republic of Belarus, part of the company's net profit may be transferred to the members of the employee collective as own (share ownership). However, the formation of joint ownership from net profit is practically not used in the activities of agricultural organizations. At the same time, the creation of joint ownership from profits increasing the company's equity is one of the manifestations of value increase and a promising way to stimulate the increase in production efficiency.

To shape the potential of human resources in agriculture, it is necessary to develop a set of measures aimed at improving the material and moral incentives for highly productive work. Otherwise, the number of labor resources for migrants from rural to urban areas will only increase and the lack of highly qualified workers will have a significant impact on the performance of the agricultural sector. However, the change in the social structure of rural residents is a constant and inevitable process (Marks-Bielska, 2018).

[2] This solution, otherwise called the "declaration procedure" (or "simplified procedure") concerns the citizens of 6 countries: Armenia, Belarus, Georgia, Moldova, Russia and Ukraine. It allows to obtain a permission to perform work – without the necessity to obtain a work permit – for 6 months in consecutive 12 months in the sectors of economy not related to seasonal works.

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CONCLUSIONS

The study concludes that the reform of the agricultural system is of key importance for the future performance of Belarusian agriculture.

1. The lack of a uniform approach to the development of the selected spheres of the agro-industrial complex leads to significant disproportions in their effectiveness. Directive planning does not allow considering a number of socio-economic, technical-technological, political, natural-climatic and other factors (questions arise about the purposefulness and necessity of long-term planning and forecasting as well as rational definition of production efficiency criteria).

2. The creation of large cluster formations should be accompanied by appropriate justification and calculation of potential opportunities and threats (the emerging "social security cushion" allows large associations to manipulate state bodies and additionally receive funds that could be more rationally used by other economic entities. This leads to a significant decrease. resource efficiency; profit ceases to be the main determinant of efficiency).

3. The lack of diversification of market outlets for agricultural products leads to a significant dependence of Belarusian producers on the market conditions of the Russian Federation (the growing self-sufficiency of the Russian Federation in terms of its own food may lead to overproduction of Belarusian agricultural products without available outlets). The level of self-sufficiency in basic agricultural products in the Republic of Belarus is quite high (in 2019, meat – 132.8%, milk – 240.8%, eggs – 128.4%, potatoes – 111.0% and vegetables and melons – 107.3%) and requires constant development of foreign trade.

4. Shaping the human resources potential is impossible without developing an effective system of material and moral incentives (otherwise, agriculture without an appropriate staffing will remain one of the most problematic sectors of the real economy, despite its undoubted importance and importance in ensuring food security and the country's independence).

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TAXATION OF PROPERTY GIVEN INTO DEPENDENT POSSESSION BY AN ENTITY SUBJECT TO A PROPERTY TAX EXEMPTION

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ABSTRACT

Motives: Does the real property owned by an entity subject to the real property tax exemption and placed in the dependent possession of another entity give rise to an obligation to pay the tax in the amount payable by the entrepreneur?
Aim: In a situation where the property is in the possession of the entrepreneur, he is obliged to pay the highest amount of tax – in 2021, the rate of this tax is PLN 24, PLN 84 per m^2. However, the Act on Local and Duties and Fees provides for certain exceptions for entities which, due to their activities, benefit from a tax exemption, because of which no funds are credited to the budget of a local government unit. Therefore, it can be concluded that the tax authorities want the largest possible number of properties to be taxed in the highest amount. Their task is facilitated by the fact that the provisions of tax law are not clear as to the definition of "seizure of real estate for conducting business activity", which allows the tax authorities to freely decide what such activity is and what is not. Recently, an opinion has developed that the mere transfer of real estate into dependent possession based on a civil law contract justifies the statement that the entity conducts business activity. Therefore, the article in question attempts to answer the question whether, and if so, in what amount, the entity that benefits from the tax exemption is obliged to pay tax if it gives the property into dependent possession, and whether it is possible to use tax optimization and make the division of real estate for tax purposes?
Results: The interpretation of the provisions of a.l.t. applied by the tax authorities to date, which boils down to the assumption that the mere fact of leasing real estate proves that business activity is being conducted and prejudges the loss of acquired right to tax exemption, is not justified in any way. In the provisions of the a.l.t., the legislator clearly indicates that the subjective use of the real property for purposes that entitle the entity to use the tax exemption is of significance. At the same time, when the tax exemption does not extend to part of the property, it is possible to subdivide it for tax optimisation purposes.

Keywords: tax law, property tax, business activity, principles of tax law, dependent possession, taxation, tax exemptions, tax preferences, tax rates

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INTRODUCTION

The principle of openness and transparency of the law applies to the entire branch of financial law. These principles are referred to as normative general principles that have been explicitly formulated in the Act on Public Finances (Act on Public Finances, 2009). Such a location means that they refer to tax law, and therefore also to tax laws.

Cezary Kosikowski emphasizes that to maintain the above principles, it is not only required to maintain the formal dimension of openness, i.e., to publish laws and their amendments in a promulgation body, but it is necessary to guarantee material transparency consisting in ensuring their legibility and understanding. However, the high frequency of changes made and the techniques of marking them means that the addressee of the standards is not able to familiarize himself with the introduced changes, despite their announcement and entry into force of the relevant *vacatio legis* (Kosikowski, 2007).

Another problem, on the way of the taxpayer to the proper application of tax law, is the misunderstood and abused by the legislator so-called autonomy, which in this case means the rejection of all institutions and normative definitions and phrases established in the law and then replacing them with their own phrases used to define the same institutions. In the nomenclature of tax law, we find a difference, among others, in the subject of definitions of real estate, premises or building. These two circumstances have a negative impact on the understanding and application of tax law in Poland, leading primarily to its abuse by both taxpayers and tax authorities.

There is no doubt that if the real estate is in the possession of an entrepreneur and is occupied for business purposes it is subject to taxation at a higher tax rate (Jóźwiak, 2020). However, how to assess a situation in which a given entity conducts business activity in one property and, for example, runs an unpaid public benefit organization? If we treat the regulations only according to their literal wording, we should conclude that such real estate cannot benefit from tax exemption. Nevertheless, considering the objectives and principles of tax law, one should consider whether it is not possible, within the limits of tax optimization, to apply a tax exemption in some part, and if so how to do it?

Another case in which there is a problem with interpretation of the legal regulations is a situation in which an entity benefiting from exemption from real estate tax, e.g. the entity referred to in Article 7.1.5 of the Act on Local Taxes and Duties[1] (hereinafter referred to as a.l.t.) or the entities referred to in Article 7.2 of the a.l.t.[2], lease or, on the basis of another legal relationship, give a dependent possession of real estate to another entity which also carries out an activity entitling it to exemption from real estate tax. The tax authorities take the view that due to the contractual relationship between the two entities, there is an element indicating the conduct of business activity and, consequently, the necessity to apply the tax rate as for entrepreneurs. However, is this approach correct in view of the principles and objectives of tax law and the meaning of the notion of economic activity?

MATERIALS AND METHODS

To answer the above questions, the author used primarily a dogmatic-legal research method, which is appropriate for the analysis of legal regulations, court case law, as well as *soft law acts*. The subject of dogmatic legal analysis is both the very content of the law and its interpretations, found in case law and literature. To consider the subject more comprehensively, the author also used the historical

[1] There is an exemption from property tax on land, buildings or parts thereof occupied exclusively for the statutory activities of associations for children and young people in the field of education, upbringing, science and technology, physical culture and sport, apart from those used for business activities, and land occupied permanently for camps and rest bases for children and young people.

[2] This includes, among others, universities, federations of higher education and science system entities, public and non-public organisational units covered by the education system, nurseries and children's clubs, scientific institutes, research institutes.

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method to examine how the legislator's approach to property tax exemptions developed at the turn of the last 30 years, this period is a period corresponding to the time frame of the applicable law relating to real estate taxation. Because of the above, the first analysis of legal acts and the provisions contained therein concerning the subject matter of the study was carried out. Secondly, it examined how these provisions are applied by administrative authorities and administrative courts. Next, the position of the judiciary and the position of the legal literature was compared, with particular attention paid to the teleological aspects of the existence of tax exemptions.

Exemption from property tax general issues

The issue of real estate taxation in a broad sense refers to several factual situations, the occurrence of which is associated with the occurrence of tax liability. It can be the mere fact of owning real estate, real estate trading (e.g., sale, donation), earning income from real estate (e.g., renting), or an increase in the value of real estate (adjacency fee) (Duch-Chojna, 1993).

Each of these states, in principle, involves the creation of tax liability. It should therefore be pointed out that the subject-matter of taxation is therefore not the immovable property itself but the conduct of the taxable entities which is inherent in the immovable property (Etel, 1998).

In the broadly understood tax system, we will also find a different scope of the concept of "real estate" depending on what tax we are currently dealing with, e.g. if we are talking about income tax, we will look for the concept of real estate in the provisions of the Civil Code (1964), on the other hand, when it comes to real estate tax, which is the subject of this article, it is regulated in the Act of 12 January 1991 on Local Taxes and Duties. According to this Real Estate Taxation Act, the following real estate or construction works are subject to real estate tax: land, buildings or parts thereof, and structures or parts thereof related to conducting business activity. Since the enactment of the law in 1991 to this day, despite repeated amendments, neither the subject, nor the subject of the tax, nor the method of calculating the tax base have changed. The method of its calculation is based on the area or usable area of the property. An exception to this rule is the taxation of buildings related to running a business, where the tax base is the value of the building[3].

A significant change in the provisions of a.l.t. took place at the beginning of 2003. It referred, among others, to a certain ordering of the grounds entitling to tax exemptions. Until the end of 2002, exemptions from real estate tax could result from three sources: the Act on Commercial Property Tax itself, separate acts and resolutions of the municipal council. It might seem that this system was orderly and did not pose difficulties in finding tax exemptions. However, the problem was that the catalogue defined as: other acts was open, so it was difficult to establish a full list of acts in which tax exemptions could be found, especially as these "separate acts" often had nothing to do with the tax system at all. Such a lack of systematization, in which it would be possible to indicate clear criteria that determine inclusion of a particular property in the category of tax-exempt facilities caused great difficulties at the stage of applying the law (Etel, 1998). Moreover, the exemptions were introduced in an "uncontrolled" way, surprising taxpayers and even the tax authorities themselves. The consequence of this situation was frequent tax evasion, which to a large extent affected the significant depletion of municipal income on this account (Etel, 2013).

After the amendment of 2003, the legislator transferred to Art. 7 of the a.l.t. some of the entities that were subject to exemption under the above-mentioned "separate acts". However, this is still not a complete catalogue, because there are three exceptions where the tax exemption remained regulated in non-tax acts (Dowgier et al., 2020). This concerns the exemption from property tax enjoyed by churches and religious

[3] This issue does not relate to the subject of this article; therefore, it will not be described, more on this topic A. Biedacha, *Wartość początkowa budowli*, ABC, Lex (accessed 23.07.2021).

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associations, real estate located in special economic zones and real estate of the State Treasury designated for road construction (Act on special principles of preparing and implementing investments in the field of public roads, 2003). The municipal council, by way of a relevant resolution, may also continue to apply exemptions from real estate tax.

Despite a certain ordering of the categories of tax exemptions, the legislator has not managed to avoid questionable issues. From the point of view of this article, Art. 7 par. 2 of a.l.t., which contains a list of entities subject to the exemption, is significant. The exemption is subjective in nature and covers only entities enumerated in the Act, which are involved in teaching and research activities in the broad sense of the word. By creating this list, the legislator based itself on a peculiar system of "tax support", i.e., such a mechanism, which by means of tax exemption helps the development of certain areas, in particular the system of education and science, as an important pillar of society. This assumption should certainly be assessed as right and necessary, especially in the perspective of the stimulative function of taxes, the main assumption of which is to create taxes in such a way as to mobilized taxpayers as much as possible to undertake specific actions, useful from the point of view of society (Jaszczyński, 2017)[4]. At the same time, the legislator excluded the possibility to exempt such entities referred to in Art. 7(2) of the a.l.t. in the situation when they are occupied for business activity. However, it does not follow from the provisions of the Act what the said "occupation" means or how to understand "economic activity".

[4] The stimulation function means the use of tax instruments to influence the conditions of activity of individuals and the direction and pace of their development, the behaviour of citizens and entrepreneurs. The stimulation function is realised through the differentiation of tax burdens, thanks to which the tax can influence the decisions of entities in an encouraging or discouraging manner.

Tax exemption and economic activity

As can be seen from the above, the fact whether a given entity uses the property in question to conduct business activity is of fundamental importance from the point of view of tax exemptions under the Act on Local Taxes and Duties. In those provisions, it is expressly stated that certain immovable property is exempt from tax, except for those used or occupied for the purpose of carrying out economic activity. The essence of this exclusion does not raise any doubts, the legislator exempts the so-called statutory activity of individuals. From the point of view of the principle of fiscalism, this assumption is correct. Since the entity earns income from running a business, there are no grounds for applying a tax exemption or preferences. Practice, however, shows some problems. One of these problems is related to the fact that, as indicated above, the exemption in question is subjective – objective.

The first part – subjective character – means that the exemption may be applied only to an institution with the status of a taxpayer in the proceedings. It follows that if, for example, a higher education institution leases land or buildings from another entity, e.g. from a commercial law company which does not enjoy tax exemption, and conducts educational classes on their premises, and therefore the real estate is used for purposes related to the activities of the higher education institution, the company will not be able to take advantage of the discussed tax exemption, claiming that the real estate is occupied for educational purposes. It follows from the wording of Art. 1a (1) (3) of the a.l.t. that the sole fact of possession of the real property by an entity having the status of entrepreneur, entered in the register of entrepreneurs, and not the way the real property is used, determines whether it is subject to the increased tax rates (Judgment of the SA in Rzeszów, I SA/Rz 946/14). To benefit from the exemption, each taxpayer (e.g., co-owner) must fulfil the conditions for exemption set out in the Act (WSA verdict in Wrocław, I SA/Wr 1087/07). The exception here is the case when the real estate belongs to the State Treasury, because then higher education institutions retain the status of taxpayers and benefit from tax preferences (Dowgier et al., 2020).

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The second part – the subjective character – limits the scope of the subjective exemption only to objects of taxation used for specific purposes, which means that if the property held by an exempt entity is handed over in a dependent possession to another entity for purposes other than those covered by the exemption (the conduct of business activities), it cannot benefit from the exemption (Pietrasiewicz, 2017).

The above leads to the conclusion that an entity enjoys the tax exemption in question only if it simultaneously meets two conditions, for example: it is a higher education institution (subjective), and the subject of the real estate tax is not occupied for business activity (objective). On the other hand, does the obligation to pay tax at the rate appropriate for an entity engaged in business activity arise when an entity exempt under Art. 7 of the a.l.t. transfers a real property into dependent possession to another entity of the same group but between them a civil-law agreement is concluded, e.g., a lease agreement? In other words, may the mere conclusion of such an agreement be evidence of economic activity and eliminate the possibility of applying the tax exemption? After all, both the subjective and objective nature of the seizure of the real property does not change. At this point, it is worth noting that in 2021 the tax amounts to PLN 24.84 per m^2 of usable area (Notice of the Minister of Finance, 2020), while in 2022 it will amount to PLN 25.74 (Notice of the Minister of Finance, 2022).

To try to answer these questions, it is first necessary to define the concept of occupation of real estate for the purpose related to business activity. In this matter, the Local Taxes and Duties Act in Art. 1a (1)(4) refers to the provisions of the Entrepreneurs' Law (hereinafter: e.l.) (Entrepreneur Law, 2018). It therefore becomes necessary to assess the non-tax provisions. Article 3 of the e.l. indicates that "business activity is an organised profit-making activity, performed on its own behalf and in a continuous manner". For clarity, the definition of an entrepreneur in Art. 4 of the a.l.t. should also be quoted: "An entrepreneur is a natural person, a legal person or an organisational unit not being a legal person, to which a separate act grants legal capacity, performing business activity. Entrepreneurs are also partners in a civil partnership to the extent of their business activity. The rules of taking up, carrying out and termination of business activity by foreign persons are determined by separate provisions".

It follows from the above that for an entity which is in possession of real property and is subject to the tax exemption under Art. 7 of the a.l.t. to lose this entitlement, it must carry out business activities in its own name, on a continuous basis and for profit. The issue of profit-making purpose is particularly important from the point of view of real estate tax, because even such activity which has never generated income will be deemed to be profit-making if it was established for such purpose (Judgment of the SA in Katowice, III AUa 424/19). According to well-established jurisprudence, however, incidental and sporadic activity of an entity will not constitute economic activity (Judgment of the SA in Lublin, III Ua 550/18).

Whether an entity will be exempt from taxation or not may significantly affect its financial situation; depending on the area which will be subject to taxation, such an entity will be obliged to pay tax in the amount ranging from several hundred zlotys to several thousand zlotys. Taking this into account, the vague nature of the notion of "connected with business activity" and "occupied for business activity" is contrary to the principles and objectives of tax law (Świstak & Smoleń, 2021). In view of the great importance for the taxpayer, the terms "in its own name", "continuously", as well as "occupied" and "bound" cannot be subject to any arbitrary interpretation or raise doubts (Jóźwiak, 2020).

The doctrine as well as the jurisprudence already examined the issue of "business occupation", but did not recognize this concept in two parts, i.e., "occupation" and "business activity" (Pahl, 2012). Interpreting these concepts separately is justified by the fact that they occur in different configurations, as indicated above, the property can be occupied for business activity as well as it can relate to business activity. The notion of "economic activity" has already been explained above, so here it is necessary to explain how

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"occupation" and "binding" should be understood for the purposes of tax law.

None of the acts related to taxation defines the above concepts, therefore in this case it is necessary to use the jurisprudence and doctrine. At the same time, there are no grounds to interpret these notions in the same way, despite their different wording (Judgment of the Supreme Administrative Court, II FSK 355/15). Thus, the notion of "buildings occupied" for a specific type of business activity, in accordance with the approach presented, among others, by the Voivodship Administrative Court in Poznań, means actual performance of activities therein which constitute conducting a specific type of business activity. At the same time, it is essential to separate a building or its part for carrying out this activity (WSA in Poznań, III SA/Po 449/10).

The 'association' with economic activity, from the perspective of the real estate tax is used to define the subject scope (Judgment of the WSA in Szczecin, I SA/Sz 513/10). In the judgment with act signature SK 39/19 of 24 February 2021 the Constitutional Tribunal ruled that with respect to real estate tax, a higher tax rate for real estate owned by an entrepreneur, but not related to his/her business activity, is unconstitutional. The cited judgment of the Constitutional Tribunal was delivered based on a case in which a natural person conducting a one-person business activity owned real property which was in no way connected with the business activity conducted.

Making a correct assessment of the premises quoted above is of key importance, as the determination that a given activity is or is not an economic activity causes that the premise of occupation of the taxable object loses its significance (Świstak & Smoleń, 2021).

The above clarifies how bonding and occupation are to be understood. It is therefore necessary to determine how the occupation of real estate by an entity benefiting from the tax exemption should be understood. The judgment of the WSA in Warsaw of 21 August 2015 will be helpful here, which indicated that in the case of educational activity, the occupation of real estate should be understood in a very broad sense. Namely, real estate occupied for educational activity is real estate related to the running and functioning of an educational institution of continuing education. Thus, real property occupied for educational purposes includes not only real property or parts thereof where teaching takes place, but also other ancillary premises serving the proper functioning of the continuing education institution and allowing for the proper conduct of teaching activities, such as the reading room, sanitary rooms, canteen, storerooms (lockers) and other utility rooms, corridors, staff rooms, including the office of the director, facilities and other premises necessary for the proper functioning of the continuing education institution (WSA judgment, III SA/Wa 3525/14).

In conclusion, it must be agreed that the necessary condition for recognising whether a given immovable property is occupied for the pursuit of an economic activity must be assessed from the point of view of the continuity and permanence of that activity and having regard in any way to the exercise of an economic activity (it is related to it) and the entity which holds it is aimed at making a profit.

Taxation of immovable property in dependent possession

The practice of tax authorities indicates that the very fact of giving real estate for use to another entity, e.g. because of concluding a contract, the subject of which is a lease or lease, proves a change in the purpose of real estate (Decision of SKO in Olsztyn, SKO.53.1067.2020). In the case law, however, more and more often one can meet with a different position, according to which not always because of a contract whose subject is real estate, the entity owning it will lose the right to benefit from the tax exemption (e.g., specified in Art. 7(2)(1) a.l.t.). The mere fact of giving real estate into dependent possession does not prejudge the fact of conducting business activity (Judgment of the Administrative Court in Wrocław, I SA/Wr 768/17). It is only when the dependent holder occupies the subject of taxation in a manner which the tax legislator treats as a basis for the loss of tax exemption that it will be justified to impose real

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estate tax at the rate which is appropriate for real estate connected with the pursued business activity and occupied for the purpose of carrying out such activity (WSA judgment in Gorzów Wielkopolski I SA/Go 668/19).

Important and from this point of view is also the individual interpretation of the Municipal Office in Cieszyn of 11 December 2013 (Fn.II.3120.3.35.2013.1), the considerations of which must be divided in their entirety. The interpretation indicates that the renting by a school or the body managing the school of classrooms to another school, covered by the education system, does not change the purpose of part of the building for activities other than education, and thus the taxpayer does not lose the right to exemption from property tax. It was also rightly stated in the explanatory memorandum that to exclude the right to exemption, it is necessary to determine when the property is not occupied for educational activities.

The phrase "occupied on" means the permanent use of a work in whole or in part for a specific purpose. Premises for other purposes will not be occupied for conducting educational activities, even if they are occasionally used for such activities, but also vice versa, rooms intended for educational activities will benefit from the exemption, even if they are occasionally used for other purposes, including conducting business activity (Pahl, 2012).

Similar conclusions result from the ruling of the Supreme Administrative Court of 14 September 2018, which in its content indicates that the essence of the exemption in the case of real estate tax is its subjective character. This character proves that in determining whether an entity benefits from tax exemption, the very occupation of the real property for an activity exempted from the tax burden under the Act is significant (Judgment of the Supreme Administrative Court, II FSK 2514/16).

Therefore, it must be stated that the conclusion of an agreement based on which a given entity will use the real estate will not always prove that it conducts business activity and thus eliminate the possibility of applying the tax exemption. Each time the authority should consider whether a given entity uses the real estate for the purpose connected with its economic activity, i.e., whether it is its basic activity aimed at making profit and performed in its own name and on its own account. Otherwise, it is difficult to speak of an economic activity.

Answering the questions posed in the previous part of this paper, the mere fact of transferring the real property into dependent possession does not in itself trigger the prerequisite justifying taxation of the real property in the amount payable by an entity conducting economic activity. If the real estate is still used by an entity subject to the tax exemption referred to, inter alia, in Art. 7 a.l.t. for a purpose consistent with its principal activity, the mere fact of concluding an agreement enabling the use of the real estate should not affect the tax obligation.

However, if the property in a certain part is used by the owner for business activity, and in part for conducting, for example, statutory activities, then for the purpose of tax optimization it will be allowed to divide this property. An example of this may be a situation in which the university has transferred part of the property into dependent possession on the basis of a lease agreement to a person running a bar or bookstore. This part of the property will then be taxed at the highest rates, while the remaining part of the property where the attachments take place will benefit from the tax exemption.

RESULTS AND CONCLUSION

The interpretation of the provisions of a.l.t. applied by the tax authorities to date, which boils down to the assumption that the mere fact of leasing real estate proves that business activity is being conducted and prejudges the loss of acquired right to tax exemption, is not justified in any way. It is not justified by the literal wording of the substantive provisions of tax law, nor by their purposive interpretation. In the provisions of the a.l.t., the legislator clearly indicates that the subjective use of the real property for purposes that entitle the entity to use the tax exemption is of significance. Mere occasional letting of real estate, which in fact brings little financial benefit, cannot justify the imposition

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of real estate tax at the amount payable by persons conducting exclusively business activity on the real estate.

The individual interpretation made by the tax authority competent for the city of Cieszyn, which has been referred to in the text of this article, should be assessed positively, where the authority indicates that it is significant to assess the subject of the activity performed, which is not affected by occasional business activity.

The interpretation of regulations presented so far by the tax authorities should be assessed as contrary to the fundamental principles of tax law, i.e., the principle of legal certainty and the principle of protection of acquired rights. Violation of these principles and application of a peculiar arbitrariness in assessment of factual situations contributes to the loss of citizens' trust in tax authorities and affects the tax burden of the obliged entity beyond measure.

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ILLEGAL DOMESTIC TOURISM OF POLES DURING THE COVID-19 PANDEMIC – INTRODUCTION TO THE RESEARCH

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ABSTRACT

Motives: Tourism is one of the most affected industries by the COVID-19 pandemic. The restrictions introduced by the Polish government, dictated by the rapidly increasing number of positive cases in the country, led to severe restrictions or complete cessation of the accommodation, catering and tourist services. These restrictions resulted in greater interest in the "little homeland" tourist offer, the dispersion of tourist traffic and the development of so called "grey zone" through unofficial functioning of accommodation facilities.
Aim: The purpose of this paper is to characterize the profile of tourists who paid for the accommodation services in Poland during the second wave of the pandemic, lasting from 7th November 2020 to 11th February 2021. The research methodology included a diagnostic survey conducted through the use of a digital questionnaire circulated in social media. In total 100 responses were subjected to qualitative analysis. On the basis of the obtained results, the authors analyzed the following criteria: the number, time, place, length and method of organization of trips; type of accommodation with the costs estimate and the method of obtaining information about the functioning of the chosen facility; means of transportation to the destination, main and secondary travel motives. The study also presents the changes declared by the respondents in the frequency of organizing a one-day trip and several-day-long trips away from the place of their daily residence, as well as the assessment of the quality of the services provided against the price.
Results: Almost 70% of the respondents paid for the accommodation services in the given time frame at least once, mainly booking private lodging using Booking.com portal. The organized trips were usually short-term and lasted 3 days. Only every 5th trip was planned in advance, before the restrictions were introduced. The main motive for the trip was the desire to change the environment, understood as escaping the city and relaxing outdoors. The vast majority of respondents did not suffer from COVID-19 before the trip, and every fourth respondent considered the applicable restrictions as too severe.

Keywords: pandemic, COVID-19, tourist behavior, domestic tourism, Poland

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INTRODUCTION

The pandemic COVID-19 has been recognized as one of the most influential events of the 21st century (Zenker & Kock, 2020). Among the many spheres of human life, the tourism industry was particularly hit due to the global lockdown (Dongoh et al., 2021). Tourism has a significant economic impact on society's income, wealth and employment on the chosen geographic area. In many places tourism is the basic mean of economic growth (Bashir & Shahzad, 2020). On a global scale, the tourism economy oscillates around 10%, while in Poland the share of broadly understood tourism services in the GDP structure is estimated at around 6% (www.unwto.org, 2020). During the years directly preceding 2020, the tourist activity rate in domestic and foreign tourist trips of Poles increased. The number of domestic tourist trips amounted to approx. 48 million, and the tourist expenses of Poles were estimated to reach 31 billion PLN (Panasiuk, 2020).

All the volumes of inbound tourist traffic to Poland and intra-domestic, as well as revenues from tourism, showed a high growth dynamics at the average annual level of 6–7% (MKDNiS, 2020). The tourism economy was thus steadily developing in terms of quantity, value and quality until COVID-19 pandemic.

The pandemic reached Poland on March 4th, 2020, when the first case of infection was recorded. The first restrictions were introduced on March 10th – mass events were cancelled and the number of people allowed to attend events was reduced. On March 20th the government introduced the „epidemic state", thus travel and public space use restrictions came into life. Restaurants were officially closed for business and only allowed to deliver take-away food. From March 31st accommodation services were prohibited both for long-and short-term stays. The summer period was characterized by easing the restrictions which, however, returned again in the fall. On 23rd October 2020, significant restrictions were reintroduced after the government announced the whole country a "red zone" in relation to the high rate of infected people. On 2nd December, during the II wave of pandemic, the number of infected people reached 1 million cases. As a result, from 29th December 2020 till 17th January 2021 the government introduced a national quarantine. Recalling the words of Burleigh (2020), on the one hand organized trips may mean spreading the coronavirus to poorly prepared places, on the other their absence may aggravate existing economic problems. Due to the spread of COVID-19 and imposed restrictions on international travel, the popularity of domestic tourism has been increasing worldwide.

The risk is an inherent element of any decision-making process and also applies to issues related to the organization and management of tourism (Quintal et al., 2010). For some tourists the ability to manage the risks to some extent makes their travel experiences more stimulating and memorable (Karl et al., 2020; Quintal et al., 2010). The risk that arises from COVID-19 is related to endangering one's own and others' health, and not with the excitement associated with the experienced travel. Despite this, many people voluntarily and consciously decide to break the applicable standards and restrictions by organizing tourist trips at times when they should not take place.

The goal of this article is to characterize the profile of Polish tourists who used the paid accommodation services in the country during the second wave of the pandemic, lasting from 7th November 2020 to 11th February 2021. It should be emphasized, that the selected time period partly includes the date of introducing the national quarantine. An extensive survey was conducted to determine the preferences and attitudes of tourists towards travelling through COVID-19. The survey was carried out on a carefully selected group of respondents. The data was collected using an online questionnaire with a total of 100 respondents aged 18 and over. The diagnostic survey consisted of 29 questions, mostly closed, concerning the widely understood way of organizing a trip.

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LITERATURE REVIEW

The dynamic development of the global tourism market is conditioned to a large extent by the existence of various threats that cause quantitative or qualitative changes in its structure. The phenomena that constitute these threats may be periodic or permanent. Regardless of the duration, they affect the state of tourism development, and above all, the level of tourist offer and the state of meeting the needs of tourists in tourists destinations (Panasiuk, 2013). Threats of varying intensity may affect the interest offer, thus reducing tourist mobility and travel to tourist destinations affected by these phenomena. Additionally, they can influence decisions regarding tourist trips in general to neighboring destinations and regions, countries or even other continents (Panasiuk, 2020). In extreme cases, they cause an almost complete limitation of global tourism mobility. In practice, however, the COVID-19 pandemic is the first time in the history of modern tourism when this actually happened.

The COVID-19 pandemic has caused severe disruption to the economy and business operations. The current pandemic situation in the literature is referred to the theory of the "black swan" (Mączyńska, 2020; Mielech, 2020) or supply and demand shocks (Beck & Janus, 2016). According to the "black swan" theory, things that were thought impossible before may actually happen. In line with this theory, the majority of companies from the tourism sector have been adversely affected by the pandemic. The most noticeable effects include the suspension of operations, a drop in revenues, and other problems that none was prepared for. The appearance of pandemic, and the associated risk of a high level disease, caused a reaction of public authorities in many countries, leading to the closing of boarders, limiting the mobility of inhabitants and freezing the functioning of industries, including tourism. The tourism economy has become one of the most affected areas by the restrictions. It will probably take the longest time, among all other industries, for tourism to recover from it. The government's activity during the pandemic involved taking appropriate steps regarding public health policy. Due to the fact, that the restriction resulting from the sanitary regime particularly affected the tourism economy, it is also necessary to reorganize the tourism policy, which is highly presented by Bosiacki and Panasiuk (2017).

COVID-19 has created conditions that affect the lives of all people around the world, forcing political, economic and socio-behavioral changes in societies on an arguably unprecedented scale in the modern area. Baum and Hai (2020) considered some of the key areas where COVID-19 has affected the rights of consumption and access to hospitality and tourism at both international and local level. In fact, national boarders in Europe, North and South America have been closed to most travelers, for both leisure and business purposes. In some cases, this has involved the reintroduction of border controls that were lifted many years ago (e.g. the Schengen zone in Europe). Many countries, including Australia, China and New Zealand, have closed their boarders completely to foreigners and non-residents (Chinazzi et al., 2020). Many airlines have kept both domestic and international services to a minimum and in extreme cases stopped providing services altogether. Rail and bus service providers have also scaled back their services in response to both falling demand and government restrictions on "unnecessary travel". As a consequence, the global pandemic has affected our lifestyle, including our right to personal mobility by limiting access to travel both locally and beyond, which used to be taken for granted in many societies.

Until two years ago, before the current state of emergency, restriction on physical mobility would have been unthinkable in most countries. On the social level, the concept of "social distance" entered the common lexicon (Long, 2020), a concept that is a complete opposite of our expectations related to hospitality and tourism. COVID-19 challenged this assumption in a very short time and placed many of us in a temporary blockage, limited by boarders' controls and lack of means of transportation that reduced our geographic and social mobility (Baum & Hai, 2020). As Sheller stated (2020), "all human movements were

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suddenly stopped". In many places, the main reasons for visiting destinations by tourists have been removed by the closure of cultural venues such as theaters and museums, postponement of sporting events (including the Tokyo Olympics), restricted access to beaches and national parks, and the closure of retail outlets and gastronomic. Emergency legislation has been introduced in many countries in Europe and around the world, which effectively locks citizens in their own homes, further restricting travel, even within the nearest cities. These special regulations were also enforced through financial sanctions and further criminal sanctions. In the UK, police have used drones to identify visitors at tourist viewpoints. Special checkpoints were created to prevent entry to national parks (Baum & Hai, 2020). In Poland, a temporary ban on accessing the forest spaces and parks has been introduced. The restrictions also applied to visiting friends and family and it was recommended to spend Christmas with the closest family members.

One of the most difficult issues to predict is the consumption behavior in terms of tourism demand during and immediately after the pandemic. According to the first studies, the desire to travel by plane in Europe and both Americas dropped by ca. 30%, by 50% in Asia, while the intention to travel fell by an additional 10–20% (Gallego & Font, 2020). Although the impact of COVID-19 pandemic on economy is dynamically changing, the available literature offers scientific analysis of the situation, with particular reference to current tourism trends and forecast changes. The priority will be to provide tourists with a sense of security. Entities of the tourism market must take into account the guidelines of the World Health Organization (WHO, 2020), which include i.e. the compliance with appropriate health safety standards regarding the guest service at the hotel. It is crucial to develop appropriate management and control strategies for introduced changes. Škare, Soriano and Porada-Rochoń (2021) point out, that the possibility of reviving tourism industry around the world will depend on cooperation between individual entities, which should replace mutual competition in order to reduce the costs of the pandemic's effects.

Mass tourism in the post-covid era will cease to be a free-for-all service, through a gradual shift from quantitative to quality tourism (Nepal, 2020). According to Romagosa (2020), the areas with a qualitative diversified offer are in a better economic situation than those that have focused so far on growth instead of development. Among the post-pandemic trends, Wachyuni and Kusumaningrum (2020) paid attention to the development of nature-focused and short-term tourism, organized taking into account the health issues of the reception area.

According to Królak (2021), "there is an opportunity for Poland to promote the unique phenomenon located on the Vistula river, unknown to the world, meaning the *spa* tourism. This is particularly important in the content of the aging societies, but also in the context of the pandemic". By developing spa tourism globally, tourism industry could support the health care sector in fulfilling its mission. Therefore in the future, planning a tourist trip may require taking *wellness* aspect into account by promoting health elements, including both physical activity and spiritual balance.

The changes in tourist behavior will be of a long-term nature. It should be assumed that in the post-pandemic period, the structure of tourism demand will change significantly, especially in the short term (up to 1 year after the end of the pandemic and sanitary restrictions), in favor of domestic tourism (Panasiuk, 2020). Such behavior is already observed in many countries or regions, where fewer restrictions apply to travel within the country, as long as individuals adhere to government health protocols. Relatively minimal restrictions on domestic travel, combined with a strict ban on international tourism in Poland, contributed to a significant increase in domestic travel, although there are also opposing voices pointing to the draining of Polish domestic tourism with further restrictions (Jęczmyk & Kasprzak, 2020). Domestic tourism is becoming the only viable option for those seeking an escape or refuge from everyday life (Bradley, 2020). Romagosa (2020) defines this phenomenon as "tourism regionalization", which focuses on exploring the immediate surroundings. In this context, there

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is also a noticeable increase in trips to the so-called second homes, which as indicated by Seraphin and Dosquet (2020), constitute a kind of travel services placebo. In fact, they do not cover the range of services that tourists would use during their regular stays. The described domestic tourism boom has become a global phenomenon (Barbour & Jasper, 2020; Bull, 2020). Some authors emphasize the shift towards domestic travel in the U.S. and China caused by restrictions and bans on global and domestic travel (Barua, 2020). European domestic tourism is not that strong (Dušek & Sagapova, 2021), however, it is emphasized that the global COVID-19 crisis may provide an opportunity to transform European tourism into a more social one, in which the rights and interest of local communities count more. However, this does not mean displacing the popular model of mass tourism, which will continue to dominate, despite the change in the way it functions (Nepal, 2020).

MATERIALS AND METHODS

In order to achieve the purpose of the study and provide an answer to the research questions, an analysis of statistical data was carried out along with the data from the reports. The conducted own research was of a pilot- and demonstrative nature. For the sake of the study a proprietary questionnaire was used, which contained five metric questions (i.e. about gender and age) and 24 questions related to the posed research questions. The questionnaire was located on the Google Drive and the link was distributed electronically to various thematic groups, mainly on Facebook. It should be noted that the undertaken research was strictly limited due to the restrictions prohibiting overnight stays and the use of hotel and catering services in Poland. The analyzed time horizon coincides with the occurrence of the so-called second wave of the pandemic, which peaked in the second half of November 2020 (Chart 1).

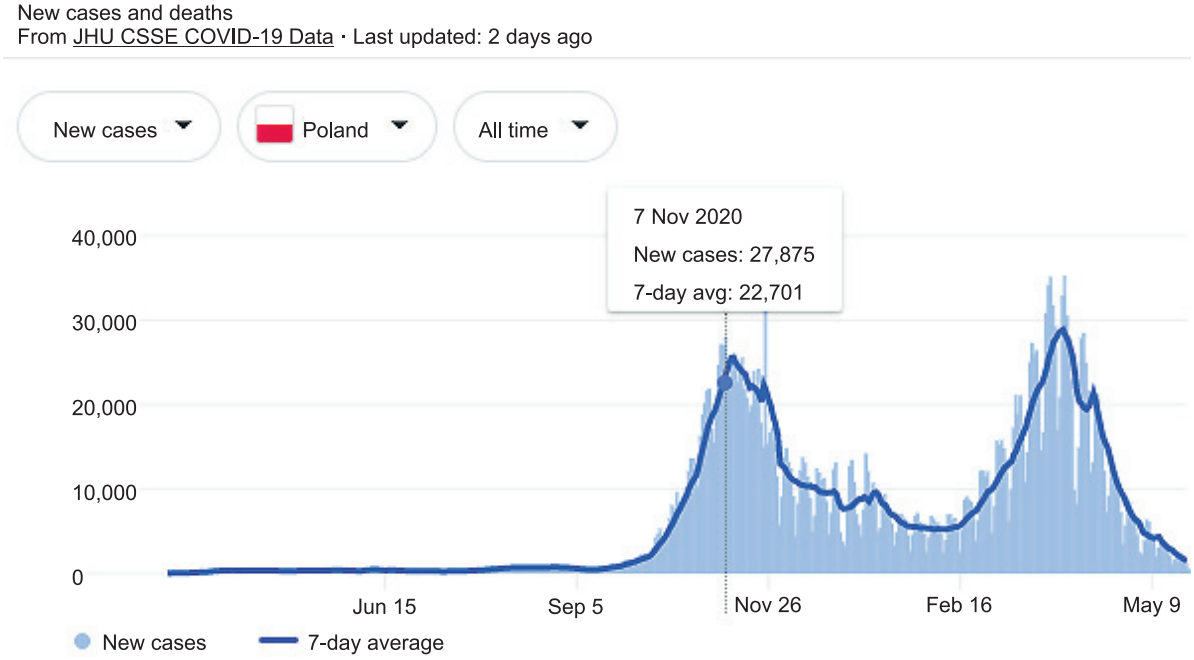

Chart 1. The number of positive cases of SARS-CoV-2 in Poland
Source: https://github.com/CSSEGISandData/COVID-19 (24.05.2021).

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RESULTS

A total of 100 correctly completed questionnaires were obtained (69 by female and 31 by male respondents). The majority of the respondents were representatives of the Y and Z generations, i.e. people in the 19–32 age range, located both in big cities (above 500,000 inhabitants) and smaller towns and villages. More than half of the respondents described their financial situation as good (52%), and nearly every third respondent as average (34%). In terms of professional activity, the participants were dominated by the students' group (42%), IT experts (11%), academics (7%), financial sector (7%) and commerce employees (6%).

Most of the respondents (68%) made one trip in the indicated period, which was planned by 79% only when the restrictions were in force. About 32% of tourists decided for more spontaneous trips, out of which the biggest group included people travelling at least twice (Chart 2).

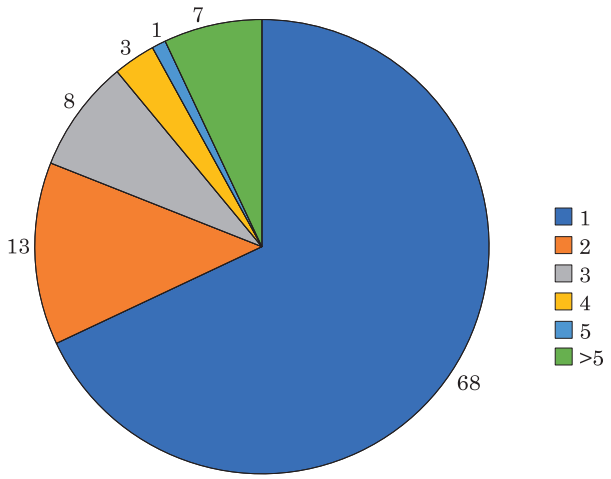

Chart 2. Number of trips organized during the COVID pandemic restrictions, between 7.11.2020 and 11.02.2021 (n = 100)
Source: own preparation.

The most popular trips were organized by the end of the year, in December (33%) and January (28%). They were mostly short-term trips, with a predominance of 3-day travels (28%), followed by 4-day (14%) and 2-day travels (13%), planned mostly around statutory holidays. In November, despite the long weekend associated with the anniversary of regaining independence (November 11th), only 15% of travels were recorded, while in February – 24%.

The time of increased inspections and additional introduced restrictions in the country did not stop the study group from travelling. However, the enforced regulations might have influenced the selection of transport from the place of residence to the place of accommodation. The most frequently chosen means of transport was a car (79%) and a train (14%). Only six respondents took a coach bus and only one an airplane. For most of the respondents, the main purpose of their trip was the need to change the everyday living environment (25%). Every fifth respondent described him or herself as an active tourist, motivated to try trekking during holiday. The remaining travelers were motivated by the desire to spend time with their loved ones (18%), recreate (17%) and to do sports, like skiing (10%). Among the remaining main travel purposes individual tourists mentioned i.e. medical consultation, religion, shopping, culture and education. Determining the full profile of tourists is possible thanks to the secondary goals of trips, among which the most frequently indicated was recreation (49%), the need to change the daily living environment (33%), the desire to spend time with loved ones (21%), active tourism related to trekking (12%) and skiing (7%). Among the remaining secondary goals, tourists indicated, i.e. winter swimming and learning about animate and inanimate natural values (Chart 3).

Based on the tourist attractions and destinations indicated by the respondents, five main reception areas can be distinguished: the high mountain area – Tatra Mountains (30%), the lower mountains – Karkonosze and Jizera Mountains (30%), Baltic Sea coast (6%), biggest cities, i.e. Cracow, Warsaw, Wroclaw (22%) and the lake district (3%). The average distance between the place of residence and the reception area was around 337 km. Every third respondent chose a destination located 200–300 km from the place of everyday life, 18% within the 300–400 km distance, 13% at a distance of 100–200 km and 500–600 km.

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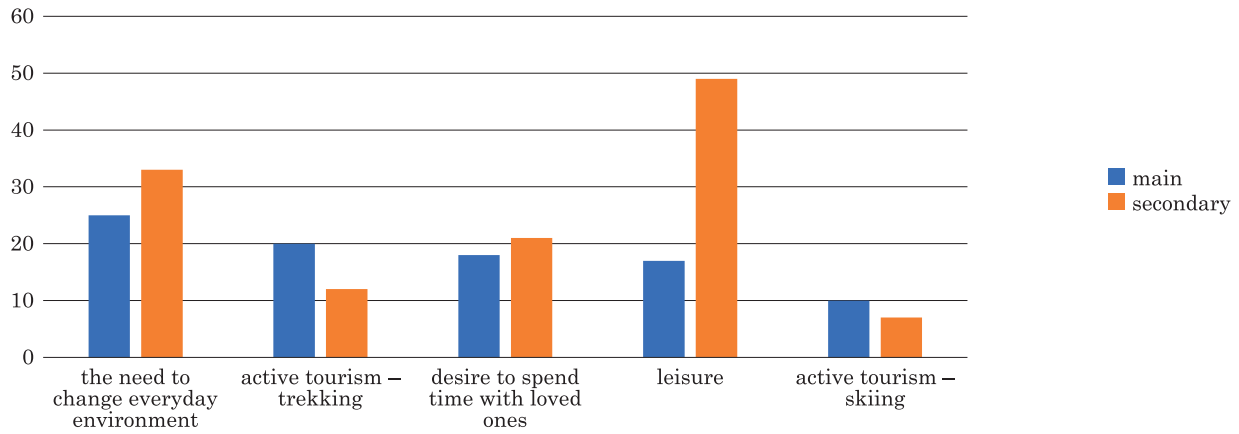

Chart 3. The main and secondary reasons for travelling during the COVID pandemic between 7.11.2020 and 11.02.2021 (n = 100)
Source: own preparation.

The lowest percentage of respondents was recorded for places located within 100 km from the place of residence (8%) and further than 600–700 km (3%) and 700 km (3%).

When asked about whether they planned to come back to the visited place after the COVID-19 pandemic was over, 81% of respondents answered "I don't know". These answers were thoroughly analyzed and compared with the destination place and the length of stay. The authors made a conclusion, that the majority of respondents visited well-known destinations as indicated in the reception areas – 29% tourists visit them regularly, and 49% sporadically. The respondents organized mostly short trips (2–3 days long), during which they visited historical buildings in the main cities, like Wroclaw, Szczecin, and Gdansk. Additionally, they highlighted such activities like local hikes and walking on the beach. Only 22% of respondents decided to visit a completely new place during the pandemic restrictions.

Tourists most often traveled in a group of friends (39%) and a partner (38%), what definitely contrasts with the number of family and individual trips (Chart 4).

The most popular choice of accommodation was private lodging which was booked by nearly half

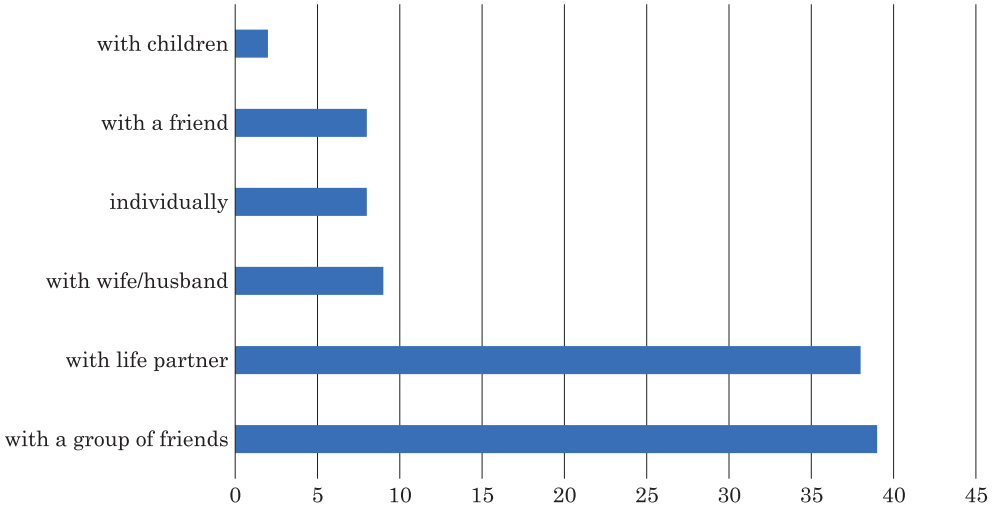

Chart 4. Methods of travelling during the COVID pandemic between 7.11.2020 and 11.02.2021 (n=100)
Source: own preparation.

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of the respondents (49%). The remaining categories of hotel facilities (11%) and short-term holiday homes (8%) were much less popular. Despite the applicable restrictions, slightly more than 3/4 of establishments published their offer online. The main source of information about the hotels activity was Booking.com and private recommendations (Chart 5).

Among the ways of circumventing the restrictions, only 3 tourists mentioned such solutions, as "renting a parking space with a shared apartment for free" (1%), "renting a ski storage room with an apartment for free" (1%), "providing accommodation services for business travelers" (1%), "long-term rental with contract termination immediately after signing" (1%). In other cases, the accommodation service was advertised simply.

Some of the respondents contacted the facilities' owners by phone (15%) or spoke directly with the owner on the facility premises (17%), using their previous experience of staying in a chosen place. In general, most of the respondents learned about the available accommodation via Booking.com (45%), from personal referrals (19%) or other portals, like: Facebook (8%), Airbnb (6%), OLX (3%).

Accommodation prices varied depending on the tourist destination and the category of the accommodation facility. The largest group (23%) included tourists who spent approx. 40–50 PLN per person per night. The following price ranges covered a similar number of respondents: 50–60 PLN (12%), 60–70 PLN (11%), 70–80 PLN (11%), 80–90 PLN (8%), 90–100 PLN (10%), above 100 PLN (8%). By comparing the two most frequently declared travel motives with the expenditure, it can be easily noticed that tourists whose desire was to change the everyday surrounding incurred higher expenses than those interested in active tourism (Chart 6).

The majority of respondents positively assessed the price-quality ratio of the accommodation services offered, reporting it was either very good (56%) or good (35%). It is worth mentioning, that despite some critical opinions, none unequivocally declared never to return to the place he or she visited (Chart 7).

Due to the significant limitations in the operation of catering facilities (limited to take-away meals only), many restaurants temporarily suspended their activities. This situation forced tourists to arrange meals, which took many forms. 71% of respondents

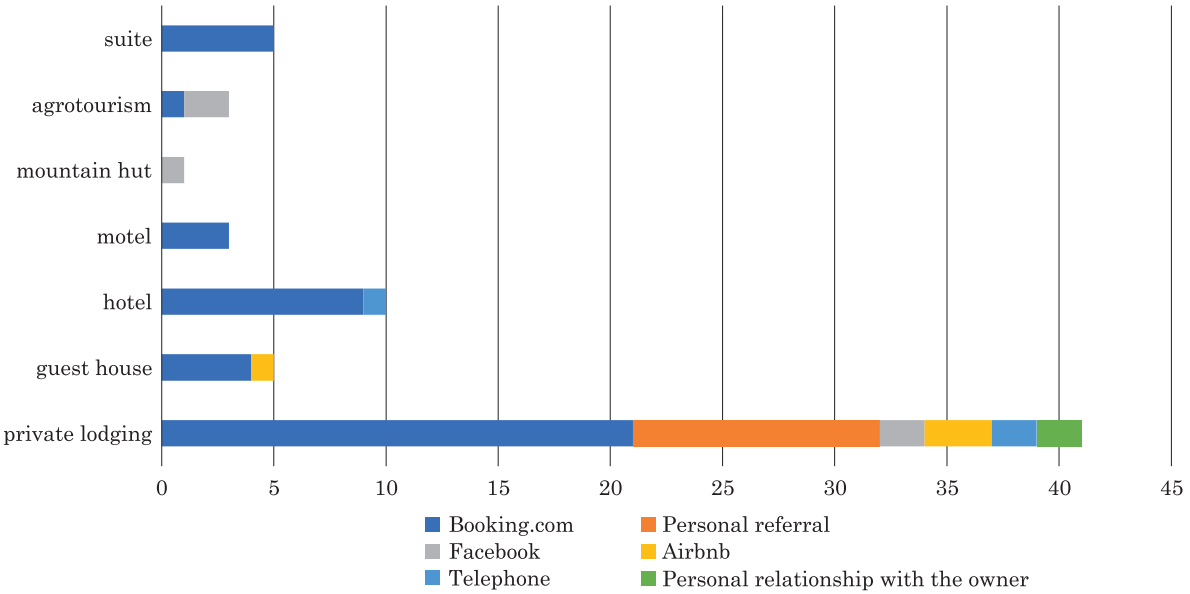

Chart 5. Main sources of information about officially available accommodation facilities (n=68)
Source: own preparation.

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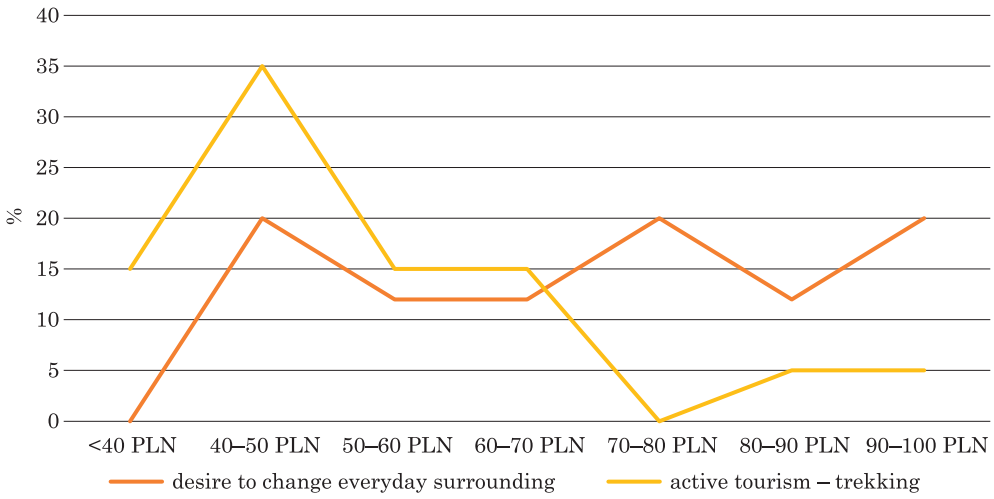

Chart. 6. Accommodation price (per person per night) according to the travel motives (n=45)
Source: own preparation.

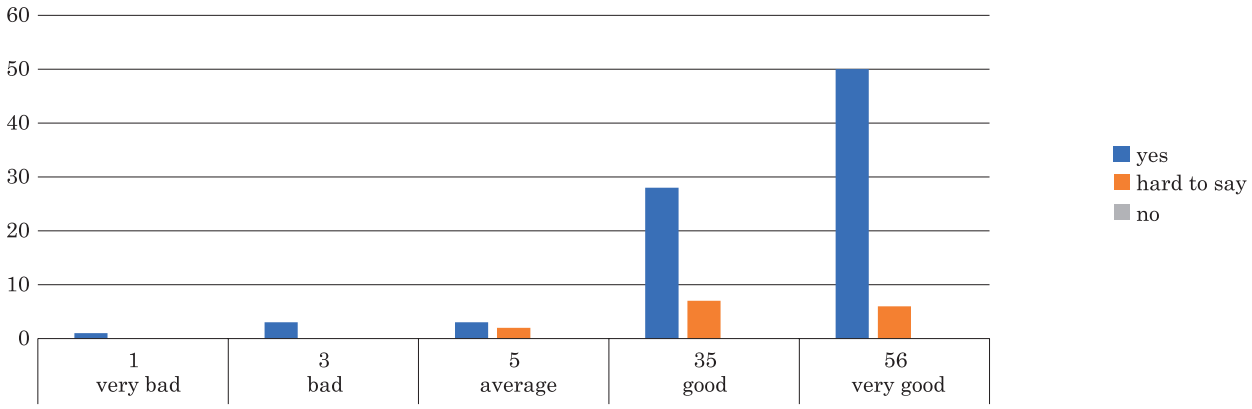

Chart. 7. Assessment of the price-quality ratio of the provided accommodation services and the declared willingness to return to the same place (n=100)
Source: own preparation.

decided to prepare their own meals, while 46% took advantage of the local takeaway offer, while 2 respondents admitted to visit illegally open restaurants in the reception area, which regularly served customers. A popular choice was to order meals by phone or mobile applications which was used by 20% of respondents. Some of the accommodation facilities guaranteed half board (10%) or full board (5%).

The COVID-19 pandemic, with all its risk related of a high level disease, caused a reaction of public authorities which introduced further restrictions limiting the possibility to travel. The respondents were asked whether the above-mentioned limitations had any impact on the frequency of undertaken trips. The results are presented in Table. 1 where the most frequent answers indicate a decrease in both one-day and several-day trips.

Table 1. The frequency of trips undertaken during the COVID pandemic (n = 100)

One-day trips	Number of responses	Several days trips	Number of responses
increased	22	increased	13
decreased	40	decreased	55
no change	38	no change	32

Source: own preparation.

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The decisions to restrict mobility may be associated with the fear of falling ill, because as indicated by the study results, the majority of respondents was not sick before the trip (85%). The authors also obtained information, that directly after their departure 4 respondents turned out positive with SARS-CoV-2. For the 73% respondents the epidemiological restrictions in the country related to tourism were inappropriately severe. For 7% of the respondents the adopted solutions were just, while 4% of tourists considered it to be too gentle. The rest of respondents were not able to unambiguously answer the question.

CONCLUSIONS

It is no exaggeration to say, that COVID-19 dominated and changed every aspect of human life in 2020 (Lew et al., 2020). Individual countries take different measures to mitigate the negative effects of the pandemic. The World Travel Council (WTTC, 2020) recommends the implementation of postulates aimed at reviving tourist regions. The most important among them is the adequate crisis management, which should encourage active tourism promotion combined with rebuilding trust among potential visitors. This is where the question arises – can the actions of entrepreneurs actually attract tourists if they are against the government guidelines, although supported by expert opinions? The conducted research does not allow to provide an unambiguous answer, as it was carried out only among respondents who willingly decided to travel during the restrictions. In this context, it is necessary to refer to a broader perspective on the issue of organizing free time, which can be spent in the place of one's own residence, without the need to use accommodation services.

According to the studies by Kugiejko (2021), during COVID-19 pandemic in 2020 the average leisure time resources increased. The form of work has also changed as many employers introduced remote work, home office or a hybrid system. This way it became possible to work remotely from any place in the world. The analyzed reports (Minkwitz, 2021) presented that the respondents travelled mostly for recreational purposes during pandemic. Despite the restrictions and isolation, many people spent vacation or summer holiday away from home. They went mostly on short, one-day trips to various places in Poland. Some mentioned they missed the possibility to participate in organized trips: "(…) participation in trips organized by travel agencies or Polish Tourist and Sightseeing Society (PTTK) gave me a feeling of connection to other human beings and allowed to explore the region better (…)". Similar behaviors were observed in the studied group of respondents (n = 100) where the change in nature of daily work or its temporary absence resulted in a greater number of departures among young people (during the restrictions); most of them lasted during the weekend.

As we can see, tourism and trips have become a permanent part of people's lives. They are no longer available only to a selected group of respondents but to anyone who has the will and the opportunity. During the restrictions, tourists seem to be less demanding and their expectations regarding the reception area are not that high. Being aware of the enforced restrictions, they often chose well-known places that they can rediscover in line with their own plan. Sightseeing, however, becomes a secondary factor in relations to the crucial desire to change the everyday surroundings. This developing trend may consequently lead to the development of cultural and ethnographic tourism, described by the slogans "4H", in which people pay special attention to habitat, heritage, history and handicrafts. As a result, the closest homeland raises greater interest as well as the idea or local touring. This way the tourists can discover a specific *genius loci* and use the natural and cultural conditions of the geographic environment for leisure. As a consequence, we can talk about the intensification of the "staycation" phenomenon, which is more and more quoted in the literature in the context of pandemic and post-pandemic developing trends in regional tourism (cf. Knežević & Ogorevc, 2020, Knežević et al., 2021) The interest in the tourist values of the place of everyday life may be of particular

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important in case of inhabitants of the largest cities in Poland, as they are the epicenters of tourist traffic.

When analyzing the collected data, it is worth mentioning the study about developing trends in Poland before and during the COVID-19 pandemic (cf. Juszczak, 2020). There is a noticeable similarity in the obtained data in terms of the predominant short-term trips and the lowest domestic tourist traffic in November. However, the pandemic influenced the purpose of these trips, which were previously primarily recreational. During the second wave of covid infections and associated restrictions, the need to change the daily living environment became the main goal of the trips, followed by leisure as indicated by the largest group of respondents as a secondary goal. Similarly like pre-pandemic, tourists concentrated mostly on the Baltic Sea coast and mountain resorts, associated mostly with active tourism (trekking and skiing). Special attention should be also paid to the diversification of tourist services, enabling tourists to choose the preferred form of departure, tailored to their own expectations and capabilities.

The restrictions regarding the possibility of organizing trips and the factors indicated as reasons for resigning from tourist trips resulted in the fact that the number of activities, such as sightseeing, slightly decreased in favor of active recreation. The selected regions that dominated in the tourist trips during pandemic are also worth analyzing. As previously discussed, it was four regions of the country dominated by the mountain area (60%), followed by large urban areas (22%). The choice of mountain areas (including the Tatra National Park and the Jazira Mountains) could be related to the desire to spend free time actively out in the wild, where it wasn't obligatory to wear face masks. This assumption may be confirmed by the data from the monitoring of tourist traffic, which has been carried out for several years in the area of Table Mountains National Park. According to the published data, the number of tourists in 2020 was lower in annual terms, but during the summer holiday (from July to end of August) record numbers were recorded. The authors put special attention to the voluntary dispersion of tourist traffic which was confirmed by a significant increase in the number of tourists visiting the previously less popular areas of the park (from 25% to 223%). This can be interpreted as a precaution to maintain greater social distance and rest away from the crowded tourist routes. On the other hand, the tourists' preference to spend free time in the large urban centers (i.e. Wroclaw, Gdansk) provided respondents with access to tourist infrastructure or attractions (incl. the Long Market in Gdansk, the Centennial Hall in Wroclaw), especially the one that did not require service of additional people. Despite the applicable restrictions, most trips were organized during Christmas and New Year periods, which is connected with longer day off work or comes from the tradition of travelling at that time. Based on the research, the fact of travelling did not affect the number of SARS-CoV-2 infections, however, this might be related to the sanitary rules obedience and social distancing by travelers and a significantly lower number of visitors in those regions.

This study presents issues connected with the research about tourist behavior during COVID-19 pandemic and introduced restrictions. The identified groups of issues included mobility restrictions and using accommodation during lockdown. The individual parts of the article present general issues related to the changes in the tourist traffic, and threats resulting from the spread of COVID-19 pandemic. The authors also mentioned the scope of public policy in counteracting and limiting the negative effects of the pandemic, resulting from reduced tourist traffic and freezing the functioning of the tourist economy.

During the initial period of the pandemic, the public activities generally ignored the state of the functioning of tourism economy. The worsening crisis in the functioning of tourism enterprises, related to the inability to run the business as usual, did not affect the authorities' decision. Thus, officially, it was not possible to undertake activities related to the management of tourist traffic by hotel, restaurants and tourist carriers. The temporary suspension of hotel activities did not affect the difficulty in finding

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accommodation. The majority of analyzed cases related to the "illegal" provision of tourist services. The full analysis of the scale of this phenomenon would enable the estimation of budget losses of individual communes due to non-payment of the due climate tax. However, it will be extremely difficult due to the activities of administrators and tourists outside the applicable law, which limits the possibility of obtaining reliable and credible data.

The undertaken research is an introduction to further analysis of the phenomenon of illegal domestic tourism during the pandemic. It will require the comparison of the obtained results with the available reports and indicators describing tourist traffic during the COVID-19 pandemic on a local, regional and national level. In the future, it is worth conducting a comparative analysis that allows determining the changes that have occurred in the way Poles travel in recent years (pre- and post-pandemic) and enables presenting the forecasts in this area. The upcoming trips will be organized in a different reality, in which vaccination may become the passport to legal travelling. As a consequence, it will contribute to the development of a new model of tourism, commonly described as "3xV" (Visit, Vaccination, Vacation) where the main problem of illegal trips may already be a thing of the past.

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HOUSING QUALITY IN THE REPUBLIC OF MOLDOVA

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ABSTRACT

Motives: The term "housing quality" is very complex and refers to all qualitative aspects of housing. In this context, the present study based on an extensive analysis of the literature that addresses various aspects of housing quality (monographs, landmark publications, international reports, methodological guides, normative and legislative acts, and statistical data) was developed. The particular case of the housing quality in the Republic of Moldova consists in the degree of comfort that the population benefits from the level of localities' utility infrastructure.
Aim: The study aims to provide an overview of the housing quality in the Republic of Moldova at national, regional, and local levels. Therefore, the main factors which influence the territorial distribution of structural indicators and their outstanding effects in the researched area were analysed.
Results: The research results showed that the quality of housing in the Republic of Moldova depends on technical and economic development, thus major discrepancies between different categories of Administrative Territorial Units and Development Regions are registered.

Keywords: Housing Quality, Housing Index, Technical Comfort Index of the Habitat, The Index of Housing Density

INTRODUCTION

One of the central problems of modern society is the housing quality, which means both the house (home) and its degree of comfort (Antonescu, 2014). As a result, the Global Housing Index was developed worldwide, which is a tool to assess the policies and practices under which housing in a country is – or is not – owned, rented, financed, subsidized, serviced, regulated, planned, and built (Katz, 2012). Governments around the world have formally recognized universal rights to adequate housing and living standards, according to United Nations Human Settlements Program (UN-Habitat, 2004, 2012). Back at the 1996 United Nations Habitat II Conference, it was established that adequate shelter means much more than just a roof. It also means adequate privacy, space and security and a place to thrive. Furthermore, poor housing can lead to many health problems, which can lead to different infectious diseases, such as tuberculosis, stress, and depression. Everyone should therefore have access to good

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quality housing and a pleasant home environment that makes them happy and content (WHO, 2002). Social and economic measures implemented at the local level should aim to improve the inhabitants' welfare, living standards and quality of life. These goals are achieved primarily by promoting house building, protecting the environment, improving the availability of technical and social infrastructure, designing policy frameworks that support investment, and promoting social and economic mobilization of local communities (Pawlewicz & Flasińska, 2021).

The housing quality can be understood in many ways (Vâlceanu & Zulaica, 2012), for example, studies on the issue may have many interpretations and implementations through government housing policies, academic research, etc., and usually may achieve one or more of the following goals (Lawrence, 1995):

– the assessment of aesthetic and/or use values of residential buildings;
– the identification targets for upgrading or replacing the existing housing stock;
– the allocation of housing loans and subsidies by consideration of effective occupancy conditions, household income, and expenditure;
– concern about health and wellbeing of residents in relation to the internal and external conditions of housing neighborhood.

According to *The Right to Adequate Housing Toolkit* (OHCHR & UN-Habitat 2009, 2012) an adequate home should meet several criteria, such as:

– security of tenure;
– availability of services, materials, facilities and infrastructure;
– affordability;
– habitability;
– accessibility;
– location;
– cultural adequacy.

Trudel (1989) considers the housing quality the primary aspect of people's quality of life. At the same time, quality of life is an imperative goal of sustainable human development (Streimikiene, 2015; Janusz, 2020). According to Aplopi (2008) the existence of the human population is based on living conditions. Thus, housing is the defining element of human development, increasing the quality of life, a measure of social welfare but also a motivating factor for the economy and investment.

Castro (1999) entails in his analysis on housing quality the psychological, social, and environmental factors that define mental, physical, and biological health; whereas housing is the ability of a habitat to meet the objective and subjective needs of a person or group to which it belongs. Thus, according to the World Health Organization, good housing quality is a key element in ensuring a healthy village. The understanding of housing quality among the actors reveals there are rich and various meanings and interpretations of housing quality (Maimon, 2018).

In the Republic of Moldova, until the adoption of the Law regarding the housing (2015), housing policy was regulated by the Housing Code (1983) which was the functional legislative document during the USSR. The main aspects mentioned in this code had established the basic principles of the population register which aimed to improve the living conditions, the use, and the maintenance of the housing stock in good condition and solve disputes in the housing field.

Some aspects regarding the quality of the dwelling were reflected in the methodology for evaluating the dwellings, subject to the privatization process embodied in Law on the privatization of housing, here being established the correlation between the quality indicators and the consumption indicators of the dwelling. Currently, the legislation of the Republic of Moldova on housing is based on the principles of the Constitution of the Republic of Moldova, the Civil Code, international treaties which the Republic of Moldova signed, and other normative acts related to housing.

MATERIALS AND METHODS

Information regarding housing quality in the Republic of Moldova is provided by the National Bureau of Statistics. The data collection is delivered by the statistical research "About the housing stock" which includes two basic indicators:

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Provision of housing for the population / in square meters per inhabitant;

$$A_L = S_T/N_P, \quad (1)$$

where:

A_L – provision of housing for the population;
S_T – total area;
N_P – average number of resident population.

The share of the total area of dwellings equipped with various types of utilities;

$$S_{T(i)} = S_{T(i)}/S_{ti} * 100\%, \quad (2)$$

where:

$S_{T(i)}$ – the share of the total area, equipped with various types of utilities;
S_{Ti} – the total area, equipped with certain types of utility;
S_T – total area.

The data obtained from the statistical survey "On housing" are disjointed into:
– total per country;
– by regions (Chișinău, North, Center, South and Territorial Administrative Unit Găgăuzia);
– by districts;
– by urban and rural localities.

In the present study, two synthetic indicators were used to assess the housing quality: the Technical Comfort Index of the Habitat and the Index of Housing Density, which are the basis for determining the Housing Index.

When calculating the Technical Comfort Index of the Habitat, 5 variables were used: equipped houses with a centralized water supply system, sewerage, central heating system, natural gas, and bathroom (shower). The most important element among these 5 is the sewerage infrastructure, which is the least common in both rural and urban areas due to high implementation and maintenance costs. This is followed by access to running drinking water, which is deficient in most rural localities, then the supply of bath/shower installations, gas, and central heating. Each variable will be set according to its importance. The Index was calculated according to the following formula (Manolache, 2017):

$$TCIH = 0.30 * Es + 0.25 * Ew + 0.20 * Eb + 0.15 * Eg + 0.10 * Eh \quad (3)$$

where:

Es – provision of houses with sewage;
Ew – provision of houses with drinking water;
Eb – provision of houses with bathroom (shower);
Eg – provision of houses with gas;
Eh – provision with central heating.

To calculate the Housing Index, the ratio between the Technical Comfort Index of the Habitat and the Housing Density Index was elucidate. The Index was calculated according to the following formula:

$$HI = TCIH/HDI \quad (4)$$

where;

HI – Housing Index;
TCIH – Technical Comfort Index of the Habitat;
HDI – Housing Density Index.

RESULTS

The housing stock represents the totality of the habitable rooms, regardless of the ownership form, including houses, specialized houses, flats, service rooms and other residential rooms in other buildings used for living. In 2020, the housing stock of the Republic of Moldova constituted 1302.1 thousand dwellings with a total area of 89187.7 sq. m. As for resident areas, in urban localities, 560.2 thousand houses with a total area of 39921.3 sq. m. were registered, which is 44.8% of the total. Rural localities have 749.7 thousand houses with a total area of 49266.4 sq. m. or 55.2% of the total. The average share of living space was 71.3% of the total area, in rural areas, this indicator is 72%, and in urban areas, it is 70.5%.

Based on the data of the Population and Housing Census from 2014, it was estimated that the average age of the flats stock in the Republic of Moldova is ≈ 38.1 years, this value being close to the one recorded in the urban area, therewith it was 31.5 years in rural areas (Cujbă & Sîrbu, 2020).

During the transition period (after 1990), 157.970 houses were put into operation in the Republic

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of Moldova, which is ≈13% of the housing stock. In just three administrative units, the share of housing built in the last 20 years is on the edge of 20% – Criuleni (19.9%), Chișinău (20%), and Ialoveni (20.9%). The districts in the North of the country are at the opposite pole – Dondușeni (4.2%), Ocnița (5.1%), Edineț (7.3%), Florești (7.5%) greatly affected by the depopulation process in rural localities.

Living conditions are an important indicator of the well-being of the country's population (Cujbă & Sîrbu, 2018), providing the person with biological, psychological, social, and family needs. The houses equipped with the main amenities express the comfort level of the housing stock and obviously, the quality of housing.

Although there has been a steady increase in the level of technical endowment of the housing stock, at the beginning of 2020 in localities of the Republic of Moldova, 38.8% of houses were not connected to the drinking water network, 41% had no sewerage, 52.7% had no central heating, and 9.5% had no gas (Table 1).

Table 1. Degree of housing stock of the Republic of Moldova equipped with the main amenities in 2010–2020 period

Year	Drinking water (%)	Sewerage (%)	Central heating (%)	Natural and liquefied gases (%)
2010	44.2	43.8	35.1	87.8
2011	46.3	46.3	36.3	88.7
2012	47.5	47.5	37.6	89.0
2013	50.1	49.9	39.3	89.4
2014	51.7	51.5	40.4	90.0
2015	53.5	53.2	41.5	90.2
2016	58.2	55.8	46.0	90.4
2017	58.7	56.3	46.1	90.1
2018	59.6	57.5	46.4	90.2
2019	60.4	58.3	46.9	90.3
2020	61.2	59.0	47.3	90.5

Source: own elaboration based on data https://statistica.gov.md/.

Therefore the role of the Housing Density Index is to show the concentration of inhabited space. Analysing the distribution of the Housing Density Index in the Republic of Moldova, whose calculations is based on data collected in the 2014 Population and Housing Census, we can identify that the highest values are in the Central, Southern, and South-Western districts of the Republic of Moldova. The maximum values were registered in the districts of Hîncești, Ialoveni, Strășeni, Taraclia, Cahul and Cantemir, with an index between 3.4 and 3.6. Over time, these regions experienced a positive demographic evolution because of a larger number of family members.

In the districts in the South-West of the Republic of Moldova, the maximum values are registered in the townships: Andrușul de Jos (Cahul district) – 4.2, Tartaul (Cantemir district)– 4.4, and Cotovscoe (Territorial Administrative Unit Găgăuzia) – 5.2. The minimum values of the Housing Density Index, below the national average, are registered in the districts located further North of the Bălți municipality – Dondușeni (2.4), Ocnița (2.7), Soroca (2.7), Drochia (2.8), Florești (2.9), Briceni (2.9), etc. For these districts, the increase in the demographic aging process and the pronounced decrease in the birth rate are specific. At local level, the absolute minimum values were registered in the townships: Naslavcea (Ocnița district) – 1.7, Briceni (Dondușeni district) – 1.9, and Iarova (Soroca district) – 2.0.

The Technical Comfort Index of the Habitat considers the services of superior rank – sewerage, drinking water, central heating, gas, and bath (shower). Providing technical and utility infrastructure, the Republic of Moldova faces pronounced intra-regional discrepancies. Thus, according to the Technical Comfort Index of the Habitat, except for TAU Găgăuzia, the following major differences can be observed between districts within each Development Region, for the years 2011 and 2020 (Figures 1. a and b):

1. The average value of the Technical Comfort Index of the Habitat increased from 51.0 in 2011 to 57.9 in 2020. If in 2011, only the municipalities of Bălți (82.4) and Chișinău (96.7) had a value higher than 65, then according to the data from 2020, this category also includes Taraclia district (66.9) and TAU Găgăuzia (71.3).
2. In the Center Development Region, the most equipped districts with technical infrastructure:

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Ialoveni (54.0), Străşeni (55.2), and Anenii Noi (64.9) – all located at the border of Chişinău municipality. At the same time, we can identify districts with a worse situation: Şoldăneşti (25.2), Teleneşti (25.9), Criuleni (33.4).

3. In the North Development Region, the administrative units within Bălţi-Soroca-Edineţ triangle can be mentioned, which, according to the Technical Comfort Index of the Habitat, in 2020, registered values >35 and a deeper decline for the rest of the districts.
4. In the South Development Region, the Technical Comfort Index of the Habitat is lower only in 2 administrative districts, Cantemir and Leova. It should be mentioned that the situation has improved significantly compared to 2011.
5. The Găgăuzia Development Region, over the last decades has become one of the most dynamic regions in the Republic of Moldova. This region benefits from the advantages offered by the special autonomy and more advanced degree of fiscal and administrative decentralization.

To better understand the distribution of municipal services on the territory of the Republic of Moldova, the maps were developed (Figures 2 and 3). From the concerned map, it can be noticed that the index value is higher in the areas around Chişinău and in the towns in the valley of Dniester and Prut rivers. Also, the influence of the cities of over 20 thousand inhabitants like Bălţi, Ungheni, Cahul, Orhei, Soroca and Comrat ensures a higher degree of technical equipment for the surrounding localities. These cities are the main centers which extend municipal services to the nearby regions. The highest values of the Technical Comfort Index of the Habitat are reached in the following urban localities: Chişinău, Cimişlia, Frunză, Străşeni, etc. with an index of over 95. For the rural localities, the highest index values are recorded in Stăuceni

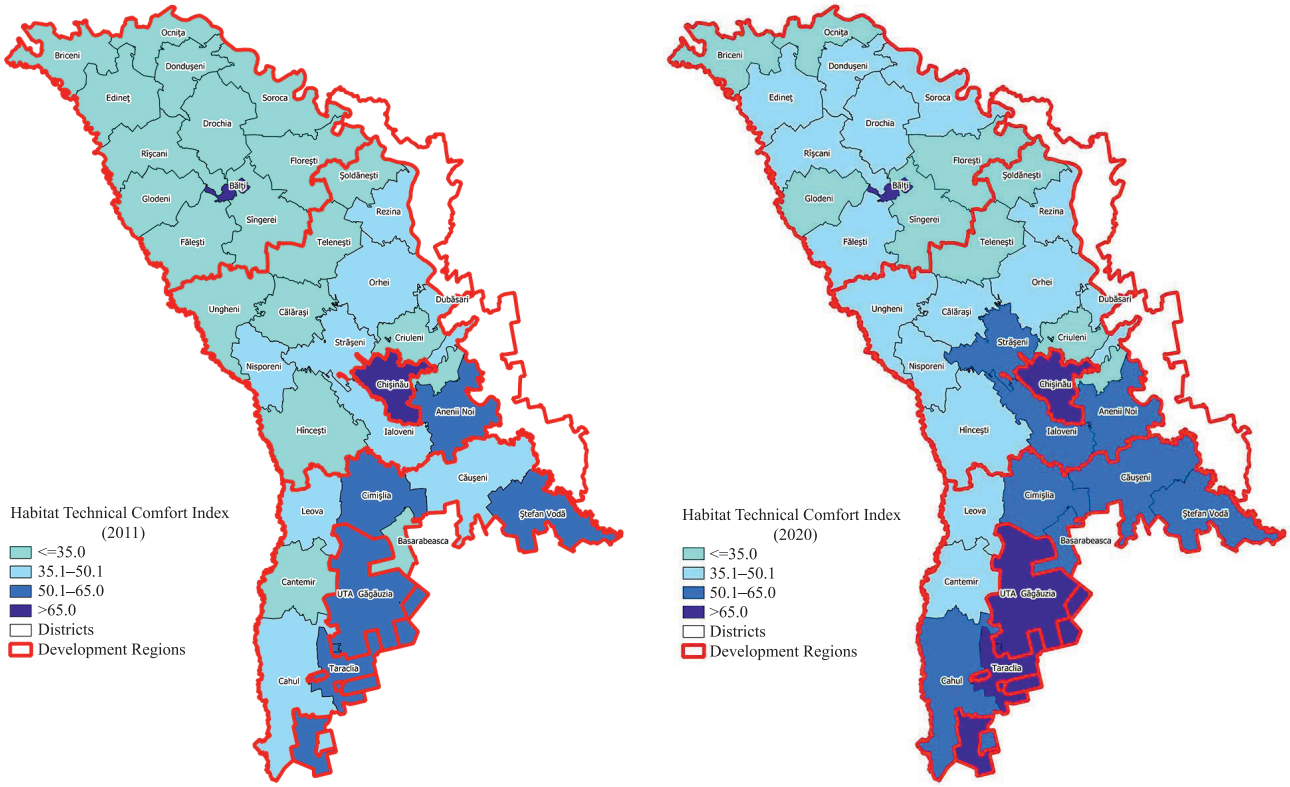

Fig. 1. The Technical Comfort Index of the Habitat spatially represented by Development Regions of the Republic of Moldova: a. 2011, b. 2020

Source: own elaboration based on the data of National Bureau of Statistics.

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commune, Chișinău municipality. At the same time, the lowest values are registered in townships from the Șoldanești district (Hlingeni and Salcia), where are identified a series of localities which lack housing facilities, such as Poiana, Alcedar, Cuşmirca, and Fuzăuca.

All these differences have complex causes, from the implementation of innovations to the physical-geographical conditions of landscape, influenced obviously by human being. Many of the localities with a low share of utilities are affected by accentuated rural environment and population with very low incomes.

At the same time, the Republic of Moldova is characterized by excessive administrative-territorial fragmentation (898 mayoralties), which creates very great impediments to the development and operation of technical and municipal infrastructure. Thus, for example, the National Strategy for water supply and sanitation (2014–2028) claims that there are conditions for the development of centralized sewerage systems only for townships with more than 5000 inhabitants, which means that over 90% of all rural LPAs in the country do not fulfil the requirement and should work with neighbouring Local Public Authorities.

Table 2. Synthesis of the results obtained in the actions implementation concerning centralized water supply and sewerage in localities of the Republic of Moldova in the period 2016–2020

Areas of intervention	Planned	Accomplished	Progress in implementation
Centralized water supply and sewerage	318 km of water supply network	297.8 m of water supply network	93.6%
	147 km of sewerage network	99.3 km of sewerage network	67.5%

Source: own research based on MARDE reports on the implementation of National Strategy for water supply and sanitation 2016–2020.

According to the National Strategy for Regional Development (2016–2020), the efforts to implement the regional development policy in practice must be directed towards identifying the development needs of the regions. Among the main needs at the regional level is the provision of water and sanitation to the population. In the reference period 2016–2020, 93.6% of the design for the water supply and only 67.5% for sewerage was reached (Table 2). This gap is explained by the predominant focus of interventions on less technically complex works, which implies relatively smaller investments, while works related to sewerage network development require very high costs.

In this context, the Housing Index is a result that aims to provide an overview of the communities, relating the Technical Comfort Index of the Habitat with that of Housing Density Index. Analysing and comparing the maps of the Housing Index from 2020 with the Technical Comfort Index of the Habitat for the Republic of Moldova, we can observe a similarity in the distribution of the two indicators, thus the same areas being problematic and having high values. In one hand, the highest values of the Habitat Index are found in the main cities of Chișinău, Bălți, and in other hand in the localities Soroca, Dondușeni, Leova, Cantemir, Frunză (Ocnița), Cneazevca (Leova), Index's values are low (Figures 2 and 3).

The values of the Habitat Index are numerically changed compared to those of the Technical Comfort Index of the Habitat, but qualitatively the localities keep the tendency. Overall, the two indicators overlap in terms of quality, with the Housing Density Index not significantly changing housing comfort, the density having high values where the Habitat Index is low, and the opposite, having low values where comfort is high. The Habitat Index, just accentuates the differences between the localities of higher rank and those of lower rank.

For the objective and systemic assessment of the distribution of the Housing Index at territorial level, the statistical indicators of the central trend (mean, median and mode) and the distribution indicators (dispersion and standard deviation) were researched (Table 3).

The arithmetic mean (X) is the indicator which usually shows where the data tends to grow. The simple arithmetic average of the Housing Index for the Republic of Moldova was 11.7. Values higher than

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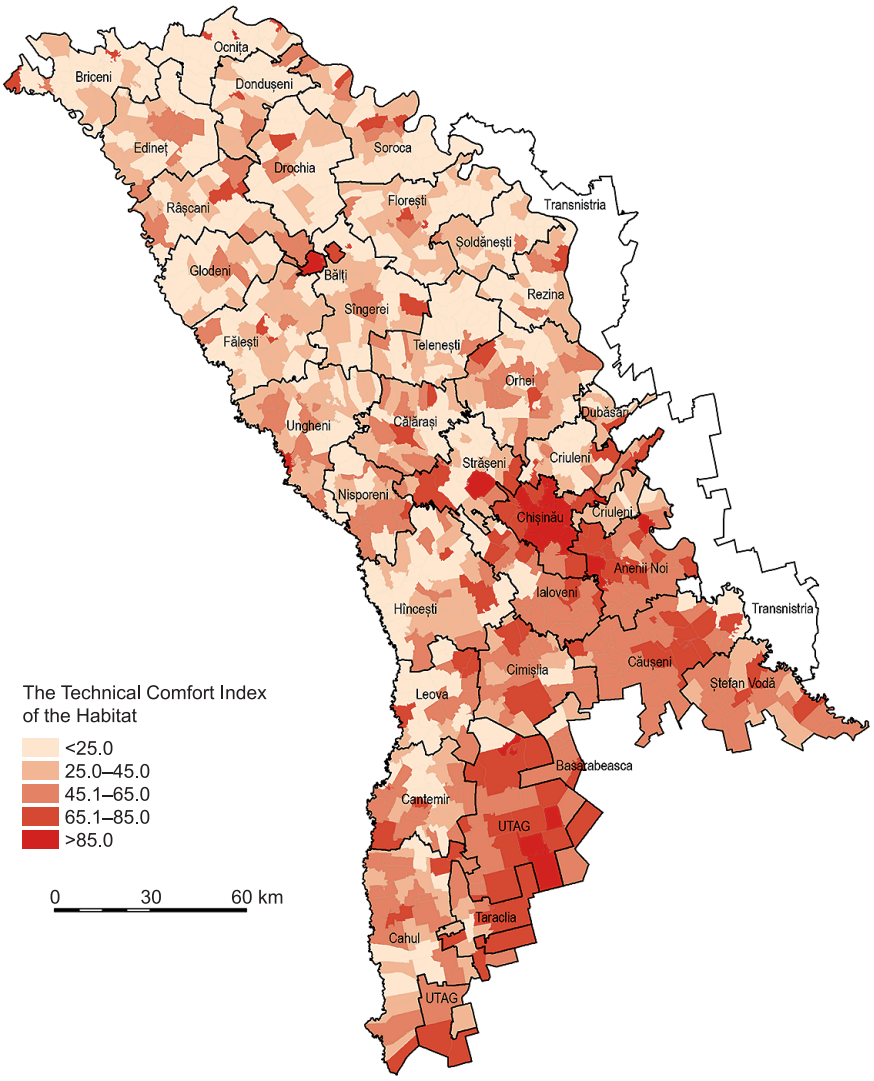

Fig. 2. The Technical Comfort Index of the Habitat, at the commune level (Republic of Moldova, 2020)
Source: own elaboration based on the data of National Bureau of Statistics.

the national average were recorded in ≈ 30% from the number of administrative-territorial units of level II, namely: Ștefan Vodă (16.9), Anenii Noi (18.9), TAU Găgăuzia (19.0), Chișinău (23.3), Bălți (25.3), etc.

Median or quartile of 50% (Q2). The median value of the statistical elements surveyed is 9.9, meaning that in 18 districts the Housing Index is lower than the reference value, and in 17 districts the value is higher. Also, the calculations reveal that the median is close to the average, so we can conclude that in this case we have a normal theoretical distribution with a tendency towards symmetry. Asymmetric or exocentric distribution of the median was registered only for Ocnița and Leova districts.

Mode (Mo) is a useful indicator in the analysis of large series in which we are interested. The following data series were established for distinct statistical units (districts) according to the most frequently

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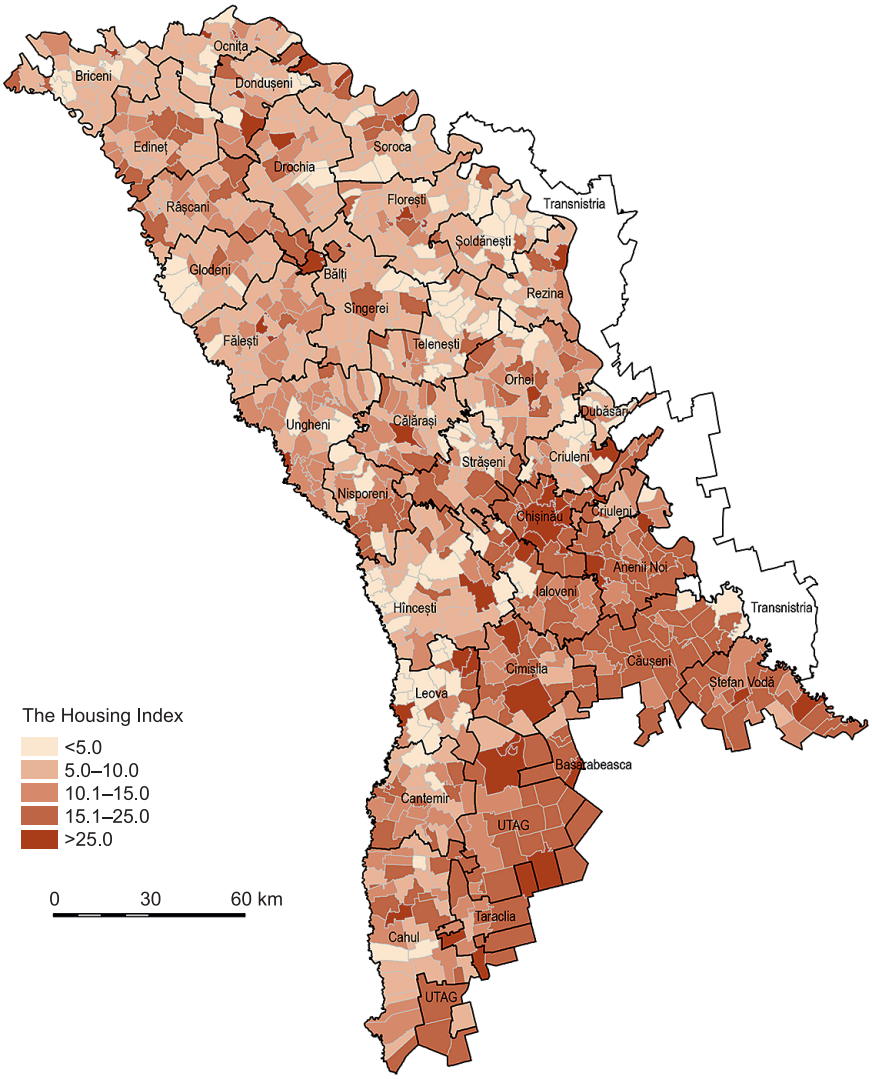

Fig. 3. The Housing Index, at the localities level (Republic of Moldova, 2020)
Source: own elaboration based on the data of National Bureau of Statistics.

encountered value: *multi-modal* (10 districts), *bimodal* (7 districts), *unimodal* (10 districts), and *amodal* (8 districts). Mo = 5.6 in the data sequence of all statistical elements. In the case of multimodal series, the mode loses its quality as an indicator of the central trend. Thus, in just 30% of the administrative units, the mode *(Mo)* is significant.

The extreme values of the characteristics of the Housing Index for the Republic of Moldova constitute $X_{min.} = 0$ and $X_{max} = 51.5$, having a wide range of variation. Although, in statistical research, extreme values have little significance, for the present study, the main advantage of these indices is the presentation of the existing differences within a statistical community (administrative-territorial units).

The differences between the maximum and minimum of the series of values give us information about the range width of values on which the data in the series extends (amplitude of variation). The highest values of amplitude (A) were recorded in the

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Table 3. Statistical interpretation of the Housing Index, for districts of the Republic of Moldova (2020)

No.	District	*N*	$\bar{x}$	Q_2	*Mo*	*Min*	*Max*	***A***	***σ***	***CV***
1.	Chișinău	19	23.3	22.2	22.2	9.5	40.1	30.6	6.9	29.6
2.	Bălți	3	25.3	24.0	0	18.7	33.3	14.6	6.0	23.7
3.	Anenii Noi	26	18.9	19.4	0	3.8	30.1	26.3	5.6	29.6
4.	Basarabeasca	7	15.8	15.2	0	6.0	26.9	20.9	6.2	39.2
5.	Briceni	28	8.3	6.5	5.2, 5.5, 6.5	4.0	25.8	21.8	5.3	63.9
6.	Cahul	37	11.7	10.3	8.0, 9.3, 12.6	4.4	26.0	21.6	5.2	44.4
7.	Cantemir	27	12.4	12.6	0	4.4	32.6	28.2	6.3	50.8
8.	Călăraș	28	11.2	10.9	0	3.4	29.7	26.3	5.8	51.8
9.	Căușeni	27	17.8	17,2	16.5, 17.0	12.3	24.0	12.1	2.8	15.7
10.	Cimișlia	23	15.4	15.1	0	5.8	26.2	20.7	5.1	33.1
11.	Criuleni	25	9.8	8.6	5.0	3.2	25.8	22.6	5.9	60.2
12.	Dondușeni	22	10.0	7.0	5.9, 10.0	4.1	32.1	28.0	7.5	75.0
13.	Drochia	28	9.8	7.0	6.8, 7.7, 7.9, 8.8	4.5	29.9	25.4	5.5	56.1
14.	Dubăsari	10	9.8	9.8	0	0	20.7	20.7	6.6	67.3
15.	Edineț	32	10.5	8.4	6.8, 7.8, 8.2, 8.6	3.6	22.7	19.1	5.1	48.6
16.	Fălești	33	9.3	7.3	7.1	4.4	27.9	23.5	4.4	47.3
17.	Florești	40	9.9	7.6	4.5, 5.9, 6.9, 7.6, 9.0, 9.1	1.6	27.2	26.2	6.3	63.6
18.	Glodeni	19	9.1	8.5	4.7	4.1	24.0	19.9	4.7	51.6
19.	Hîncești	39	8.5	6.2	3.7, 4.5, 4.7, 5.4, 6.2	2.5	27.2	24.7	5.5	64.7
20.	Ialoveni	25	14.5	15.4	26.4	2.8	26.4	23.6	6.6	45.5
21.	Leova	25	11.1	4.6	3.7, 3.9, 4.5	3.4	34.7	31.3	9.7	87.4
22.	Nisporeni	23	11.5	11.8	15.8	3.7	24.1	20.4	6.5	56.5
23.	Ocnița	21	10.5	6.6	5.4, 7.7	3.4	51.5	48.1	11.4	108.6
24.	Orhei	38	11.1	10.0	4.4, 5.6, 7.0, 14.7, 14.9	2.8	30.6	27.8	6.1	55.0
25.	Rezina	25	9.0	8.2	4.0, 5.0, 6.2, 8.2	4.0	27.5	23.5	5.0	55.6
26.	Rîșcani	28	11.3	10.4	5.7, 7.2	5.3	24.7	19.4	5.0	44.2
27.	Sîngerei	26	8.8	7.2	5.9, 7.2	4.4	27.0	22.6	5.0	56.8
28.	Soroca	35	10.6	7.1	9.9	4.4	32.8	28.4	7.6	71.7
29.	Strășeni	27	10.6	7.6	3.5, 5.6, 11.7	2.0	24.9	22.9	6.9	65.1
30.	Șoldănești	23	6.5	5.1	1.4, 2.8	1.4	21.4	20.0	4.7	72.3
31.	Ștefan Vodă	23	16.9	17.1	18.3	8.9	27.6	18.7	4.6	27.2
32.	Taraclia	15	15	17.8	0	5.9	27.7	21.8	6.1	40.7
33.	Telenești	31	7.5	5.4	4.9	3.5	18.7	15.2	4.3	57.3
34.	Ungheni	33	10.3	10.9	11.2	3.1	27.2	24.1	4.5	43.7
35.	UTA Găgăuzia	26	19.4	20.3	18.8, 20.3	5.0	28.3	23.3	5.0	25.8
	R.Moldova	898	11.7	9.9	5.6	0	51.5	51.5	6.9	59.0

Source: own preparation.

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following districts Cantemir (28.2), Soroca (28.4), Donduşeni (28.0), Chişinău (30.6) and Ocniţa (48.1).

The mean square deviation (σ) is the most important indicator of variation, which highlights the value range, around the average in which the individual values of the studied characteristic were distributed. The value of the Housing Index for the Republic of Moldova has (σ) = 6.9. The maxim (σ) was registered for the Ocniţa district – 11.4 and the minimum (σ) in the Căuşeni district – 2.8.

The coefficient of variation was used to compare the degree of variation of the characteristics (CV). The closer the level of the variation coefficient is to zero, the lower the variation, the more homogeneous the community will be, and the average will have a high degree of representativeness. The average value of the CV for the Housing Index of the Republic of Moldova was 59%, therefore, the average of 11.7 is not representative for all statistical units (35 TAU), and the data cannot be generalized. Thus, for the administrative-territorial units with CV >35% of the Housing Index, it is recommended separating the data on grouping characteristics.

The intensity of the dependence between the Technical Comfort Index of the Habitat and the Housing Index was measured using the correlation coefficient and simple linear regression (Apetrei et al., 1996). To determine the regression parameters, 100 pairs of values were randomly selected for the analyzed indicators, being represented in the correlation graph (Figure 4).

For the values considered, the normal equations is a follows:

$$9988 \cdot a + 5106.329 \cdot b = 1552.698$$
$$5106.329 \cdot a + 333882.298 \cdot b = 100508.699$$

where:

b = 0.2897

a = 0.7433

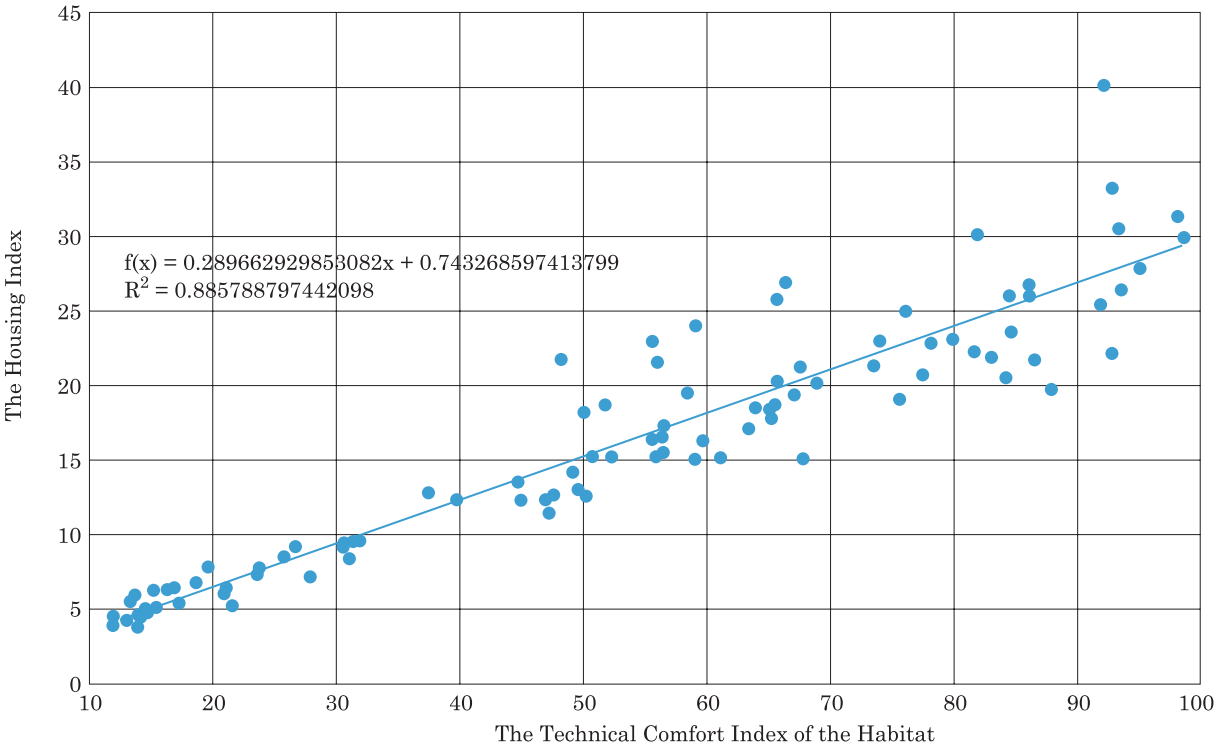

Fig. 4. The correlation between the Housing Index and the Technical Comfort Index of the Republic of Moldova 2020
Source: own preparation.

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Thus, we obtain the empirical regression coefficients:

b = 0.2897; a = 0.7433 ⇒ the form of the regression equation:

$$y = 0.2897\ x + 0.7433$$

The regression coefficient b = 0.29 shows the average variation of the effective indicator (in units of measurement y) with an increase or decrease of the value of the factor x per its unit of measurement. Therefore, with an increase of 1 unit, y increases on average by 0.29 units. The coefficient a = 0.743 shows the predicted level of y, only if x = 0 is close to the sample values.

The coefficient of determination (correlation) R^2 = 0,8858. So, in 88.58% of cases, changes in x lead to a change in y. The high value of the coefficient of determination shows that the level of accuracy of the regression equation is high. The remaining 11.42% of cases are due to the influence of factors that cannot be considered by the model (specification errors).

Verification of the significance of the regression model was performed using the F-Fisher Criterion test. The real value of the criterion $F_{calc.}$ = 752.304. The value of the Fisher criterion by degrees of freedom $k_1 = 1$ și $k_2 = 97$, $F_{tab.}$ = 3,92. Because $F_{calc.} > F_{tab.}$, it turns out that the coefficient of determination is statistically significant.

CONCLUSIONS

Housing quality is a multidimensional concept assessed by examining a number of physical and social characteristics of the housing environment. At the same time, international practice shows that the quality of housing is also influenced by the environmental conditions in the neighbourhood, which are the basis of housing quality.

In the Republic of Moldova, the housing quality, traditionally, is approached in terms of territorial and functional relations established with the network of public facilities necessary to ensure minimum living conditions. This fact is explained by the high rate of poverty and social inequality among the population, formed during the transition period, without financial possibilities to connect to the technical-utilities infrastructure, which is very deficient especially in rural areas.

Tracing the research results on the Republic of Moldova, there is inequitable distribution of Housing Quality Indices with major discrepancies between urban and rural areas. On one hand, peri-urban localities and those crossed by national roads are experiencing technical development and an increase in housing quality, while on the other hand, isolated areas due to demographic instability and depopulation experience stagnation in the development of technical infrastructure.

The current housing situation in rural areas decisively influences the quality of living conditions and, implicitly, the quality of life in the Republic of Moldova. Households in rural areas and in areas bordering administrative units (districts) are deficient in terms of access to utilities (running drinking water, sewerage, natural gas, sanitation services, lack of access infrastructure, etc.). The great variety of living situations determines the precariousness of the living conditions, against the background of poverty generating social phenomena with a special impact on the population.

In order to improve living conditions, it is necessary to develop and implement several action plans at the national level, such as: transforming the housing sector into a basic sector of the economy interconnected with other economic sectors, primarily with infrastructure; the adoption of housing insurance programs for vulnerable groups and the correlation of total housing costs with household income; stopping the degradation of the housing stock and increasing the quality of housing both in urban areas and especially in rural areas.

Author contributions: authors have given approval to the final version of the article. Authors contributed to this work as follows: CUJBĂ Vadim developed the concept and designed the study. SÎRBU

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Rodica collected the data, analysed and interpreted the data, prepared draft of article.

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