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Ekonomistów Środowiska i Zasobów Naturalnych

THEORETICAL AND METHODOLOGICAL PROBLEMS

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PROBLEMY TEORETYCZNE I METODYCZNE

Katarzyna **TOKARCZYK-DOROCIAK** • Marta **SYLLA**

INTEGRATING ECOSYSTEM SERVICE ASSESSMENT AS A TOOL TO SUPPORT DECISION-MAKING IN THE FRAMEWORK OF ENVIRONMENTAL IMPACT ASSESSMENT

Katarzyna **Tokarczyk-Dorociak,** PhD • Marta **Sylla,** MSc – *Wroclaw University of Environmental and Life Sciences*

Correspondence address:
Institute of Landscape Architecture
Grunwaldzka Street 55, 50-357 Wroclaw, Poland
e-mail: katarzyna.tokarczyk-dorociak@upwr.edu.pl

ABSTRACT: In the current legal system concerning the environmental legislation in Poland, environmental impact assessment (EIA) constitutes an essential tool for the protection of ecosystems. A report that is being prepared within EIA includes different methods to assess the impact of a given project on the environment. The combination of the currently used methods and ecosystem services assessment may allow for a better understanding of the consequences of the environmental change. This article presents the theoretical framework of integrating the ecosystem services assessment into the EIA procedure and its use in a report on the environmental impact assessment of a given project.

KEY WORDS: environmental impact assessment, ecosystem services, Poland, integrated approach

Introduction

It is important to maintain high critical point of preservation of a healthy environment, after which the destroyed ecosystem will cease to provide the services on which we depend (TEEB, 2011). The need to stop the loss of biodiversity is highlighted in the second target of the EU Biodiversity Strategy 2014-2020 (European Commission, 2011). It is also expressed in the Polish Programme for conservation and sustainable use of biodiversity (Resolution No. 213 Of the Council of Ministers, 2015). The environmental impact assessment (EIA) and strategic environmental assessment (SEA) constitute two legally binding tools suitable for combating these problems (European Commission, 2013). The purpose of conducting the impact assessments is to optimize the decision-making process on economic, social or other activities negatively affecting human health and quality of life, as well as more general environmental conditions, including species diversity and sustainability of ecosystems (Engel, 2009).

The aim of this study is to investigate the possibility of integrating the environmental impact assessments and the concept of ecosystem services in order to improve the practice of environmental impact assessments by taking advantage of current methods and approaches applied in ecosystem service assessments. It is also our aim to contribute to the scientific debate on the integration of the ecosystem service concept into environmental impact assessment. We assumed that the environmental impact assessment procedure and the concept of ecosystem services have a convergent goal, which is striving to preserve the environment for present and future generations. Moreover, the scope of environmental data acquired at the stage of preparation of the EIA report largely coincide with the data needed to evaluate the ecosystem services. We performed a desk research based on a comparison of the scope of required assessments by the legislation on environmental impact assessments (The act of 3rd October 2008 on the Provision of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, legal status: 15.10.2016) with the literature review of ecosystem services assessment.

The use ecosystem service concept for environmental impact assessment

The concept of ecosystem services concept explains the relationship between society and nature by the use of the notion of the benefits that people derive from ecosystems (MEA, 2005). It enables to recognize the relationship between basic ecological and economic concepts, and the combined analysis of these two subsystems, which in turn leads to a unified presentation of economic and ecological assessments (Solon, 2016). It can also serve as a tool to inform local communities and politicians about the relationship between human and nature and the need for sustainable development (Solon, 2016). In this regard, environmental policy should be based on well-established ecological facts and mechanisms to support decision-making. The EIA allows for the assessment of the impacts of various human activities on the environment. The design and assessment of the impacts of the different investment scenarios might include the anticipated future provision of ecosystem services (Esmail, Geneletti, 2017). The investment may affect the relative mix of ecosystem services within its impact area as well as trade-offs among them (Geneletti, 2013). The implementation of ecosystem service assessment has been conducted for various case studies across the globe (Partidario, 2016). The results prove that ecosystem service approach may help address some current problems with environmental assessment practice (Baker et al., 2013). In particular, the integration of ecosystem service may improve the identification of impacts and its significance for affected communities and their well-being (Rosa, Sanchez, 2016).

Environmental Impact Assessment – the basic tool of environmental protection

The environmental impact assessment in Poland is a basic tool for environmental protection and prevention of negative impact on natural environment. The EIA procedure is regulated by the act of 3rd October 2008 on the Provision of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments. The law provides an administrative procedure for a planned investment that may have negative effects on the environment. One of the elements of this procedure is a report on the environmental impacts. The environmental impact assessment includes the preparation and verification of the report, obtaining the required opinions and agreements with administrative bodies and ensuring public participation in the procedure. According to the art. 66 point. 1 of the act of 3rd October 2008 the EIA report shall contain a descrip-

tion of the planned project, the characteristics of the natural elements of the environment within the scope of the expected impact of the planned project, a description of investment options taking into account the specific features of the project or its impact as well as the comparison of variants in terms of impact on the environment. The report shall also contain the methods that were used to carry out the assessment. The methodology concerning different scenarios of the impacts of an investment must include permanent, temporary, reversible, irreversible, direct, indirect, and cumulative impacts. The assessment of environmental conditions and projected impacts is prepared in relation to people (especially human health), plants, animals, fungi and natural habitats, protected areas and ecological corridors, water, air, climate noise, climate change, soil and surface of the earth, including the mass movements of the earth, the landscape, material assets, monuments and cultural landscape, as well as the interactions between these elements.

Integrating ES to the EIA procedure

There have been several attempts to integrate ecosystem service concept in environmental impact assessments (Partidario, Gomes, 2013). This integration in the field of strategic environmental assessment (SEA) has been well described by prof. Geneletti (2014), especially for SEA in the field of spatial planning (Geneletti, 2011). In our contribution, we have combined steps of the EIA procedure in Poland (the assessment of the impact of an individual investment) and the main steps of the assessment of ecosystem services (table 1).

The general ecosystem service assessment framework designed for impact assessment (Landsberg et al., 2013) fits the EIA procedure in Poland. The theoretical framework of integration indicates the steps where ES may complement and enlarge the EIA. ES assessment may be conducted at the early steps of the EIA procedure to consider the potential impact of the investment on the provision of ecosystem services and to support decision-making of the environmental protection authority on the scope of the assessment. In the scoping step of the EIA, the ES assessment requires public consultation to prioritize relevant ecosystem services. That is an additional action to what is required by the Polish law. In the case of the full procedure of EIA, the public consultations are expected to be held after the EIA report is delivered. Therefore, the integration of ES approach into EIA may improve

Table 1. Integration of the steps in assessments of environmental impact and ecosystem services

Steps of the EIA procedure, according to the Polish Law		Main steps of the ES assessment for EIA	Detailed steps of the ES assessment for EIA
The investment proposal, the initial location		–	–
Screening – the initial diagnosis of whether an investment requires a full EIA procedure (including the EIA report)		–	The possibility of using ES concept to estimate which ecosystems will be impacted by an investment and an initial estimate of the changes in the supply of services
Opinion of the environmental protection authority (The General or Regional Directorate for Environmental Protection), together with the scope of the report		–	The possibility of mapping of ES by the nature protection authority
Scoping – the determination of the scope of the report (for investments for which the report is required)		1.Identify relevant ecosystem services 2. Prioritize relevant ecosystem services – (stakeholder consultations) 3. Define the scope and information needs of the ecosystem service assessment	1.1. Identify ecosystems the project could impact 1.2. Identify ecosystem services the project could impact 1.3 Identify potentially affected ecosystem service beneficiaries and benefits 2.1 Identify ecosystem services for which project impacts could affect the ability of others to derive benefits 2.2 Identify ecosystem services that are important to beneficiaries' livelihoods, health, safety, or culture 2.3 Identify ecosystem services for which beneficiaries have no viable alternatives 3.1 Delineate the precise ecosystem service impact assessment area (with relation to the scope set in the previous step) 3.2 Identify indicators of project impact on ecosystem services
COLLECTION OF INFORMATION	Description of the environmental impact within the project's scope (components according to the law or in accordance with the decision on the scope of the report)	4.Establish the baseline for priority ecosystem services	4.1 Assess current ecosystem service supply and demand 4.2 Assess sustainability of current ecosystem service demand
	Assessment of the projected (potential) impacts of different scenarios of the project (variants may concern: location / different technology and the business as usual (which in some cases may also have a negative impact)	5. Assess project impacts on priority ecosystem services in different scenarios (5b – optional) Value the project impacts on priority ecosystem services	5.1 Predict project impacts on ecosystem service supply based on at least 2 different scenarios 5.2 Predict project impacts on ecosystem service demand based on at least 2 different scenarios (5b.) Conduct the valuation based on the predicted impacts on ecosystem service supply and demand based on at least 2 different scenarios
	Impact assessment on Natura 2000 sites	5. Assess project impacts on priority ecosystem services in different scenarios (5b – optional) Value the project impacts on priority ecosystem services	5.1 Predict project impacts on ecosystem service supply based on at least 2 different scenarios 5.2 Predict project impacts on ecosystem service demand based on at least 2 different scenarios (5b.) Conduct the valuation based on the predicted

Designing solutions that minimize negative impacts and, if necessary environmental compensation	6. Mitigate impacts of project on priority ecosystem services	6.1 Design measures to mitigate loss and enhance gain in ecosystem service benefit
Public consultations (21 days)	–	Possibility to support public consultations with the results of ES assessment
Agreements / opinions of Regional Directorate for Environmental Protection/ Regional Inspectorate of Environmental Protection	–	–
Analysis of the collected material as well as proposals and comments from the consultation	–	–
Release or refusal to issue a decision on environmental conditions of the project and the explanations	–	ES may be included in the reasoning part of the decision (e.g. the results of the cost-benefit analysis)

„-" in the table means that in the method proposed by Landsberg et al. (2013) no main or detailed stage to which a step of the EIA procedure can be referred to has been identified

Source: authors' own work based on Landsberg et al. (2013) p. 34 and The act of 3rd October 2008.

the involvement of stakeholders and the assessment of the significance of the investment's impacts for affected communities.

Integrating ES to the EIA report

Ecosystem services are directly related to the ecosystem condition and its capacity to provide ecosystem services. In table 2, we marked grey environmental components which are related to ecosystems. The impact on the following environmental components is compulsory to be assessed within EIA procedure (The act of 3rd October 2008):

- biodiversity, flora, fauna, protected areas including Natura 2000;
- soil and groundwater conditions;
- water (water resources and water quality);
- landscape.

We integrated the EIA report and related type of ecosystem services assessment on the basis of the act of 3rd October 2008, sample reports, expert knowledge, and CICES 4.3 classification (table 2). Ecosystem services can be divided after Millennium Ecosystem Assessment into four main groups namely: provisioning services, regulating services, supporting services and cultural services, or according to CICES 4.3 into 3 main types: provisioning (P), regulating& maintenance (R) and cultural (C).

Table 2. The scope of the report and related type of ecosystem services

	EIA (information included in the report)		Ecosystem services
Environmental Components	**Sources of data on the current state of the environment**	**Information on the anticipated impacts of the various scenarios of investment at the stage of implementation/operation/closing**	**Ecosystem service type related to the component of the environment/does not apply +comment**
Waters (hydrological conditions and water resources)	• Flood risk maps • Environmental monitoring of surface water and groundwater • GIS database of Wetlands • Field measurements	• Change in the quality of water and its' chemistry (pH, BOD 5, COD, nitrate, phosphate, etc.). • Assessment of the possibility of bacterial contamination • Changes in physical conditions (transparency, suspensions) • Changing quantity of water resources	P R C
Land cover and soil (soil and groundwater conditions, agricultural suitability of the soil)	• Soil maps • Samples from Pits (rarely) • Residual water table (from literature or own measurements) • Digital Elevation Model (DEM) • Corine Land Cover • Orthophotomaps	• Land use change (area of the investment with soil sealing assessment) • Assessment on projected land degradation by increased density (soil loses fertility) • Assessment of soil condition under pollutant emissions and wastewater influence • Changes in physiography (analysis of DEM)	P R C
Natural resources (geological structure and mineral deposits)	• Geological maps and the register of deposits • Data on the geological resources and it exploitation • Central Geological Database of Polish Geological Institute – National Research Institute	Information of the increased exploitation of natural resources	Does not apply
Air (air quality)	• Data from State Environmental Monitoring (Kostrzewski, Mizgajski, Stępniewska, Tylkowski, 2014)	• Change in the emission of pollutants (dust, gases) • The results of modeling changes in air quality due to emissions	Does not apply Decreasing air quality will negatively affect the condition of the ecosystem and its ability to provide ecosystem services
Noise (acoustic conditions)	• Acoustic maps • Noise measurements	• The results of modeling the acoustic conditions • The increase in sound intensity (dB) • The increase in vibration	Does not apply Structural landscape elements may provide ecosystem service of noise reduction

Protected areas	• Central Register of Nature Conservation Forms • Geodatabase of Nature Conservation Forms	• Analysis of the negative impact of pollution on protected areas	P R C
Flora, fauna	• Flora and fauna inventory, • Data provided by The General or Regional Directorate for Environmental Protection • Maps of Ecological corridors by The Mammal Research Institute of the Polish Academy of Sciences • The Forest Data Bank	• Collisions with location of habitats of flora and fauna • Cutting trees and shrubs • Habitat destruction • The intersection of ecological corridors • The formation of barriers to animal migration • The impact of pollution of water, soil, and air on individual species of plants and animals • The disturbance of animals as an impact of noise	P R C
Climate	• Data provided by the Institute of Meteorology and Water Management – National Research Institute	• The forecasted impact of investment on the local climate, mainly related to the emission of gases into the air and change of land use for non-forest. At a local scale, minor impacts are identified	Does not apply Changing (topo) climate will affect the condition of the ecosystem and its ability to provide ecosystem services
Cultural elements (monuments, cultural landscape)	• Field visit • Register of objects of cultural heritage	• Impact of vibrations on historic buildings • The impact of air pollution on historic buildings	Does not apply Only ecosystems can provide ecosystem services
Landscape	• Field visit • Maps according to Kondracki • Geoportal	• Negative changes in the landscape • Introduction of invasive elements into the landscape	R P C
People (health conditions)		Impact on human health (mainly by exceeding noise standards, pollutants emissions)	Does not apply Ecosystem service beneficiaries

Components associated with the ecosystem for which EIA and ES integration is straightforward are marked grey

Source: author's own work.

The ecosystem services are only produced by the ecosystems. Therefore, we linked types of ecosystem services to the related ecosystems that may produce them. It should, however, be acknowledged that ecosystem service may be negatively affected by the investment and the capacity of ecosystems to provide services may be hindered. Moreover, many regulating services, such as air quality regulation, mediation of smell/noise/visual impacts or global climate regulation by reduction of greenhouse gas concentrations are

closely linked to the environmental components that are required by the law. However, if ecosystem services are to be identified, they should be located at the place of provision, i.e. in the ecosystem.

The data gathered to assess the current state of the environment in EIA may be easily used as an input data to construct ES indicators and proxies. The level of details of data collected for the EIA reports differs significantly depending on the localization and type on investment. The use of more detailed data relates to new investments and those located on the environmentally valuable areas.

Conclusions

The EU and national legislation have not introduced the obligation to assess the impact of the planned project on the potential provision of ecosystem services. The act of 3rd October 2008 does not specify what methods should be performed to assess the impact of the planned project on individual components of the environment. From a legal point of view, it is allowed to use the ecosystem service approach to performed EIA. From the methodological point of view, EA fits the EIA procedure and extends it. The practice of EIA clearly indicates the need to use modern methods and new approaches.

The results of this research indicate at which steps of the EIA procedures the ES assessment may complement and enlarge the impact assessment. We specified for which environmental components of EIA report the ES assessment is most suitable. We believe that the additional information resulting from the ecosystem services assessment may contribute to the more sustainable management of environmental resources and services.

The contribution of the authors

Katarzyna Tokarczyk-Dorociak conceived the original idea, did literature review, performed the integration of the steps in assessments of environmental impact and ecosystem services, analized the scope of the report and related type of ecosystem services (60%).

Marta Sylla did literature review, performed the integration of the steps in assessments of environmental impact and ecosystem services, analized the scope of the report and related type of ecosystem services (40%).

Both authors discussed the results and implications and prepared the manuscript at all stages. Both authors contributed extensively to the work presented in this paper.

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Mirosław **BRONIEWICZ**

ENERGY EFFICIENCY OF STEEL BUILDINGS

Mirosław **Broniewicz,** Prof. – *Bialystok University of Technology*

Correspondence address:
Wiejska Street 45E, Bialystok, 15-351, Poland
e-mail: m.broniewicz@pb.edu.pl

ABSTRACT: The aim of this paper is to investigate the environmental credentials of steel buildings and to present the environmental impact categories and values in a steel housing activity through a case study of steel office building. In this framework, a life cycle assessment (LCA) methodology was applied, which provides an understanding of the overall environmental performance of a housing construction. The relative influence of the service lives of different building components compared to the energy use of the buildings with a different energy efficiency is presented. As the analysis showed, recycling of construction waste becomes a critical issue, which can ensure a number of environmental benefits. The aim of this research activity was also to point out the need for an integrated approach in the design process, combining environmental performance assessment with structural calculations. Environmental impact assessment of the construction activity was carried out, following the inventory listing, in order to reach to useful conclusions on the environmental study of the project. Although steel and concrete proved to be responsible for the negative environmental impacts the ability of reuse and recyclability of steel has decreased the negative impacts of steel construction on environmental burdens.

KEY WORDS: steel buildings, life cycle assessment, energy efficiency

Introduction

Buildings are responsible for 40% of energy consumption and 36% of EU CO_2 emissions. Energy performance of buildings is a key to achieve the EU Climate & Energy objectives, namely the reduction of a 20% of the greenhouse gases emissions by 2020 and a 20% energy savings by 2020.

On 18 May 2010 a recast of the Energy Performance of Building Directive (EPBD) 2002/91/EC was adopted. This Directive, 2010/31/EU strengths the energy requirements for new and existing buildings. So, when a refurbishment is planning is important to plan also the improvement of the energy efficiency of the building. Major renovations of existing buildings, regardless of their size, provide an opportunity to take cost-effective measures to enhance energy performance.

A building is a complicated system with many sub-systems and built up out of many different materials. Alternative designs may have different material configurations and each of them may have different service lives. For reasons of comparison it would be good to calculate an impact per year of use. However, it is most likely to be very inaccurate to simply assume a service life of, let's say, 50 years, or perhaps 75 or 100 years. Also, it becomes difficult to compare building designs with relatively short service lives, with designs that may have longer service lives. It becomes even more complicated when we take into account that the building will be a combination of many different service lives. Because we cannot predict the future we can perhaps assume average expected service lives of subsystems with a certain distribution. What the influence will be of these assumed service lives and their distribution, combined with their specific environmental impact on the environmental impact of building as a whole, is the subject to be investigated in this case study "virtual office". For this reason, the virtual building will be divided in its elementary sub-systems ("building layers") for which basic alternatives, perhaps with different service lives can be used. The main focus is to study the influence of the materials impact due to the construction and demolition of the building and the intermediate replacements of building elements.

Environmental impact of the building

An impact of a building over its entire service life is assumed as the sum of one or more building elements, each with different service lives. The Annual environmental impact depending on the service life of a building might look like in figure 1.

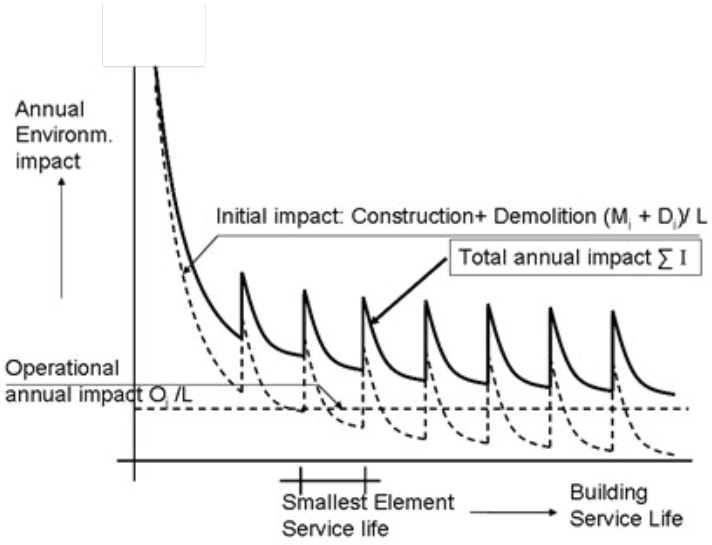

Figure 1. Annual environmental impact versus service life of a building with the influence of a recurring building element with a shorter service life

Source: (Blok, Herwijnen, 2006).

The total impact ∑I is the sum of the impacts related to all the needed materials and processes involved with the construction of the building (M_i) the materials and processes related to the demolishing of the building (D_i) and the materials, energy and processes related to the operation of the building (O_i).

The environmental impact of the building can be presented as:

$$\frac{(M_i+D_i)+O_i}{L} < R, \tag{1}$$

where:

M_i – initial impact of the building related to the materials and energy used in the construction of the building,
D_i – the impact of the building related to demolition,
O_i – operational impact over the whole service life of the building including energy and maintenance,
L – the service life of the building according to a Life scenario,
R – allowable maximum of the annual environmental impact.

In case when the building has not only a negative impact but also a positive effect for example by generating more energy than it uses (for example by photovoltaic cells) the annual total impact of a building with positive C2C (cradle to cradle) effects is presented in figure 2.

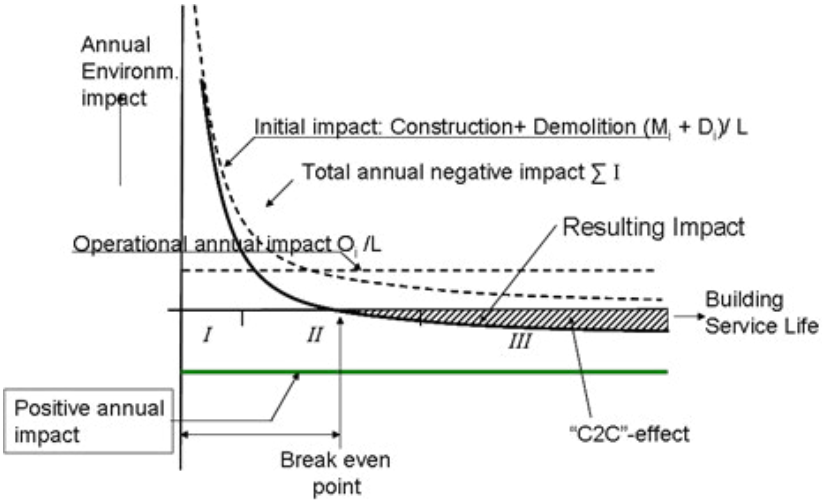

Figure 2. Total annual environmental building impact with positive "C2C" effect
Source: (Braungart, Mcdonough, 2002).

Because more and more the aim will be to realize zero energy buildings, the initial materials will become more and more important. Their relative contribution to the whole of the impact is likely to become bigger. The influence of the service life over which we depreciate these impacts, therefore will also increase.

Virtual model of the building

A very simple model of a virtual office building was used as the object of this study (figure 3).

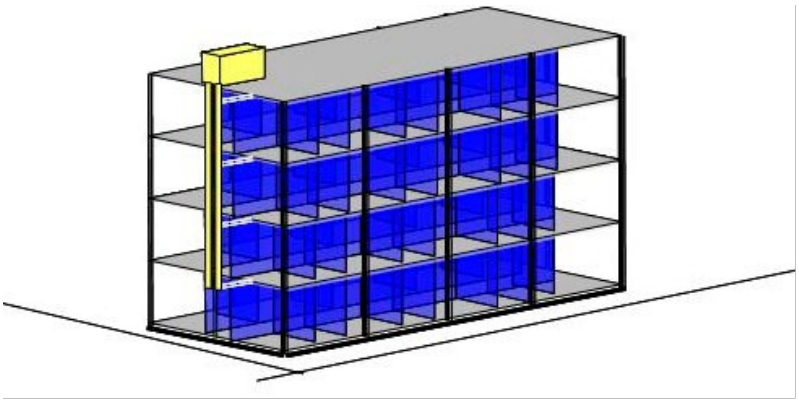

Figure 3. Virtual Office Building
Source: (Blok, WG1, Action C25, 2007).

It will be assumed that the different service lives of the building layers can actually be achieved. Whether or when flexibility is actual influential on the materials impact of a building could be an outcome of this case study.

The subdivision of the building layers and elements are presented in table 1.

Table 1. Subdivision of the building layers and elements

Building system	Building elements	Materials/ Alternatives
Structure	Columns Beams Floors (including Roof) Lateral Bracing systems	Steel structure Concrete structure (Timber structure)
Facade system	Glazing Window frames Closed window area's Thermal Insulation material	Aluminium curtain wall-systems (Brick in external wall) Thickness 50-150 mm, alternative materials
Roofing	Waterproofing Thermal Insulation Moisture barrier	
(Foundation)	Not into account yet	(Pile versus/ strip)
Infill /partitioning	Light weight partition systems Ceiling system Floor screeds	Light weight steel + plasterboard Lightweight clay fired bricks
Services	Material impact were assumed at a fixed amount	
Access	Material impact to be disregarded at this stage	

Source: (Action C25, 2007).

The overall dimensions of the building and relative figures which are used in the calculations are: length – 40 m, width – 15 m, floor to floor height – 3,5 m, the number of floors – 4, the number of persons working – 80, window openings – 25% of floor area, service life of a building – 80-year, ground floor area – 600 m^2, roof area – 600 m^2, foundation area – 600 m^2.

If, for example, a building layer skin, or façade, has a functional service life of 30 years and cannot be replaced because it is also part of the main bearing structure, it means that this layer is limiting the whole service life of the building to 30 years, despite the fact that other parts of the structure perhaps have a technical service life of 75 years.

The structure of the office building is a steel structure with pre-stressed concrete hollow core floor slabs and integrated steel beams. The dimensions of beams and columns of the steel structure is given in table 2.

Table 2. Steel structure materials

Steel column axis B	HE240A	60,3 kg/m
Steel columns axis A and C	HE220A	50,5 kg/m
Steel beams B	THQ 180×5-290×30-500×20	164 kg/m
Steel beams axis A and C	THQ 180×5-190×25-400×12	90,8 kg/m
Connecting members	HRS 120×5 on average	20 kg/m
Lateral bracing members	HRS 150×8	35 kg/m
Hollow core floor slabs	HVP 200 mm	270 kg/m^2
Concrete structural layer	50 mm concrete	100 kg/m^2

Source: (Action C25, 2007).

Total calculated amounts of steel for the virtual office: 105 Tons. Total amounts of concrete in the steel structure (floors): 810 Ton = 345 m^3 concrete. Building weight per gross floor area: 915.00/ 2400 = 381 kg/m^2.

Used Material and Energy data information

The material data, the CO_2-eq, was obtained from different sources. Too limit the complexity of the work and to simplify the case study, data was obtained from existing databases and/or the data obtained from material producers. For different locations and perhaps future studies these data can be adapted to local circumstances.

For structural steel, produced in Europe, the following figures can be found in table 3. The figures are based on Dutch product information on steel (MRPI, 2003).

No detailed LCA calculations have been carried out for the subsystems. For example, the construction methods and the way the components are assembled and installed to form building elements was ignored. This means that the data quality is rather rough, for example not high enough to compare different material solutions in great detail, or to exactly calculate the CO_2 burden for a given solution with great accuracy. Because here the main study focuses on the relevancy of the different service lives on the total CO_2 impact, this poses no direct problem. Also, the assumed service lives themselves are estimates. So even more exact material data cannot provide a much higher accuracy. The goal of the investigations is to see what the trends are in the relative influences of different building layers, compared to energy use (for different energy efficiencies) this approach gives a sufficiently clear insight.

Table 3. Impacts of Construction Steel in Building Construction (MRPI)

Index		Measurement unit (columns, beams etc.)	Heavy steel (partition walls)	Light weight steel
Humane toxicity		kg 1.4 DB	2,9E+01	8,5E+01
Abiotic depletion		kg SB	2,8E+00	6,9E+00
Ecotoxicity	water	kg 1.4 DB	5,7E+00	1,6E+01
	sediment	kg 1.4 DB	9,2E+00	2,7E+01
	terrestrial	kg 1.4 DB	1,7E-01	1,7E-01
Acidification		kg SO_2	3,0E+00	3,0E+00
Eutrophication		kg PO_4	4,2E-01	4,2E-01
Global warming pot.		kg CO_2	4,8E+02	4,8E+02
Ozone depletion		kg CFK11	1,1E-04	1,1E-04
Energy		MJ	7,30E+03	1,70E+04

Source: (Action C25, 2007).

Other various data for building materials which were incorporated in the developed spreadsheet used for this case study was obtained from (Malmqvist, Glaumann, 2007).

The amounts of CO_2-eq for the materials used were calculated and aggregated to totals per building component, subsystem, or building layer. The results of kg CO_2-eq are given in table 4.

For this virtual office building case study, no specific location was chosen. Although for real buildings the location is very much influential on the energy consumption, for the virtual office building the location is unknown and the energy consumption therefore is also very much fictitious.

For this reason, it was decided not to calculate possible energy consumptions based on local climate, thermal resistance, thermal comfort and indoor climate in great detail. Instead of this, a comparison was made based on different assumed energy concepts. For these different building configurations, the energy consumption per square meter was estimated, and these estimates were used in the different life scenarios of the Virtual Office Building. Here the three most extreme energy concepts are given:

- Virtual Office Building with low thermal insulation and high energy consumption. (For example, old or not upgraded existing building stock). The energy consumption was based on 300 kWh/m^2/A.

Table 4. The amounts of CO_2-eq for the construction materials

Building element	Materials	Amounts	Burden	Totals
		[kg]	[kg eq CO_2]	[kg eq CO_2]
Structure A (steel)	steel	104.988	113.597	
	concrete reinforced	810.000	106.920	
	in situ layer	345.000	45.540	266.057
Structure B (concrete)	concrete reinforced	1.500.170	198.022	198.022
Internal partitions A	Light weight steel	1.368	1.481	
	gypsum board	15.484	4.645	
	rockwool	722	1.055	7.180
Internal partitions B	Clay fired bricks	33.540	4.773	6.573
	plasterboard	16.512	1.800	
Floor finish screed	sand cement	192.000	25.344	25.344
Ceiling system	particle boards	12.000	1.344	1.344
Facade system A	glass (double)	7.267	4.397	
	aluminium	1.836	20.449	
	brick	231.000	40.177	
	plasterboard	4.158	1.247	
	Light weight steel	378	409	
	insulation Rockwool 50 mm (Also alternative thicknesses were used)	1.617	2.361	69.040
Facade system B	insulation Rockwool 200 mm	6.468	9.443	
(3 double glazing)	Glass (other materials as A)	10.901	6.595	78.321
Roof insul. finish	expanded polystyreen (80mm) (Also alternative thicknesses were used)	792	1.428	1.428
Groundfloor insulation	expanded polystyreen (80 mm)	720	1.298	1.298

Source: (Action C25, 2007).

- Virtual Office Building with energy consumption in accordance with current energy standards. (For example, new office buildings). The energy consumption was assumed to be 90 kWh/m^2/A.
- Virtual Office Building with very low energy consumption. (For example, buildings using "passive house" concepts). The energy consumption was assumed to be 15 kWh/m^2/A.

Results of the research

As could be expected for (old) buildings with a high annual energy use, the annual CO_2 impact is almost entirely depending on the (high) annual energy use for the operation (mainly heating and/or cooling) of the building.

Overall, it can be said that the influence of service lives of the infill partition walls (taken as 20 year), and the services and building envelope (40 years) is relatively small. It is not new, but building codes and building energy standards can strongly reduce the CO_2 production and that upgrading and increasing the energy efficiency of existing building stock can be very effective in terms of CO_2 reduction.

The expected annual CO_2 impact of this old virtual office building configuration, with its assumed energy use lies approximately between 300 and about 240 Tons eq CO_2. From this, based on the assumed average use of 80 persons staff, this would amount to 3,8 Ton P/A to 3,0 Ton P/A (eq CO_2 per person per year). Again, it should be noted that these figures are just estimates with a relative value, rather than an absolute value, due to the assumptions that were made.

One step further, of course, is to decrease the annual energy use and increase the energy efficiency. It was assumed that with passive concepts, and further improvements on insulation (thickness of 200 mm was assumed) as well as using triple glazing solutions, use of highly energy efficient services, the energy consumption could be reduced to a level of 15 kWh/m^2/A. It can be clear that by drastically reducing the energy impact, the resulting overall CO_2 burden almost entirely depends on the materials and the service lives of the building and its elements.

Because the impact of the materials is relatively high in buildings with high energy efficiency the effect of different service lives was studied for this Virtual office configuration with this assumed very low energy use. In the above scenarios, the assumed service lives of envelope (facade and roof) of 40 years and infill partition walls of 20 years are relatively long. To see what the influence of changes in the service lives would be, a scenario with, just the opposite: relatively short service lives was studied. As the results show the CO_2 impact rises depending on the service life of the building from 30-15 Tons eq CO_2/A for service lives of 25 years to approximately 50-25 Tons eq CO_2/A for service lives of 40 years.

Conclusions

In general, it can be said that for "Virtual office Buildings" built according to current energy standards, the overall CO_2-impact mostly depends on the annual energy use. The initial material influence remains comparatively small for "Virtual Office Buildings" that can achieve a service life of approximately 15 to 20 years or more. For buildings with shorter service lives, the shorter the service life will be, the more governing the material impact will become.

For future buildings with much lower energy consumptions the material impact becomes much more important and cannot be ignored when minimizing the CO_2 impact. Especially the building layers with shorter service lives can have a big influence on the overall CO_2 impact. Though not studied in this case study it can be expected that this trend will also be seen in other impact categories.

The influence of the building structure (causing the highest amount of initial CO_2 impact) still remains rather small if service lives of 20 years or more can be achieved. The difference between a steel structure and concrete structure configuration in the case study also was rather small.

For building elements with short service lives it becomes very much worthwhile to minimize CO_2 impacts by using materials and solutions with a low CO_2 impact.

In achieving CO_2 neutral building, the material impact cannot be ignored. To compensate for the initial materials, this annual positive C2C effect, the compensation or storage of CO_2, needs to be much higher than the annual energy use of the building. With current possibilities to generate energy or compensate CO_2, it will be, though it is possible, very difficult to achieve a CO_2 neutral building.

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Włodzimierz KACZOCHA • Jan SIKORA

ETHICAL VALUES AND NORMS IN THE MANAGEMENT OF ATTRACTIVE NATURAL AREAS

Włodzimierz **Kaczocha**, Prof. – *European Univeristy of Business in Poznan*
Jan **Sikora**, Prof. – *University of Zielona Gora*

Correspondence address:
University of Zielona Gora
Licealna Street 9, 65-417 Zielona Gora, Poland
e-mail: sikorajan@interia.pl

ABSTRCT: Because of their natural and anthropogenic values, attractive natural areas are protected by law. The protective activities are connected with the proper management of these areas. The paper proposes the thesis that ethical values and norms referred to ecology are not taken into consideration in the management of attractive natural areas, both in theoretical and practical terms. The study presents attractive natural areas as a valuable common good, and discusses a place of values and norms in ethics. The project of ethical concept of management in these areas containing the adopted values and moral norms that refer to ecology was also formulated.
The paper was written based on the scientific literature and official documents.

KEY WORDS: attractive natural areas; management; values and standards

JEL: R11, R52

Introduction

Naturally valuable areas are one of the forms of nature protection in our country. They contain not only sociably acceptable natural values but also the anthropogenic ones. It can therefore be recognized that these areas are a common good which society and its authorities should be especially concerned for. An example of intentional and conscious caring for the conservation of nature-value areas is their proper management, taking into account specific ethical standards. The aim of this article is to present a design of the ethical concept supporting the management of these areas. In this concept, basic ethical values and specific moral standards are recommended, which should be followed by institutions and their employees dealing with the management of valuable natural areas. To write this article, the appropriate literature on the subject was used, both scientific and official.

The areas of natural value as a common good

When defining nature-value areas, it can be stated that these are areas characterized by high biodiversity, where their resources must be managed in a well thought-out and sustainable way. They are geographically separated legally protected places due to an interesting landscape and distinctive natural values. The currently established forms of protection of the countryside in Poland are: national park, landscape parks, nature reserves, protected landscape areas, Natura 2000 areas, nature monuments, documentary sites, ecological sites, nature and landscape complexes as well as areas of plant, animal and mushroom species protection (The Act of 16 April on nature conservation). Naturally valuable areas are created in order to stop the degradation of the natural environment, maintain ecological balance, conduct scientific research and environmental education as well as to maintain recreational and natural values to ensure the conditions of good recreation (Sikora, 2010). According to the Act on Nature Conservation of 2004, the task of valuable natural areas is to: 1. maintain ecological processes and ecosystem stability; 2. preserve biodiversity; 3. preserve the geological and paleontological heritage; 4. ensure the continuity of existence of plant, animal and mushroom species and their habitat, by maintaining or restoring them to an appropriate conservation status; 5. protect landscape values, greenery in towns and villages and trees; 6. maintain or restore of natural habitats, as well as other natural resources, creations and components of nature to an appropriate state of protection; 7. shape appropriate human attitudes toward nature

through education, information and promotion in the field of nature protection (Art. 2 p. 2, The Act of 16 April on nature conservation).

Therefore, naturally valuable areas have these values in question, which are subject to legal protection and are socially desirable and respected. Therefore, one can agree with the statement of K. Zimniewicz that all forms of natural areas are a common good (Zimniewicz, 2014). If so, it is up to society, local communities and individual people to preserve and protect this common good.

According to W. Kaczocha, caring for the common good, understood as a set of social and ethical values, under democratic conditions, depends on the acceptance of these values by the majority of citizens and by a sovereignly elected political power, because these are purposeful values, which are important for society. Citizens and political authority seek to realize the common good through appropriate democratic policy principles that relate to the various spheres of social, economic and political activity in accordance with established and valid values (Kaczocha, 2015). Therefore, if we include naturally valuable areas as part of the common good as a physical value, we must, as it has been previously stated, manage properly (professionally) taking into account certain ethical values and standards.

Values and norms in ethics

In the article we try to present a design of an ethical concept, containing a set of values and norms regulating attitudes and actions of people managing areas of natural value. If we find that a state of affairs is valuable, we consciously or unintentionally adopt certain values indicating the value of this state of affairs, which we respect in our actions. The adopted values become the goal of human life or professional activity, around which norms are formulated indicating the ways to act in pursuit of these values. Values contain general objective and subjective content, while norms are drafted in the form of directives (as obligations and prohibitions), have specific content, recommend appropriate behavior or prohibit specific behaviors. If a state of affairs is valuable to us because of the value we respect, it means that it is adequate, or in other words it objectifies (or materializes) the content of values. Thus, the values are determined by goals – the meaning of life and action, and are the basis for our appreciation (evaluation) of people, social relations, cultural products and the world of nature.

When, in order to realize a given value, we act in the same way as moral or professional norms dictate, our actions are evaluated positively in a moral and professional sense. In such situations it is said that the very content of

values is valuable to us (in its intellectual sense), as well as its objectification (or implementation) as well as our actions, which make a value come true.

Here the question arises of where come from the values and norms in the ethical doctrines that relate to the "whole of life", i. e. all its aspects and the question about the origin of values in professional codes of ethics. In answering this question, it should be noted that the authors of such codes take over certain values from ethical doctrines. That is to say that a set of values is derived from theological doctrines or from a philosophy developed by a particular thinker, or within a specific philosophical school. Without going into detailed considerations about the important issue of how values are understood and how they exist, we can conclude that heteronomical (or religious) schools of ethics take over values that are theologically justified, that they have been passed on by God (in the same way also moral norms) and by virtue of the divine message they should be respected by all believers of a given religion. It can be metaphorically said that heteronomical ethics have a "strong" meaning in the sense that they do not allow values and norms to be relativized, i.e. their relative validity depending on the particular goals of people.

In autonomous (secular) ethics, values are justified philosophically so that free human reason is the source of all values and norms (such was a view of I. Kant in the eighteenth century) or experience and reason together are fundamental attitudes to devise norms and values (this assumption was and is still proclaimed in utilitarian ethics). Once again it is useful to use a metaphor here that autonomous ethics have a "weaker" effective power, because values and norms in practical life are usually relativized due to particular individual or group interests.

An autonomous ethics without assumptions, which does not refer to philosophy, includes Tadeusz Kotarbinski's "independent ethics". He developed, among other things, the concept of a "trustworthy guardian", who, led by the obligation of conscience, helps others in a situation of distress, without claiming compensation, for his or her conscience commands to provide help to other people if they are in need (Kotarbiński, 1966). Such an attitude of a guardian as a value and a norm is suggested in our ethical theory, addressed to people managing goods, especially valuable in culture and natural assets. We therefore broaden the understanding of a trustworthy guardian, who also directs his or her care towards goods of value in culture and nature. We are convinced that this broadening of caring remains in the "spirit" of this Polish philosopher, ethicist and logician who demanded human respect for all creatures in the world within the scope of our activity (Kotarbiński, 1966, p. 34).

In view of the recommendation of the described attitude for people managing valuable natural areas (i. e. national and landscape parks, nature

reserves, etc.), next to the name of managers of employees with appropriate education (technician, engineer, etc.) or employees in appropriate positions (manager, forester, gamekeeper, guardian, etc.), we propose to adopt a general name for all employees –nature conservation officers or park/reserve guardians, etc., of course, with the official preservation of professional titles, degrees of education and position held (for example, in the working environment it would be well heard, especially when visitors or tourists are present, when we introduce ourselves as the manager of the reserve or a park, forester, park guardian, etc.).

A draft of the ethical convention on the management of valuable natural areas

A set of three ethical values

A set of three ethical values, which we recommend within the framework of our project, is based on heteronomical ethics – Catholic ethics. These values have, as it has been mentioned above, a theological justification. The four further values that we take from autonomous ethics, with the exception of Kotarbinski's ethics, are philosophically justified. To avoid the accusation of merging values derived from different ethics into a single concept (such mergers are called eclecticism and they are done to formulate a position that suits us subjectively), we explain that the recommended values, although they are justified differently, may be understood as identical or close to meaning in terms of their content.

In every ethical doctrine that defines (standardizes) the whole of human life, and in every ethical conception concerning an appropriate fragment of human life or action, some fundamental value is assumed. We suggest to accept such a value from Catholic ethics, which is the existence of nature as a "integral system", as Pope Francis states in the encyclical *Laudato si*. It is an integral whole in material meaning, because it exists objectively; at the same time, it also exists in the subjective (spiritual) sense as a *misterium*[1], which should be "admired in a leaf, in a path, in dew ..." (Franciszek, 2015). He writes that "The human ecology is inextricably linked to the concept of the common good, to which every human person belongs, "social welfare and security and social peace" (Franciszek, 2015, pp. 136-137). It should be emphasized that such an approach to ecology, which assumes the protection and development of nature as a common good, was formulated so clearly for

[1] Misterium in Latin means mystery. In theology, a term referring to a salvific event – the coming to earth of Christ the Son of God.

the second time in Catholic ethics and theology. For the first time, the approach of the Catholic Church to nature as a common good was presented in the Catechism that "animals as well as plants and inanimate beings, are destined for the common good of humankind in the past, present and future. The enjoyment of wealth (of nature) … cannot be separated from the observance of moral requirements" (Katechizm, 2002).

It should be remembered that John Paul II in the encyclical entitled *Solicitudo rei socialis* (Jan Paweł II, 1994), while dealing with the moral aspects of contemporary social and economic development, wrote that "in respect of the visible nature we are subjected not only to biological laws but also to moral ones, which cannot be crossed with impunity". He formulated a moral norm requiring "respect for the creatures of the visible nature" (Jan Paweł II, 1994, p. 64-65), which requires respect for these natural and necessary biological laws.

Because of the presented views we assume that the primary value, let us repeat it, is to preserve the existence of nature as an integral system created by God. The next two values are that nature is a common good for people and that nature is a moral object demanding ethical recognition, as John Paul II wrote.

Four values are recommended in autonomous ethics, which are close to Catholic values in terms of content. In the 1980s J. Aleksandrowicz developed the concept of "ecological conscience" as the expression of the "new humanism of tomorrow", which obliges people to protect all ecosystems to "preserve ecological balance" i.e. to guarantee the existence of natural harmony. He wrote that what serves the preservation and development of ecosystems is "good" in an ethical and biological sense (Aleksandrowicz, 1988). Therefore, it can be considered that such an understanding of ecological conscience is an ethical value.

Hans G. Gadamer (co-creator of philosophical hermeneutics) wrote that "in the face of modern science with its range of technical applications that generate both benefits for people and evil, and "decompose nature –we must take on an increased responsibility", because it is now a question of "the whole human existence in nature, the task of controlling the development of human potential and human control over the forces of nature, so that it has not been ravaged and destroyed, but remained together with our existence on this earth. Nature can no longer be seen as an object of exploitation. It must in all its forms appear to be experienced as a partner, but this means that it must be understood as the other one, with whom we live together" (Gadamer, 1992). The first sentence is a warning and demands responsibility on the part of people for the preservation of nature as a whole, and it also presents an ontological view that the whole of human life (existence) from

birth to death is situated in nature; therefore, if we consider human life to be a cultural and existential value, we must take the view that nature is also a value in this dual sense. The second sentence of the philosopher should be understood in the anthropological sense, being a partner of humans, is this "other one" in the subjective sense, although it does not have a subjective consciousness. The author did not explain in detail the content of the quoted second sentence. He was probably aware that it was we who were responsible to create partnership relations with nature, in the same way as we create them with others, and the understanding of the other one is to learn it slaws of development and accept the right to maintain life. Thus, learning about the laws of nature development is not only a cognitive value (i.e. the goal of science), but it is also an ethical value, because without recognizing the laws of nature we will not understand its richness and preserve its substance, i.e. its existence.

At the end of the second paragraph it is also developed the idea of a trustworthy guardianship in relation to valuable natural assets, which is also the value of the autonomous ethics. In our subjective opinion, this value and also a norm of professional activity is accepted and implemented "on a daily basis" by almost all employees responsible for the maintenance of valuable natural assets, when in situations of danger – natural or caused by humans – they protect these assets without asking for payment and promptly repair the damage caused, without knowing that Kotarbinski formulated an ethical concept of a guardian. At the same time, the ethical imperative of guardianship as a professional duty, in most such situations, takes the issue of remuneration for saving nature's assets to the background. To put it more forcefully, when repairing damage, we are dealing with a traditional understanding of employee dedication, for which above all ethical praise is expected (as it is known the employees' superiors usually forget about it).

We have adopted seven values, accompanied by appropriate justification, including the principal value, i.e. the maintenance and protection of nature as an integral state. As can be seen, these values refer to the whole natural ecosystem, except when some goods are used. Then it is the user's ethical duty to rebuild or reproduce an ecosystem that is depleted by its exploitation, as it is done by foresters after cutting down a fragment of a forest. What remains, however, is the issue of using non-renewable natural resources, which cannot be recreated. We are not dealing with this issue because it is not the subject of our deliberations (Devall, Sessions, 1994).

When it comes to valuable natural areas, there is no doubt that all described ethical values refer to them, in other words, the whole pool of seven values is realized on their territory through the activity of appropriate institutions managing them and individual people. It can be said that it is the

institutions and people who act as trustworthy guardians. Thanks to the material realization of values by institutions and people valuable natural areas exist at all (of course, valuable areas of any form are created according to appropriate biological, natural and legal criteria). In the first part of the article we have written that values contain abstract and objective content, without any indication of how to implement them. Values generally define goals – the meaning of life and general objectives, as in the case of described values of professional activity. If we accept values for religious or intellectual reasons (or for both reasons together), so if we are convinced of them, we accept an ethical obligation (often called duty in ethics) to implement them through the implementation of commandments, i.e. moral norms, which determine how we should act. Due to such a nature of the norms, their content is not justified, but it is edited in the form of orders as to how to deal with specific situations, what partial tasks should be performed in order to realize the respected values. In short, norms are formulated because of the intention to realize values.

A set of recommended moral norms

Specified norms have a subjective and objective scope of application, i.e. they should manage the activities of institutions and at the same time the actions of individual employees and volunteers, dealing with the management, protection and maintenance of valuable natural areas.

1. We suggest that prudence should be accepted as a prime norm (it was recommended by Aristotle), which obliges anyone who accepts these values to consider carefully in-depth analysis of the proposed actions, whether as a result of their implementation there will be any damage or threat of damage; if damage is expected to occur, it is a moral obligation of the person designing individual, group or institutional actions to refrain from implementing or redesigning actions aimed at eliminating potential hazards.
2. The second norm recommends systematic vocational education in the sense of having appropriate theoretical competences, or acquiring knowledge and skills from experienced people (preferably from both sources), competences necessary to practice professional prudence.
3. The third norm requires that the common good, which is valuable natural areas as an integral whole (systems), must be preserved in the best state of existence; the realization of the first (prudence) and fifth norm (individual and collective professional activities) is a prerequisite for the fulfillment of this norm.
4. The fourth norm obliges employees who maintain valuable natural areas to publicly disseminate these values, in particular the view that all

nature, including its valuable areas, are material and cultural values as a common good.

5. The fifth norm requires continuous professional activity to maintain the existing natural balance in areas of natural value and the principles of their sustainable development.
6. Another norm obliges individual employees to form an ecological conscience, which requires the protection of natural assets in the areas mentioned above and obliges them to accept individual responsibility for the damage caused, despite the practice of the norm of prudence.
7. The subjective (individual) expression of ecological conscience is the attitude of a trustworthy guardian towards the whole and particular natural assets. However, the attitude of such a guardian cannot be commanded by anyone from outside because it is a sovereign decision of the individual. Thus, this norm does not have prescriptive status and it can only be voluntarily approved and applied.
8. The eighth norm prescribes subjective treatment of individual natural assets in a valuable area as if they were like us humans, entities that live and die according to their own biological laws; through such subjective treatment it is expressed the ethical "respect for beings of nature".
9. The last norm requires employees to practice personal courage (in Greek ethics there was the virtue of bravery) in any situation where there is a danger from people that there will be some kind of destruction in a valuable natural area; the implementation of this norm must also be applied to employees in case of threat from institutions, especially economic ones, which, due to their particular economic interests, seek to limit territory and assets of valuable natural areas.

Conclusion

At the end of the discussion, we would like to point out that the formulated project of the ethical concept relating to the management of valuable natural areas overlaps in part with the values of ecological ethics proposed by the authors (Kaczocha, Sikora, 2016). Among other things it is the same understanding of the values of ecological conscience and natural ecosystems, which are an important element of the idea of sustainable development. The values of ecological ethics covered in the article, as well as moral norms helpful in the management of nature in general, and especially valuable natural areas, should be accepted and implemented not only by institutions responsible for these areas, but also by every employee and by all intelligent people. Therefore, it is extremely important to raise the ecological awareness of the

society towards understanding, assimilation and dissemination of appropriate values and norms of ecological ethics. Such educational activities should be supported not only by employees of state forest institutions, national parks, landscape parks, nature reserves and other protected landscape areas, but also by educational institutions and social ecological organizations.

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ENVIRONMENTAL POLICY AND MANAGEMENT

POLITYKA EKOLOGICZNA I ZARZĄDZANIE ŚRODOWISKIEM

Piotr Jacek **BIAŁOWĄS**

REORGANIZATION OF THE ENVIRONMENTAL MANAGEMENT SYSTEM IN THE PROCESS OF MERGERES – PRACTICAL ASPECTS

Piotr Jacek **Białowąs,** PhD, Eng. – *Wrocław University of Economics*

Correspondence address:
Wrocław University of Economics
Komandorska 118/120, 53-345 Wrocław, Poland
e-mail: piotr.bialowas@icloud.com

ABSTRACT: The aim of the article is to present a way to reorganize the environmental management system in the situation of merging companies. This problem was presented on the example of five energy sector companies, which as a result of the consolidation process formed one entity with the group structure. The article is of a practical nature mainly due to the presentation of the implemented principles of assessment of environmental aspects as well as the presentation of the requirements of the new environmental management standard.

KEY WORDS: company consolidation, mergers, acquisitions, environmental management system

Introduction

The analysis of the functioning of most of the world's economies allows one to see clearly many characteristic phenomena. These include, first and foremost, the increasing role of Value Businesses Management in increasingly less stable market conditions. This may be linked, inter alia, to the dynamically growing role of the financial markets as well as to the role of capital itself in business management. In recent years it has become evident that businesses are using different concepts to increase efficiency and reduce operating costs. Undoubtedly, these include the use of outsourcing concepts or the radical overhaul of organizational structures, most often linked to employment restructuring. One of the most common activities that has gained in importance in recent years, due to its universality, is the consolidation of economic entities[1]. In such case, the effects of consolidation related to the increase in the value of an enterprise are visible, inter alia, as a result of economies of scale and market share (for example: Białowąs, 2015a, p. 234-243; Białowąs, 2015b, p. 45; Suszyński, 2003, p. 276-288). Consolidation of entities, besides many easily achieved effects, also results in a number of cost-generating effects. This is due to, for instance, the need to arrange organizational structures after consolidation, unification of management systems with particular emphasis on standardized systems and elimination of duplicate functions. When talking about cost reduction and radical restructuring processes, undoubtedly cost-effective environmental management systems can be questioned here. However, given that commercial organizations must meet many formal and legal conditions, it may be true that the role and shape of environmental management systems is changing, but their functioning in enterprises is not notably limited even in the case of radical restructuring processes.

The purpose of this article is to assess the impact of organizational changes resulting from the merger of companies on the operation of a standardized environmental management system. The issues discussed in the article will concern the case of consolidation of five companies operating in the energy sector[2].

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1 There have been the entities of the energy sector to be mentioned as examples of the biggest consolidation processes concerning Polish organizations in recent years.

2 The article is based on the personal experience of the author, who was the strategy director of the Lower Silesia concern and was responsible for carrying out the first project in Poland in the electricity distribution subdivision, devoted to redevelopment and certification of an integrated management system, which was an element of the environmental management system.

General characteristics of the environmental management system

It can be said that every company operating on the market has an environmental management system[3]. This system can be more or less effective and, consequently, cause a greater or lesser impact on the environment. Undoubtedly, the environmental management effectiveness of the organization complies with the ISO 14001:2015 system. Furtermore, the consistent and perfecting actions taken in the coming years are aimed at reducing environmental impact (in line with the idea of the afore mentioned standard). The main mechanism by which the system should operate is the management of the environmental aspects. The environmental aspect recognizes any effect of the organization's processes that causes changes in the environment of the organization, both unfavorable and positive. Among examples of negative environmental aspects are waste, all kinds of organized and unorganized emissions, water and electricity consumption etc. An interesting example of a positive environmental aspect is water oxidation in a hydroelectric power plants as a result of passing through a turbine. In accordance with the requirements of the system, any organization wishing to have a system compliant with the requirements of ISO 14001: 2015 should identify environmental aspects (the current standard does not require the organization to have a procedure for identifying these aspects as it was required in its earlier version), make inventory and impact assessments, take measures to reduce the impact of those aspects that have the greatest impact on the environment.

It should be noted that the new standard attributes the most significant environmental aspects to the greatest risks of an enterprise, which seems to be in line with modern organizational management trends[4]. The simple and logical mechanism on which the standard was built alongside its other formal requirements regarding the internal audit system, identifying objectives, the build-up of pro-quality awareness, the formulation of environmental policies and the mechanism of continuous improvement, all of these lead to environmental issues systematization at the microeconomic level (Pochyluk, Grudowski, Szymański, 1999, p. 51-162). Standard requirements have been in recent years of evolution (the last change introduced in the standard took

3 This is not a place for a system that complies with specific requirements (e.g. norms). Formulating this concept, the author has the power to think of such functions as in any business, such as waste management or compliance with legal requirements.

4 The necessity of paying compensations because of negative environmental impact can be a source of significant reduction in the value of a company, public companies listed on a stock exchange in particular.

place in September 2015). The most important changes include enhancing the role of the environmental management system in the strategic planning of the company, the greater commitment of the organization to influence its suppliers in terms of environmental protection, which is particularly important in view of the intensification of outsourcing processes. It is important to bear in mind that economic practice has accused the authors of an anachronism in matters of documentation system. Over the years before 2015, the requirements of the ISO 14000 series, which was the domain of any other standardized system, were centered on the records in the documentation confirming the existence of the events. The permanent development of information techniques and information technology, their spread in even small organizations has resulted in many records being reflected in information systems. Therefore, in the new standard, the authors rightfully departed from using the terms "documents and records" in the documentation for the sake of a new term, namely „documented information". This also makes it easier to integrate with other standardized systems.

An important element to note is the lack of standardized criteria for assessing the importance of particular environmental aspects identified. Liberal regulation in this area forces the functioning of differentiated standardized environmental management systems in enterprises, in particular in range of their effectiveness. It is one of the main elements that affects the need to modify the environmental management system during the processes of merging business entities. 3strThe lack of standardized criteria concerning the assessment of the aspects causes different organizations to have diversified systems, despite being evaluated as conforming with the requirements of the same standard in the wake of their certification process. It is worth emphasizing, however, that even, possible to occure in different organizations, extremely different efficiency of systems, resulting from restrictive or liberal criteria of their evaluation, the sole fact that actions were taken to reduce the impact on the environment should be regarded as very beneficial. Nevertheless, it should be borne in mind that as much as the aspects may differ, the criteria for their identification must be transparent and quantifiable (Whitelaw, 2004, p. 4).

Changes in the functioning of the environmental management system – case study

As mentioned earlier in this article, consolidation of an organization, regardless of the number of entities being part of the new structure, results in taking a number of adjustment actions. In this case, the consolidation process is understood as a merger of two or more companies, for example as a

result of a merger or acquisition. In the illustrated example, it is significant that as a result of the merger of five independent companies, one legal entity with a corporate structure was formed – former independent companies became subsidiaries of the consortium. Further conclusions will be made on the basis of an analysis of the actions taken as a result of the consolidation of five companies from energy sector[5]. A simplified model of changes in the functioning of entities is illustrated below.

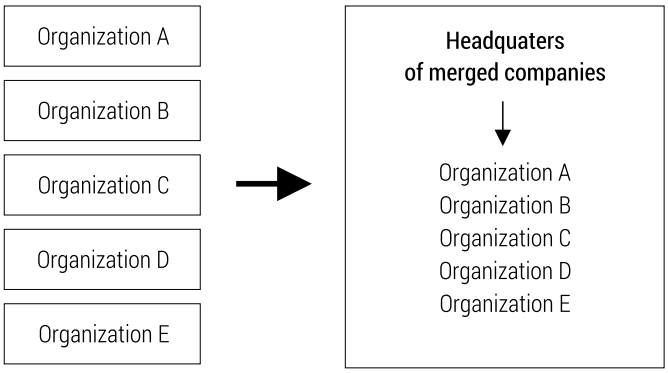

Figure 1. Changes in the functioning of entities before and after the consolidation

Source: authors' own work.

Up to the moment of the merger of five companies, they were fully autonomous in the design and implementation of pro-environmental policies. Although each of the five organizations under review went through formal third-party audits for conformance to the ISO 14000 standard and was certified for compliance with the norms, a detailed analysis of the system before the consolidation indicated a number of differences in system performance.

Among the most important ones are:

- Different number of environmental aspects and varied criteria for qualification of significant and insignificant aspects.
- Diverse policy in reducing environmental impact.
- Diverse number of environmental management programs.
- Diverse environmental objectives.
- Diverse performance assessment based on the system of indicators.

[5] The necessary condition to consolidate companies was a government consolidation program for the electrical power enineering sector, which, despite many modifications and evolutions, has been ongoing to date.

The above defined differences are all of greater importance because the researched organizations were characterized by similar processes due to their actions in the same sector. According to the author, this is a natural phenomenon and it stems from the nature of the requirements that make it possible to shape the system freely. However, from a point of view of the effectiveness of the system, with no boubt must it be recognized that these systems, operating in the same organizations, differed significantly. Examples of detailed differences in the criteria for assessing environmental aspects for the two organizations are presented in table 1 and table 2.

Table 1. Criteria for assessing environmental aspects in the examined organization A

Impact assessment *	Validity for the organization assesment*
A – scale of influence	E – the impact of the law (including decision coverage, permition, etc.)
B – impact severity	F – the impact of interested parties (including complaints and social reception of organizations)
C – probability of occurrence	G – economic impact (fees and environmental costs)
D – duration of impact on the environment	H – technical feasibility of changing influence (market availability)
	I – the possibility of a financial change of influence (generating appropriate funds)
	J – organizational capacity to change influence (including impact on other processes and activities)

* scale rating 0-3
Qualification: 0-10 – irrelevant, 11-20 – moderate, 21-30 – significant

Source: authors' own work based on the examined enterprise data.

Table 2. Criteria for assessing environmental aspects in the surveyed organization B

Impact assessment *
A – legal requirements – assessment of being subject to legal requirements
B – interested parties – assessment of the conflict occurance
C – Costs
D – Energy consumption – evaluation of the phenomenon

*) rating 0 or 1
By a significant aspect one understands each aspect which received at least one point in any criterion.

Source: authors' own work based on the examined enterprise data.

As it is apparent from tables 1 and 2, in the organizations that went through the consolidation process a very diverse methodology was applied to assess environmental impact. The implication of this was a strongly varied policy of the newly established company formed on the basis of five autonomous enterprises, which had to be remodelled. It is worth noting that if there are standardized environmental impact assessments contained in ISO 14001 series standards, in the guidelines regarding these in other documents, there will certainly be maintained similar level of environmental impact assessment even after the merger of different organizations.

Changes in the environmental management system after the consolidation of entities

Changes aimed at introducing a unified policy in a newly created organization should include, first of all, the redefinition of criteria for the assessment of environmental aspects. The introduction of unified rules for aspects assessmant enables a rational planning process and budgeting activities aimed at reducing the impact of the organization on the environment. These actions allow the formulation of uniform environmental objectives within the whole organization as well as the implementation of unified environmental management programs. The main stages of work performed on the reconstruction of the environmental system in the examined organization are characterized in figure 2.

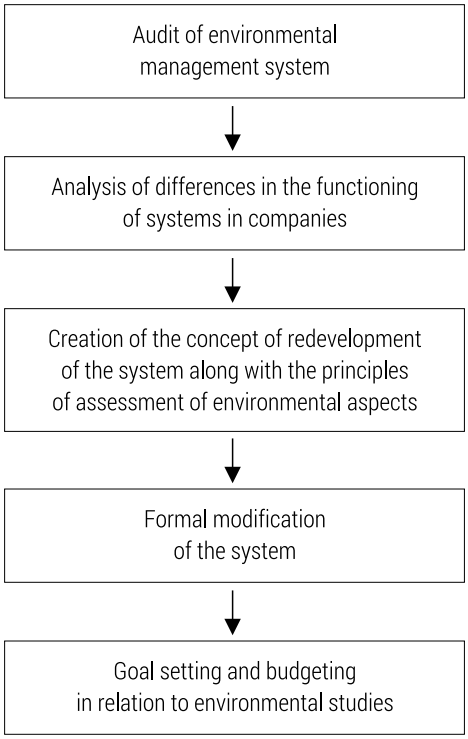

Figure 2. Stages of work in the scope of environmental management system after the consolidation of entities

Source: authors' own work.

New unified criteria for assessment of impact on the environment were introduced as a result of the system rebuilding. The criteria are shown in table 3.

Table 3. Unified criteria for environmental impact assessment after entity consolidation

Criteria for assessing environmental aspects	Description
Legal requirements	Score from 1 to 3 has been introduced depending on whether or not the environmental aspect is regulated. When the identified environmental aspect is legally regulated (both on the internal and external level) and the legal requirements for this aspect are not met, the value of the assessment is 3; when both existence of requirements and certain legal requirements meet – the value of the evaluation is 2; in any other case the value of the evaluation is 1.
Interested parties	Rating in scale 1-3. The criterion reflects the impact of the aspect on the social reception of the organization, interest in addressing specific issues by clients, authorities, social organizations and residents (including complaints) not to mention inspection bodies and institutions, such as the Inspection for Environmental Protection, the National Labor Inspectorate, the National Sanitary Inspection, the Supreme Audit Office, etc.
Environmental risk	Criterion is a resultant of the following items: the frequency of the occurance of environmental influences (or the estimated probability of the impact occurrence in emergency situations) and the potential for environmental hazards assessed on the basis of knowledge of the harmful effects on the environment in view of the content of dangerous substances or specific physico-chemical properties; Criteria assessed on a scale from 1 to 3 based on additional detailed tables which were not attached to the article due to their voluminosity.
Each aspect that has received more than 6 points is to be considered as significant. Also, each of these aspects resulting from the organization's failure to fulfill legal requirements.	

Source: authors' own work.

It seems difficult to value the approach to environmental impact assessment in accordance with the presented in the article criteria applied before and after the consolidation process. It also seems difficult to assess whether, as a result of remodelled criteria, actions minimizing environmental impact of the newly created organization will be more or less intensified. However, taking into consideration the rationality of organization management at the strategic level, what most often becomes the priority is the unification of the

principles of assessment of phenomena and policies in the particular areas of the company, including the field of environmental protection.

From the afore mentioned analysis of the hereby presented phenomenon of differentiation of the environmental management system efficiency in relation to the same requirements resulting from the ISO 14000 series standards, one can clearly point out the great implications in the management and organizational sphere resulting from the modification of the organizational structure of the companies, especially in the consolidation of business entities. The example of system redevelopment presented above, also indicates that modification of widely understood management systems in the face of consolidation of organizational structures is a very laborious activity, which has its consequences in changes concerning seemingly unrelated processes such as modification of investment policy (as a result of the change of qualification of environmental aspects) but also the need to rebuild and centralize procedures and functions resulting from the elimination of autonomy in former independent entities. In the light of these considerations the continuation of the environmental management system in the face of changing conditions of its functioning is a very important issue. This causes, for example, the necessity of partially duplicated environmental systems, one of which is the continuation of environmental programs that have been implemented so far (reducing the impact of processes on the environment) and the other results from new programs which are rooted in modified (unified) environmental aspects.

Conclusions

In conclusion, it is important to reflect on the future of environmental management systems in the light of changes that are noticeable in terms of operating conditions. Certainly, it is important to note the growing business responsibility and the risk to the organization in the event of a negative impact on the environment. On the other hand, it should be borne in mind that commercial entities are striving to increase their profitability with each passing year – this remark concerns especially public entities listed on stock exchanges, which results from the strong pressure of shareholders to demonstrate systematic growth of financial results. It is obvious that pro-environmental actions are cost-intensive – especially in the case of manufacturing companies, and thus may affect the reduction of profitability. Everything points to the fact that a „counterbalance" to the potential depreciation of environmental management systems is precisely the risk of environmental impacts and possible costs arising therefrom.

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Norma PN-EN ISO 14001:2015-09 Systemy zarządzania środowiskowego – Wymagania i wytyczne stosowania

Monika **KOLENDO** • Łukasz **KOLENDO**

USING GIS IN THE MUNICIPALITY SUITABILITY ASSESSMENT FOR THE TOURISM AND RECREATION DEVELOPMENT

Monika **Kolendo**, MSc • Łukasz **Kolendo**, MSc – *Bialystok University of Technology*

Correspondence address:
Wiejska Street 45A, 15-351 Bialystok, Poland
e-mail: monika.kolendo@wp.pl; l.kolendo@pb.edu.pl

ABSTRACT: The work presents the possibilities of implementing the GIS technology in assessing the tourist attractiveness of the selected municipality. In the study, a point classification method was used in the base fields 250×250 of size. The valorisation of the areas of the municipality was carried out based on considering selected elements of the natural environment such as the land form, land use, hydrographic conditions, forest areas and valuable natural areas. Based on the conducted research it has pointed out that about one quarter of the area of the municipality can be characterized by high and very high attractiveness in terms of tourism and recreation development, mainly due to the high altitude of the land form, favourable hydrographic conditions and the presence of forest areas.

KEY WORDS: GIS, tourism and recreation, valorisation

Introduction

Agritourism and rural tourism nowadays is perceived as an alternative form of tourism to mass tourism and its potential is seen with many local governments in fostering regional economic development (Lee et al., 2013). It can be distinguished by many advantages, the most important of which include the possibility of staying close to the natural environment, air purity and rich landscape values (Ziernicka-Wojtaszek, Zawora 2011).

For this reason, tourism is one of the most popular directions in a municipality development. However, to make the best choice of the areas of the greatest possible suitability for tourism, it is necessary to make valorization. Valorization is a way to determine the validity of the surveyed areas in terms of the established criteria. Performing this type of valorization in terms of tourism and leisure can indicate the best areas for its development (Tokarska-Osyczka, Iszkuło 2014).

Among the many methods of valorization of natural resources, the method of point classification in the basic fields is the one of the most widely used by researchers (Richling 1992). Despite various modifications of the discussed method, resulting from the purpose, the spatial scope of analysis and the availability of data, the analytical process includes the following steps (Cygan et al., 2011):

- the delimitation of the base field (artificial field, administrative units etc.);
- to designate a set of evaluation criteria;
- the assignment of points to base fields, according to the scale used;
- to sum points within the base fields and classify them into fixed ranges.

One of the computer-aided tools for supporting this type of analysis is Geographic Information Systems (GIS). Its field of application is very broad and one of them is the possibility to make spatial analysis, including valorization (Colosi et al., 2009; Varjú et al., 2014). With the use of GIS software, it is possible to create many cartographic studies that visualize partial evaluations and final valorization results. The publication of such studies may also contribute to the promotion of the tourism industry, which may have the effect of reversing the unfavorable trend of generating scarce revenue compared to its potential capabilities (Leszczyńska, 2003).

The purpose of this study is to carry out tourist and recreational valorization in the area of the Szypliszki municipality, and consequently to identify the most valuable areas suitable for tourist development, including the development of accommodation and catering facilities, agritourism farms, holiday villages and other tourism infrastructure.

Study area

The research area covered includes the Szypliszki municipality. It is a rural municipality, located in the north-eastern part of the Podlaskie Voivodeship, in the Suwałki Lake District (figure 1). The seat of municipality and at the same time the most compact built-up area it is there a small town Szypliszki. According to 2015 data, the municipality is inhabited by less than 4 000 people, and its total area is about 156.5 km^2, which implies that there are only 25 inhabitants per 1 km^2 (Local Data Bank, Central Statistical Office).

The area of the municipality of Szypliszki was analyzed due to its location in the valuable natural areas of the Suwalki Lake District. Unquestionable landscape values of this area make it necessary to design optimal spaces for meeting tourist and recreational needs as well as limiting building development and anthropopression in valuable areas. Such activities have their reflection in the records of planning documents at the level of the whole municipality. According to the changes introduced in 2011 to the Study of Conditions and Directions of Spatial Development of the Szypliszki municipality one of the most important priorities in the municipality is the concentration of activities related to tourism activization.

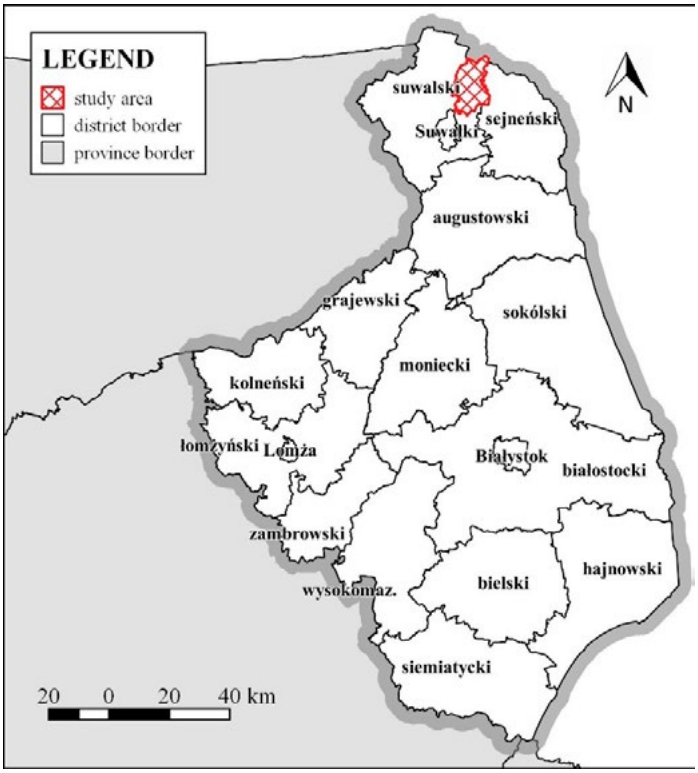

Figure 1. The localization of study area against administrative division

Source: author's own work based on data from CODGiK in Warsaw.

Materials and research methods

In the evaluation of tourism and recreation values of the studied municipality it was used a modified method of point classification in the basic fields. According to the methodology used, first, the site was divided into regular fields of 250×250m. As a rule, studies on tourism and leisure values are conducted in a 1×1 km grid (Lisiak et al., 2017). In this paper, it was decided to use a reduced primary field due to the use of detailed spatial data, including numerical spatial altitude data derived from Airborne Laser Scanning ALS. A grid of squares covering the entire municipality covers a total of 2707 primary fields.

When selecting a set of evaluation criteria, the attention was focused on the evaluation of selected elements of the natural environment, whose quality in a large measure determines the possibilities of tourism development in the studied area. In the final evaluation, five elements of the natural environment were included in which one or two evaluation criteria were selected (table 1).

The assessment criteria listed in table 1 are assigned in a 6-point scale (from 0 to 5). In the case of criteria related to the distribution of forests and the areas of natural value, the possibility of assigning an additional 1 point to the assessment was applied. With regard to the forest distribution an additional point was assigned in the case of appearing in the eye of the grid of forest that has a protective function or it is a partial reserve, and in the case of the criterion of areas of natural value, if a natural monument was identified in the eye of the grid, together with a high coverage of areas of high natural values (> 80%).

Table 1. The criteria of tourist and recreation attractiveness evaluation in the municipality of Szypliszki

Land form	Land use	Hydrography	Forest areas	The areas of the natural value
relative heights [m]	a land use class	the length of watercourses [m] the length of a shoreline of water reservoirs [m]	the length of a forest boundary [m]	the share of areas of high natural values

Source: author's own work.

The final evaluation of tourist and recreational attractiveness of the studied municipality was determined as the sum of points obtained in the primary field in the light of the used evaluation criteria. On this basis, the LAC (Landscape Attractiveness Coefficient) was determined of the following pattern (Chojnacka-Ożga, Gabryszewska, 2011):

$$LAC = \Sigma P_1 / \Sigma P_{max.}$$

where
ΣP_1 – the sum of points obtained by a spatial unit as a result of valorization
ΣP_{max} – the sum of all possible points obtained by a given spatial unit

The values of the above coefficient are in the range from 0 to 1. With this in mind, the area of the municipality was segmented into the following classes (table 2).

Table 2. The valorization criteria of tourist and recreation attractiveness of the municipality of Szypliszki

LAC value	the valorization of a primary field in terms of tourist and recreation value
0,00-0,20	the areas of very low attractiveness
0,21-0,30	the areas of low attractiveness
0,31-0,40	the areas of moderate attractiveness
0,41-0,50	the areas of high attractiveness
>0,51	the areas of very high attractiveness

Source: author's own work.

Multi-criteria analysis of tourist and recreational attractiveness requires gathering and considering various spatial data sets, including:

- the database of topographic objects BDOT10k – obtained from the resources of the Regional Center for Geodetic and Cartographic Documentation in Bialystok,
- a Digital Terrain Model DTM in the ARC/INFO ASCII GRID format, which measures the height of points in a regular grid of 1m mesh, interpolated based on a cloud of points from Airborne Laser Scanning (ALS) [an average height error is up to 0.2 m] – the Central Center for Geodetic and Cartographic Documentation (CODGiK – abbreviation for the name of the institution in Polish) in Warsaw,
- a digital orthophotomap with an area pixel size of 0.25 m – CODGiK in Warsaw,
- the data of the Central Register of Nature Conservation Forms, obtained from the resources of the General Directorate for Environmental Protection (http://www.gdos.gov.pl/dane-i-metadane),
- a layer of forest mapping derived from the Forest Data Bank (BDL – abbreviation for the name of Polish forestry spatial database) (https://www.bdl.lasy.gov.pl/portal),

- the data of the State Boundary Register – the Central Center for Geodetic and Cartographic Documentation (CODGiK) in Warsaw.

The analysis needed for tourist and recreational valorization was done in the environment of free and open-source QGIS software (Szczepanek, 2012).

The valorization of tourist and recreational attractiveness done by the method of point classification

Land form

The shape of the land form in the Szypliszki municipality is characterized by a fairly varied height structure. Its values vary from 136.77 m to as much as 252.22 m above sea level. On the other hand, the average height of the surveyed area is 190.82 m above sea level, and the standard deviation is of 18.00 m, which is a relatively small dispersion of values around the average height (figure 2). The largest elevations in the Szypliszki municipality take the form of a strip running from the south-western up to the north-eastern end of the studied area. However, a significant reduction in the terrain can be seen in the south-east.

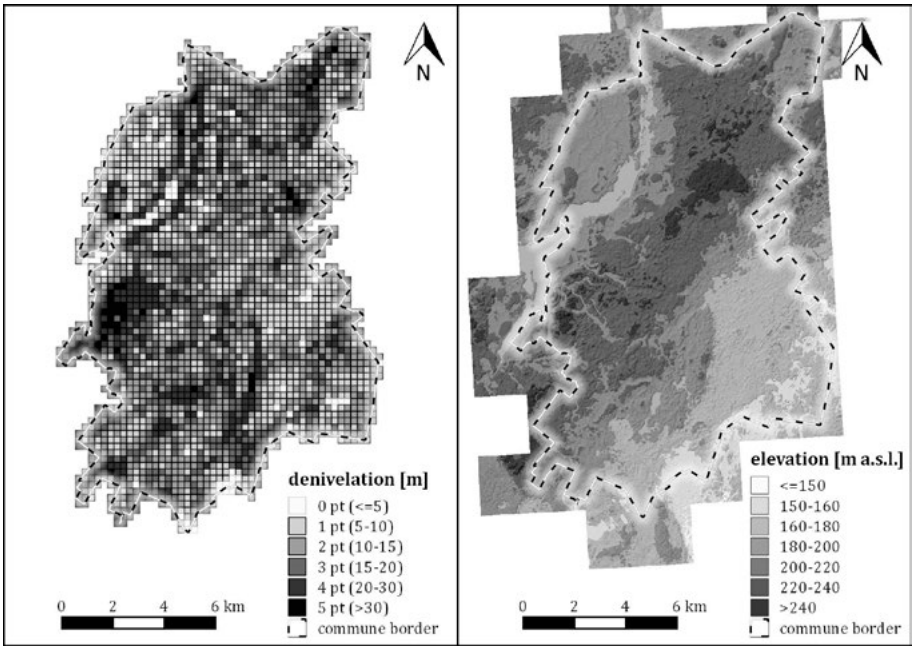

Figure 2. Land form point classification (on the left) and an altitude map of the studied area (on the right)

Source: author's own work based on data from CODGiK in Warsaw.

Land form valorization was performed using one parameter – field relative heights – determined as a difference between the highest and the lowest altitude points within the basic field of calculations. The large variety of young glacial terrain is reflected in the relatively large spatial polarization of the results. The assessment of the structure of the terrain in the municipality of Szypliszki showed that the areas with the highest values are in the south-west and the north-east part of the studied area. The lowest scores were awarded to flat areas in the north-west and south-east of the municipality. It is worth noting that the score of 0 occurred only 68 times (2.51%), and it was given mainly to the area within the lake of Szelmet Mały and the depression in the south-eastern part of the studied area.

Land use

Land use largely determines the way a potential tourist perceives the space, and indirectly influences other features such as, for example, the availability of points and view lines (Cygan and others, 2011).

The valorization of the area of the municipality of Szypliszki in terms of land use structure was based on the principle of visibility analysis and the smallest possible hiding of the landscape for an observer. Therefore, it was assumed that areas covered with tall and densely located objects (such as trees and buildings) are less desirable than open areas (such as meadows or arable land) and because of that they were rated lower (table 3).

Table 3. A list of the area of land use classes in the municipality of Szypliszki and their corresponding point values

Scoring	The class of land use	The object class code bdot10k	The area [ha]	The share [%]
-1	industrial areas and wasteland	PTGN, PTNZ, PTWZ	9.37	0.06
0	urban areas	PTKM, PTPL, PTZB	340.85	2.18
1	permanent crops	PTUT	28.98	0.19
2	forests and grassy vegetation	PTLZ, PTRK	2699.70	17.26
3	arable land	PTTR	6459.98	41.29
4	wetlands and surface waters	PTWP	92.60	1.87
5	meadows and pastures	PTTR	5813,25	37.16

Source: author's own work.

Point values in the primary fields were assigned according to the table below. Where there is more than one type of coverage in each mesh, the points in this field were determined in proportion to their surface area, and the result was rounded to integral numbers according to generally accepted mathematical rules.

The final result points to the high attractiveness of the municipality area in the light of this criterion. In the vast majority of cases (81.12%) the basic fields were of 3 or 4 points (successively 1025 and 1171 cases). These are mainly agricultural areas (arable land and grasslands) as well as occupied by surface waters. The analyzed area is characterized by a small degree of urbanization and industrialization, which results in the fact that fields that had been assigned 0 or 1 point, were present only 5 times (figure 3).

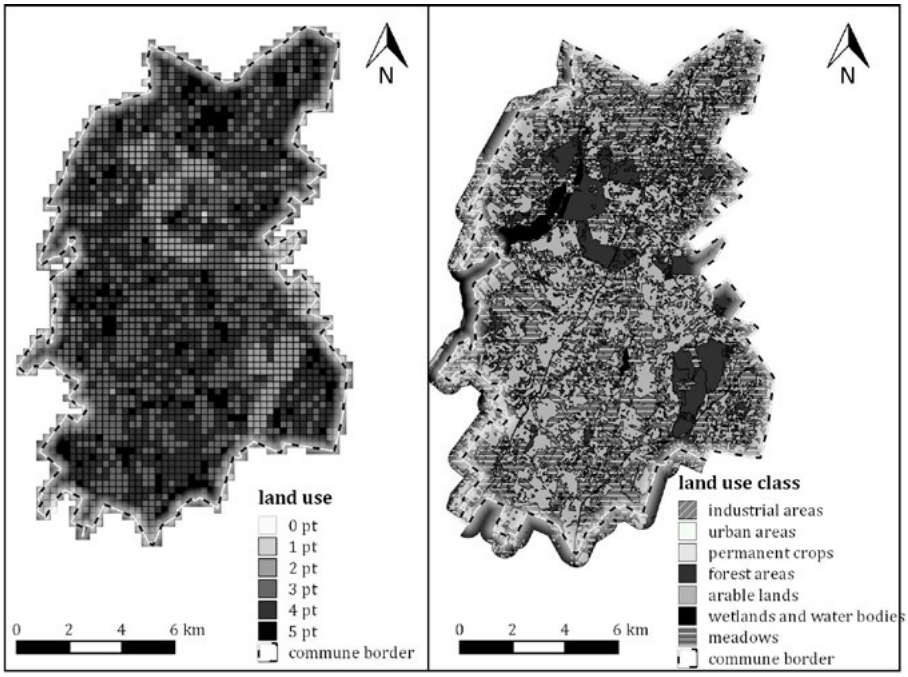

Figure 3. The point classification of land use conditions (on the left) and the map of land use classes (on the right) of the studied area

Source: author's own work based on data from CODGiK in Warsaw.

Hydrography

The influence of hydrographic conditions on the potential of the municipality of Szypliszki in terms of a tourist function development was assessed using two criteria: the length of watercourses and the length of the shoreline of water reservoirs in the respective primary fields.

The area of the studied municipality abounds in the presence of many water reservoirs located almost in the whole area, however, their area usually does not exceed 1 ha. The largest water reservoir is the lake Szelment Mały located on the eastern border of the analyzed municipality. The lake is characterized by its elongated shape and a strongly varied coastline. It is worth noting that in the analysis, water reservoirs of less than 0.1 ha were omitted, to limit the inclusion in the final assessment of unattractive reservoirs of anthropogenic origin (e. g. fish ponds). The river network is less varied and the total length of watercourses in the municipality is 82.83 km. Within the criterion of the length of watercourses in the primary fields, no linear man-made watercourses (meliorations) were considered. The point classification of hydrographical conditions and in terms of the range and the length of the shorelines of water bodies is presented in figure 4.

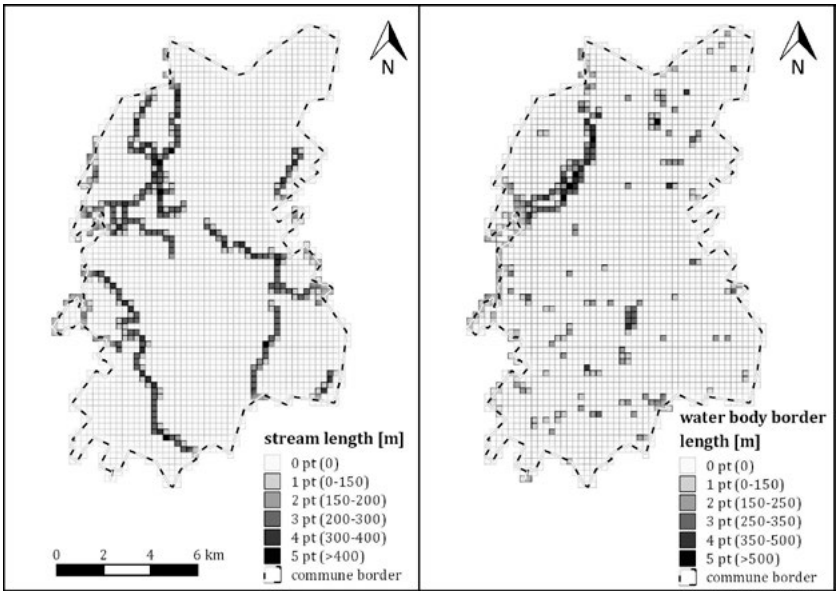

Figure 4. The point classification of hydrographical conditions in terms of the length of watercourses (on the left) and the length of the shoreline of water reservoirs (on the right) of the studied area

Source: author's own work based on data from CODGiK in Warsaw.

Within the evaluation of hydrographic conditions, the score in the range of 1-5 was obtained by a small number of primary fields. For the criterion of the length of watercourses, there were 348 fields, and in the relation to the criterion of the length of the length of the shoreline of water bodies, there were 270 base fields. Detailed information on the frequency of occurrence of particular assessment points of hydrographical conditions is presented in figure 5.

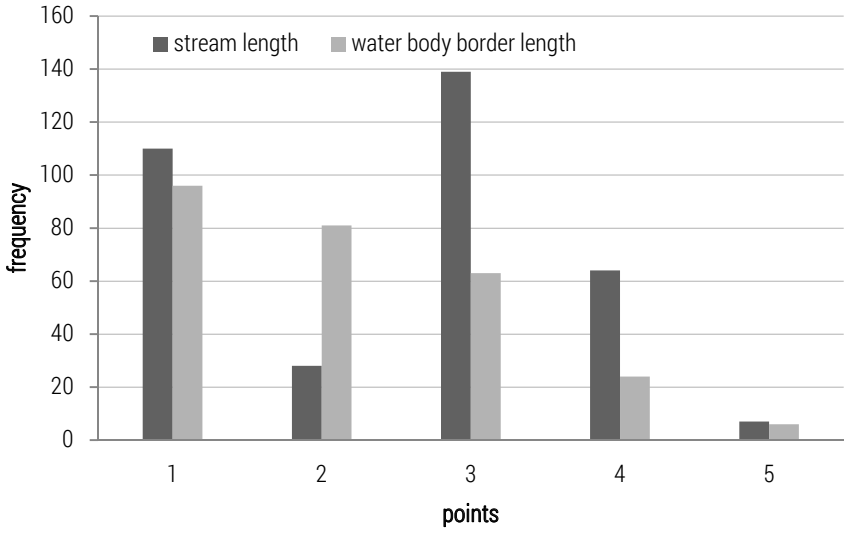

Figure 5. The histogram of the occurrence frequency of point values (<> 0 points) within hydrographical conditions

Source: author's own work.

The distribution of forest areas

In the case of forest areas valorisation in the analysed municipality, it was assumed that the most attractive tourist attraction of the forest is in the place of contact with another form of land cover (so called ecotonal transition zone). Consequently, the length of the forest border was included in the analysis, but not the share of the forest area in the primary field. After assigning point values to the primary fields because of the length of the forest boundary, the selected meshes of the grid an additional 1 point was given due to the presence in their area of a forest that was a partial or protective reserve (e.g. soil-protective forest). The spatial distribution of values related to the distribution of forest areas is presented in figure 6.

Within the criterion of the length of the forest border and the distribution of protective forests, the highest points of the grid are located mainly in the central and northern part of the analyzed municipality (4-5 points). This is mainly due to the presence of numerous forest areas, including protective forests.

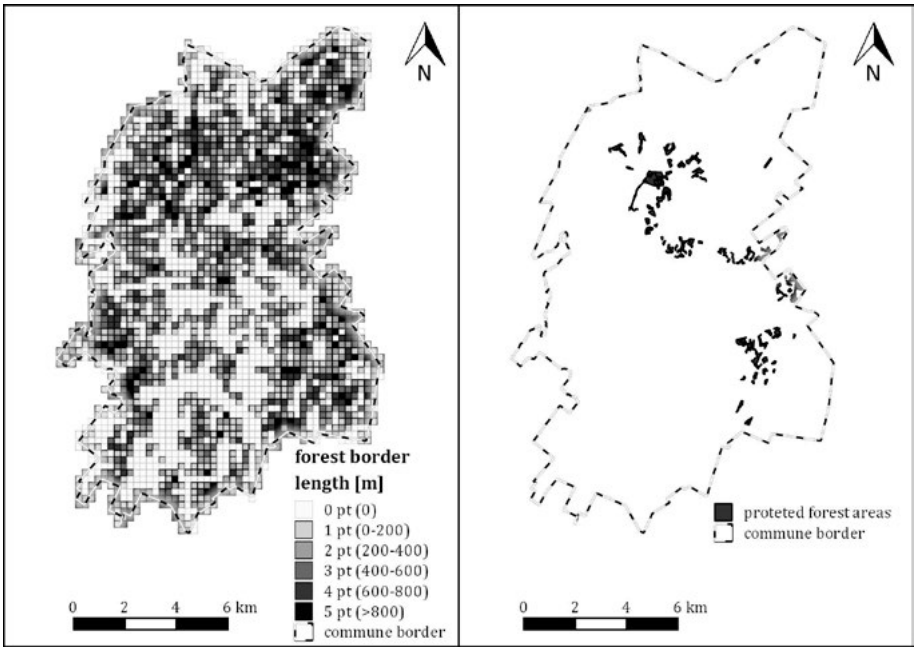

Figure 6. The point classification of forests in terms of the forest border (on the left) and the distribution of protective forests (on the right) in the studied area

Source: author's own work based on data from CODGiK in Warsaw and BDL.

The areas of natural value

The last criterion included in the analysis was the percentage coverage of primary fields with areas of high natural value. In this category, the following areas were included: ecological corridors, protected landscape areas, Natura 2000 sites, national parks, landscape parks and nature reserves. Percentage coverage of natural valuable areas was determined based on the vector mask generated from the layers listed above. The selected meshes of the distribution grid were given with an additional 1 point if there was at least one natural monument within them, while at the same time the covering with areas of natural value was of more than 80%.

The spatial distribution of the values associated with the distribution of valuable natural areas is presented in figure 7. In view of this criterion, the areas with the highest natural values are located in a belt extending from the north-western to the south-eastern ends of the studied area (figure 7).

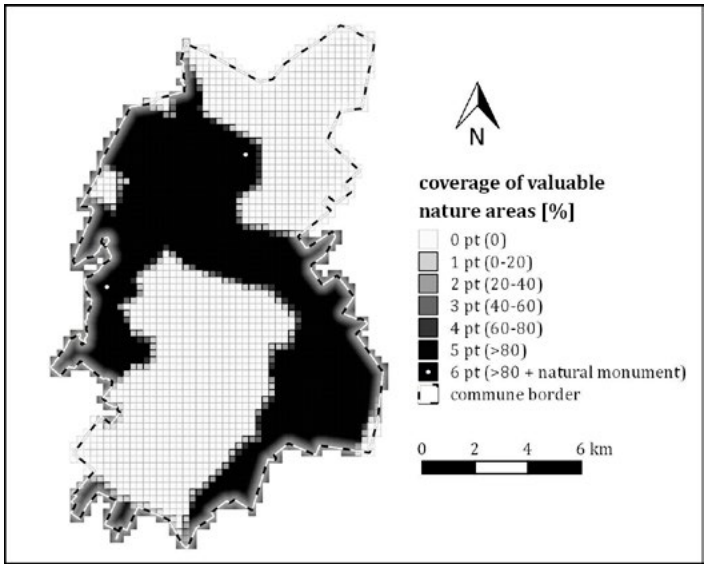

Figure 7. The point classification of the areas of natural value in the studied area
Source: author's own work based on data from CODGiK in Warsaw.

The final assessment

After determining the points in each field within the used evaluation criteria, it was possible to calculate the LAC (Landscape Attractiveness Coefficient), the distribution of which is shown in figure 8. The values of a LAC coefficient in the analysed area range from 0.22 to 0.78. the average value of the applied coefficient was 0.33, which corresponds to the moderate tourist and leisure attractiveness.

The most representative (862 cases) are the primary fields of low attractiveness in terms of tourism and recreation (figure 9). These are mainly agricultural lands located in the southern and northern parts of the studied area. Primary fields with moderate tourist and recreational attractiveness are the next largest group (29.48%). The primary fields with moderate attractiveness are in the south-eastern and central part of the research area. This category of primary fields is agricultural land with some share of forest areas raising the overall assessment of the areas of the municipality.

The next two most valued categories of primary fields (high and very high tourist and recreational attractiveness) account for a total of 26.30% of all cases. Based on the valorisation, two main localizations of the areas of the highest effectiveness can be identified. The first of them is the area located in the western and the north-western part of the research area around the lake Szelment Mały. The other one is the area located in the south-eastern part of the studied area within the large forest complex. The areas rated the highest are characterized by varied land forms and the presence of valuable elements of the natural environment (surface water tanks, watercourses, forests, and protected areas), (figure 8B and 8C).

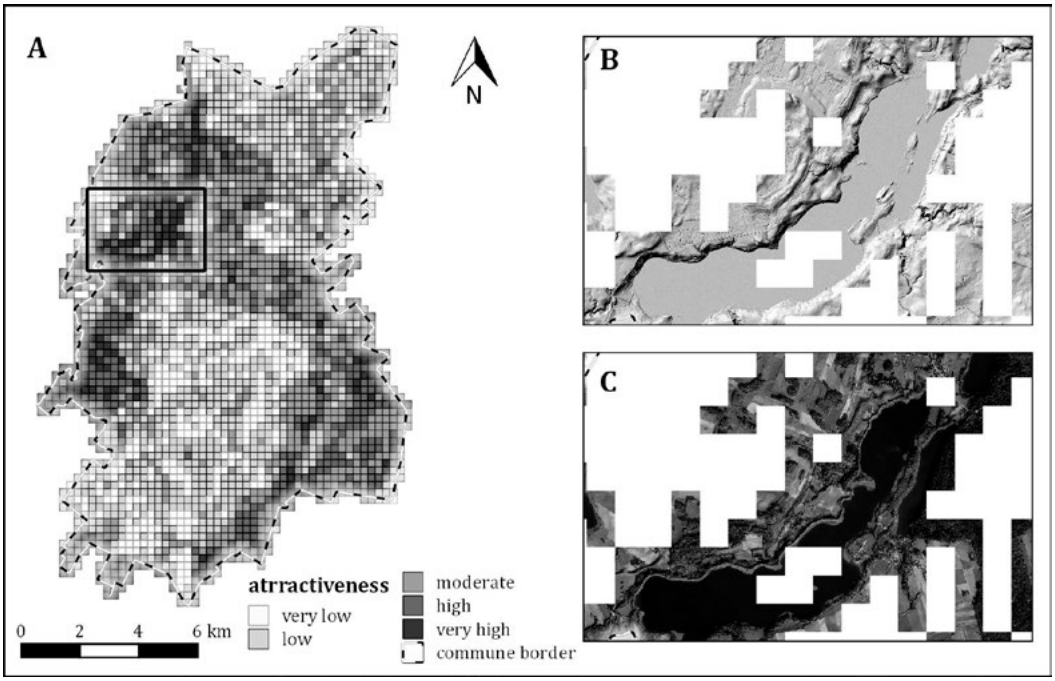

Figure 8. The suitability of the area of the municipality of Szypliszki in terms of tourism and recreation development (A) an the presentation of spatial conditions of the highest evaluated areas: land forms (B) and a digital orthophotomap (C)

Source: author's own work based on data from CODGiK in Warsaw.

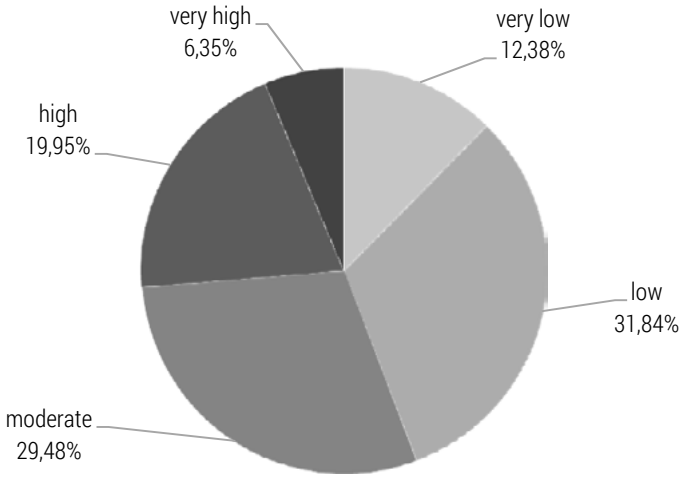

Figure 9. Percentage share of ranges of tourist attractions in the municipality of Szypliszki
Source: author's own work.

Summary

The use of GIS technology and selected spatial data sets allowed the development of a comprehensive valorisation of the municipality's area in terms of tourist and recreational attractiveness. This analysis considers selected elements of the natural environment, which have been identified as main factors that decide of attractiveness of an area. As a result, it was pointed out that nearly 25% of the area of the surveyed municipality was characterized by high and very high tourist and recreational attractiveness.

It is worth mentioning here that the analysis does not consider all the elements determining tourist and recreational attractiveness of the studied municipality. Undoubtedly, such elements are the conditions related to the cultural landscape and tourist infrastructure (accommodation, catering facilities and tourist attractions).

At present, the natural environment is an increasingly important component of the economic calculation. However, the introduction of natural capital into the economic calculation generates many informational challenges. The monetary valuation of the natural environment poses a complex problem, which requires the gathering and considering many detailed data. Their acquisition often entails considerable financial outlays, increasing in line with the size of the studied area. In this context, the methodological approach presented in this paper may be used, allowing for delimitation of areas of the

highest natural values to carry out monetary valuation (Becla, 2013; Zielińska, 2011).

Increasing availability of geospatial data collected in the state geodetic and cartographic resources, as well as GIS software (especially in a free license) means that the analytical approach presented in the paper can be successfully used to evaluate the potential of a selected municipality in terms of the development of a tourist function. The recognition of this type of conditions is particularly important in the process of planning and selection of directions of optimal spatial management in the municipality and at the stage of creation of strategy and development documents (e.g. the Development Strategy of the Municipality).

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The contribution of the authors

Monika Kolendo – 50%
Łukasz Kolendo – 50%

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Rafał NAGAJ

CHANGES IN THE ELECTRICITY SECTOR IN POLAND IN THE LIGHT OF ENVIRONMENTAL PROTECTION AND DEVELOPMENT CONDITIONS OF AGRICULTURE AND RURAL AREAS

Rafał **Nagaj**, Prof. – *University of Szczecin*

Correspondence address:
Faculty of Economics and Management
Mickiewicza Street 64, 71-101 Szczecin, Poland
e-mail: rafal.nagaj@usz.edu.pl

ABSTRCT: The aim of the article is to present the effects of changes in the electricity sector in Poland after the accession to the EU, taking into account the environmental protection and the development of agriculture and rural areas. The paper presents the ideas of the energy and climate policies in the European Union and their effects on the environment and the development of agricultural areas in Poland. The changes in the electricity sector in Poland were presented by the author in the context of the development of agriculture and rural areas. The analysis indicated that the transformation in the electricity sector had a strong impact on both the environment and agriculture and rural areas. The main effects are the increase in the production of energy crops, tax effects for rural communities and landscape changes caused by the appearance of sources of energy renewable plants.

KEY WORDS: electricity industry, energy and climate policies, energy crops, rural areas

JEL: Q48, Q28, Q01

Introduction

Since the beginning of the 1990s, the electricity sector, as have other parts of the economy, experienced drastic changes that were not only the result of systemic change, but were related to the adaptation of this sector to the requirements of the European Union. These changes were related to the re-regulation, restructuring, liberalization and ownership processes and to the implementation of the economic policy objectives pursued by the European Commission. The latter, in relation to the electricity sector, was concerned with energy and climate policies. The result was the creation of an electricity market, the adoption of environmental targets of 3×20% (European Parliament and the Council, 2009a) and the inclusion in the definition of electricity safety of the environmental aspect (European Commission, 2000).

The aim of the electricity policy is to ensure the safety of the electricity sector, while preserving the sustainable development of the country, at national, regional and local level. Therefore, electricity sector security is understood as an uninterrupted supply of energy at reasonable and low prices, whilst maintaining care for the environment. This goal was driven by changes in the power sector, and their end result was to increase competitiveness in this part of the economy, maintaining sustainable development at local and regional level. As a result, the process of modernization of energy plants in Poland has begun. It aimed to reduce pollutant emissions into the environment and to build installations using renewable energy sources (RES), especially from wind, biomass and biogas. It affected not only the environment, but also agriculture and rural areas.

The aim of the article is to present the effects of changes in the electricity sector in Poland after the accession to the EU, in the context of environmental protection and the conditions of the development of agriculture and rural areas. The paper will present the targets of the energy and climate policies in the European Union, their impact on the environment and the development of agricultural areas in Poland. Attention will be focused on both the changes in the area of environmental protection and the promotion of renewable energy sources. Energy and climate policies are also related to the development of energy crops and changes in the surrounding local environment, so the changes in the electricity sector in Poland are presented by the author in the context of the development of agriculture and rural areas.

The paper is descriptive and analytical and based on the observational method, basic statistical methods such as dynamic analysis and time analysis and deduction method. The main source of data is the Central Statistical

Office of Poland and Eurostat. The research period in the empirical part is the period after the accession to the European Union, and for the assessment of climate change period from 1990 to 2014.

Energy and climate policies and changes in electricity sector in Poland

Transformations in the electricity sector in Poland began in 1990, the decision was made to dissolve the Energy and Coal Industry (Wspólnota Energetyki i Węgla Brunatnego) and to create transmission, distribution and generation sub-sectors within the electricity sector (later was also trading). Another important element of the change was the enactment of the Act of Energy Law (Ustawa Prawo energetyczne, 1997) and subjecting the electricity market under sector regulation. Since then, it began the process of commercializing the electricity business, and it created the foundations for privatization and long-term restructure and consolidation processes. The result is that the electricity sector is dominated by three entitles (PGE SA, Tauron PE SA and Enea SA, which together put more than half of the total volume of electricity in Poland). The most important event, however, was Poland's accession to the European Union. This has led to the need to adapt to EU requirements and to adopt directives introduced by the European Commission. Particularly important are the directives implemented in the framework of energy policy and those related to climate Policy. The implementation of electricity directives has resulted in the separation of network activity from sales and generation, the wholesale market has been established and developed, and final customers have acquired the opportunity to change their electricity supplier. This has led to the development of competition, and the business decisions of businesses (other than „incumbent energy companies" which are regulated in the pricing process) have started to be made on the basis of economic calculation. The most important are the two components: pricing for customers and investment plans. The result of the first component is that there is business freedom for suppliers to set prices, and consumers have the option of choosing a supplier. The second element has an impact on the security of electricity system and the nature of these investments and their location. The result of these changes is the construction of power plants and the production by companies of those manufacturing technologies that are most cost-effective and economically efficient. Another result of energy policy is promotion of distributed generation, which unfortunately is slowly developing in Poland (Combined heat and power generation as % of gross electricity generation was 16.76% in 2005 and 16.09% in

2015 (Eurostat, 2017b). Another element are electricity "prosumers", whose development build more and more energy micro-installations. In Poland, on July 1, 2016 came into force the amendment to the Act on RES (Ustawa o odnawialnych źródłach energii, 2015), in which the concept of „prosumer" was defined and in relation to earlier proposals, it was decided to cancel for prosumers the possibility of resale of unused produced electricity and it was replaced by a system of mutual settlements. In return for tariffs guaranteed for surplus power produced, prosumers will be able to get discounts from power plants to the energy they receive. Regardless of whether these changes are beneficial to "prosumer program", or vice versa, it will undoubtedly affect its development and thus rural areas, because prosumers are mainly in agricultural communities.

The second type of economic policy influencing the development of the electricity sector, but also of agricultural and rural areas is climate policy. Under this policy, the first step was to implement the provisions of the Kyoto Protocol, and later the implementation of the 3×20% target set by the European Council in March 2007, according to which the greenhouse gas emissions in the EU compared to 1990 levels should be reduced by at least 20%, share of renewable energy in the final energy consumption should increase to 20% and should be improved energy efficiency by 20%. The reference target for RES for Poland is 15% (European Parliament and the Council**,** 2009b). All these climate targets resulted that in the EU on the one hand modernizing the existing generation capacities to reduce their negative impact on the environment was started, and on the other hand, withdrawing from operation „impure" ecological and energy-inefficient technologies and building power plants using renewable energy sources. Similarly implementation occurred in Poland.

The broader use of renewable energy sources is the main driver for achieving these goals. How big changes have occurred as a result of such energy and climate policies is shown in figure 1. It is worth noting that since 2000, in net electricity installations in the EU only the electricity from RES is more (figure 1 top panel). The only exception to conventional energy carriers is natural gas, which, however, is a carrier with a relatively low negative impact on the environment. Among the technologies that use „green energy", the electricity installations for wind energy, solar panels and biomass are being primarily built. It should also be stressed that the environmental targets imposed by the European Commission have led to a significant increase in the share of RES in the consumption of electricity in each EU country (Figure 1 bottom panel). It is worth adding that the current effects of this policy have caused the goals of the European Commission to go much further. So in the directive 2009/28/EC (European Parliament and the Council, 2009b)

the targets for renewable energy are set out, while in the Green Paper (European Commission, 2013), published in March 2013, the European Commission has created the impetus to start a discussion on the environmental targets and policies after 2020. As a result, targets for greenhouse gas emissions up to 2050 have started to be established, according to which the initial assumption of 80-95% reduction of these gases was taken (European Commission, 2011).

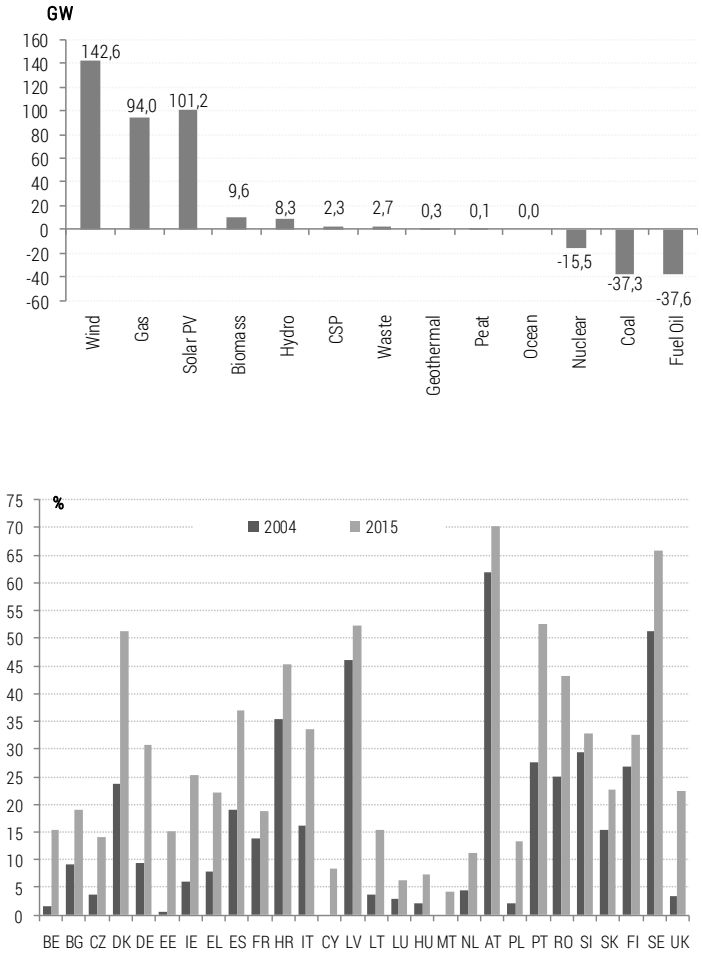

Figure 1. Net electricity installations in the EU in 2000-2016 (top panel) and the share of RES energy in electricity consumption in the EU Countries in 2004 and 2015 (bottom panel)

Source: (EWEA, 2017 p. 14); (Eurostat, 2017a).

The result of these actions at EU level in Poland have been various systems of support for projects using renewable energy in the form of green certificates and subsidies for investments, which are currently funded by the EU funds from the Regional Operational Programs 2014-2020 and the Infrastructure and Environment Operational Program for the years 2014-2020 and funds from the national programs of the National Fund for Environmental Protection and Water Management (NFOŚiGW). Also, more ambitious targets are proposed for energy efficiency. At the end of November 2016, the European Commission proposed to extend the energy savings requirements after 2020 and raised the energy efficiency target to 30% by 2030 (European Commission, 2016). These proposals will lead to the promotion of distributed energy and high-efficiency cogeneration technologies.

Electricity sector versus environment and agriculture

The investments and transformations that have taken place in the electricity sector and the electricity policy have caused that, apart from changes in the structure and regulation of the electricity sector, there have also been changes in its impact on the environment. The tangible result of this was a decrease in pollutant emissions (figure 2).

Energy industry in Poland, especially power generating plants, has made very large investments since 1990, resulting in a significant reduction in emissions of key air pollutants and greenhouse gases. The main investment outlays were made in the 1990s, so that the share of power generation in total emissions of the economy decreased significantly for each type of pollutant emitted. However, even after joining the EU, despite the fact that the shares in the economy did not change so much, the level of emissions dropped significantly (in 2005-2014 for sulphur dioxide from 879.9 to 446.5 thousands of tons, for nitrogen oxides from 327.0 to 255.2 thousands of tons, for particulates from 52.2 to 18.1 thousands of tons, and for carbon dioxide from 180.6 to 159.8 millions of tons) (see figure 2). This resulted in cleaner air, and also having a less negative impact on the soil, which is the basis of good agriculture.

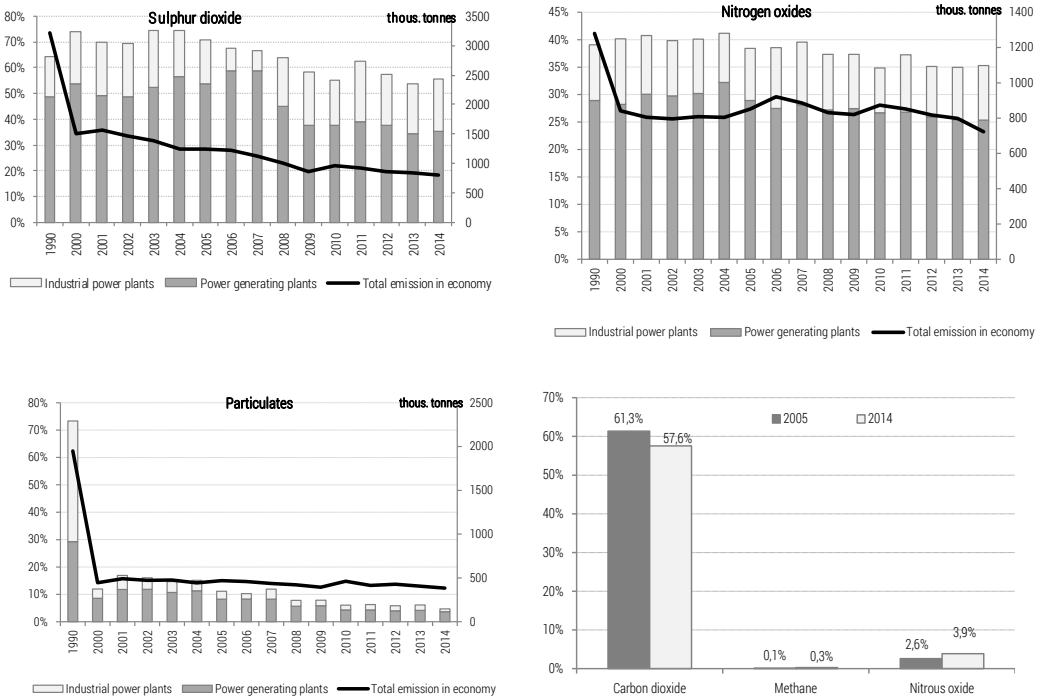

Figure 2. Share of electricity sector in the emission of major air pollutants in Poland in 1990-2014 and in greenhouse gas emission in the economy in 2005 and 2014

Source: (GUS, 2007b, p. 231, 234); (GUS, 2008, p. 233); (GUS, 2009, p. 229, 232); (GUS, 2010, p. 227); (GUS, 2011, p. 228); (GUS, 2012b, p. 225); (GUS, 2013, p. 228, 231); (GUS, 2014, p. 229, 232); (GUS, 2015, p. 221, 224); (GUS, 2016b, p. 218, 221).

The main influence of the electricity sector on agriculture as whole and rural communities is, however, takes place in a different way. Firstly, through energy agriculture, which involves the production of plants used as biomass for the production of electricity, which is co-incinerated with coal in existing power plants and CHP plants. For this purpose in Poland were established energy plantations, among which are: willow, Virginia mallow, miskantus, Rosa multiflora, sakhalin rdest, perennial grass and oilseeds such as rape or tuberous sunflower. As a result, the area of energy crops grows steadily (Grzybek, 2015). As a result, electricity from biomass is growing. While in 2004 it was 768.2 GWh, in 2015 it was 9027 GWh (GUS, 2007a, p. 37; GUS, 2016a, p. 41). Energy crops are related to energy investments, which in Poland are the result of the development of low-emission technologies and using renewable energy sources. As in the whole European Union, the share

of renewable energy in the consumption of electricity in Poland is constantly growing (figure 3 top panel). While in 2004 it was only 2.2% then in 2015 it was already 13.4%.

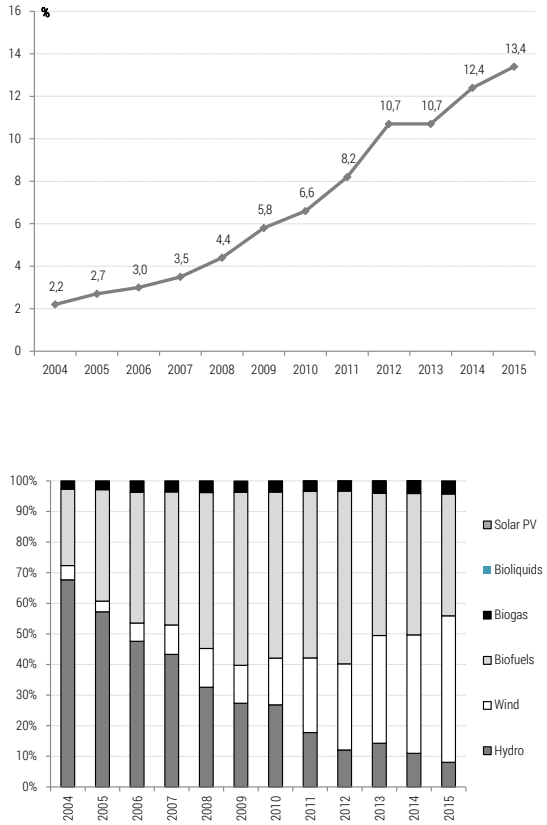

Figure 3. Share of RES energy in the consumption of electricity in Poland in 2004-2015 (top panel) and structure of the share of renewable energy in electricity production in Poland in 2004-2015 (bottom panel)

Source: author's own work based on (Eurostat, 2017a); (GUS, 2007a, p. 37); (GUS, 2012a, p. 58); (GUS, 2016a, p. 41).

In Poland, the EU's reference climate targets have not yet been met, but „green" energy carriers are becoming more and more important in the electricity sector and will be more widely used in electricity generation. This means even further development of energy crops, which implies an increase in their area and in incomes for agriculture. Although the share of biomass in total RES used in electricity production in Poland since 2013 is already

decreasing (Figure 3 bottom panel), however, this share is still very high (39.8% in 2015) and the volume of electricity produced from biomass in absolute quantities is increasing. The most important renewable energy source in Poland, as well as having the highest growth rate, is the wind energy (47.9% in 2015). This is due, on the one hand, to the fact that this technology is relatively inexpensive, next to that of biomass or waste. The second factor is the support system. In the period up to 2015, green certificates were the main source of support for which led to the development of two technologies in particular: co-firing of biomass in existing coal power plants and offshore wind power plants. The third energy carrier with significant growth dynamics was biogas.

Biogas is a technology that has been given a high priority and has received legal, political and financial support in recent years. Thus in Poland there is an increase in the amount of agricultural biogas, which is another element of the impact of energy and climate policies on agriculture and rural areas. Agricultural biogas plants produce biogas from plant biomass, from various types of waste and feces from food, plant or animal origin and from sewage. This gas, in turn, is used to produce electricity. Within the framework of the energy and climate policy in Poland is driven development of agricultural biogas plants. For this purpose the document was produced by the Ministry of Economy (in cooperation with the Ministry of Agriculture and Rural Development) and adopted by the Council of Ministers in July 2010 a strategic program in this field for 2010-2020 (Ministry of Economy, 2010). According to him, the aim is to build an average of one agricultural biogas plant in each municipality using agricultural biomass by 2020. This means the desire to build approx. 2.5 thousands such installations in Poland. Figure 4 shows a map of existing and planned biogas projects in Poland.

It can be noted that biogas plants are being built, or are being planned for their construction, throughout Poland, although practice indicates that there are numerous obstacles in this regard. These are often, apart from the administrative-legal-spatial conditions, the social resistance of the local residents. They result most often either because of the reluctance of having such a type of installation near the home or fear of change and lack of reliable and complete information on the benefits and risks. However, the construction of new biogas plants results in the development of energy crops, which in turn expands the sales opportunities of agricultural output outside the food market, ie. the energy market. As part of support for producers of electricity in agricultural biogas plants are used various incentives and financial and legal support. In mid-2016 was introduced in the Act on RES (Ustawa o odnawialnych źródłach energii, 2015), for producers being the subject to registration into regulated activity, the possibility of separating the so-called „Blue duty"

(the electricity produced in installations using agricultural biogas) from the „green duty" (Obligation to obtain and submit to the President of the Energy Regulatory Office to write off certificates of origin of electricity generated in RES or pay a substitute fee). In addition, the possibility of fulfilling the „green duty" and „blue duty" by paying the substitute fee was seriously limited. In this way incentives were created for the production of electricity in installations using agricultural biogas. Since mid-2016, according to article 223 point 1 of the RES Act, it is no longer possible to start building new installations or activities based on a green certificate system. It has been replaced by an auction system for new renewable energy generation capacity that promotes other energy carriers than wind and biomass. Advertised auctions for 2016 (Rozporządzenie Rady Ministrów ..., 2016) and 2017 (Minister of Energy, 2016) show that other technologies, mainly agricultural biogas and bio-waste, are to be supported.

Figure 4. Map of biogas projects in Poland in 2016

Source: (Bio Alians, 2016).

It is worth noting that installations using agricultural biogas are becoming more and more common (table 1). Moreover, these increases amounts are every year at a rate of over ten percent. This means that more and more electricity is produced from agricultural biogas and, on the other hand, there is a need to produce more and more energy crops.

Table 1. Number of installations in Poland using renewables energy sources

Period	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Installations using biogas*	11	74	87	103	125	144	156	170	189	196	200	206
Installations using biomass	2	6	7	11	15	18	19	27	33	36	38	41
Installations using biomass solar energy	0	0	0	0	1	3	6	9	17	119	268	473
Installations using wind energy	28	104	160	227	301	413	526	696	835	931	1039	1193
Installations using hydro energy	112	684	694	710	724	727	746	770	784	756	752	761
Install.using biomass co-combustion tech., bioliquids, biogas or agricultural biogas with other fuels	8	n.a.	n.a.	28	38	41	47	43	41	44	44	35
Total	161	868	948	1079	1204	1346	1515	1715	1899	2082	2341	2709

* It does not include biogas plants subject to registration in the register maintained by the President of ARR
Source: URE data in reports for the years from 2005 to 2016: *Sprawozdanie z działalności Prezesa Urzędu Regulacji Energetyki*, http://www.ure.gov.pl/pl/urzad/informacje-ogolne/sprawozdania/2916,Sprawozdania.html [08-09-2017].

The last element of the electricity sector's impact on agriculture is the financial element. Changes in the electricity sector caused an increase in installations using RES. It should be remembered that such installations are located in rural areas, i.e. near the energy input.

On the one hand, this results in a change of landscape in these areas and on the other hand generates revenue for municipalities in the form of taxes paid by the companies that produce electricity in these plants. Another income element for farmers is income from energy crops. They enable farmers to diversify their income. It should also be remembered that some of the crops, such as beet and rape, are used for food and for energy purposes. As a result, higher demand causes an increase in the prices of these energy crops, which translates into higher income of farmers.

Conclusions

The analysis carried out in the article indicated that the changes that occurred in the electricity sector in Poland also had implications for agriculture and rural areas. This was achieved on the one hand by the lower emission of pollutants into the air, thus lowering the negative impact on soil qual-

ity, and by promoting renewable energy sources in the country. The latter resulted in an increase in the number of installed power plants, after the accession to the EU several dozen times, and above all in the volume of energy crops. The latter enabled farmers to diversify their sources of income and increase their income. For municipalities, however, it has benefited in the form of tax revenues. The effects of the energy and climate policies of the European Commission indicate that electricity in Poland, like in other EU countries, will have an increasingly stronger impact in this area of the Polish economy. It seems that increasingly important role of climate policy and promotion of prosumers will cause us in the coming years to face the emergence of energy cooperatives and municipalities that will play the role of both producers and energy providers. This research area will certainly require more study and provide a new field for hypotheses.

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Dariusz STARKOWSKI • Paweł BARDZIŃSKI

ROAD TRANSPORT PROCESS ANALYSIS, OF MUNICIPAL WASTE, ON THE BASIS OF A CHOSEN SERVICE COMPANY. CLASSIFICATION AND IDENTIFICATION OF WASTE

Dariusz **Starkowski,** PhD, Eng. Senior Lecturer – *Poznan School of Logistics, Chair of Logistics Bases*

Paweł **Bardziński,** MSc, Eng., Head of Logistics Division – *Altvater Piła Sp. z o.o. – ENERIS Ochrona Środowiska*

Correspondence address:
Poznan School of Logistics, Chair of Logistics Bases
ul. E. Estkowskiego 6, 61-755 Poznań, Poland
e mail: dariusz.starkowski@wsl.com.pl

ABSTRCT: The article discussed the process of road transport operation planning connected with municipal waste transport and the organization of mixed waste collection on the example of shipping routes analysis carried out by means of transport of a service company in Wałcz commune in West Pomeranian voivodship. The article consists of seven parts, all of which present elements of a planning and transport process connected with municipal waste in road transport from legal, technical and economic perspective. Legal information concerning a road transport of goods was provided along with conditions that have to be met in order to perform this kind of transport and business activity. Moreover, technical and legal aspects of municipal waste transport vehicles were approached. The article covered as well the characteristics of: transport process, transport technologies, transport systems, the analysis of work capacity on the basis of drivers' working time and a description of optimal routes for providing services in the commune taking into consideration a technological process of municipal waste transport step by step. The aim of the article is to show the most significant definitions of this field, identification, classification and packaging labeling used in waste management.

KEY WORDS: road transport, municipal waste, provisions of law, transport centre, legislative directive, transport operation

Introduction

As for the costs of waste management system in Poland, over 70% constitute waste collection and transport to waste treatment plants or recovery in further use in national economy. The said costs are connected with growing petrol prices, higher drivers' and loaders' salaries and create a need of a transport logistic system optimization in utility companies (Eco-companies). In order to rationalize the transport system there are several commonly accessible programs used that optimize shipment routes, technical condition of vehicle fleet and RFID system created to analyze the location of waste containers. Such solutions are implemented in many undertakings due to more dynamic and competitive market. The transport operation needs to be planned with a number of activities taken into consideration such as relocation of a load treated in terms of technology and logistics. The first thing to consider is to choose proper means of transport. Then, appropriate fixing devices are to be picked that come along with a certain type of cargo. Rules and methods of choosing proper means of transport during a transport operation planning play an important role in the whole process. Planning and implementation of the said issues is a key element of waste delivery to the receiver in accordance with his/her individual conditions of the contract and transport.

The notion of municipal waste and its classification

Each transport of a load concerns a specific cargo. Apart from determining its specificity it is also important to set the character and the course of a transport operation. Various waste demand certain requirements to be met in compliance with its character. Exact knowledge of the load is a key to implement proper activities that are complimentary to the transport process. In order to analyze municipal waste it should be defined what municipal waste is.

Waste management itself aims to obtaining, transportation, recovery and performing activities that dispose of waste. The terms connected with this issue are:

- municipal waste – the definition of municipal waste is included in article 3, paragraph 1 point 7 of the Act on Waste, which states that it is the "waste that originates from households with end-of life vehicles excluded, and waste that does not contain hazardous waste originating from other waste producers, which due to its character and composition resemble household waste; mixed municipal waste remain mixed even if process-

ing took place which did not significantly affect its character." (Regulation…..... 2014);
- municipal sewage sludge-means residues accruing from sewage treatment plants in fermentation chambers;
- medical waste – is created by healthcare activities or after scientific connected with medicine;
- waste storage – all activities aiming at waste storing prior to its further transport, disposal or recovery;
- veterinary waste – created by veterinary healthcare activities or the ones connected with health related research;
- biodegradable waste – waste that is degraded through microorganisms;
- inert waste – waste that is insignificant to the environment, people and animals.

Classification of municipal waste is depicted in (figure 1), (Kozlak, 2009). Conducting transport activities entails production of various kinds of waste. Waste production therefore, is a feature of business activity and waste management has become a problem of all societies and economies. Waste can be divided into two basic types: municipal solid waste (classified as a group 20 in accordance with waste catalogue) originating from households, which is not discussed in the article, and business activity related waste (there are 19 waste groups in accordance with waste catalogue) (Regulation ……. 2014). It should be remembered that there exists an official waste classification depicted in waste catalogue – currently Regulation of the Minister of Environment of 9 December 2014 on waste catalogues applies (Journal of Laws of 2014, item 1923). Waste is divided into groups, subgroups and types of waste depending on its source, qualities determining waste as hazardous and components which if exceeded in terms of limit substance values, make waste hazardous.

The division is related to waste record – keeping and reporting. Waste that is created in production companies and households is:
- Transport related and load securing waste, e.g. packaging and securities of goods such as paper, cardboard, foil and plastic, used wooden pallets etc. including waste coming from damage of transported goods;
- Waste that is related to maintenance of vehicles in the garage [used operational fluids of vehicles, oil and air filters, used tyres, lining and brake pads, dampers, partly used airbag bellows, metal scraps, operating fluids packaging, empty pressurized canisters, cupboard and paper and plastic packaging etc. (Starkowski, Bienczak, Zwierzycki, 2011).

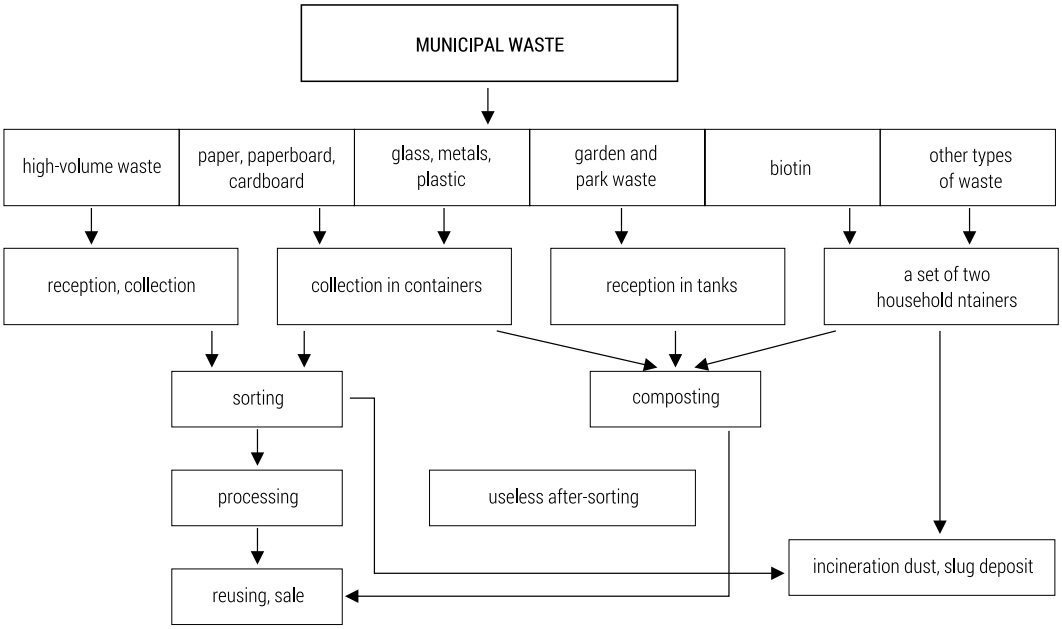

Figure 1. Classification of municipal waste

Source: authors' own work.

Rules of waste classification

Waste catalogue has groups, subgroups and their codes. Hazardous waste is marked with an asterisk*. Every type of waste was given a six digit code, which consists of two digits that define the group, next two digits specifying subgroups and the last two digits defining a type of waste. Waste catalogue which was determined in Regulation of Minister of Environment of 9 December 2014, should be presented in accordance with rules – First: Classification in relation to source generating the of waste – groups 01 to 12 or 17 to 20. Next a six digit code has to be ascribed. Classification of waste from specific branches of industry is an exception. This type of waste can be divided into several groups (table 1), (Kozlak, 2009):

First: If packaging waste that is communal waste but collected during selective collection

- First: If packaging waste is municipal waste but collected separately – it is classified directly in the group 15 01, not 20 01.
- Second: If an appropriate item was not fund among groups 01 to 12 or 17 to 20, then the waste is classified in groups 13 – 15.

- Third: If the item is still unfound in the above mentioned groups, it should be covered by group 16.
- Fourth: if waste does not match group 16, it should be classified in a group of waste origin and ascribe a code 99 at the end – wastes not otherwise specified.

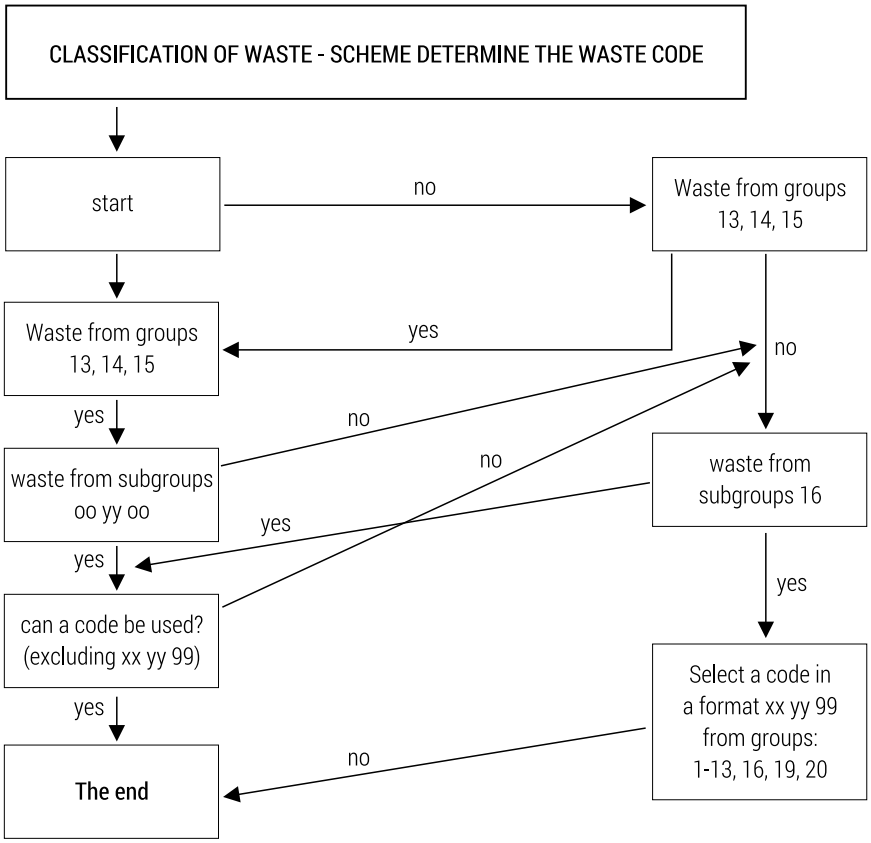

Figure 2. Municipal waste and its identification

Source: authors' own work.

The scheme below depicts phases of an appropriate waste classification (figure 2), (Teodorowicz, 2010):

- waste organic solvents, refrigerants and propellants (except groups 7 and 8) – 14;
- waste packaging, absorbents, wiping clothes, filter materials and protective clothing not otherwise specified – 15;
- waste not otherwise specified – 16;

- construction, demolition and road infrastructure waste (including excavated soil from contaminated sites) – 17;
- waste from human or animal health care or related research (except kitchen and restaurants waste not arising from immediate health care) – 18;
- waste from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial– 19;
- municipal waste including separately collected fractions – 20.

Table 1. Proper waste classification

Group	15	Waste packaging, absorbents, wiping clothes, filter materials and protective clothing not otherwise specified
Subgroup	15 01	Waste packaging (including municipal packaging waste collected separately)
Type of waste other than hazardous	15 01 01	Paper and cardboard packaging
Type of hazardous waste	15 01 10	Packaging containing residues of or contaminated by dangerous substances (e.g plant protection products toxicity class I and II – very toxic and toxic)

Source: authors' own work.

Municipal waste is classified into group Q14 as substances or objects that Carnot be used by the holder any longer. Municipal waste belongs to group (table 2), (Regulation… 2014).

Table 2. Place of municipal waste in waste catalogue

Code	Groups, subgroups and types of waste
20	municipal waste including separately collected fractions
20 01	Separately collected fractions (except 15 01)
20 01 01	Paper and cardboard
20 01 02	Glass
20 01 08	Biodegradable kitchen and canteen waste
20 01 10	Clothes
20 01 11	Textiles
20 01 13*	Solvents

20 01 14*	Acids
20 01 15*	Alkalines
20 01 17*	Photochemicals
20 01 19*	Pesticides
20 01 21*	Fluorescent tubes and other mercury-containing waste
20 01 23*	Discarded equipment containing chlorofluorocarbons
20 01 25	Edible oil and fat
20 01 26*	Oil and fat other than those mentioned in 20 01 25
20 01 27*	Paint, inks, adhesives and resins containing dangerous substances
20 01 28	Paint, inks, adhesives and resins other than those mentioned in 20 01 27
20 01 29*	Detergents containing dangerous substances
20 01 30	Detergents other than those mentioned in 20 01 29
20 01 31*	Cytotoxic and cytostatic medicines
20 01 32	Medicines other than those mentioned in 20 01 31
20 01 33*	Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33

Explanations:
* Hazardous waste is marked with an asterix in waste catalogue „*" Current classification of the Polish Classification of Goods and Services (pl. PKWiU) is given below. The classification was introduced through the Regulation of Council of Ministers of 4 September 2015 (Journal of Laws of 2015 item 1676) for application as of 1 January 2016, in statistics, record, documents, accounts official registers and information systems of public administration (Act on keeping of the commune in a clean and orderly condition ……2015).

Group	20	Municipal waste including separately collected fractions
Subgroup	20 03	Other municipal waste
Type of waste	20 03 01	Mixed municipal waste

Place in PKWiU / 2015:
Section E WATER SUPPLY; SEWAGE AND WASTE THOGERHER EITH RELATED SERVICES
Chapter 38 Services related to collection, reusing and waste disposal

PKWIU symbol:
P38.11.31 Municipal, non-recyclable non-hazardous waste

Identification and packaging labeling

It is very important for the municipal management to know the informative function of labeling. In the process of waste collection and sorting it is significant to know the labeling system inter alia in terms of recycling – waste reusing. There are certain materials that can undergo this process. It is the producer or importer that should label the packaging (Mendyk, 2012). Labels were determined in an Act of 13 July 2013 on management of packaging and packaging waste. That constitutes a change as the former Act of 2004 stipulated that it was the producer who had to label the packaging with recycling symbols. Labeling that can be found on the packaging needs to be clear, visible and legible. It should contain (Starkowski, Bienczak, 2012; Zwierzycki et al., 2012):

- type of material used for production;
- reuse labeling(in case of reusable packaging);
- recycling labeling (in case of recyclable packaging).

Labeling may take the form of a package label. The package leaflet has to be attached in case when the size done not allow to label the package. The Act does not lay down minimal size of labeling. All patterns are shown in the Regulation of the Minister of Environment of 3 September 2014 on specimen of package labeling. The specimen indicate type of material that packaging is made of. Here are the following types of packaging (Starkowski, Bienczak, Zwierzycki et al., 2011):

- made of plastic;
- made of paper and cardboard;
- made of steel and aluminum;
- made of wood including cork;
- made of cotton and jute;
- made of glass;
- multi-material.

Characteristics of a logistic process

The term **logistic process** is an orderly sequence of operations that aims to provide flow of information and materials. A set of processes creates a logistic system which is understood as a coherent configuration of elements.

The system comprises: production, transport, storage and receiver. What should be taken into account are relations between the particular elements. It concerns the flow of finance, information and goods. A logistic process is a part of (Starkowski, Bienczak, Zwierzycki et al., 2011):

- supply logistics which covers movement of goods, raw materials, intermediate products from suppliers to production companies. Placing a proper order and stock keeping is an important thing to remember in relation to logistics;
- production logistics which main aim is to transfer products during the process of production and effective management of finished products that go to the warehouse;
- distribution logistics deals with delivery of ordered products to the receiver. The most significant factor in this case is low cost and short period of execution of the supply. Such factors affect market competitiveness of the company (Regulation…., 2014).

The logistic process entails the following processes (Poskrobko, Poskrobko, 2012):

- communication, which is a factor that the process could not exist without. Communication and therefore information is a basic element of the process – working on clients' orders needs to be done diligently so that the order complies with the client's needs. Every mistake done in this matter may influence company's image;
- flow of materials management, is a process which aims at defining an accurate number of materials and good timing of the delivery;
- management of stocks, deals with the storage of Raw materials, finished products or intermediate products which will be used;
- storage, is a chain of activities which are directed at stock keeping in specified conditions at a given time;
- transport, consists in transfer of goods and people. The term is also used in relation to information flow (Ficon, 2008).

What a company gains by implementing this rule is not only customer's satisfaction but also a stronger position in the market and in turn competitiveness. Applying the principle demands better warehouse management, faster and flexible reaction to clients' needs (Ficon, 2008).

When we talk about logistic processes it should be remembered that logistics has its origins in an ancient civilization (Janiak, 2008). Treated as an area of management, logistics is a set of aims and activities that aims at accomplishment of the task using own resources. Moreover, we should also add activities that support transfer of goods and people. The activities are the flow of information, money but also other material resources such as vehicles used in performance of the task. The scope of logistics is very extensive and includes (Skowronek, 2012):

- information management which plays a key role in logistics. Information has an impact on supply, transport, the handling of orders in the company;

- materials management, has a function of defined materials delivery and simple access to the goods during storage;
- transport management, it should be pointed out that freight forwarding has a primary function in this case, as the route has to be planned in such a way that cargo goes into the right place in a good, time and condition;
- storage management, includes all warehouse tasks such as record keeping, keeping goods in required conditions and informing about possible shortcomings;
- safety management is the most significant as it is directly responsible for human security. What matters is a proper packaging labeling especially during hazardous waste transport;
- packaging management consists in providing a proper product security through packaging.

The packaging is designed to protect the product, inform the client about the contents and it can also be a promotional element. The analysis of logistic waste management should also define that the above mentioned rules pertain to service companies that municipal company undoubtedly is. In respect of the article, we can say that the company is a business entity that conducts its activity for commercial purposes. It is entered into the Commercial Register and it obtains remuneration for performed services.

Review

The problem of appropriate logistic processes management in the premises of a municipal company id tightly connected with a proper identification of the sorted and transported waste including municipal waste. Hence, subject knowledge is related mainly to knowledge of proper legal provisions and abiding by the current rules. Municipal waste transport is a demanding task as when the carrier plans it many factors such as type of waste, packaging labeling, waste classification, transport duration, appropriate vehicle, natural environment safety and security of other participants of supply chain need to be considered. Failure to comply with at least one of the guidelines may lead to financial loss, sanctions and penalties.

The contribution of the authors

Dariusz Starkowski – 90%
Paweł Bardziński – 10%

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Mikołaj **JALINIK**

ANTHROPOGENIC TOURIST ATTRACTIONS IN FOREST AREAS

Mikołaj **Jalinik,** Prof. Eng. – *Faculty of Forestry, Bialystok University of Technology*

Correspondence address:
Faculty of Forestry, Bialystok University of Technology
Pilsudskiego Street 1A, 17-200 Hajnowka, Poland
e-mail: jalinik@op.pl

ABSTRACT: Anthropogenic tourist attractions are an important element and essential segment of the tourism industry, which stimulates the interest in travelling and ensures the satisfaction of visitors. The more anthropogenic attractions in a given area, the more demand for tourist services is observed. Anthropogenic attractions are characterized by the fact that demand for them depends on innovativeness and entrepreneurship of service providers. Another feature is their variability and diversity, which does not cause monotony by visiting specific places and localities. According to A. Lew (Lew, 1974), without tourist attractions there would be no tourism and without tourism there would be no tourist attractions. Due to the particular value of forest areas, the construction of anthropogenic attractions in these areas is most welcome. In general, it can be said that anthropogenic tourist attractions should be a magnet attracting tourists to the region.

KEY WORDS: forest areas, anthropogenic attractions, the functions of forest areas

Introduction

Forest areas are a multi-layer, plant community, in which trees are predominant. They are not only used for firewood harvesting, the production of various wood products and groundcover, but they are also a place for tourism and recreation. Many benefits can be derived from forest areas, but on condition that they are exploited in a well-thought and well-managed manner in terms of tourism. Apart from the natural values of forest areas, it is advisable to create as many anthropogenic attractions as possible. These can be recreational facilities and equipment, closely linked to tourism activities, which are man-made and constitute a valuable tourist objects.

Forest areas is also "oxygen" factory, which provides an unpolluted environment, silence, peace, tranquility, birds' singing and contact with nature. They also fulfil a social function as a place for tourism and recreation. If anthropogenic attractions are added to the advantages (natural values) mentioned above, this area will be used exclusively for the regeneration of mental and physical health. According to various sources the morbidity rate in our society is steadily increasing, including mainly diseases of the 21st century (cancer, mental illnesses, heart attack, hemorrhage, etc.), and in this case forest areas area desirable place to spend free time and at the same time they can help extend the average human lifespan. It should be remembered that health is the highest human value.

In many European countries, such as Germany, Switzerland, Austria, France and others, forest areas are used to regenerate mental and physical health using anthropogenic attractions. Forest areas also fulfill many other functions that can be defined as the totality of tangible and intangible values use values of the services and benefits provided by forests. Each of the functions is very important, but the most important is the social (health) function.

The aim of the study is to present the importance of anthropogenic attractions in forest areas in order to improve physical and mental health, as well as the possibility of managing leisure time for potential tourists by using the above-mentioned attractions.

The functions of forest areas

Forest areas are a plant formation in which trees dominate where a peculiar ecosystem is created, in which plants, animals, soil, water and microclimate function, forming an indivisible whole. They are the most complex and sustainable terrestrial ecosystem in the world. Forest areas can be created naturally and with human intervention. In a natural way, forest areas evolve, taking up new treeless areas (succession), and with them also other elements of the natural environment change.

Health function is an important function for the renewal and maintenance of a person's physical and mental health. Therefore, it is advisable to recommend forest areas for rest, where there is a specific and unique microclimate, among harmoniously colored trees, in unpolluted environment, saturated with essential oils, containing phytoncides (volatile compounds which have healing effects in some diseases of the respiratory system, characterized by bacteriostatic properties), and in the result physical and mental health can be improved (Muszyński, Kozioł, 2013).

It is the statutory obligation of the State Forest Enterprise (Państwowe Gospodarstwa Leśne Lasy Państwowe) to manage forests in a securely sustainable manner aimed at maintaining the sustainability of forests and increasing forest resources. Forest areas fulfil various and very important functions, and these are:

- ecological functions
  - production and replenishment of oxygen in the atmosphere,
  - binding of carbon dioxide and thereby mitigating the "greenhouse effect",
  - intercepting dust and gas pollutants of air,
  - control of water conditions in and near the area,
  - shaping the global and local climate,
  - counteracting floods, avalanches and landslides,
  - enabling the livelihood of many plant and animal species.
- economic functions
  - the source of timber used as building, furniture, heating and paper material,
  - the source of biomass,
  - the place of food production (forest animal meat, mushrooms, and forest fruit),
  - a place of refuge for animals,
  - a workplace for many people.
- social functions
  - health function,

– tourism and recreation,
– the education of society.

Forest areas are an important factor in the attractiveness of the area and, with an efficient and optimal forest policy, they can be a significant element in the development of tourism. The development of tourism and recreation in forest areas is one of the most important forms of using the non-productive functions of forests. It should be added that forest areas are exposed to atmospheric, ecological, social and economic activities.

An analysis of the historical links between man and forestry shows that forestry is a form of land use that provides many different benefits. The extent and level of forest functions depends both on the nature of the forest and the way the forest management is carried out. Forest areas are also valuable natural areas, which should be protected and at the same time a development strategy should be proposed which would allow to protect all desirable resources and natural values without limiting the socio-economic development opportunities of local communities.

One of the most important advantages of forest areas is the absorption of carbon dioxide and oxygen release, which is why everyone feels very good in the forest. In general, it can be said that forest areas should be used primarily by humans and not the other way round. The biotherapeutic properties of tree species and forest communities have been known since ancient times. For example, pine and mixed coniferous forests have a healing effect on respiratory diseases, while volatile substances have a disinfecting, bactericidal and fungicidal effect and reduce blood pressure. On the other hand, forest fruits are the source of the most valuable vitamins and the most assimilable sugars (Jalinik, 2016).

Forest areas create favorable health and recreational conditions for society, provide the development of ecological education of society and they are a place of rest for artists, poets, writers, prose writers, musicians, and painters and they are often places of inspiration. They are also an excellent place for consumer tourism, i.e. the tourism combined with hunting, the harvesting of forest vegetation (mushrooms, edible fruits and herbs), as well as gathering exhibits (Grochowski, 1992). Non-consumption tourism is very valuable for health, consisting only in staying in forest areas and walking through healthy and charming places. This creates exceptionally favorable conditions for rest, relaxation and health regeneration, mainly for the elderly and people who are advanced in years.

In the development of tourism and recreation in forest areas, their role in social life is increasingly emphasized. Modern tourism is not a homogenous and a compact economic sector, but a complex one. It is characterized by numerous links to many areas of social and economic life.

The types of exemplary anthropogenic tourist attractions

Forest areas are a common good, but they should be properly managed in terms of tourism. It should be remembered that the development of tourism depends on many factors, and tourist attractions are a bug that attracts large groups of tourists and are one of the most important components of tourism. The concept of "tourist attractions" was introduced to professional literature by Cohen in 1972 (Cohen, 1972). Lundberg interprets tourist attractions in a simplified way (Lundberg, 1985), as anything that interests tourists". Goodall, on the other hand, regards tourist attractions as a "characteristic, often unique place, e.g. natural environment, historical monument or such events as festivals and sporting events" (Goodall, 1990). According to Podemski "tourist attractions" include not only the elements of nature and culture, but also e. g. the level of prices, the attitudes of local population toward tourists and tourism and tourist facilities together with the entire technical infrastructure (Podemski, 2004).

According to Sikora (Sikora, 2012), anthropogenic attractions are a human work in a given area, which may be conducive to the development of tourism. The author also lists other types of attractions, such as the following:

- natural, including national parks, landscape parks, forest areas, gardens, orchards, and nature trails;
- architectonic – churches, monuments, palaces, manor houses, cemeteries, and the ruins of castles;
- cultural – festivals, shows, exhibitions, fairs, flea markets, church fairs, canoeing rafting, sports competitions and festivities;
- recreational – walking, canoeing, skiing, horse riding, hunting, observation of forest animals, cycle paths, Nordic walking and rope parks.

The greater the variety of human-made attractions offered, the greater are possibilities to satisfy the requirements of tourists who will willingly decide to extend their stay in a given area or to repeat their arrival and visit, as well as to pass on their positive opinions to friends and family.

Taking into account the existing values and tourist attractions in a given area, it is necessary to undertake actions aimed at developing the area, which would be not only an open-air museum, but also a place of rest, recreation and education. Planning measures should therefore be taken to obtain financial resources for the development of a forest area that would serve tourism and recreation purposes.

There are many forest areas in Poland, where anthropogenic attractions could be created, creating the possibility of an attractive way of spending free time. The most interesting are shown in the pictures below (figures 1 and 2).

Figure 1. An example of a rope parking a forest area
Source: www.polskieparkilinowe.pl [12-10-2017].

Figure 2. An example of a rope parking a forest area
Source: www.polskieparkilinowe.pl [12-10-2017].

The rope park is a special type of a publicly accessible sport and recreational attraction, consisting of ropes, ladders, bridges and platforms spread at various heights (even up to several meters above the ground, often in forest areas, between trees, but it can also be constructed in an open space between specially arranged columns). Rope and balance exercises not only have a positive impact on the physical condition but also improve physical fitness, as well as help find non-standard solutions in planning and making strategic decisions.

Rope parks provide unforgettable experiences and outdoor activities. It is a form of recreation for children, young people, adults and the elderly. The only limitations are too small height and ill health, which may even deteriorate by physical effort. The vogue for active recreation and extreme sports makes such parks very common in many European countries. As for Poland they have just started to appear. For example, in 2005, four new rope parks were set up, and at the end of 2008 there were already forty-five of them, spread throughout Poland. In 2016 there were more than two hundred rope parks, and new ones were constantly being built (*www.polskieparkilinowe.pl*).

Recreational pathways, often referred to as health paths, also have an impact on the improvement of physical and mental health. Most often they should be built in forests or tree-covered areas. They consist of a set of exercise equipment, which is arranged along a walking trail of about approx. 100 meters from one station to another (figure 3).

Figure 3. Recreational path (health path)

A railing set; a ladder set; ping-pong tables; basketball backboards; swings; carousels; climbing ropes – lifting rods; balance beams; a walking path (ca. 100 m – approx.. 100 m)

Source: authors'own work.

Recreational (health) paths are used in many European countries, such as Germany, Austria, Belgium or Switzerland, which can be confirmed by the author of this paper. Recreational facilities should be constructed on one side of the walking path in order to have a moment of rest before reaching the next station.

Another form of recreation in forest areas should be paths for bicycles and pedestrians (figures 4 and 5).

Figure 4. An example bicycle path in a forest area

Source: www. polskanarowery.sport.pl [20-09-2017].

Figure 5. People doing attractive Nordic walking on a walking path

Source: www.lasy.gov.pl/informacje/wydarzenia/nordic-walking-w-lesie [10-09-2017].

Cycling in forest areas is a suitable form of recreation. Riders are not at risk of danger from motor vehicles and inhalation of exhaust fumes. The riders do not have to pay attention to road signs and riding is quiet and noiseless. Riding people listen to birds singing and the sound of trees. The scent of flowers, resin or blooming lime trees is scattered everywhere. Cycling in forest areas, it is possible to come into contact with wild animals and admire the whole range of colors, dozens of shades of green in spring or yellow and brown in autumn. In forest areas it is possible to ride side by side with impunity, even in a group of four people, if you have a sufficiently wide road, and riding in a group brings people together and facilitates interpersonal contacts.

It is also worth mentioning that when cycling through forest areas, it is possible to pick up mushrooms, berries, raspberries or wild strawberries, whose taste and smell cannot be compared to other garden fruit, and in the heat, nothing will replace the coolness that a forest cluster can give us. It is similar when walking in the forest or doing Nordic walking (figure 5).

The anthropogenic attractions, in contrast to natural attractions, are characterized by the fact that their character, shape and attractiveness change. There may be other ideas and organizational solutions that will interest visitors at any time.

In addition to the paths for pedestrians and cyclists, educational paths should be built in forest areas (figure 6). They are one of the most common elements of recreational forest management. Forest educational paths play a very important role in passing on forest knowledge and related issues to various groups of people. According to Ważyński, educational paths are specially designed walking routes designed for active recreation in the forest (Ważyński, 1997). The way they are delineated, the subject matter in the stops, as well as other parameters, such as their length, can determine the success or failure of a newly built path. An obvious advantage of educational paths is the combination of educational and tourist functions, and an important task of the paths is to "develop" respect for a forest and the work of foresters.

Visitors have the opportunity to learn about the structure of a forest ecosystem, tree and shrub species, and herbaceous plants and animals living there. Educational paths play a special role in forest areas and, for example, they provide information about threats in the forest (fires, harmful insects, dangerous animals and others) and methods used by foresters to prevent them.

The sleigh ride with a bonfire is also an anthropogenic attraction (figure 7). According to the fans of this form of recreation, it is the most attractive winter form of spending leisure time. It is possible to enjoy the nature while riding

through the forest areas. It is much time to watch the snow cover of the trees. The sleigh ride is an excellent form of integrating people of different social and professional groups.

Figure 6. An example educational path in a forest area
Source: https://pl.wikipedia.org/wiki/Ścieżka_przyrodniczo-leśna_w_Lesie_Marcelińskim [02-10-2017].

Figure 7. Sleigh rides in forest areas
Source: www.malygosc.pl [10-10-2017].

Sleigh rides also have a cultural dimension. During a sleigh ride in some regions of the country, Polish national dances are performed such as cracoviennes, mazurkas, polonaises, kouiaviacs with oberek, as well as regional

polkas and drabants. Sleigh rides are often accompanied by music, singing and playing at the bonfire. In the evening, the sleigh ride is often lit up with torches, which is a unique attraction.

Summary

Tourist anthropogenic attractions are considered to be a key component of the tourism market and an important tourist factor for every tourist. Attractions stimulate interest in travelling to the destination and ensure the satisfaction of visitors to places in forest areas.

In the group of anthropogenic attractions, a significant number of features can be distinguished that influence the quality of rest. These are facilities and material objects, closely related to human activity and produced by it, which are valuable in terms of tourism. Every object or device that is an anthropogenic attraction is distinguished by the following features:

- it "attracts" tourists;
- it has a core (*nucleus*), which is a feature that distinguish it from other objects or devices;
- it has a designator (marker), i.e. appropriate information about the core, thanks to which the tourist knows about the existence of attractions (e. g. information boards, descriptions in a guide book or other publications).

Anthropogenic attractions as opposed to natural attractions are characterized by innovativeness, variability (uniqueness) and for this reason they are a magnet attracting tourists to the region, and at the same time they stimulate the demand for other tourist services. The greater is their number, the more attractive is the region. Therefore, the aim should be to have as many of them as possible, which will contribute to increased tourist traffic and improve the budgets of communities and inhabitants living in forest areas.

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Pawel **TADEJKO**

ENVIRONMENTAL MONITORING SYSTEMS USING INTERNET OF THINGS – STANDARDS AND PROTOCOLS

Paweł **Tadejko,** PhD, Eng. – *Bialystok University of Technology*

Correspondence address:
Bialystok University of Technology
Wiejska Street 45A, 15-351 Bialystok, Poland
e-mail: p.tadejko@pb.edu.pl

ABSTRACT: The Internet of Things (IoT) consist of smart connected devices in homes, businesses and cities that has the ability communicate over an Internet without human-to-human or human-to-computer involvement. IoT communication standards and platforms has a high potential for a wide range of applications in different domains. Collecting the data by a large number of sensors, is a challenging task because of many open issues. Effective collection and distribution are crucial for classes of smart city services such as environmental monitoring, public security, transportation, and other. Unfortunately there are many connection gaps between the raw sensor data and the information context that are needed by high-level services and applications. Utilization of some Semantic Web standards provide better integration of sensor with applications, but still is far from being solved. Therefore, we have analyzed selected standards, protocols, and architectures and have suggested some enhancements into "common semantics" model.

KEY WORDS: IoT, Internet of Things, environmental monitoring, semantic IoT, smart city

Introduction

Internet of Things is a platform where every day devices surrounding us become smarter, every day collecting the data and processing becomes intelligent, and every day communication becomes more useful for people. The Internet of Things (IoT) has been defined in Recommendation ITU-T Y.2060 (ITU-T Study, 2015) as "a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies". While the Internet of Things is still evolving, its effects have already stared in making incredible changes in many areas as a universal solution media for providing services in completely different ways. Gartner (Rivera, Rob, 2014) reported that 25 billion devices will be connected to the internet by 2020 and those connections will facilitate the used data to analyze, preplan, manage, and make intelligent decisions autonomously. The US National Intelligence Council (NIC) has embarked IoT as one of the six ''Disruptive Civil Technologies" (Council National Intelligence, 2008). In this context, we can see that service several sectors, such as: smart city, e-health, e-governance, transportation, e-education, retail, agriculture, process automation, industrial manufacturing, logistics and business management etc., are already getting benefited from various forms of IoT paradigm and technology.

First wave of IoT systems in smart city domain emphasized on connecting sensor using lightweight protocols such as CoAP and XMPP (old fashioned publish/subscribe communication model). The Smart-Object devices with domain specific smart automatic rules are rapidly replacing first wave of IoT devices (Kortuem et al., 2010). Although these devices do not utilize semantic technologies (Park et al., 2014), they provide higher-level of sensor-to-application communication than just plain transfer of raw sensor data.

Sensor data representation formats used in a sensor networks is various, and most of them cannot understand the value's meaning in other systems. Therefore, values and information from the systems must be prepared, shared and provided additional metadata information for other applications. The second challenge is develop knowledge discovery techniques and services for big smart city data storing, transfer and provide useful analytics.

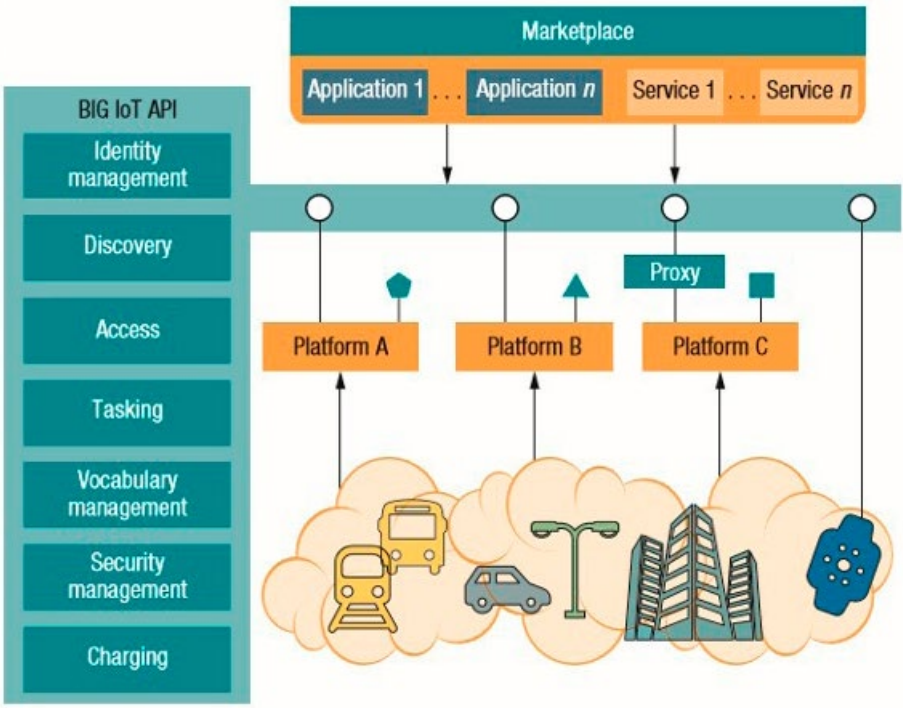

Figure 1. A model of a basic Internet of Things (IoT) ecosystem architecture

Source: (Bröring, et al. 2017), https://www.infoq.com/articles/enabling-iot-platform-interoperability [15-10-2017].

Most of the current IoT services (figure 1) require IoT applications (BIG IoT API) to have knowledge of IoT middleware (communication software) and sensors or sensor networks for accessing IoT resources. Heterogeneous IoT middleware are not easy to be accessed by different applications since each IoT gateways has no open and standardized Application Programming Interface (APIs). Various organizations such as the OpenIoT Alliance, AllSeen Alliance, and IPSO Alliance are working on standardization of „Internet of Everything" communication protocols to provide interoperability between various solutions.

Although the utilization of many standards provide better integration of semantic knowledge with ICT (Information and Communications Technology) systems, the interoperability challenges on IoT is not solved and more advanced semantic IoT architecture is required to provide higher level of interoperability between connected IoT systems.

An overview of literature

The Internet of Things has evolved very fast in recent years and sometimes the term IoT refers, erroneously, only to device and the way connected devices called „things". However there are more than just devices, even for devices with advanced systems and high computing power such as smartphones.

The main characteristics and functions of the layers (IoT Stack) rely on the capacities of an IoT system to provide functions, protocols and operations across those layers (Serrano, Soldatos 2015). From the physical level protocols (device) where raw data are collected, to a layer with a well-defined APIs (protocols) and protocol-driven information system that enabling services at a business level. The IoT Stack for service delivery models and interoperability for the Internet of Things is shown in figure 2.

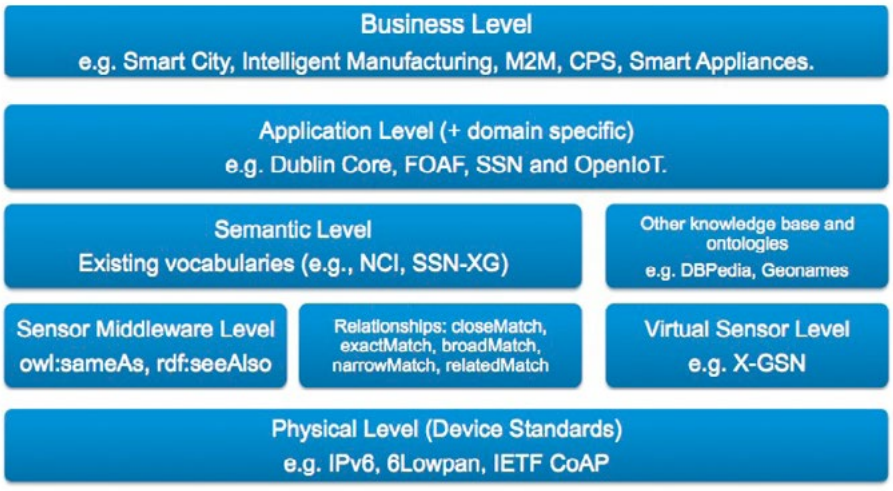

Figure 2. IoT stack for service delivery and interoperability: protocols and standards

Source: (Serrano, Soldatos 2015), https://iot.ieee.org/conferences-events/wf-iot-2014-videos/26-newsletter/september-2015.html [15-10-2017].

Functional design and implementation of a complete Wireless Sensor Network (WSN) platform can be used for many purposes, e.g. monitoring of long-term environmental changing based IoT applications (Lazarescu, 2013).

The OpenIoT Architecture

The integration of multiple IoT systems demand to have interoperability platforms able to communicate between all the IoT solutions. One of them is OpenIoT. OpenIoT was incepted in 2010 with the main goal of converging sensor data systems using cloud computing infrastructures with IoT. OpenIoT focuses on the IoT Data Stream management (Serrano et al., 2013) shown in figure 3. OpenIoT is a design concept that implemented sensor platform of the IoT Stack.

The main areas of features of OpenIoT address some needs in principle to:

- guarantee semantic interoperability of various IoT services and sensor data streams;
- maintain the reference model implementation for semantically interoperable IoT;
- enable the delivery of services utility-based – as Sensing as-a-Service.

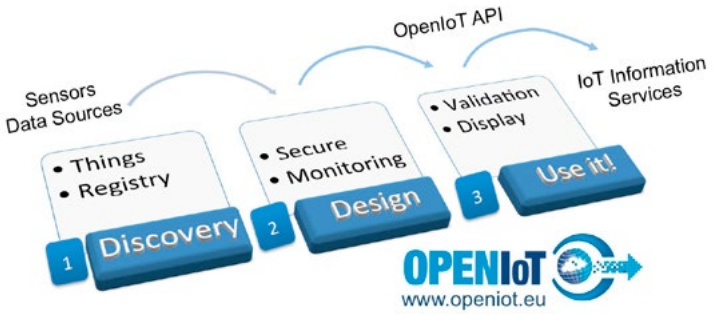

Figure 3. The OpenIoT platform implementing the IoT Stack

Source: (Serrano, Soldatos, 2015), https://iot.ieee.org/conferences-events/wf-iot-2014-videos/26-newsletter/september-2015.html [15-10-2017].

The elements described in the platform „OpenIoT Stack" (Serrano, Soldatos, 2015) are part of a process with relations and interactions for the IoT landscape. The OpenIoT stack (Serrano et al., 2015) has been designed in the context of IoT systems and defines and establishes the relations between the operations and the role that sensors, devices and services can play in the whole IoT systems.

Semantic IoT

Interoperability between messaging protocol in modern IoT applications, multiple application level protocols such as CoAP (Constrained Application Protocol), XMPP (Extensible Messaging and Presence Protocol) and MQTT (Message Queue Telemetry Transport) are proposed by various organizations to become the de facto standards to provide communication interoperability. However, we need special layer, located between physical level sensors and cloud-based services that we call a gateway. A smart IoT gateway framework (additional layer based on standards and protocols) is a software solution that bridges the semantic gaps between the raw sensor data and the information context that is needed by top-level services and applications (Desai, Sheth, Anantharam, 2015).

One of the major initiatives, which utilizing Semantic Web for IoT architecture, includes the OpenIoT project, funded by Europe Unions framework program. The OpenIoT focuses on developing open source software platform for IoT interoperability using linked sensor data, protocols and services (OpenIoT Consortium, 2012). Many providers of IoT hardware and APIs design their own semantic IoT service platform, but most of them provide building blocks that are very similar, e.g. knowledge base, resources management, ontology, semantics process, analytics, broker. On the figure 4 we see sample one of the them.

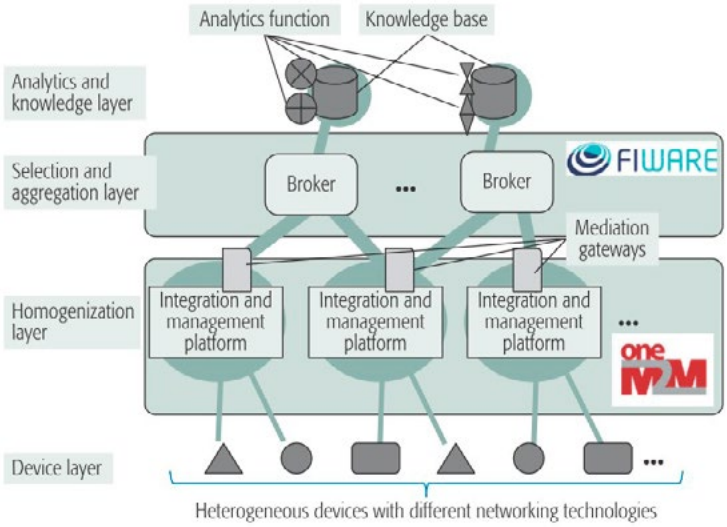

Figure 4. Functional Architecture of Semantic IoT Service Platform. Architecture of IoT Process Automation and its 3 GEs (Generic Enablers)

Source: (FIWARE 2014).

Next Generation Network

The Next Generation Network (NGN) is a packet-based (send data in separate, small blocks) network able to provide telecommunication services and to make use of high Quality-of-Service multiple broadband technologies. In NGN concept, services are independent from underlying transport-related technologies. Another important element is Wireless Sensor and Actuator Networks. WSANs will be used in a broad set of heterogeneous application scenarios leading to a big variety of deployments with completely different communication infrastructures, protocols, data-rates, latencies, etc. For example, in some cases, SANs could be available through a broadband Internet connection or even satellite, while in others they could be accessible through GRPS connectivity.

Research methods

Semantic subsystem is not enough to create truly "intelligent" services. Such services combine input events (triggers) and real-time IoT information with other data sources from mobile devices and social networks. In order to integrate many various heterogeneous systems, semantic reasoning as well as knowledge processing is needed to correctly link and map different data, as well as to provide semantic searches.

Most interesting research areas in bridging this gap and make services more useful for ordinary mobile phone or smartwatch users. There are many study on designing advanced semantic gateway that makes uses of services available in easy way. For instance, if someone would want to know the current temperature and air humidity of a shopping mall, office building or other public place. The request can be handled by special services, but not probing directly the devices or set of sensors. The conversion from the high level concept of „temperature of a location" to low level of device „data from sensor X" has to be translated in the system level.

To provide services that the knowledge of Internet of Things can be used by high level as a named services, semantic and ontology has been considered as a key technology. And the last thing is geofencing. Geofencing is a critical set of concepts for the IoT. It's the basic technologies to start using the IoT services depends on our location or stop devices from working outside of our secured environments. For IoT systems, an ontology can provide high-level abstraction for device metadata to enable semantic-oriented presentation of the environment and to provide interoperability of the sensors, systems and applications.

Results of the research

Syntactic and semantic interoperability have already been widely addressed in literature, but areas of environmental monitoring systems are mentioned as a one of many areas of application. Most of the existing work has focused in ontology design (Wang et al., 2012) (Nambi et al., 2014). The authors present the concept of a Smart Entity and Control Entity that is used for ontology alignment and match-making. This enables automation of deployment of IoT applications in heterogeneous environments.

Work of the authors (Ganzha et al., 2017) aims at the design and implementation of an open framework and associated methodology to provide interoperability among heterogeneous IoT platforms, across a software stack (devices, network, middleware, application services, data and semantics). They focus on the data and semantics layer. Specifically, the role of ontologies and semantic data processing.

The paper (Ruta et al., 2017) proposes a SWoT framework in Wireless Sensor Networks (WSNs) enabling cooperative discovery of sensors and actuators. A extension of the CoAP protocol makes possible to use semantic matchmaking via nonstandard reasoning to better characterize the resource discovery.

Advanced architecture with special gateway was proposed in (Desai, Sheth and Anantharam, 2015). The paper proposes a gateway and Semantic Web enabled IoT architecture to provide interoperability between systems, which utilizes established communication and data standards. The Semantic Gateway as Service (SGS) allows translation between messaging protocols via a multi-protocol proxy architecture.

Interesting cross-sectional analysis we can find in (Kovacs et al., 2016). Paper presents many standards, protocols and techniques as a elements of Global IoT services (GIoTS) that are combining locally available IoT resources with cloud-based services. The authors explain a system architecture for achieving world-wide semantic.

More technical technological approach we have in (Park et al., 2014). The paper focuses on how technologies contributes to improving interoperability between IoT devices, and making easily use of them. The proposed technology platform provides semantic-based IoT services, and semantic interoperability of devices.

Authors (Gyrard, Serrano, 2015) share their vision of Semantic Web of Things applied to smart cities. They highlight main research challenges and propose way to applied the semantic IoT engine to smart cities. The proposed semantic engine is applied to three use cases, existing solutions: Machine-to-

Machine Measurement (M3) framework, FIESTA-IOT EU project and VITAL EU project.

Semantic IoT Standarization

Key standardization efforts that have sought to establish sensor data models for sensors to be accessible and controllable via the Internet (Web Services and HTTP) include:

- OGC Sensor Web Enablement (SWE): The SWE efforts established by the Open Geospatial Consortium include following important specifications: Observation & Measurement (O&M), Sensor Model Language (SensorML) and Sensor Observation Service (SOS) (Botts et al., 2008);
- Semantic Sensor Network (SSN) ontology: The SSN ontology, developed by W3C provides a standard for modelling sensor devices, sensor platforms, knowledge of the environment and observations (Atkinson et al., 2017), (Compton et al., 2012);
- Semantic Sensor Observation Service (SemSOS): The Semantic Web enabled implementation of SOS. SemSOS implementing a semantic reasoning service acting on the knowledge base (Henson et al., 2009). SemSOS is the principal component of Semantic Sensor Web (Sheth, Henson, Sahoo, 2008).

Environmental monitoring

Environment monitoring is key for multiple applications and requires that devices used in acquiring environment data to be scattered over a wide area. Monitoring is quite complex and challenging process, but with recent advances of dedicated protocols, standards and semantic models in many areas there is a good premise for automating almost each activity in monitoring of any system, process, and environment.

Publication (Cocioaba, Tudose, 2017) describe a system which integrates the two networks' main capabilities (Wi-Fi and IEEE 802.15.4 Networks) by monitoring data in a heterogeneous Wireless Sensor Network. Nodes can transmit sensor data over the Internet to other devices, server applications or cloud based solutions, making the whole process of environmental monitoring accessible.

Work of the authors of the paper (Tovarnitchi, 2017) shows the main questions identified while trying to design architecture for an OpenSmartWorld environment monitoring system, e.g. what kind of system should have and what technologies and standards should be used in order to support required functionalities.

Table 1. Research areas of environmental monitoring systems based on ideas of IoT

	Areas of research			
Proposed solution	sensors and devices	sementic/ ontology	gateway layer	Internet/cloud
Cocioaba and Tudose 2017	High	Low	High	High
Tovarnitchi 2017	Low	Low	High	High
Mois, Folea and Sanislav 2017	High	Low	Low	Low
Andrés 2016	High	Low	Medium	Low
Boubrima, Bechkit and Rivano 2017	Low	Medium	Low	Low

Source: author's own work based on publications research.

Authors (Mois, Folea, Sanislav, 2017) presents three different IoT-based wireless sensors for environmental and ambient monitoring: one employing HTTP, one using Bluetooth Smart. All of the presented systems provide the possibility of probing remote sensors and visualizing data from every device with an Internet connection.

This work (Andrés, 2016) presents a new development model for wireless community networks. This model is based on the use of the monitoring of air quality and environmental variables in order to reward less polluted areas. The CleanWiFi network constantly monitors the air for pollutant gases, and uses the same data for public WiFi service, displaying information about the quality of the air to the user.

In this paper (Boubrima, Bechkit, Rivano, 2017) authors focus on an alternative or complementary approach, with a network of low cost and autonomic wireless sensors. Their main contribution is to design stochastic model of nature of pollution.

Dedicated IoT Platform

The benefit of developing dedicated IoT platforms (figure 5) is that it is relatively easy to maintain IoT applications in one domain. System has a limited selection of different types of IoT devices and operations. For service providers, it is easy to manage the devices and data of the selected domain specific applications. Unfortunately, in this case, users need special applications or web site for each dedicated systems.

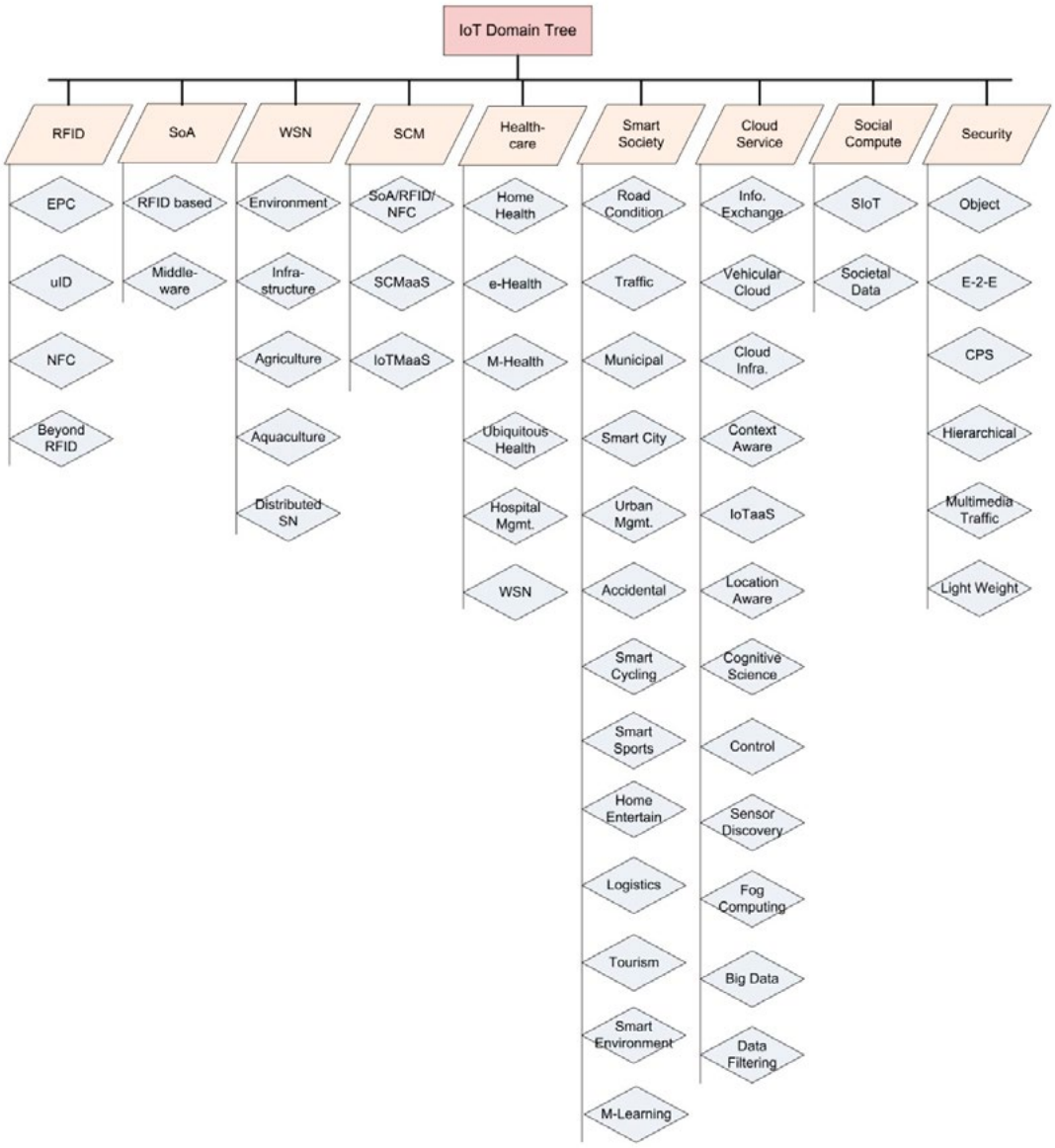

Figure 5. Application domains of IoT cloud platforms, also "Home Entertain", "Logistics", "Tourism", "Smart Environment", "M-Learning", "Fog Computing", and many more

Source: (Ray, 2016).

Universal urban IoTs, in fact, should be design to support the Smart City vision, which aims at exploiting the most advanced technologies to provide useful services for the administration of the city and for the citizens. Users wants mobile application and services in one platform with good user expe-

rience, not hundreds of small apps. Unfortunately, in the real world, most of the solution providers wants to build their own platform and standards, even based on W3C guidelines.

W3C Recommendations (Atkinson et al., 2017) provides guidelines to help data providers to design more useful services linked as a part of Smart City platform for citizens. It introduces the concept of cross-domain data such as climatic, occupation, pollution, traffic, activity, etc. Semantic Sensor Network standard can help to build a tools to share dataset with many domain ontologies specific to smart cities.

Conclusions

The Internet of Things is a recent communication paradigm that envisions a near future, in which the objects of everyday life will be equipped with sensors, and suitable protocol stacks that will make them becoming an integral part of the Internet and our life. The IoT solutions landscape is full of different and incompatible proposals for the practical realization of IoT systems. Therefore, from a system perspective, the realization of an IoT solutions, together with the required services and devices, still lacks an established standards, frameworks and best practice. Currently, most of the IoT services are provided by different platforms and systems, and each platform often is associated with a certain domains.

Semantic Sensor Network is visualized as the key solution for heterogeneous sensors which enables semantic integration for real time systematic measurement and handling of environmental dynamics to achieve essential solutions or services. SSN follows a horizontal and vertical modularization architecture by including a lightweight but self-contained core ontology. With their different scope are able to support a wide range of applications and use cases, including environmental monitoring.

We suggest that cities authorities should deploy a solution based on W3C standards and their own Smart City IoT guidelines. There are a few good examples where developing standards can help to build widely adopted IoT platform. One of them is Australian Government Linked Data Working Group. Developing Government standards for guidance and establishing technical mechanisms for „Linked Data" implementations will ensure individuals, businesses and organisations can benefit from the opportunities these technologies offer.

The smart city concept received in the last few years a significant research effort and technological development. We believe that one of the possibilities is to solve the problem of interoperability of solutions from different provid-

ers is design by W3C Organization a guidelines and implementation of a reference IoT semantic gateway framework.

Acknowledgements

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STUDIES AND MATERIALS

STUDIA I MATERIAŁY

Jacek MARCINKIEWICZ • Tomasz POSKROBKO

MARKET KNOWLEDGE AND DECLARED PREFERENCES IN THE CVM (USING WIND POWER PLANTS AS AN EXAMPLE)

Jacek **Marcinkiewicz,** PhD • Tomasz **Poskrobko,** PhD – *University of Bialystok*

Correspondence address:
University of Bialystok
Warszawska Street 63, 15-062 Bialystok, Poland
e-mail: t.poskrobko@uwb.edu.pl

ABSTRCT: The article attempts to assess the impact of the factor related to the knowledge of the real estate market on the declared preferences in the CVM. A set of factors widely described in the literature, potentially affecting the outcomes of the frame experiment (such as gender, education, social status) has been enriched with the factor related to market knowledge.
The research was conducted on a group of 1,200 people by the CATI method in 2015. Due to the level of knowledge of the market, respondents were divided into four groups. Measures determining the degree of dependence of features (market knowledge and WTP declarations) were used: independence tests, medium difference tests (ANOVA).
It was found that knowledge of the market determines the willingness to pay (WTP). Knowledge of the market is an important factor affecting the discrepancies between the respondents' declarations to pay for the good valued. Therefore, meteorological indications for conducting CVM studies should be enriched by considering this circumstance.

KEY WORDS: contingent valuation, wind power plants, CVM study methodology

Introduction

Contingent valuation method – CVM is currently one of the key methods facilitating the analysis of relations between economy and the natural environment, allowing for valuation of environmental goods and services that are not subject to market exchange. Tomasz Żylicz draws attention to this question, writing: "if we want environmental protection to be undertaken in a way that is consistent with social preferences, we should be able to value it in money. This is an urgent need, because we would like to see improvements in the natural environment to become as quickly as possible, without waiting for changes in the ecological awareness that require generations" (Żylicz, 2014).

The result of the CVM survey is the determination of the respondents' average readiness to pay for a specific improvement or maintenance of a resource, asset or service of the environment. The basis for valuation is the construction of a hypothetical situation in the form of an event scenario in which the state of non-marketable assets is modified (Czajkowski). The research can be carried out by two techniques: "by asking the users of the non-market good under investigation if they are willing to pay (WTP – willingness to pay) to be provided with that good, or what compensation they are willing to accept (WTA – willingness to accept) for the fact that the good they have right now will be taken from them" (Żylicz, 2004).

Despite its popularity, the method of contingent valuation is sometimes criticized as being inaccurate and unrepresentative. On the other hand, however, the Contingent Valuation Panel (CVP) chaired by Kenneth Arrow and Robert Solow (Arrow, Solow et al., 1993, p. 5), which was set up to assess the usefulness of CVM in economic research, concluded that it could be used as a reliable way of measuring values, provided that certain methodological guidelines were followed(Arrow, Solow et al., 1993, p. 17). The observance of these indications is aimed at minimizing the difference between actual and declared willingness to pay for a given good, and their essence is boiled down to an attempt to predict circumstances influencing these discrepancies.

In a modern perspective, CVM is treated as one of the experimental economics methods. According to the classification of J. A. List (List, 2008), the method of contingent valuation method is a framework experiment. It differs from standard economic experiments in that it is not carried out in the laboratory, and therefore it is necessary to examine carefully and control the external factors influencing the environment of the experiment. Most often, in the case of the contingent valuation method, sociological factors such as gender, age, education, social status and specific factors such as protesting respondents are subject to scrutiny. Their control allows to some extent to

predict circumstances affecting potential discrepancies between declared and actual preferences.

In the authors' opinion, these well-known factors should be supplemented by the problem of knowledge of the market based on which a hypothetical research scenario is constructed. In this article, the real estate marked is used as an example, and market knowledge is assessed based on respondents' declarations that they made or intended to make a property purchase/sale transaction.

The purpose of the article is to verify the following hypotheses:

- there is a relationship between the knowledge of the market, and a declaration expressed in a qualitative way, concerning the influence on the change of the value of properties located near wind power plants,
- the knowledge of market is a significant factor modifying the amount of declared impairment loss of the property in the studies using the contingent valuation method.

Research methodology

It was decided in the research to select a targeted sample by selecting four counties: Puck, Suwałki, Żuromin, and Ełk. The main reason for the selection of these counties was the fact that there were there both concentrations of wind power plants (or wind farms) and individual turbines scattered in the county. According to the authors, the mere presence of wind plants may influence their perception of the landscape (Marcinkiewicz, Poskrobko, 2015) and in relation to the assessment of their impact on the value of property. To be sure of this, the authors, apart from three counties with considerable numbers of wind power plants (i.e. the counties of Puck, Żuromin and Suwałki), also chose one control county without such power plants – the county of Ełk. The location of these counties is shown in the figure below.

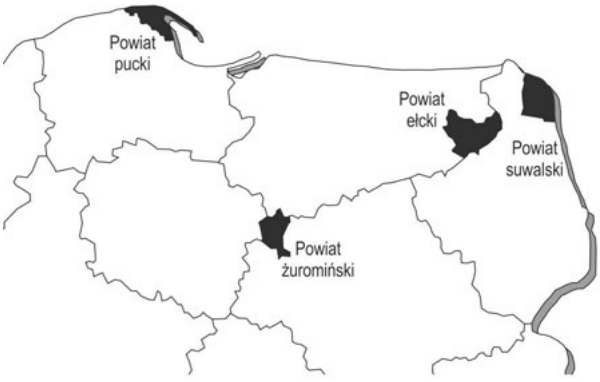

Figure 1. The location of the counties covered by the study

Source: authors' own work.

Another criterion for the selection of counties was their tourist attractiveness. It has been assumed that people living in areas where tourism is a significant branch of economy in the region will be more sensitive to landscape quality problems. In this case, the control sample was Żuromin county, where tourism is only marginally developed, the other counties: Puck, Suwałki and Ełk, are characterized by considerable touristic values, resulting from natural and landscape features. The northern and eastern borders of Puck county are delimited by the shoreline of the Baltic Sea, while from the south and south-west they are bounded by large woods of Darzlubska Forest, waters of Lake Żarnowiec, and moraine hills. Ełk county, which is in Masuria, is characterized by two types of landscape. The northern and eastern parts are highly undulating, with numerous moraine valleys filled with lakes. In the central and southern parts, the terrain goes into the Plain of Augustów. The county of Suwałki is a transitional region between the Masurian Lake District, the Lithuanian Lake District and the Plain of Augustów. Suwałki county is characterized by a very varied post-glacial landscape with numerous hills and moraine depressions.

The research scenario presents a hypothetical situation in which it is possible to introduce an absolute ban on the location of wind power plants in the county. However, such a ban would entail some financial burdens. It has been assumed that if people perceive a decline in the value of the property because of the location of wind power plants in their vicinity, they will be willing to pay a certain amount of money in exchange for the certainty that such power plants will not be built in their vicinity. It was also assumed that an economically rational entity would not be willing to pay more than the decrease in the value of the property. On this basis, it is possible to determine what is the change in the value of the property because of the location of wind power plants in their vicinity. Economic value is by its very nature subjective and depends on the decision of individual participants of a market exchange. Since, in the proposed scenario, the respondents were willing to pay a certain price for the lack of wind power plants, it is expected that in real life situations they expect at least such a decrease in value if they were real estate sellers or offer at least the same lower price if they were buyers (Ligus, et al., 2015).

In the study, the format of closed questions asked in the form of a referendum, recommended in the subject literature (Garrod, Willis, 1999), was used. The research was carried out on a group of 1200 people using the CATI method (computer-assisted telephone interview). Interviews with respondents were conducted in the first quarter of 2015 by a company specializing in survey research.

Respondents were divided into four groups due to their level of knowledge of the market:

- group A – a prominent level of knowledge of the real estate market – persons who have made transactions of purchase or sale of real estate in the last five years and within next five years are planning to make such transactions again;
- group B1 – average knowledge of the real estate market – persons who have not made any real estate purchase or sale transactions in the last five years, but within next five years they plan to make such transactions;
- group B2 – average knowledge of the real estate market – persons who have made transactions of purchase or sale of real estate in the last five years but have not planned to make such transactions within next five years;
- group C – low knowledge of the real estate market – persons who have not made any transactions of purchase or sale of real estate in the last five years and who do not plan to make any such transactions within next five years.

The results of the study were subject to statistical analysis. Measurements were used to determine the degree of dependence of features, including the independence test. As a zero hypothesis, it was assumed the independence of the examined features, i. e. the lack of relation between the level of knowledge of the market and the influence of wind power plants on the value of real estate against the alternative hypothesis assuming their statistically meaningful relationship. The analysis was supplemented by an average difference test (ANOVA) performed with reference to the respondents' declared WTP levels. The ANOVA test assumes that the analyzed features should be subject to normal distribution and have homogeneous variances. Due to the specific nature of the data (closed questions in the form of a dispute), the assumption of normality of distribution was impossible to fulfill. Some authors (Glass, et. al., 199=72) have shown that in large samples the analysis of variances is quite resistant to breaching this assumption. Due to the large sample used in the study, the authors concluded that the lack of normal distribution in it does not constitute a barrier to the use of ANOVA test.

The analysis of results

The knowledge of the market and perception of the influence on the value

It was decided to study the hypothesis that there is a relationship between the knowledge of the market and a declaration concerning the influence on the change of the value of the property located near wind power plants. The

researched were given the possibility to assess the overall impact of wind power plant locations on the value of properties located in their vicinity. Three answers were possible to choose from in this part of the study:

- increasing the value of property;
- no impact on the value of property;
- the reduction of property value.

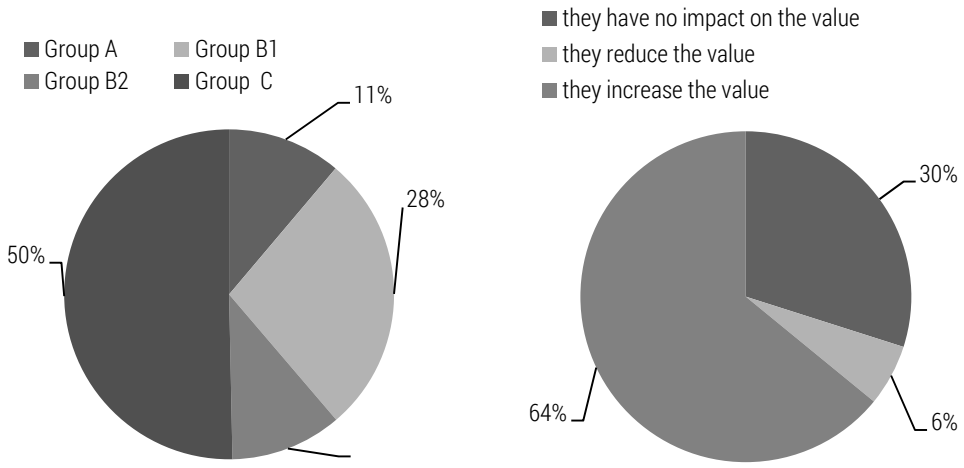

Figure 2. The structure of respondents due to their market knowledge (a) and declarations on the impact of wind power plants on the value of real estate (b)

Source: author's own work.

More than half of the respondents are in the group of people who do not know the market (group C). The clear majority of respondents believe that wind power plants reduce the value of properties located in their vicinity, and only 6% believe the other way round. Nearly one third of surveyed people do not see the relationship between the location of wind power plants and the value of the property.

Research show that there is a statistically meaningful relationship between market knowledge and the perception of the impact of wind power plants on the value of property. The distribution of responses according to age is presented in table 1, and in brackets the calculated theoretical numbers are given, i.e. "artificially created" numerical values that would have taken place in the case of the independence of the stochastic characteristic. The greater differences between empirical numbers and theoretical numbers, the stringer the correlation of the examined features was.

Table 1. The relationship between market knowledge and position regarding the impact of wind power plants on the value of property

Position regarding the impact of wind power plants on the value of property	Market knowledge				Total
	Group A	Group B1	Group B2	Group C	
They have no impact on the value of property	33 (40,1)	73 (99,0)	39 (39,2)	214 (180,7)	359
They reduce the value of property	97 (85,9)	235 (212,1)	86 (83,9)	351 (387,1)	769
They increase the value of property	4 (8,0)	23 (19,9)	6 (7,9)	39 (36,2)	72
Total	134	331	131	604	1200

Source: author's own work.

Declarations of non-impact on the value of real estate most often appeared in group C, i. e. among people who were least familiar with the market (35.4% of responses). A significant percentage of such responses leads to the logical conclusion that people who are not familiar with the real estate market do not have a definite view on the effects of wind power plants on the real estate market. This may be due to the fact that such people do not try to predict potential effects of wind power plants' location. Even partial knowledge of the market can change this situation. There is a clear decrease in the number of declaration of no influence in groups A, B1 and B2. The average percentage of respondents in these groups was 24.3%. The percentage of respondents who believe that wind power plants negatively affect the value of real estate increases together with the increase in the knowledge of the market. The largest is in group A (72.4%), and the smallest in group C (58.1%). Data show that among those unfamiliar with the market, 58.1% of respondents perceive property value loss because of its location near a wind farm. Regardless of market knowledge, the percentage of people declaring a positive influence of power plants is low and does not exceed 7%. Respondents may indeed perceive a positive relationship, but to a certain extent, these attitudes can be explained by the phenomenon of so-called protestors (Arrow, et al., 1993). The protest may be related to the willingness to manifest his or her attitude towards the development of renewable energy sources.

The analysis shows that there is a link between market knowledge and the perception of the impact of wind power plants on the value of property. This confirms the value of statistics $\chi 2 = 24{,}73$, which, at the significance level of 0.0004, allows to reject the zero hypothesis of no relationship between the examined features, and thus to consider market knowledge as a factor influencing the perception of the impairment of properties located in the vicinity of wind power plants.

Market knowledge and WTP declarations

The conducted research prompts the authors to make a hypothesis: the knowledge of the market is a significant modifying factor in the amount of declared value loss of real estate, in research using the contingent valuation method. This in turn may deform the value assessment of a good, valued with using CVM method. The authors attempted to verify this hypothesis based on empirical studies.

In the case when the researched person was convinced of the negative impact of power plants on the value of property, a hypothetical scenario was presented to him or her with the following wording: "It is possible to introduce an absolute ban on the construction of wind power plants in the county, however, this would involve the introduction of a tax on real estate purchase and sale transactions. Such a tax would be paid equally by the buyer and seller of the real estate". After the interviewer described and possibly fine-tuned the hypothetical situation, the respondent was asked questions about the amount of tax in the form of: PLN X for each 100,000 of transaction value (Y% of the transaction value), where, after each positive answer, the value of X (and thus of Y) was increased. Four thresholds were applied in the study:

- PLN 300 for each 100,000-transaction value (0.3% of the transaction value)
- PLN 1000 for each 100,000-transaction value (1% of the transaction value)
- PLN 3000 for each 100,000-transaction value (3% of the transaction value)
- PLN 5000 for each 100,000-transaction value (5% of the transaction value)

Respondents declaring no impact of wind power plants on the nearby properties and respondents declaring their positive impact were included in the group with zero readiness to pay WTP = 0.

Respondents declaring a negative impact of wind power plants on the properties located in their vicinity, however, who are not willing to pay a 0.3% tax on the purchase/sale transaction, were included in a group declaring the WTP in the range of 0 to 0.3%. It was assumed that their propensity to pay is 0.15%. It was decided to choose the middle of the range because in this case, the estimation error is the smallest. Similarly, amounts were allocated to thresholds, assuming that WTP was set at 0.65% (for responders declaring readiness to pay not less than 0.3%), 2% (for respondents declaring readiness to pay no less than 1%), and 4% 9for respondents declaring to pay not less than 3%). The remaining respondents were included in a group declaring WTP = 5%.

Table 2. The distribution of responses by groups depending on the assigned WTP

WTP	Group A	Group B1	Group B2	Group C	Total
0%	37	96	45	253	431
0,15%	62	143	58	233	62
0,65%	15	41	16	73	15
2%	7	29	7	24	7
4%	7	7	2	5	7
5%	6	15	3	16	6

Source: author's own work.

Among all the respondents, the average willingness to pay did not exceed 0.5%. However, some differences can be observed depending on the degree of knowledge of the market. With the growing knowledge of the real estate market, the average willingness to pay increases. In group A, the average WTP is the highest (0.68%) and it is the smallest among people who do not know the market (group C).

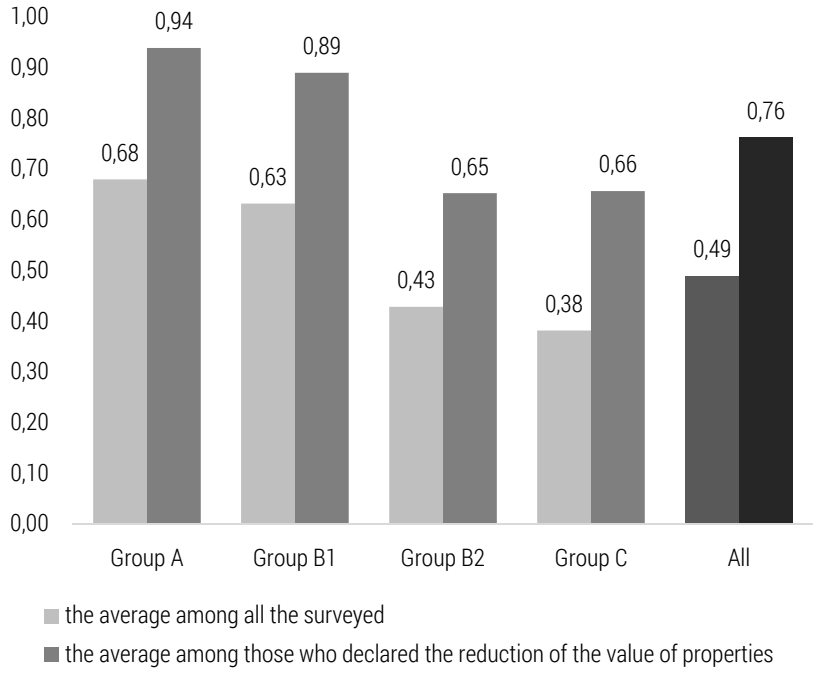

Figure 3. The average WTP level depending on the level of market knowledge

Source: author's own work.

An ANOVA test was carried out to investigate the relevance of differences between the declared averages. The result is presented in table 3. The significance of the text below 0.001 allows to reject zero hypothesis of equal mean values groups. Thus, statistically significant differences can be observed between average WTP in individual groups.

Table 3. ANOVA variance analysis based on all replies

SUMMARY

Groups	Number	Mean	Variance
Group A	134	0,68	1,773
Group B1	331	0,63	1,489
Group B2	131	0,43	0,916
Gorup C	604	0,38	0,869

VARIANCE ANALYSIS

The source of variance	SS	df	MS	F	The p value
Between groups	19,07	3	6,36	5,55	0,00088
Within the groups	1370,55	1196	1,15		
Total	1389,62	1199			

Source: author's own work.

The above average distribution in individual groups is partly due to the aforementioned share of declarations of no impact or positive influence of wind power plants on the value of real estate in the distribution of the responses (table 1). To mitigate the impact of this type of responses, the average WTP was also calculated only among people who perceive the impact of wind power plants on the value of property as negative. However, this treatment did not change significantly the arithmetic means in individual groups. Still the highest willingness to pay is declared by those who are most familiar with the market (group A).

Table 4. ANOVA variance analysis carried out based on the replies of the persons declaring value reduce of the property

SUMMARY

Groups	Number	Mean	Variance
Group A	97	0,94	2,211
Group B1	235	0,89	1,869
Group B2	86	0,65	1,252
Group C	351	0,66	1,317

VARIANCE ANALYSIS

Variance source	SS	df	MS	F	The p value
Between groups	11,81	3	3,94	2,47	0,0604
Within the groups	1217,07	765	1,59		
Total	1228,88	768			

Source: author's own work.

The effect of narrowing the sample to people who perceive the negative impact of wind power plants on the value of real estate is to reduce disproportions between the number of individual groups and to reduce disproportions between variants in individual groups. Similarly, to all the surveyed, in the group of people declaring that the value of property tends to decrease due to its location in the vicinity of a wind power plant, statistically significant differences can be observed between the average value of declared WTP. Although the significance of the ANOVA test was higher than 0.05 ($p = 0.06$), the authors found the results interesting and encouraging further analysis. In the next step (due to the similarity of averages) the aggregation of groups A and B1 as well as the aggregation of groups B2 and C were performed and the average difference test was carried out. The results are presented in table 5.

The test of average differences in aggregated groups indicates that differences between WTP means are statistically significant ($p<0.001$). This allows a zero hypothesis of the same mean in the aggregated groups to be rejected. The observed differences posed a question to the authors about the actual differentiating factor declared WTP, i. e. the purchase within the last five years or the intention to make a purchase within the next five years.

Table 5. Difference test results for averages in groups A + B1 and B2 + C

	A+B1	B2+C
Mean	0,904	0,656
Variance	1,963	1,301
Observations	332	437
Summary variance	1,587	
The difference in averages according to the hypothesis	0	
df	767	
t Stat	2,709	
P(T<=t) unilateral	0,003	
Test T unilateral	1,647	
P(T<=t) bilateral	0,007	
Test t bilateral	1,963	

Source: author's own work.

Discussion of results

The studies on the perception between the location of wind power plants and the value of the properties in their vicinity showed a statistically significant correlation between the grouping factor (belonging to group A, B1, B2 or C) and the amount of declarations. This means that market knowledge determines the willingness to pay (WTP). The research results indicate the gradation of the declared WTP size depending on the level of market knowledge. Persons belonging to group C, i.e. those who did not sell or buy in the market and did not intend to do such transactions within the next five years, most often declared a complete lack of willingness to pay. On the other hand, those who carried out transactions in the last five years and intended to carry out such transactions in a five-year perspective showed the highest propensity to pay.

It is quite interesting, somewhat surprising for the authors, to observe the fact that a higher propensity to pay was found in the group of persons intending to carry out transactions within the next five years (group B1) than in the group of persons who had already made such transactions in the recent past (group B2). It was expected that the situation would be opposite, i.e. those who are only just planning to participate in the market will show a lower level of WTP than those who were already in contact with the market.

Unfortunately, the structure of the questionnaire and the results do not allow to formulate a clear explanation of this issue. The observed phenomenon is so interesting it can be a prolegomenon for further empirical research.

Conclusions

During the carried out empirical data analysis, the hypothesis that "there is a relationship between the knowledge of the market and a declaration expressed in a qualitative manner concerning the influence on the change in the value of real estates located in the vicinity of wind power plants" has been positively verified. People who know the market are more likely to see a decrease in the value of properties located close to wind farms than those who do not know the real estate market.

The second hypothesis presented in the article, i.e. that "the knowledge of the market is a significant factor modifying the amount of the declared impairment of the real estate in the studies using the contingent valuation method", is also confirmed in the presented analysis of results. The average value of the declared WTP is the highest in the group that has acquired property over the last five years and intends to carry out a transaction within the next five years.

The positive verification of the hypothesis leads the authors to conclude that the factor of market knowledge is a significant factor influencing the discrepancy between the actual and declared willingness to pay for the value of the asset being valued. Therefore, methodological indications for carrying out studies with using CVM method should be supplemented by considering this circumstance, it seems reasonable, in the context of the shown discrepancies, to ask which group of respondents (having market or non-market knowledge) declares values closer to the actual choices, and thus to the real values of the goods being valued. As the structure of the study was based on a hypothetical situation, there is no reference point against which it is possible to compare the declared preferences of the designated groups. As a result, it is therefore not possible to establish clearly which of the groups is closer to the actual choices. However, logic indicates that priority should be given to declarations of people who know the market based on which a hypothetical scenario is constructed.

The contribution of the authors

Jacek Marcinkiewicz 50% – concept and objectives, literature review, statistical analysis.

Tomasz Poskrobko 50% – concept and objectives, literature review, research.

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Piotr **BOŁTRYK**

THE PROCEDURE OF OBTAINING A DECISION ON THE ENVIRONMENTAL CONDITIONS OF CONSENT FOR THE IMPLEMENTATION OF AN UNDERTAKING ON THE EXAMPLE OF AN INVESTING CONSISTING IN THE CONSTRUCTION OF A BROILER HOUSE IN A MULCHING SYSTEM TOGETHER WITH ACCOMPANYING INFRASTRUCTURE (part 2 – the environment impact of assessment and issuing the decision)

Piotr **Bołtryk**, PhD – *Bialystok University of Technology*

Correspondence address:
Faculty of Civil and Environmental Engineering
Wiejska Street 45E, 15-351 Bialystok, Poland
e-mail: p.boltryk@pb.edu.pl

ABSTRACT: The purpose of this paper is to give the reader the understanding of the procedure for obtaining a decision on the environmental conditions of consent for the accomplishment of the undertaking in Poland. The method of case study was used in the research. The subject of the study was the implementation of the investment in the municipality of Kuźnica involving the construction of a broiler house in the mulching system for 30,000 broiler chickens with accompanying infrastructure. The tips contained in the paper can provide invaluable assistance to investors wishing to undertake projects requiring environmental conduct.

KEY WORDS: decision, environment, procedure, evaluation

Introduction

The assessment whether an investment will affect the environment must be the subject of analysis by any investor wishing to complete an investment in the territory of the Republic of Poland to confirm or eliminate the need for an environmental impact assessment (herein after: EIA) for the project being implemented.

The purpose of environmental impact assessment is to anticipate potential environmental hazards during the investment planning stage and the scale of these threats, and to counteract or reduce these threats and to minimize the negative impact of the planned investment.

In the first part of the article the initial assessment of the investment was introduced. Now, it is time to elaborate on next steps that the investor should take into consideration, such as, an environmental impact reports, the environment impact assessment and the decision on the environmental conditions of consent for the implementation of the project itself.

An environmental impact reports

The most important document that is the basis for the investor's decision on the environmental conditions of the investment after the environmental impact assessment is the environmental impact report (hereinafter it is also called the environmental report).

It is a private document, originating from the investor, and created on his or her commission. It is a compendium of environmental conditions for an investment. Its scope, as it was previously stated, is defined in this case of the discussed investment by the body issuing the environmental decision (considering – according to article 68 § 1 of the act of October 23, 2008 on the provision of information on the environment and its protection, public participation in the protection of the environment and environmental impact assessment – Dz.U. No. 199, pos. 1227– the state of modern knowledge and research methods as well as the existing technical possibilities and data availability). The report should also contain all the elements listed in article 66 of the act, unless the authority decides otherwise (article 68 § 2 of the act).

The report on the impact of the planned undertaking on the environment, although it is private document and developed by people having specific information. It must be comprehensive, coherent and reliable. This means that the report must consider all requirements imposed by the legislator in the light of article 66 of the act, because it is also a key evidence in this administrative proceeding (NSA judgment in Warsaw on 11 May 2015, file number: II OSK 2313/13).

In the case of this project, the environmental report contained nearly 40 pages, and its author mainly focused on the impact of the implementation of the investment on the environment, the description of natural elements within the scope of projected impact, as well as the analysis of possible social conflicts related to the planned project. This last point was extremely important as the planned hen house bordered in a very short distance 9of about 60 meters) with some dwellings, including residential buildings.

Prior to the entry in force of the amendment of the act of 01.01.2017 (Dz.U. 2015, pos. 1936) the author of the report lawfully did not have to meet any conditions to be able to create this document. At present, the person who is the author of the report must have completed higher education in the scope of reporting or other higher education combined with relevant experience in making reports (article 74a § 2 point 2 of the act).

The introduced solution is a response to the existing low quality of the documentation prepared about the procedure for issuing a decision on environmental conditions. It should also be noted that, according to article 5 § 3 letter a of a EU directive 2011/92/EU (the directive 2011/92/Eu of the European Parliament and the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment – the Legal Journal of EU, L 212 No. 26), in order to ensure the completeness and quality of the report concerning the impact of the project on the environment, the applicant is to ensure that the environmental impact report is prepared by competent experts.

The environment impact assessment (EIA)

After the reception of the environmental impact report, the lead body (with cooperation with the other bodies) conducts an environmental impact assessment. It consists of 3 stages:

The verification of the report is made not only by its critical analysis carried out by the authority that issues the decision, but also by comments made by the parties and the public. However, to question the content of the report is not an easy task. It requires the presentation of appropriate counter-proofs, as well as specific comments and reservations concerning its content. In the judicature, it is accepted that an effective polemic with the content of the report may be based on the opinions of the specialists or on the content of so-called counter report:

"The reservations regarding the findings of the report, which require expertise, should be based on documented expertise done by an expert, who has appropriate knowledge in this field. Parties (or entities having the rights of

parties) have the right to file evidence seeking to undermine the credibility of a private document, such as a report of the impact of a project on the environment, for example in the form of an opinion prepared by a person with the relevant knowledge other than the author of the report" (decision of SKO of 03.06.2015, file number: SKO 4136/16/15).

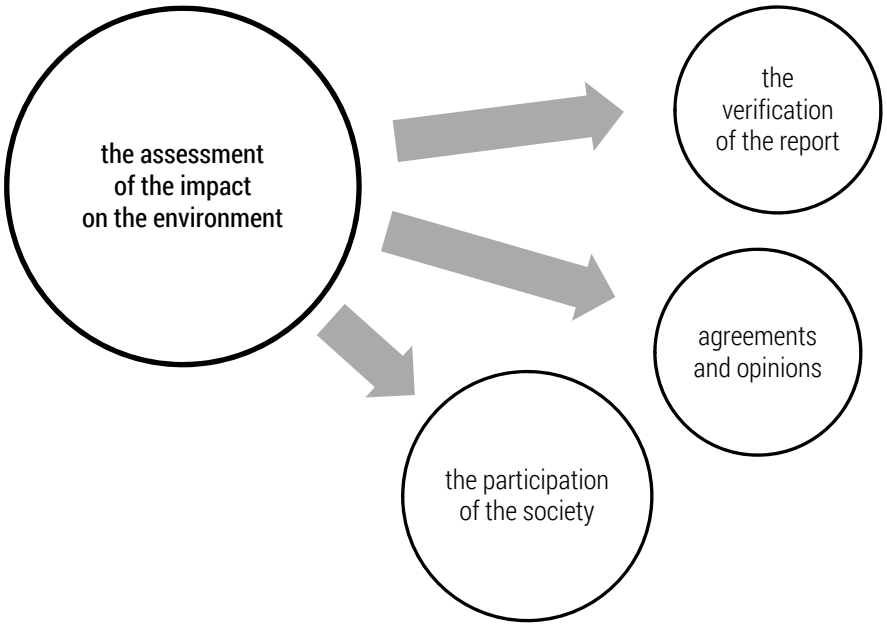

Figure 1. The stages of the impact on the environment

Source: authors' own work.

"In the case of a project whose implementation arouses a negative attitude of a part of society and the examination of the extent of its impact on the environment, it must be multidirectional specialist knowledge and when in relation to the project different opinions of specialists appear, especially concerning the waste emissions, it is possible to undermine the findings of the report only by the counter report" (WSA verdict in Białystok dated 20.08.2012, file number: II SA/Bk 536/11).

After a positive review of the report, preceded by possible investor's calls for its completion or explanation, the final content of the environmental impact report is discussed and agreed upon with the environmental protection bodies. In the case of a hen house for 30.000 broiler chickens (120 LSU) these are the Regional Director of Environmental Protection (RDEP) and the

State County Sanitary Inspector (according to article 77 §§ 1 and 2 of the act). It should be noted that this is the second time when the two bodies have to take a stand. At an early stage of the proceedings, they were asked to comment on possible environmental impact assessment. They must now express their views on the gathered evidence, including the environmental report.

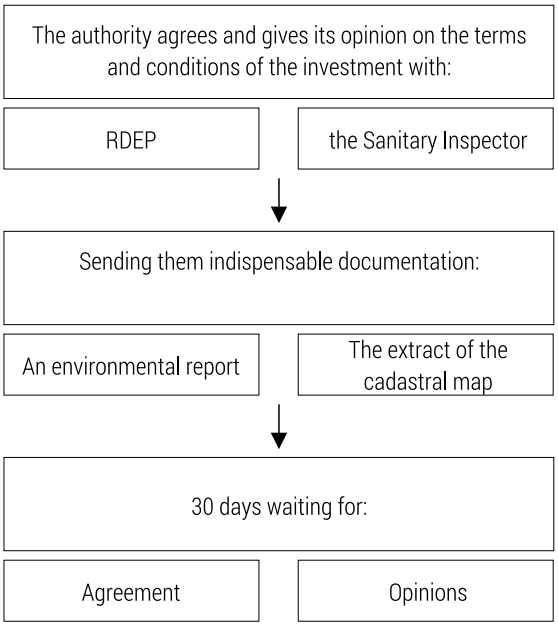

Figure 2. Agreement and opinions in the process of issuing of the environmental decision
Source: authors' own work based on article 77 § 1 of the act.

The agreement of the regional director of environmental protection is in the form of a decision. One of the element of this decision, apart from the elements that should be contained in every decision, is the agreement on the implementation of a given project and its terms. It is also necessary to provide an assessment of environmental impacts. It should not be forgotten that the arrangement of the director of environmental protection, unlike the opinion of the sanitary inspector, is binding. Although the accessory procedure is ancillary in its nature, and it is a part of broadly – defined proceedings in the main case, its outcome is binding to the body conducting the main proceedings and cannot be verified by the body alone (WSA judgment in Łódź on 20.10.2011, file number: II SA /Łd 810/11).

Although the arrangements and opinions that are issued during environmental proceedings are non-actionable (article 77 § 7 of the act), it does not

deprive the parties of the proceedings of their rights to challenge in an appeal against an environmental decision. It is because in the light of article 142 c. a. p. the party can appeal against the decision that was made (NSA judgment in Warsaw dated 09.04.2013, file number: II OSK 2396/11).

The finally element of the environmental impact assessment is to ensure public participation in the process of decision-making. This is about the society of sensu largo, that is everyone concerned. Having the attributes of a party of the proceedings is in this aspect of secondary importance. Public participation is guaranteed through publicizing (Public information Bulletin, notice, a website of the authority) of the most critical issues related to ongoing proceedings.

This is what is publicly announced:

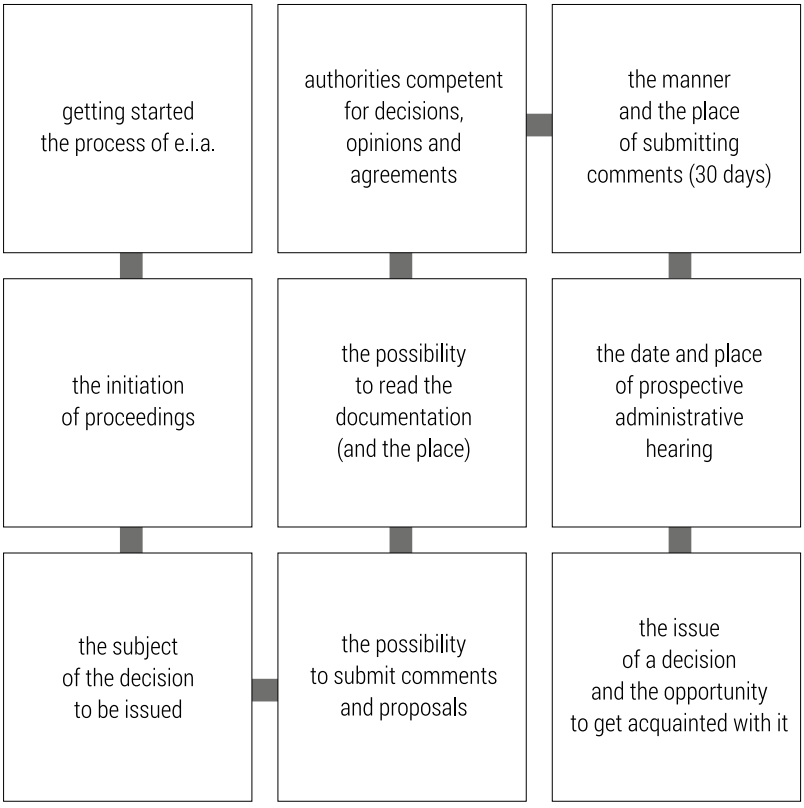

Figure 3. The stages of public participation in issuing an environmental decision

Source: authors' own work based on articles 33-34 of the act.

Dealing with complaints and requests from the interested parties can be presented as follows:

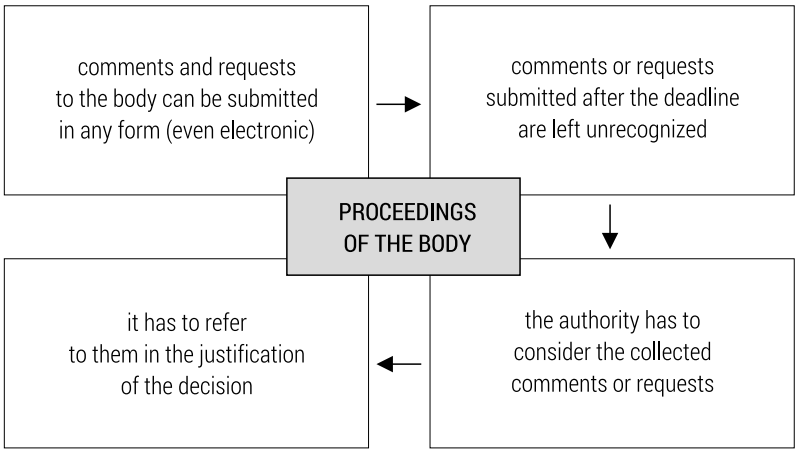

Figure 4. The proceedings of an authority with comments and requests of society
Source: authors' own work based on article 37 of the act.

It should be noted that comments and requests submitted after the deadline are not investigated. The body conducting the proceedings also has no obligation to consider social demands. However, it has an absolute mandate to address each of them. In the discussed case, during public consultation the petition of 78 villagers living in the area where the investment was to be made was received, with a request not to agree to its implementation. In its reasoning of the decision the authority referred point by point to each of the postulates, justifying its position on each of them.

Decision on the environmental conditions of consent for the implementation of the project

Following the procedure, including the environmental impact assessment, the authority must proceed with the decision.

In summary, the duration of the entire procedure depends on:

- the completeness of the application for a decision on environmental conditions 9in case of any need to supplement documents, the procedure is extended by the time necessary for the investor to complete the supplement, but not shorter than 7 days);
- the date of the opinion on the scope of the report issued by the Regional Director for Environmental Protection and the opinion of the State County Sanitary Inspector. The act specifies a 30-day deadline for issuing

a decision for consultation (for a body conducting the proceedings), and 14 days for issuing an opinion (for the opinion-making bodies);
- the date of acceptance of the report by the Regional Director for Environmental Protection and pronouncing judgment on it by the County Sanitary Inspectorate (30 days from the date of the reception of the documentation);
- the time of public participation in the decision-making process for projects for which an environmental impact assessment is being carried out (the act specifies a 30-day deadline for submitting comments and proposals).

However, whenever an environmental impact assessment is carried out, the decision of the first instance authority should be issued within a period of approximately 3 months from the date of receipt of the complete application.

Upon final notification to the parties about collecting the evidence (under article 10 of the code of administrative procedure – c.a.p.) the authority issues an administrative decision, which consists of the following elements.

Table 1. The elements of an environmental decision concerning a chicken house for 30.000 broiler chickens.

The elements of environmental conditions of agreement for the implementation of undertaking of building a hen house for 30.000 broiler chickens (120 LSU):	
- The designation of a public administration body:	The commune head of Kużnica
- The date and place of issue:	14 February 2017 Kuźnica
- The designation of a party or parts:	Investor: Mariusz B.
- The legal basis:	Article 104 c.a.p., article 71 1, §2 point 2, article 75 § 1 point 4, article 82 of the act, § 3 § 1 point 37 and point 102 of the order,
- Proper decision:	I am setting environmental conditions for the project of building a broider house in the mulching system for 30.000 heads of broiler chickens (120 LSU) with accompanying infrastructure to be implemented within the boundaries of a plot of geodetic no. … in the area of Kuźnica community, 1. The type and place of a planned project, 2. Conditions at the stage of implementation and operation of the project' 3. The environmental requirements necessary to be included in the construction project, 4. A possible re-assessment of environmental impact of the undertaking in terms of proceedings to get the construction permit

-	Legal and factual justification:	Information on the conduct with public participation with an indication of how public requests and comments were taken into consideration and to what extent conclusions and observations of the society were considered. Information on how the findings of the environmental report and arrangements as well as opinions were taken into account and considered. Justification for the need of a re-assessment in the construction permit procedure (the decision in this respect is binding on the building permit issuing body)
-	Instructions on whether and how it is possible to appeal against it and about the right to waive the appeal and the consequences of waiving the appeal.	The parties have the right to appeal from this decision to the Self-Government Appeal College in Białystok through me within 14 days from the date of delivery.
-	The signature with the name and official position of the employee of the authority empowered to issue the decision.	The commune head of Kuźnica, Mgr inż. P. Miklosz
-	Address recipients:	It is received by: • investor, • the parts according to the list, To information: • the State County Sanitary Inspector in Sokółka, the Regional director for Environmental Protection in Białystok.
-	Attachment:	A brief description of the project.

Source: authors' own work based on (Kędziora, 2011, p.579-585), article 82 of the act.

The decision containing the above items is delivered in writing to the investor and to the other parties (if there are more than 20 parties delivering by announcing is used). A person who is unhappy with the decision may challenge the decision to a higher authority within 14 days from its receipt. The decision of the Local Government Board of Appeal is final in the administrative process. Once exhausted, it is possible to file a complaint to the appropriate local Administrative Court. What's important, the court investigates the case only within legal matters, it does not deal with factual circumstances (NSA judgment in Warsaw on 10 July 1989, file number: IV SA 390/89). The final decision raises all legal effects and it is the basis for applying for a permit to build the intended investment.

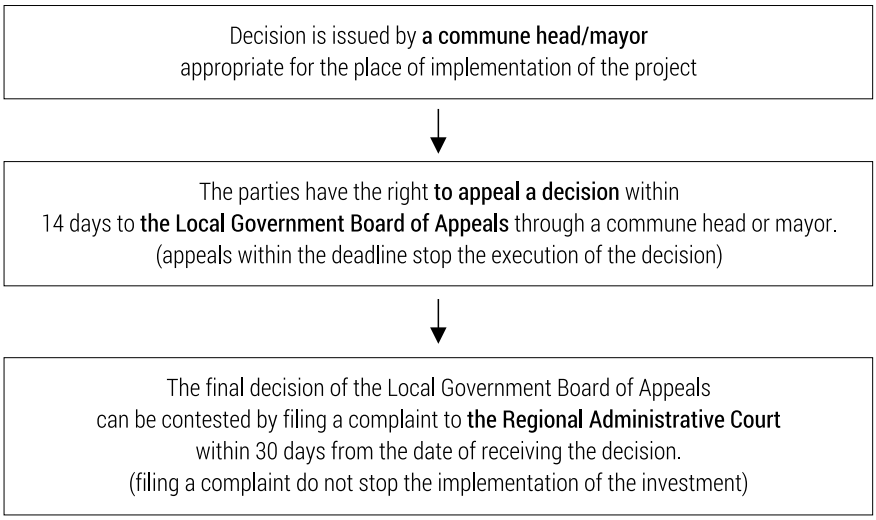

Figure 5. Appeal procedure – an environmental decision

Source: authors' own work.

Conclusions

The decision on the environmental conditions of consent for the implementation of the project is the first decision taken in the investment process. Although not all construction plans require environmental conduct, it is crucial for investors planning their investments under the environmental regulation. Its shape and scope will be conditioned by subsequent decisions made in the investment process, as it is binding both in the localization procedure and when issuing a building permit.

The discussed investment of building a chicken house for 30.000 broiler chickens (120 LSU) for breeding in mulching system along with accompanying infrastructure is a potentially significant in its impact on the environment. Therefore, undoubtedly the issuance of an environmental decision is required. The only controversy remains whether the environmental impact assessment should be carried out as a part of the initiated investigation. The practice of environmental authorities requires the affirmative answer to this question. The conduct of an environmental impact assessment for this type of investment not only allows the project to be fully veritable in terms of its environmental impact, but, above all, it ensures active public participation in the process of its release, thus avoiding many future social conflicts associated with the anticipated impact of the project.

Acknowledgements

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EU directive 2011/92/EU (the directive 2011/92/Eu of the European Parliament and the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment – the Legal Journal of EU, L 212 No. 26

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NSA judgment in Warsaw on 10 July 1989, file number: IV SA 390/89

NSA judgment in Warsaw dated 09.04.2013, file number: II OSK 2396/11

NSA judgment in Warsaw on 11 May 2015, file number: II OSK 2313/13

WSA verdict in Białystok dated 20.08.2012, file number: II SA/Bk 536/11

WSA judgment in Łódź on 20.10.2011, file number: II SA /Łd 810/11

Ewa RAUBA

SERVICES OF SURFACE WATER ECOSYSTEMS IN RELATIONS TO WATER USAGE FOR IRRIGATION OF AGRICULTURAL LAND

Ewa **Rauba,** PhD – *Bialystok University of Technology*

Correspondence address:
Faculty of Engineering Management
Ojca Tarasiuka Street 2, 16-001 Kleosin, Poland
e-mail: e.rauba@pb.edu.pl

ABSTRACT: One of the areas using the supply function of surface water ecosystems is agriculture. In the case of a lack of a sufficient amount of water for plants, it is necessary to supplement this amount through irrigation of agricultural land i.e. using the ecosystem service – water collection.
The aim of this article is to determine the surface water ecosystem services connected to water collection for irrigation of agricultural land in the area of Podlaskie voivodship and to present a method for estimating the requirements for such services as a tool for water management within municipalities.

KEY WORDS: surface waters, agriculture, irrigation, estimation

JEL: Q56

Introduction

One of the areas using the supply function of surface water ecosystems is agriculture. Agriculture is a significant user of water in Europe. Its water usage constitutes approximately 24% of the total water usage. This percentage varies significantly from country to country and in some parts of southern Europe is as high as 80% (Water resources across Europe, 2009). In countries of northern Europe water usage in agriculture is significantly lower, although it still can reach over 30% of total water usage in some areas.

The amount of water used for irrigation depends on factors such as:

- climate;
- type of crops;
- type of soil;
- water quality;
- methods of cultivation (http://ec.europa.eu).

In the case of a lack of the required amount of water for plants, it is necessary to supplement this amount through irrigation of agricultural land i.e. using the services provided by surface water ecosystems – water collection.

The aim of this article is to determine the surface water ecosystem services connected to water collection for irrigation of agricultural land in the area of Podlaskie voivodship and to present a method for estimating the requirements for such services as a tool for water management within municipalities.

Water collection for agricultural irrigation as an ecosystem service

The benefits, which people obtain from ecosystems, such as water, wood, food or climate regulation, are called ecosystem services. Currently, these are divided into four groups: provisioning services, regulating services, supporting services and cultural services (MEA, 2005).

Services of surface water ecosystems can be analysed in each of the four presented categories presented above (Ecosystems and Human Well-being, 2005). The most important one, from the point of view of people is the provisioning function.

Access to water at a given time and place, taking into account the quality and quantity of water, is also an ecosystem service. Its meaning for agriculture is obvious. Every agricultural activity requires fresh water, including cultivation (Aylward, Bandyopadhyay, Belausteguigotia, 2005).

Access to water for agroecosystems depends mainly from factors such as: infiltration and flow as well as water retention in soil and it is connected with

other types of ecosystem services. In many cases it is necessary to supplement the water requirements of agriculture through collection of surface waters or extraction of groundwater ('blue water'). In some parts of the world 80% of water used by agriculture comes from rainfall stored as soil moisture ('green water') (Molden, 2007). The division of green waters in Poland (133.8 billion m^3) in an annual scaleis following (Mioduszewski, 2008):

- agricultural land – 65.0 billion m^3,
- forests – 50.0 billion m^3,
- other – 18.8 billion m^3.

Food production consumes large amounts of water and it is estimated that to fulfil the daily food needs of a single person over 1300 m^3 of water is used (Mioduszewski, Szymczak, Kowalewski, 2011).

The forecasted climate changes, including changes in rainfall, can lead to increased risk of draught or flood. An increase in temperature will result in an increased requirement for water (IPCC, 2007).

Apart from the size of ecosystem services, which in the case of water collection for irrigation in agriculture is expressed in volume units (m^3), the financial value of such ecosystem services is also estimated. The performer estimations can be used as a tool in ecosystem management policies (Polasky, 2008).

Real water markets are rare, and the value of the services of aquatic ecosystems for agriculture were usually only partially taken into account in the conducted estimations. The majority of farmers, who collect surface waters, do not pay for this service. Estimations for water requirements in agriculture are often based on production data. The value of water is then estimated based on the increase in agricultural production for a unit of collected water (Mendelsohn, Olmstead, 2009).

Irrigation of agricultural land as a service of surface water ecosystems in the Podlaskie voivodship

Agricultural land in Podlaskie voivodship take up 1078017 ha, which is approximately 53% of the voivodship's area (Rocznik Statystyczny Rolnictwa, 2015). It is an area of potential irrigation i.e. there is a need for the services of the surface water ecosystems. The service can be presented in relations to the amount of collected water in volume units, and in relations to water usage, which is the area which was irrigated.

Water collection for agricultural irrigation in the Podlaskie voivodship in 2006 within the districts is presented in figure 1.

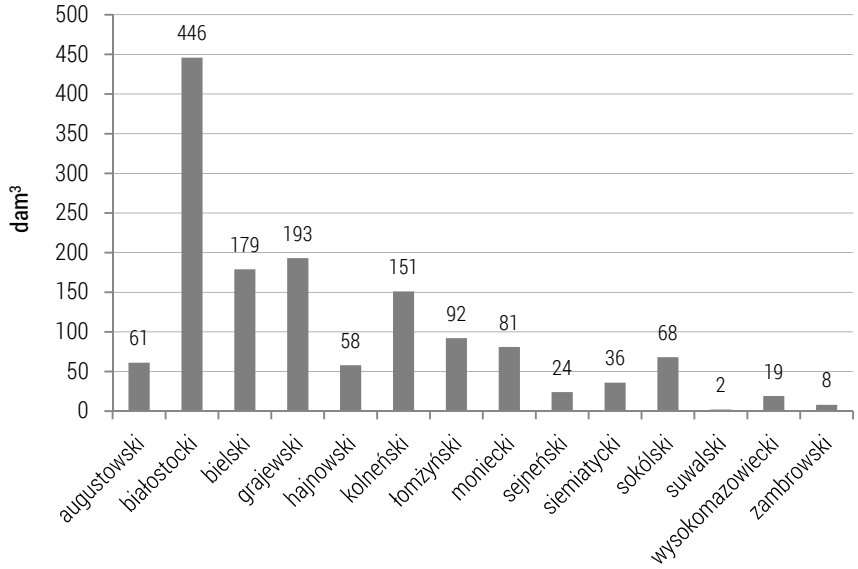

Figure 1. Services of surface water ecosystems in relations to water collection for agricultural land irrigation in Podlaskie voivodship in 2006

Source: author's own work based on (*Program nawodnień rolniczych województwa podlaskiego na lata 2007–2013*, 2008).

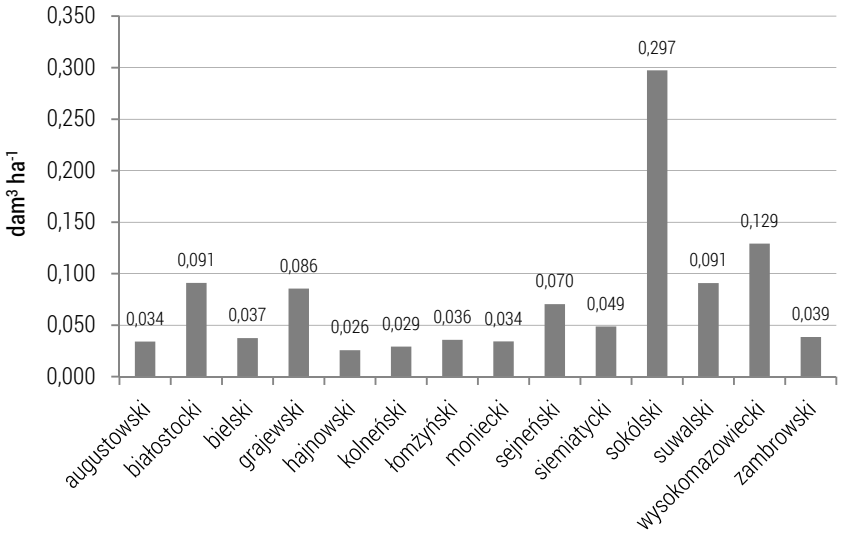

Figure 2. Unit rates of the usage of water collection services for irrigation in the Podlaskie voivodship in 2006

Source: author's own work based on (*Program nawodnień rolniczych województwa podlaskiego na lata 2007–2013*, 2008).

In total 1418 dam^3 of surface water was collected for agricultural irrigation in the Podlaskie voivodship in 2006. This water was used to irrigate 27757.8 ha of agricultural land.

Unit usage of water for irrigation was within the range of approximately 0.03 dam^3·ha^{-1} to 0.3 dam^3·ha^{-1} (figure 2).

The analysis of the amount of water collected for irrigation was conducted by the Voivodship Board of Land Amelioration and Water Facilities in Bialystok for the *Agricultural irrigation plan for the Podlaskie voivodship in years 2007–2013*. Currently, the amount of water collection is not determined. However, the size of the irrigated area is recorded.

The size of the irrigated area in the last 10 years is presented in figure 3.

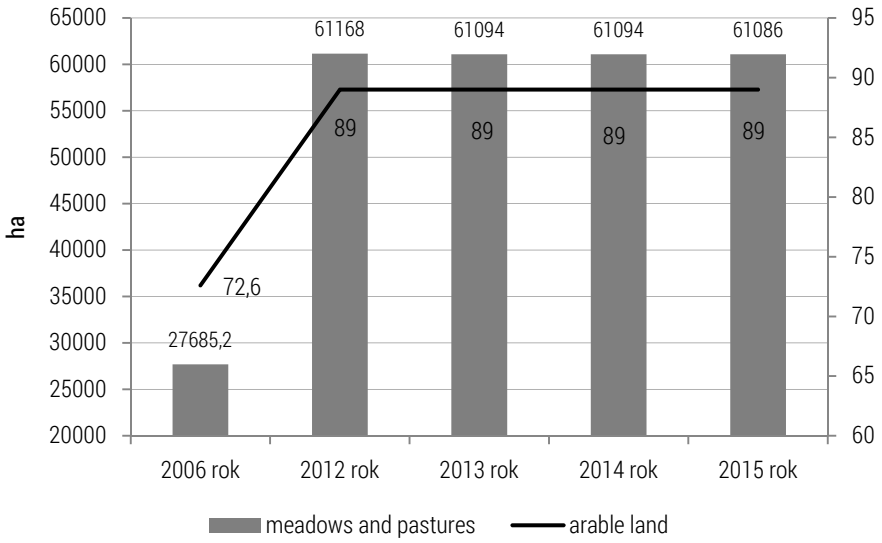

Figure 3. Size of irrigated agricultural land in the Podlaskie voivodship in 2006-2015

Source: author's own work based on data from the Voivodship Board of Land Amelioration and Water Facilitiesin Bialystok.

As seen from the data presented in figure 3, within the last 4 years the size of irrigated land in the Podlaskie voivodship was at a similar level ofapproximately 61100 ha.

The size of irrigated land in individual districts in 2006 and 2015 is shown in table 2.

Table 2. Area of agricultural land and grassland irrigated in the Podlaskie voivodship in 2006 and 2015

District	Arable land		Grasslands	
	2006	2015	2006	2015
	Area [ha]			
Augustowski		1790		6464
Białostocki		4895.8		10037
Bielski		4782.4	1	5518
Grajewski		2256		5326
Hajnowski		2252.3		3024
Kolneński	55.6	5112.5	55	7257
Łomżyński	17	2 549.60	21	3430
Moniecki		2361.2	12	4804
Sejneński		341		347
Siemiatycki		739.3		2045
Sokólski		228.6		5421
Suwalski		22		91
Wysokomazowiecki		147		1695
Zambrowski		207.5		5630
Total	72.6	27685.2	89	61089

Source: data from the Voivodship Board of Land Amelioration and Water Facilities in Bialystok.

In the Podlaskie voivodship water was used mainly to irrigate grasslands. In 2006 only in the koleński and łomżyński districts agricultural land was also irrigated. In the kolneński district this was approximately 1.1%, and in the łomżyński district approximately 0.67% of the total irrigated area in the given district. In 2015 in the kolneński district the area of irrigated agricultural land increased by 0.6 ha, and in the lomżyński district by 4 ha. Agricultural land irrigation also took place in the bielski and moniecki districts.

Access of agricultural cultivations to a required amount of water is directly linked to the size of harvest, which are a testimony to the quality of the service. Figures 4 and 5 show the size of harvest in dry years in irrigated and not irrigated fields. The analyses were conducted by the Voivodship Board of Land Amelioration and Water Facilities in Bialystok for two districts: the kolneński and łomżyński districts.

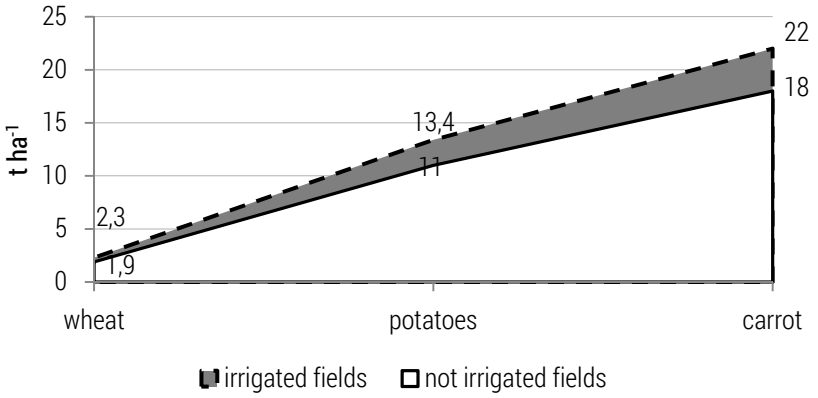

Figure 4. Harvest of chosen plants in irrigated and not irrigated fields in the kolneński district

Source: author's own work based on (*Program nawodnień rolniczych województwa podlaskiego na lata 2007–2013*, 2008).

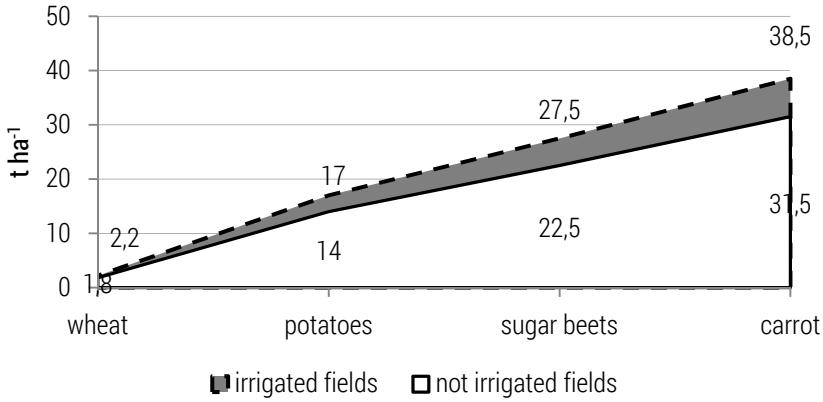

Figure 5. Harvest of chosen plants in irrigated and not irrigated fields in the łomżyński district

Source: author's own work based on (*Program nawodnień rolniczych województwa podlaskiego na lata 2007–2013*, 2008).

In both districts there was a visible increase of harvest in irrigated fields by approximately 21–22% in relations to harvest from not irrigated fields.

Method of determining the requirement for the services of surface water ecosystems in relations to water collection for agricultural land irrigation

The presented method is a simplified way of determining the water requirements for any given agricultural area, which may be supplied by the services of surface water ecosystems. It may be a tool used in water management policies of districts connected with the implementation of investments in irrigation of agricultural land.

Unit requirement for the service of surface water collection for irrigation in agriculture may be calculated using the following equation:

$$ES_j = (P_{opt} - P_r) \cdot 10, \quad (1)$$

where:

ES_j – unit rate of the requirement for the water collection service for irrigation of a given cultivation, $m^3 \cdot ha^{-1}$;
P_{opt} – optimum rainfall, mm;
P_r – actual rainfall, mm;
10 – conversion of mm to $m^3 \cdot ha^{-1}$

Based on this equation (1) the amount of water for optimal hydration of plants can be determined. Above this level the harvest will not increase, what is more it can begin to decrease. The maximum value of ES_j will be equal to the value of P_{opt}. The minimum value will equal 0, which means that the sum of actual rainfall fully provides for the water needs of plants and there is no need to use the services of surface water ecosystems.

The P_r values are available based on research conducted at the Institute of Meteorology and Water Management (IMiGW). The P_{opt} values can be obtained from literature (Dzieżyc, 1989). They were designed for individual plants and take into account soil and meteorological conditions. The P_{opt} for selected plants according to Klatt after Dzieżyc are shown in table 1.

In the case of soils other than moderately firm and other monthly average temperatures, the rates shown in table 2 can be used to determine the amount of optimal rainfall.

Table 1. Optimal rainfall for selected cultivated plants for moderately firm soil according to Klatt after Dzieżyc

Plant	Monthly rainfall in mm					
	IV	V	VI	VII	VIII	IX
	Average monthly temperature [0C]					
	8	13	16	18		
Spring wheat	45	65	70	60		
Summer barley	50	60	70	45		
Oat	50	65	75	60		
Sugar beet	50	50	60	90	90	60
Early potato	50	60	80	60		
Late potato		50	60	80	70	
Corn		50	60	70	65	50

Source: (Borówczak, 2009).

Table 2. Conversion rates for different types of soil and average monthly temperatures

Specification	Rate
Light soil	1.25
Heavy soil	0.85
Peat soil	1.00
Muck soil	1.25
Rainfall increase for every10C of temperature increase	5 mm

Source: author's own work based on (Borówczak, 2009).

The total requirement for the service of water collection for irrigation of the land for which the identification of the requirement for the service of water collection for irrigation of agricultural land is being calculated, can be obtained using the following equation:

$$ES = \sum_{j=1}^{n}(ES_j \cdot A_j), \quad (2)$$

where:

ES – total requirement for the service of surface water ecosystem related to water collection for irrigation of a given area, m^3;
ES_j – as above;
n – number of cultivation in a given area;
A_j – area occupied by a given cultivation, ha.

The presented method enables the estimation of the requirement for the water collection service for irrigation of the analysed agricultural area expressed in primary units i.e. in m^3.

Assessment of the value of the surface water ecosystem services in relations to water collection for irrigation of agricultural land

It is often difficult to put a price on ecosystem services, as they do not function within a typical products and services market.

In Poland, according to article 294 of the Environment protection law bill, the collection of surface waters for agricultural irrigation is free of charge (Prawo ochrony środowiska, 2001). It can be said that the water itself is free. This does not mean, however, that the service of the surface water ecosystems in relations to water collection for irrigation of agricultural land is not connected to any cost. The whole of the service, apart from the water, comprises of the following costs:

- design documentation for the system of water collection and distribution;
- costs of procedures to obtain permits for water collection (permit required by the Water Law Act, article 122) (Prawo wodne, 2001);
- costs of constructing the technical systems for water collection and distribution;
- usage and maintenance costs of water collection and distribution systems.

The value of water can be estimated based on the value of the benefits resulting from water usage. The value of the collected water can be estimated based on the increase in harvest, resulting from the additional water being delivered to the area.

The increase in harvest from a given area can be determined using the following equation, based on the dependencies designed by Żarski and others (*Żarski, 2013)*.

$$I_j = ES_j \cdot A_j \cdot k_j, \quad (3)$$

where:

I_j – increase of harvest of a given type of cultivation caused by the irrigation of the entire area, kg;

ES_j – unit rate of the requirement for water collection service for irrigation of a given type of cultivation, $m^3 \cdot ha^{-1}$;

k – harvest increase per m^3 of water delivered to 1 ha of the cultivated area, $kg \cdot m^{-3} \cdot ha^{-1}$;

A_j – cultivated area size, ha.

The value of k can be obtained from literature. Table 3 contains the rates designed at the University of Science and Technology in Bydgoszcz.

Table 3. Rate of harvest increase caused by irrigation for a selected plant type

Cultivated plant	k $kg \cdot m^{-3} \cdot ha^{-1}$
Spring wheat	192
Summer barley	195
Oat	163
Sugar beet	1147
Early potato	1350
Late potato	1380
Corn	280

Source: author's own work based on (Rzekanowski, Żarski, Rolbiecki, 2009).

Primary units such as kilograms of harvest can be easily converted to a monetary estimation. The value of agricultural products is determined by their purchase prices. As such, the value of the service of surface water ecosystems as water collection for irrigation of agricultural land can be determined from the following equation:

$$V_j = I_j \cdot p_j, \tag{4}$$

where:
V_j – value of the service of surface water ecosystems as water collection for irrigation in agriculture for a given type of cultivation, PLN;
I_j – increase in harvest of a given type of cultivation resulting from irrigation, kg;
p – purchase price for a given type of cultivation, PLN/kg.

The value of ecosystem services in relations to the value of collected water for irrigation of a given area of land can be established from the following equation:

$$V = \sum_{j=1}^{n} V_j, \tag{5}$$

where:
V – value of the service of surface water ecosystems as water collection in agriculture for an area for which the service is being identified, PLN;
V_j – value of water collection for a given cultivation, PLN;
n – amount of plants grown in the given area.

The services of surface water ecosystems as water collection for irrigation of agricultural land can be determined by estimating the benefits resulting from the use of such service.

Summary

The amount of water used for irrigation in agriculture is connected to the geographical location of the irrigated area. On a worldwide scale water collection for agriculture is 69% of the total amount of collected water. Agriculture is, therefore, the largest recipient of the service of surface water ecosystems in this field. Water collection for industrial purposes amounts to 19% and for living purposes – 12% (http://www.fao.org). This is why the possibilities for being more economical with the use of water resources should be sought in agriculture.It is thought that saving 1% of water used around the world for food production can mean a 2-3 dm^3 saving on water per person, which is the amount of drinking water a single person needs (Rijsberman, 2006).

Surface water collected for irrigation of agricultural land in Poland is free of environmental charges. However, this situation can change, as the Polish government aims to introduce the rule of refunding of costs of water services, including the cost of collecting surface water and extracting ground water (http://legislacja.gov.pl). This rule is one of the basic ones included in the water framework Directive (Directive 2000/60/EC).

From the point of view of surface water ecosystem protection it is important to determine the actual water collection amount in agriculture. This may be an important information for the districts on the direction of water usage in agriculture. Apart from monitoring of the current water usage, district policy of agricultural land irrigation is important. It is here, that the method for estimating the water requirements can be useful as a tool for shaping the future decisions concerning irrigation investments within districts.

Acknowledgements

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Mariusz **TRELA**

ELECTRIC ROAD TRANSPORT IN POLAND – AN ANALYSIS OF EXTERNAL COSTS

Mariusz **Trela,** PhD, Eng.– *AGH University of Science and Technology, Krakow*

Correspondence address:
Faculty of Management
Gramatyka Street 10, 30–067 Krakow, Poland
e-mail: mtrela@zarz.agh.edu.pl

ABSTRACT: The paper assumes the possibility of having road transport based entirely on vehicles propelled by electric motors. Taking into consideration the numbers of the particular vehicles and their technical parameters, the theoretical energy requirement for this sector of transport was determined. The objective assumed in the paper was to assess the difference in external costs related to the operation of combustion and electric vehicles accomplishing all of the current tasks of the road transport in the conditions of the Polish transport and energy system.

KEY WORDS: road transport, electric vehicles, external costs

Introduction

Road transport has a significant share of air pollution resulting from emission nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOCs), particles with a diameter of 2.5 μm ($PM_{2.5}$), particles with a diameter of up to 10 μm (PM_{10}) and carbon dioxide (CO_2) both in Poland and in the EU (table 1). The largest share of emission is connected with NO_x – 30,4% for Poland and 39,4% for the EU. In the case of NMVOC emission, road transport in Poland has twice bigger share than in the EU (19,3% compare to 10,6%). Share of emissions of other compounds ranges from 9.0% to 13.4% and these values are comparable to Poland and the EU.

Table 1. Road transport share in total NO_x, NMVOC, $PM_{2,5}$, PM_{10} and CO_2 emissions in Poland and in the EU in 2014 [%]

	NO_x	NMVOC	$PM_{2,5}$	PM_{10}	CO_2
Poland	30,4	19,3	13,4	9,0	12,3
EU	39,4	10,6	13,1	11,5	11,5

Source: Eurostat database (Environment and energy, Air emission inventories).

Considering that, it is no surprise that actions are taken, aimed at reducing the emissions of pollutants in this sector of economy. Since the early 1990s, more and more restrictive fuel emission standards have been successively introduced, and since 2015, standards of CO_2 emissions have also been in force. Even though these measures bring effects in the form or decreasing emissions of NO_x, $PM_{2.5}$, PM_{10}, NMVOC, and also CO_2 in recent years (Preisner, Trela, 2013), in the EU, the European Commission more and more emphatically stresses the necessity of an evolution of the combustion road transport towards electromobility arguing at the same time that the negative impact of this type of drive on the environment is negligible. It is just electromobility that is supposed to ultimately reduce the emissions of pollutants and thereby reduce external costs related to the operation of means of road transport. Thus, the purpose of the paper is to assess the external costs associated with operation of road vehicles in the Polish conditions, with the assumption that all vehicles are powered electrically; and to draw conclusions as to the direction and magnitude of changes, based on a comparison with corresponding costs for the currently operated fleet of vehicles.

Technical aspects of electric drives of road vehicles

Current for powering electric motors in the currently manufactured cars comes from batteries that have to be first charged with mains current, or from reactions in fuel cells that require refuelling with hydrogen. The choice of the manner of acquiring electric power for the drive depends on the type of vehicle and related technical and financial considerations.

Passenger cars

When creating electric vehicles, manufacturers concentrated first of all on the category of passenger cars. In this category, there are available both battery-driven vehicles and ones utilising fuel cells. With regard to the size of the offer (the only mass-produced vehicle powered with fuel cells is Toyota Mirai, not offered in Poland), the purchase price of a fuel-cell-powered vehicle, which is more than twice as high as for a battery-driven vehicle, as well as its operating costs (the cost of hydrogen is approx. PLN 50/100 km), it was assumed that the analysis would concern a model of a battery-driven vehicle. Vokswagen e-Golf was chosen as the most representative model because a corresponding combustion-engine driven vehicle has invariably been one of the best-selling models in Europe and in the world.

Key technical specifications concerning this model:

- Horsepower: 100 kW
- Max speed: 150 km/h
- Range: 300 km
- Energy consumption: 12,7 kWh/100 km
- Charging time (socket/charger/ specialised charging station up to 80% battery capacity): 17 h/5 h 20 min./45 min.

Light commercial vehicles

Light commercial vehicles, i.e. those with a maximum Gross Vehicle Weight (GVW) not exceeding 3.5 tonnes, are manufactured in the electric versions exclusively as battery vehicles. The most popular model in this category is Renault Kangoo Z.E., and it was this model that was included in the analysis. At the same time, is should be remarked that mass-produced light commercial vehicles with a higher capacity are not available at present. According to the manufacturers' announcements, Renault Master Z.E. and Volkswagen e-Crafter are to be launched in the marked by the end of 2017. It was decided that the representative mode in this group would be Renault Master Z.E due to the more credible data that are available from experience in the operation of electric commercial vehicles.

Key technical specifications concerning models Renault Kangoo Z.E./ Master Z.E.:

- Horsepower: 44/57 kW
- Max speed: 130/115 km/h
- Range: 270/200 km
- Energy consumption: 12,2/16,5 kWh/100 km
- Charging time (charger): 6/6 h
- Load capacity: 650/1000 kg.

Heavy goods vehicles

In the case of heavy goods vehicles, the limited range of electric vehicles makes their practical application only marginal. The currently manufactured structures are only capable of accomplishing distribution tasks in city centres where mileages are not high, and a range of 200 km or even 100 km can be sufficient. A representative of vehicles with payloads up to 5 tonnes can be Fuso eCanter, quite popular in this category. In the case of vehicles with payloads above 5 tonnes and below 15 tonnes, the analysis includes Mercedes-Benz Urban eTruck currently being launched in the market. And in the case of the heaviest vehicles and road tractors, the Nikola One project was considered to be a representative vehicle. The first vehicles of this model are to be manufactured in 2017, and the series production is to be launched in 2019. While the two previously mentioned vehicles are powered by batteries, the Nikola One is to have fuel cell as it is only such solution that currently enables reaching a range that would be satisfactory to owners of the fleets operating on long distances.

Key technical specifications concerning models Fuso eCanter/MB Urban eTruck/Nikola One:

- Horsepower: 185/500/735 kW
- Power source: li-ion battery/li-ion battery/fuel cells
- Range: 100/200/1800 km
- Energy consumption: 70/106/- kWh/100 km
- Hydrogen consumption: -/-/4,6 kg/100 km
- Charging time (charger): 7/2*/- h
- Hydrogen refueling time: -/-/15 min
- Load capacity: 4630/12800/26000 kg

*specialised charging station

City buses and coaches

City buses in the electric version are manufactured by both the largest automotive companies and by smaller firms, including some Polish ones, e.g. Solaris, Solbus or Ursus, and both in the battery versions and those utilising fuel cells. Due to the availability of fuel, the purchase cost and the operating costs of the bus, the battery-driven Solaris Urbino 12 electric was chosen for the analysis. A similar model in the combustion version is the definite best-seller among the Polish makes and is a popular model in the European market of city buses.

In the case of coaches, there are no mass-produced electric vehicles and likewise, there is no credible information available concerning any possible preparatory arrangements for launching such a vehicle in the market in the nearest future. This is undoubtedly due to the necessity of ensuring a long driving range for vehicles of this type. The only solution that enables accomplishment of this requirement seems to be the application of fuel-cell based drive. Therefore, the closest vehicle in terms of design that does exist and whose technical data are publicly available is the City Smile Fuel Cell Electric Bus. For the purpose of performing the analysis, this vehicle will be taken as being representative for intercity buses and coaches with the assumption that hydrogen consumption in intercity buses and coaches will be 50% of the value of fuel consumption for the city bus.

Key technical specifications concerning models SU12 electric/City Smile FCE Bus:

- Horsepower: 250/n/a kW
- Power source: li-ion battery/ fuel cells
- Range: 150/450* km
- Energy consumption: 170/- kWh/100 km
- Hydrogen consumption: -/3,5 kg/100 km
- Charging time: depends on battery capacity and refueling technical aspects
- Hydrogen refueling time: -/10 min

* In the case of intercity and coaches, the range can be easily extended by the use of other hydrogen tanks

Motorcycles and mopeds

Motorcycles and mopeds that come in electric versions are battery-powered. Several such structures have already been created and are manufactured by both renowned manufacturers of combustion motorcycles and firms that only want to be present in the segment of electric vehicles. For the anal-

ysis, a scooter offered by the manufacturer Romet, model Ev1, and a motorcycle from the firm Zero Motorcycles, model Zero S ZF 13, were selected.

Key technical specifications concerning models Romet EV1/Zero S ZF 13:

- Horsepower: 3/45 kW
- Max. speed: 45/158 km/h
- Range: 65/200 km
- Energy consumption: 2,5/6 kWh/100 km
- Charging time (socket): 7/9 h

Energy demand calculation

In order for the calculation of electric energy demand for the entire transport system to be possible, it is necessary to make some assumptions with regard to the activity of the individual means of road transport. Due to the lack of data concerning the consumption of electric energy by vehicles depending on the road infrastructure (city, outside city, motorway), the average annual mileage was taken as the only parameter that characterises this activity. It was assumed that the number of vehicles in each category would correspond to the number of combustion vehicles, which would enable accomplishment of the same transport tasks. The following division of means of transport into categories was adopted:

- passenger cars
- light commercial vehicles with a payload of up to 999 kg
- light commercial vehicles with a payload above 999 kg
- heavy commercial vehicles with a payload of up to 4,999 kg
- heavy commercial vehicles with a payload above 4,999 kg and below 14,999 kg
- heavy goods vehicles o with a payload above 14,999 kg and road tractors
- city buses
- intercity buses and coaches
- motorcycles
- mopeds.

Using the above data, the amount of energy needed to ensure the functioning of such designed theoretical transport fleet was calculated, which is presented in table 2.

In the calculations, it was assumed that the number of 5m passenger cars visible in the database of the Central Register of Vehicles and Drivers (CEPiK) is actually not reliable which is indicated by analyses comparing data from insurance companies with the data comprised in the CEPiK.

It was assumed that hydrogen is produced by electrolysis, and it is required to provide 46 kWh of electricity in order to produce 1 kg hydrogen.

Table 2. Representative vehicle, average electricity consumption [kWh/100 km], average hydrogen consumption [kg/100 km], average annual mileage [km], number of vehicles [pcs] in 2015 as well as the amount of electricity required to accomplish transport tasks [kWh] for each category of means of road transport

	representative vehicle	average electricity consumption [kWh/100 km]	average hydrogen consumption [kg/100 km]	average annual mileage [km]	number of vehicles [pcs]	amount of electricity required to accomplish transport tasks [TWh]
Passenger cars	Volkswagen e-Golf	12,7	-	11932	15723423	23,83
Light commercial vehicles with a payload of up to 999 kg	Renault Kangoo Z.E.	12,2	-	25960	1649530	5,22
Light commercial vehicles with a payload above 999 kg	Renault Master Z.E.	16,5	-	25960	798234	3,42
Heavy commercial vehicles with a payload of up to 4,999 kg	Fuso eCanter	70	-	34840	295179	7,20
Heavy commercial vehicles with a payload above 4,999 kg and below 14,999 kg	Mercedes-Benz Urban eTruck	106	-	34840	318162	11,75
Heavy goods vehicles o with a payload above 14,999 kg and road tractors	Nikola One	-	4,6	81830	367777	63,68
City buses	Solaris Urbino 12 electric	170	-	66050	11795	1,32
Intercity buses and coaches	City Smile Fuel Cell Electric Bus	-	3,5	73840	98049	11,66
Motorcycles	Zero S ZF 13	6	-	1717	1272333	0,13
Mopeds	Romet EV1	2,5	-	1474	1259187	0,05
					total	128,26

Average mileages were calculated as a weighted average of the average mileages presented for the individual types of vehicles based on: Trela, Sustainable..., 2016 and Trela, Proposal..., 2016.
Source: authors' own work.

Calculation of external costs

For the purpose of valuation of the environment, methods based on market prices (*physical linkage methods*) can be applied, e.g. the dose-effect method, the substitution, replacement, prevention, compensation, opportunity cost methods, as well as methods based on the functions of supply and

demand (*behavioural linkage methods*), which include revealed preference methods, e.g. the travel cost method, the hedonic pricing method, and the stated preference methods, e.g. the contingent valuation method (Trela, Dubel, 2014). In the paper, the methodology applied is that of the *Handbook on estimation of external costs in the transport sector* bringing together a lot of research in which the above methods were applied. The external costs were calculated for the transport fleet currently, operating based on statistical data regarding pollution emissions from road transport, and for the theoretical transport fleet consisting exclusively of electric vehicles.

Account was taken for the cost of pollution emissions, such as: non-methane volatile organic compounds (NMVOCs), nitrogen oxides (NO_x), particulate matter ($PM_{2.5}$ and PM_{10}), carbon dioxide (CO_2) sulphur dioxide (SO_2). No account was taken for external costs of traffic accidents, congestion and noise. External costs of traffic accidents and congestion will be identical for electric and combustion vehicles. External costs of noise will be lower for electric vehicles but they will not equal zero as noise is emitted by the motor, rolling resistance and air resistance. Due to the lack of a methodology enabling determining the difference in those costs, they were not taken into account in the calculations.

It was assumed that producing 1 kWh of electricity in the Polish energy system involves emission of 0.95 Mg CO_2/MWh for hard coal and 1.07 Mg CO_2/MWh for lignite (Czopek, Trzaskuś-Żak, 2011). The other emission indicators were adopted based on the *EMEP/EEA emission inventory guidebook 2016*.

It was assumed that 50.62% of electricity required to power vehicles is produced from hard coal and 33.11% of electricity comes from lignite (Rynek..., 2015).

Values of the external costs presented in Table 3 are given in prices from 2015 at the exchange rate of the National Bank of Poland from 28.07.2017 at 4.2617 PLN/EUR based on *Handbook on estimation of external costs in the transport sector.*

The total of external costs resulting from emissions of pollutants is significantly lower for the current fleet of combustion vehicles than for the theoretical fleet of vehicles powered only with electric energy in the conditions of the Polish energy system. Emissions of $PM_{2.5}$, PM_{10}, NO_x and NMVOCs, and the related external costs are admittedly lower in the case of electric vehicles than combustion ones; however, the very big difference in emissions of CO_2 and above all SO_2 (sulphur content in fuels is negligible and generates very small external costs for combustion vehicles) is the reason that the aggregate costs are almost twice as high as in the case of electric vehicles.

Table 3. External costs of pollution emissions for the theoretical fleet of electric vehicles and for the currently operating vehicle fleet

Chemical compound	Volume of emissions [mg]	External cost [pln]	Total of external costs [pln]
	theoretical fleet of electric vehicles		
PM2,5	1284	64426741	25935284500
PM10	3007	76069512	
NOx	86610	1466183509	
NMVOC	448	1894972	
CO2	107117187	14836292741	
SO2	448490	9490417026	
	actual fleet of combustion vehicles		
PM2,5	9799	3317679896	13769874818
PM10	11681	254877990	
NOx	212613	3599254392	
NMVOC	72051	304931822	
CO2	45402660	6288506774	
SO2	239	4623944	

Source: authors' own work.

Conclusions

Replacing all road vehicles in Poland with electric vehicles would involve the necessity of providing an additional amount of 128 TWh of electricity annually by the Polish energy system. This would in turn result in the necessity of increasing electric energy production by approx. 80%, which would have to lead to very substantial changes in the energy system. Additionally, it should be noted that replacing all combustion vehicles with all-electric ones would not at all lead, with the present energy system, to any benefits in the scope of emissions. This is due to the very high emissions of CO_2 and SO_2 in the process of burning hard coal and lignite. However, a reduction of external costs would be possible in the case of introducing electric cars instead of combustion ones but it would be necessary to take into account the costs of noise emissions. The assumptions that electric vehicles do not emit any noise is incorrect but noise emissions in the case of an electric vehicle is without a doubt significantly lower than for a corresponding combustion vehicle. Thus,

is seems essential to conduct research and create a methodology enabling credible calculations of external costs of noise emissions for electric vehicles, which would provide a basis for the ultimate determination which kind of drive is more environmentally friendly in the Polish transport and energy system.

Without such a tool, taking additionally into account analyses concerning the costs of purchasing and operating electric vehicles, it would be difficult to justify the sense of introducing vehicles with such a drive in Poland.

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Adam **PAWLICZ** • Robert **KUBICKI**

SHARING ECONOMY DEVELOPMENT PATHS IN NON-URBAN AREAS. THE CASE OF HOSPITALITY PRODUCT IN POLISH NATIONAL PARKS

Adam **Pawlicz,** PhD • Robert **Kubicki,** PhD – *Szczecin University*

Correspondence address:
Cukrowa 8, 70-004 Szczecin, Poland
e-mail: adam.pawlicz@wzieu.pl

ABSTRACT: Although the recent rise of sharing economy platforms revolutionized hospitality market around the world, its impact is unevenly distributed, as a majority of new P2P accommodation providers emerged in urban areas. The aim of this study is to provide sharing economy development paths in areas surrounding all 23 national parks in Poland. This study is conducted basing on data from online observation of 2 sharing economy platforms development with data gathered from official census. Results show that (1) sharing economy is still in its nascent stage in non-urban areas; (2) there is a strong positive relationship between sharing economy accommodation establishments and both the population density and income per capita, (3) population density and income per capita have no effect on the ratio between the number of traditional and sharing economy accommodation establishments. This study contributes to existing literature in following areas: (1) it assesses the sharing economy phenomenon in areas with natural attractions, (2) it validates the relationship between area population density and sharing economy proliferation, (3) it examines the connection between area economic performance and sharing economy proliferation.

KEY WORDS: sharing economy, non-urban areas, airbnb, homeaway, national parks

Introduction

The sharing economy, described by peer-to-peer transactions, has seen an immense growth lately. These marketplaces are defined by direct transactions between individuals (buyers and sellers), while the marketplace itself is provided by a third party which is called sharing economy platform (Botsman, Rogers, 2010). A recent research in Barcelona revealed that the number of beds offered via Airbnb alone, the major sharing economy platform, almost equals 70% of hotel accommodation capacity (50 969 vs. 73 158) (Gutiérrez, García-Palomares, Romanillos, Salas-Olmedo, 2017). For that reason a dramatic growth of sharing economy hospitality platforms that has less than 10 years history has often been called 'eruption'.

The emergence of sharing economy has profoundly changed the supply structure of the hospitality market mainly in urban areas. The sole fact that rental of private apartments poses a real threat to established hotel enterprises with qualified staff, experience and capital resources, questions the very foundations of hospitality marketing such as the importance of target marketing (Karapuda, Sidorkiewicz, 2014), branding, classification, economies of scale and many others. The changes that hospitality industry contemporary faces, can only be compared with the introduction of hotel chains concept in the early 50s, the proliferation of internet in 90s and rise of online travel agents in the early 2010s. Dealing with new, first disregarded than dreaded, competitors requires from hotel managers adjusting almost all marketing instruments (Sidorkiewicz, Pawlicz, 2015), while destination marketers face numerous new challenges connected with regulation and incorporation of sharing economy to the area product. It is especially important for city marketing as, up to date, sharing economy is very often credited to be an urban phenomenon (Deng, 2016; Ranchordás, 2015; Sans, Domínguez, 2016).

Sharing economy soon after its proliferation became a subject of scientific research. Still, as this phenomenon is naturally based on internet technology, also research areas chosen by scholars seem to be limited to highly developed countries with high internet literacy. As the sharing economy phenomenon grows, it can be assumed that it reaches new areas and destinations. This study attempts to address this research gap, by exploring the sharing economy phenomenon in nature-based areas in Poland.

Literature overview

Tourism economic research on sharing economy divided by the subject of study, can be roughly grouped into three main areas: peers, platforms and destinations (figure 1). Still, there are numerous studies that may cover more than one area (e.g. literature review studies). The first group covers the issues of peers, which interestingly covers usually both demand and supply side of the market (Hamari, Sjöklint, Ukkonen, 2015). Besides demographic characteristics (Wiechoczek, 2015) this research pillar covers also participating rationale and consumer behaviour issues (Tussyadiah, Pesonen, 2016).

The second main research area are sharing economy platforms. In this field, there are issues of business concept (Guttentag, 2013; Kathan, Matzler, Veider, 2016; Richardson, 2015), competition between platforms (Weber, 2016) and vogue issues of its regulation (Quattrone, Proserpio, Quercia, Capra, Musolesi, 2016).

Finally, the third main research part is destinations and impact of sharing economy. Usually it covers estimation of sharing economy activity in general in destinations, but can also cover new tourism expenditure (Zervas, Proserpio, Byers, Proserpio, Zervas, 2013) and hectic competition between traditional hospitality business and new accommodation establishments powered by the strength of platforms (Nguyen, 2014; Salvioni, 2016). Very often research is focused on the side effects of sharing economy which is reflected by bringing new tourists to urban environment causing new social contact between tourists and local community (Malhotra, Van Alstyne, 2014). This paper contributes to destination part of sharing economy research by examining the presence of sharing economy in the hospitality product in communes in Polish national parks.

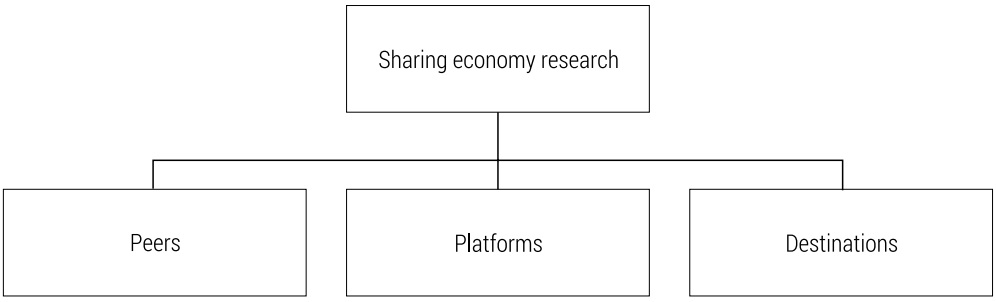

Figure 1. Sharing economy academic research areas

Source: authors' own work.

Previous research on adoption of internet technologies in public administration shows that more densely populated units, i.e. cities tend to use technology much more frequent and better use its potential (Pawlicz, Kubicki, 2016). This is also true in sharing economy research where a majority of research seem to be concentrated in the metropolis (Deng, 2016; Gutiérrez et al., 2017; Oskam, Boswijk, 2016; Rauch, Schleicher, 2015) while rural areas, in particular, seem to be neglected. Although cities are intuitively chosen as a research area (Comp. Wang, Nicolau, 2017), there is little evidence that sharing economy proliferation is related to population density. This study aims to contribute to this research gap which leads to the first hypothesis:

H1. In areas with higher population density, the ratio of accommodation establishments distributed via sharing economy platforms vs. traditional distribution channels is higher than in areas with lower population density.

Sharing economy platforms by definition base on electronic distribution channels. Therefore they can operate only in areas where both providers and customers are highly technology savvy, i.e. in areas with high access to the internet and new technologies and high internet literacy. New technologies and internet literacy are highly dependent on GDP per capita and indeed previous research was conducted mostly in developed countries with high GDP per capita.

H2. In areas with the high economic performance, the ratio of accommodation establishments distributed via sharing economy vs. traditional distribution channels is higher than in those with low economic performance.

Methodology

In order to investigate the effects of population density and economic performance on the sharing economy listings we compared data from 119 communes that are situated (at least partly) in any of all 23 national parks in Poland (hereinafter national parks communes – NPC). A commune is the lowest administrative unit in Poland and according to Central Statistical Office of Poland (*Area and Population in the territorial profile in 2016*, 2016), there are 2478 communes in Poland. 119 national parks communes represent 4,8% of all Polish communes and 6,2% of Poland's area and 3,1% population. Hence, their population density is much lower than Polish average (see table 1). The average and median income per capita, which we used as a proxy for economic performance, is also lower than Polish average but the differences are slight (ca. 5%).

Table 1. Basic information about research area

	NPC – 119 national parks communes (research area)	All communes in Poland
Average population	9929,52	15 511,4
Median population	7073	7543
Average area [km^2]	162,8	126
Median area [km^2]	137,4	112
Average population density [pop/km^2]	90,97	123
Median population density [pop/km^2]	59,2	54
Average income per capita [PLN/pop]	3459,59	3539,01
Median income per capita [PLN/pop]	3296,59	3345,91

Source: authors' own work based on (*Area and Population in the territorial profile in 2016,* 2016).

In order to collect information about the proliferation of accommodation establishments that sharing economy platforms have in their inventory we manually collected information about their availability from two major sharing economy platforms Airbnb and HomeAway. Table 2 depicts basic statistics about the availability of sharing economy platforms in national parks communes. All data have been collected between August 24 and 28, 2017.

Table 2. Basic statistics of usage of sharing economy platforms in 119 national parks' communes

	Airbnb	HomeAway
Average number of units	2,28	1,57
Median number of units	0	0
Number of communes with 0 units	78	103

Source: authors' own work.

The proliferation of sharing economy platforms in national parks' communes is still very weak as any Airbnb listings can be found only in 34% communes while HomeAway is even less popular.

Traditionally, accommodation base is assessed using the data from two main sources. The first is the official register of accommodation establishments in Poland and the second is popular in Poland web service nocowanie.pl, where accommodation providers might buy an advertisement and be included in the database. This usually covers small, non-registered in official

census, accommodation establishments. Similarly to sharing economy this data was also collected manually.

Table 3. Basic statistics of traditional accommodation establishments in 119 national parks' communes (NPC)

	Official register – GUS	Nocowanie.pl
	beds	units
Average	867,19	72,47
Median	178	9

Source: authors' own work.

In order to verify both hypotheses, we divided all communes into two groups based on their population density and income per capita. As a threshold we used a median value as both population density and income per capita data are characterized by strong positive skewness (the values of A_1 are 2,96 and 1,61 respectively). A_1 values of more than 1,00 indicate strong positive skewness (the majority of values are below the average). Skewness has been calculated according to following formula (Middleton, 2004):

$$A_1 = \frac{n}{(n-1)(n-2)} \sum_{i=1}^{n} \frac{(x_i - \bar{x})^3}{S^3}.$$

Then we calculated the ratio of sharing economy (dividend) by traditional accommodation establishments (divisor). As we have two groups of data for both sharing economy and traditional hospitality the outcome will consist of four ratios (2x2=4).

Results

Population density

The median value of population density (pop. per sq km) among NPC was 59,2. Communes with the population higher than median value will be hereinafter referred as high while other as low population density communes. The average number of accommodation units in all four analyzed databases is depicted in table 4.

Table 4. The average number of accommodation units in communes with high and low population density

	GUS	nocowanie.pl	Airbnb	HomeAway
Low	316,49	54,25	0,3	0,97
High	1409,72	91,02	2,86	3,68
Pearson	0,23	0,21	0,24	0,09

Source: authors' own work.

Table 4 indicates that there are substantially more accommodation establishments (both traditional and sharing economy based) in communes with higher population density, although the Pearson correlation numbers show weak relationship. Still the penetration of sharing economy measured as a ratio of sharing economy vs. traditional accommodation establishments is more complex (table 5).

Table 5. The sharing economy vs. traditional accommodation establishments ratios across communes with high and low population density

Ratio	Airbnb / GUS	Airbnb / nocowanie.pl	HomeAway / GUS	HomeAway / nocowanie.pl
Low	0,0031	0,0416	0,0008	0,0352
High	0.0015	0,0279	0,0004	0,0142
Spearman	0,30	0,31	0,43	0,42

Source: authors' own work.

In all 4 ratios from table 5 there are relatively more sharing economy accommodation establishments in low-density areas. Spearman coefficients are positive but relatively weak (Airbnb/GUS or nocowanie) or moderate (HomeAway/GUS or nocowanie). This clearly contradicts with the assumption of a positive relationship between sharing economy development and population density.

Income per capita

The median income per capita (in PLN) among NPC were 3296,59. Communes with the population above median value will be hereinafter referred as high while other as low income per capita communes. The average number of accommodation units in all four analyzed databases is depicted in table 6.

Table 6. The average number of accommodation units in communes with high and low income per capita and Pearson correlations between income per capita and number of accommodation units

	GUS	nocowanie.pl	Airbnb	HomeAway
Low	326,48	27,87	0,08	0,73
High	1417,07	117,85	3,08	3,92
Pearson	0,367	0,287	0,159	0,111

Source: authors' own work.

Table 6 shows that there are, similarly to table 4, substantially more accommodation establishments (both traditional and sharing economy based) in communes with higher income per capita. Pearson coefficients calculated between income per capita and number of accommodation units are, however, moderate and do not show a strong positive relationships.

Still, the penetration of sharing economy measured as a ratio of sharing economy vs. traditional accommodation establishments does not provide substantial differences (table 7).

Table 7. The sharing economy vs. traditional accommodation establishments ratios across communes with high and low income per capita

Ratio	Airbnb / GUS	Airbnb / nocowanie.pl	HomeAway / GUS	HomeAway / nocowanie.pl
Low	0,0036	0,0503	0,0011	0,0321
High	0,0032	0,0498	0,0014	0,0328
Spearman	0,27	0,24	0,49	0,49

Source: authors' own work.

All 4 ratios from table 7 have very similar values as differences do not exceed 25%. Hence it can be assumed that there is no relationship between income per capita and sharing economy proliferation. Similarly to population density relationship is positive but either weak or moderate.

Limitations and conclusions

In general, the proliferation of sharing economy in the research area is very low as it (still) represent only a fraction of traditional accommodation base. The reason for the slow development of sharing economy in areas

where tourism product is based on natural attractions may be manifold. First of all, traditional P2P accommodation markets existed in those areas before the Internet revolution as they base on traditional word of mouth, while in cities before the advent of sharing economy there were almost no P2P rental possibilities. Secondly, sharing economy platforms are particularly successful in areas where repeated purchase ratio is relatively low. For that reason, sharing economy platforms that were designed to intermediate craftsmen markets actually ceased to exist. As tourism in natural areas is characterized by higher repetition rate and longer average period of stay, a hospitality product there is less likely to be distributed via sharing economy platforms. Finally, the characteristics of the product play a role. The city break tourism is characterized by a clear separation between accommodation and attractions provision. Tourists simply spend their time in the city and just sleep in accommodation establishment, while in nature-based areas more important are additional amenities in the lodging such as swimming pools, animations etc. Those services cannot be provided on the P2P market and could hardly be promoted via sharing economy platforms.

Contemporary the major research and economic activity related to sharing economy is focused in metropolises in developed countries. Still, the paper's results show that there is no relationship between economic prosperity and population density and sharing economy development. This indicated that the future development of sharing economy platforms will not be focused on the trajectories: metropolis – cities – towns and villages or developed countries – developing countries etc.

This study suffers from major limitations connected with small sample research. Especially small number of Airbnb and HomeAway listings with low income and low population density communes indicates that results should be interpreted with caution. Future research should address those gaps and focus on other paths of sharing economy development in the hospitality market.

The contribution of the authors

Adam Pawlicz – conception, literature review, methodology – 50%
Robert Kubicki – acquisition of data, analysis and interpretation of data – 50%

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GENERAL ENVIRONMENTAL AND SOCIAL PROBLEMS

PROBLEMATYKA OGÓLNOEKOLOGICZNA I SPOŁECZNA

Grażyna KARMOWSKA

DEVELOPMENT OF THE EU SOCIETIES AND SOCIAL PROGRESS

Grażyna **Karmowska**, PhD – *Faculty of Economics, West-Pomeranian University of Technology in Szczecin*

Correspondence address:
K. Janickiego Street 31, 71-270 Szczecin, Poland
e-mail: grazyna.karmowska@zut.edu.pl

ABSTRACT: Social development is defined as a process of social changes occurring one after another in conjunction with progress understood as direction of socio-economic development. The aim of the paper is to analyze and evaluate the development of the EU societies, and to assess social progress of the EU-28 member states. The author performed an analysis of the Sustainable Society Index (SSI) and the Social Progress Index (SPI). The findings reveal that the EU-28 countries have attained high level of sustainability in terms of *Human Well being* and there is an evident convergence between them in this dimension. As it comes to the other two dimensions, that is *Environmental Wellbeing* and *Economic Wellbeing*, variation within the EU-28 is much wider (ca. 40%), and points to cross-country divergence. Basic Human Needs that are best addressed across the EU-28, whereas the Foundations of Wellbeing and Opportunity score slightly lower and show a bigger variation.

KEY WORDS: social development, social progress, sustainable society

Introduction

The main goal of sustainable development is to improve the quality of life and ensure wellbeing for present and future generations. This can be achieved through the formation of well-balanced societies that are able to effectively use resources and the potential of environmental and social innovation to ensure economic wellbeing, environmental protection and social cohesion. Human wellbeing and environment wellbeing are inextricably linked. A precondition for achieving societal and environmental wellbeing is economic wellbeing, which, however, is not a goal in itself. Hence, a question comes up: Does social progress support the formation of a sustainable society? To answer this question two aspects are scrutinized in this paper: sustainable society and social progress.

A sustainable society is a society that meets the needs of the present generation, and does not compromise the ability of future generations to meet their needs, and one in which every human being has the opportunity to develop itself in freedom, within a well-balanced society and in harmony with its surroundings (http://www.ssfindex.com/ssi/ssi-2016).

Social development is a process of social changes occurring one after the other. These changes can be either positive or negative for the society. In case of positive changes we can speak of social progress, in case of negative – of social regress. Therefore the term "social development" is neutral, whereas the term "social progress" already involves a certain evaluation of social changes (Kubiczek, 2014). Progress means a possible socio-economic development direction.

Materials and methods

The paper uses statistical data derived from the World Bank, Eurostat and the Sustainable Society Foundation. 28 European countries, members of the EU in 2016, were the subject of the research. The scope of the research covered years 2006 and 2016. Research problems were examined from both the static and dynamic approach.

Sustainable development

One of the measures of the level of societal sustainability is *Sustainable Society Index* (SSI). It is published in a two-year-cycle since 2006. One of its objectives is to capture a country's stability with regard to the three wellbe-

ing dimensions: people (Human Wellbeing – HW), environment (Environmental Wellbeing – EW) and economy (Economic Wellbeing – EW).

Each country gets a score on 21 independent variables clustered into 7 categories and 3 wellbeing dimensions measuring societal sustainability (table 1).

Table 1. Framework of the Sustainable Society Index

SUSTAINABLE SOCIETY INDEX					
Dimension	**Categories**	**Dimension**	**Categories**	**Dimension**	**Categories**
HUMAN WELLBEING	Basic Needs	ENVIRONMENTAL WELLBEING	Natural resources	ECONOMIC WELLBEING	Transition
	Personal Development & Health		Climate & Energy		Economy
	Well-balanced Society				

Source: author's own work based on www.ssfindex.com/ssi/ssi-2016 [13-02-2017].

Each indicator is expressed on a scale from 0 to 10, where a score of 10 represents full sustainability, and a score of 0 no sustainability at all. To each variable (indicator) the same weight for the aggregation into dimensions is attributed. The scores of indicators are aggregated into scores for three wellbeing dimensions. Geometric average used for all indicators within the same category and within the same wellbeing dimension provides a general evaluation of a given country's sustainability and enables cross-country comparisons. Each indicator received the same weight for aggregation in given dimensions. Following the recommendations of the Joint Research Centre (JRC) of the European Commission regarding the Sustainable Society Index, because of the strong negative correlation between Human and Environmental Wellbeing no joint index for these dimensions was created (http://www.ssfindex.com/ssi/ssi-2016).

Social progress

Many indexes that take into account a country's socio-economic development have been elaborated, among which HDI is the most popular. However, *the Social Progress Index* captures a much broader scope of social, environmental and economic factors, and therefore provides a more comprehensive and long-term developmental picture of the countries of the European Union (www.ec.europa.eu).

The European Union Regional Social Progress Index (EU-SPI) is a collaborative project carried out by the Directorate-General for Regional and Urban Policy (European Commission), Orchestra (the Basque Institute of Competitiveness) and the Social Progress Imperative, a non-governmental organization, in partnership with Deloitte and institutions being member of the EU-SPI Scientific Committee. The EU-SPI has a hierarchical structure and consists of 3 sub-indexes (dimensions), 12 components and 50 indicators. Each dimension covers 4 major topic areas of sustainability (table 2).

Table 2. Framework of the EU Regional Social Progress Index

Social Progress Index					
Dimension	**Categories**	**Dimension**	**Categories**	**Dimension**	**Categories**
Basic Human Needs	Nutrition and Basic Medical Care	Foundations of Wellbeing	Access to Basic Knowledge	Opportunity	Personal Rights
	Water and Sanitation		Access to Information and Communication Technology		Personal Freedom and Choice
	Shelter		Health and Wellness		Tolerance and Inclusion
	Personal Safety		Environmental Quality		Access to Advanced Education

Source: author's own work based on Methodological _note_eu_SPI_2016.

The EU-SPI overall score and scores at the dimension and component level are based on a normalized 0-100 scale which allows to benchmark the scores received by a region against the best and worst realistic performance on each indicator by any region.

For the purpose of this study, scores for both indexes have been put into 4 classes (table 3).

Table 3. Classes indicating levels of social sustainability and social progress

Class	Range for SSI	Range for SPI	Level of social sustainability/ social progress
1	7,50 – 10,00	80 – 100	High
2	5,00 – 7,49	60 – 79	Above average
3	2,50 – 4,99	45 – 59	Below average
4	0,00 – 2,49	0 – 44	Low

Source: author's own work.

Research results

Sustainable Society Index

Analysis of the wellbeing dimensions indicates that the EU-28 countries scored high (above 7,4) on the Human Wellbeing dimension in 2016 (table 4). The spread between extreme values decreased by 37% against 2006 data. In this dimension a clear convergence of EU-28 countries can be noted. Alas, in the other two dimensions the variation increased by over 40%, which points towards divergence in Environmental and Economic Wellbeing.

Table 4. Data on Wellbeing – Sustainable Society Index for the EU-28

Scores on the three SSI dimensions	Human Wellbeing			Environmental Wellbeing			Economic Wellbeing		
	2006	2016	2016/2006	2006	2016	2016/2006	2006	2016	2016/2006
Maximum	8,95	9,00	100,61	4,27	5,93	139,03	7,98	8,09	101,40
Minimum	6,54	7,48	114,32	1,90	2,28	120,00	4,15	2,51	60,45
Range	2,41	1,53	63,39	2,37	3,37	142,62	3,83	5,58	145,75
Average	8,12	8,30	102,23	3,14	4,25	135,40	6,12	5,63	92,06
Standard deviation	0,46	0,39	85,59	0,64	0,91	143,21	1,27	1,51	119,16
Volatility %	5,66	4,74	83,72	20,34	21,52	105,76	20,75	26,86	129,43

Source: author's own work.

In 2006 the arithmetic mean of *Human Wellbing* (HW) was 8,12 and in 2016 it rose to 8,30. *Environmental Wellbeing* (EnW) with a score of 3,14 in 2006 and an increase of only 1 point in 2016, showed a very low average. In 2006 the score on *Economic Wellbeing* (EcW) was 5,69 and in 2016 it achieved only 92% of that value. As the variation coefficients indicate, *Human Wellbeing*score throughout the EU-28 countries remains roughly at the same level (ca. 5,6% variation in 2006, ca.4,7% in 2016), whereas the level of *Environmental* and *Economic Wellbeing*differs by ca. 20% among the subject countries (figure 1).

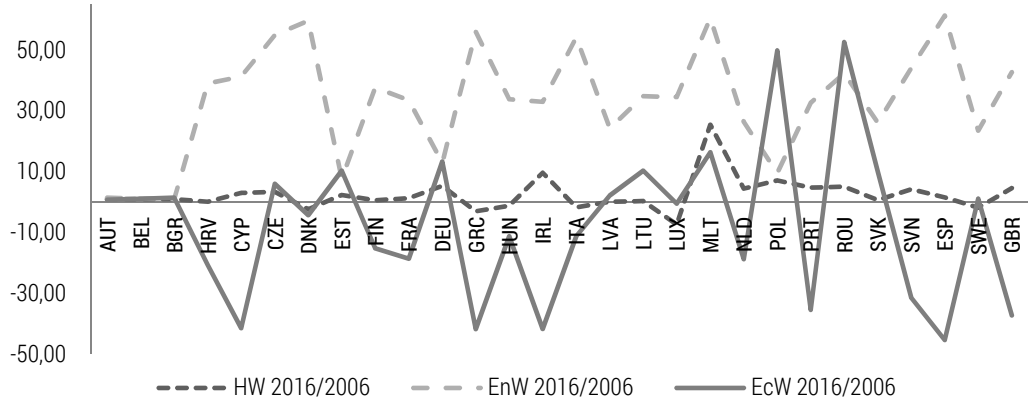

Figure 1. Dynamics in the evaluation of Wellbeing Dimensions in 2016 against 2006 in %

Key to the Figure: country codes are presented in table 5

Source: author's own work.

In 2016 EU-28 countries performed very well on the *Human Wellbeing* dimension (table 5). As it comes to *Basic Needs*, the variance was ca. 2%, and the entire EU-28 scored above 9. Research countries showed a slightly lower score on *Personal Development & Health* (above 7,6), but the variance between them was also minor (ca.4,6%). EU-28 performed worst in the category of *Well-balanced Society* (above 5), and here the cross-country differences were large (ca.11%).

In the *Environmental Wellbeing* dimension, *Climate & Energy* showed the lowest score (range of 1,75 – 5,26 with variation of over 30%). Among the 28 countries Estonia performed the worst in this category with only 1,41, and Croatia the best – with 5,24.

The spread is the largest in the *Economic Wellbeing* dimension – of ca. 6 points – with very big cross-country variation, in particular with regard to *Economy* (ca.36%).

Table 5. Dimensions and Categories of the Sustainable Society Index for 2016

Country codes	EU contries	Human Wellbeing				Environmental Wellbeing			Economic Wellbeing		
		Basic needs	Personal development & health	Well-balanced society	HW2016	Natural resources	Climate & energy	EnW2016	Transition	Economy	EcW2016
AUT	Austria	10,00	8,44	7,23	8,5	6,47	3,48	4,5	9,31	4,03	5,6
BEL	Belgium	9,98	8,62	7,54	8,7	3,68	2,08	2,7	7,89	3,44	4,8
BGR	Bulgaria	9,49	7,96	5,72	7,6	7,28	3,10	4,5	6,63	5,90	6,2
HRV	Croatia	9,89	8,06	6,73	8,1	6,98	5,26	5,9	6,61	2,44	3,6
CYP	Cyprus	10,00	7,80	6,55	8,0	5,98	3,65	4,5	5,27	2,66	3,5
CZE	Czech	9,97	8,09	7,77	8,6	6,59	1,96	3,3	8,53	7,27	7,8
DNK	Denmark	9,99	8,68	7,46	8,6	4,39	4,56	4,5	8,52	7,10	7,6
EST	Estonia	9,89	8,41	7,09	8,4	4,01	1,41	2,2	9,45	7,30	8,1
FIN	Finland	9,92	8,97	8,20	9,0	5,97	2,47	3,6	8,48	5,28	6,4
FRA	France	9,96	8,62	6,93	8,4	5,31	3,23	4,0	7,32	3,27	4,5
GRC	Greece	9,97	8,40	5,51	8,8	6,83	3,81	3,3	3,45	2,03	6,6
ESP	Spain	10,00	8,65	5,71	7,7	6,46	4,15	4,9	8,16	2,09	2,5
NLD	Netherlands	9,92	8,77	7,94	8,2	6,06	1,93	5,2	6,90	5,42	5,2
IRL	Ireleand	9,60	8,85	7,39	8,6	4,30	3,13	3,6	5,56	3,14	3,9
LTU	Lithouania	9,61	8,14	6,85	7,7	4,19	3,90	5,2	8,49	6,05	4,4

LUX	Luxembourg	9,92	7,90	5,34	8,0	4,25	1,75	4,7	7,37	7,98	6,6
LVA	Latvia	9,54	8,20	6,65	8,1	4,36	5,03	4,0	6,97	6,40	6,9
MLT	Malta	10,00	7,69	7,19	7,5	5,74	3,83	2,6	3,82	5,88	7,7
DEU	Germany	9,97	8,63	8,04	8,2	5,87	2,13	4,6	8,48	5,58	5,0
POL	Poland	9,85	8,27	7,33	8,8	6,45	3,10	3,1	7,66	5,99	6,0
PRT	Portugal	9,99	8,53	6,48	8,4	5,40	5,05	4,2	7,25	2,74	6,6
ROU	Romania	9,24	7,73	7,40	8,2	6,51	4,96	5,2	6,56	6,79	4,0
SVK	Slovakia	9,96	7,62	7,43	8,1	7,65	3,46	5,6	7,30	5,28	6,7
SVN	Slovenia	9,95	8,70	7,73	8,3	7,13	3,67	4,9	8,82	3,69	6,0
SWE	Sweden	9,98	8,93	7,52	8,7	4,24	3,54	4,9	9,51	7,00	5,2
HUN	Hungary	9,93	7,86	7,14	7,9	7,45	3,93	5,0	6,81	4,28	3,6
GBR	Great Britain	9,97	8,65	7,10	8,8	6,65	3,44	3,8	6,36	3,69	7,9
ITA	Italy	9,98	8,35	5,46	8,5	6,30	4,50	4,6	8,07	2,97	4,6
Statistics	Maximum	10,00	8,97	8,20	9,00	7,65	5,26	5,93	9,51	7,98	8,09
	Minimum	9,24	7,62	5,34	7,48	3,68	1,41	2,56	3,45	2,03	2,51
	Range	0,76	1,35	2,87	1,53	3,46	3,50	3,37	6,05	5,95	5,58
	Average	9,87	8,34	6,98	8,30	5,80	3,45	4,25	7,34	4,85	5,63
	Standard deviation	0,19	0,39	0,79	0,39	1,16	1,05	0,91	1,48	1,78	1,51
	Volatility	1,90	4,70	11,28	4,74	20,06	30,41	21,52	20,22	36,76	26,86

Source: author's own work.

Social Progress Index

To provide a more complete picture of societal sustainability, particularly with regard to Human Wellbeing, EU-SPI Index for 2016 was used (EU Regional Social Progress Index is published since 2014). Basic EU-SPI data are presented in table 6.

Table 6. EU Regional Social Progress Index for EU-28

Statistics	SPI	Basic Human Needs	Foundations of Wellbeing	Opportunity
Maximum	90,09	96,63	88,86	86,56
Minimum	72,14	84,26	74,81	54,42
Range	17,95	12,37	14,05	32,14
Average	82,51	92,37	83,58	72,42
Standard deviation	5,24	2,96	4,17	9,21
Volatility %	6,35	3,20	4,99	12,72

Source: author's own work.

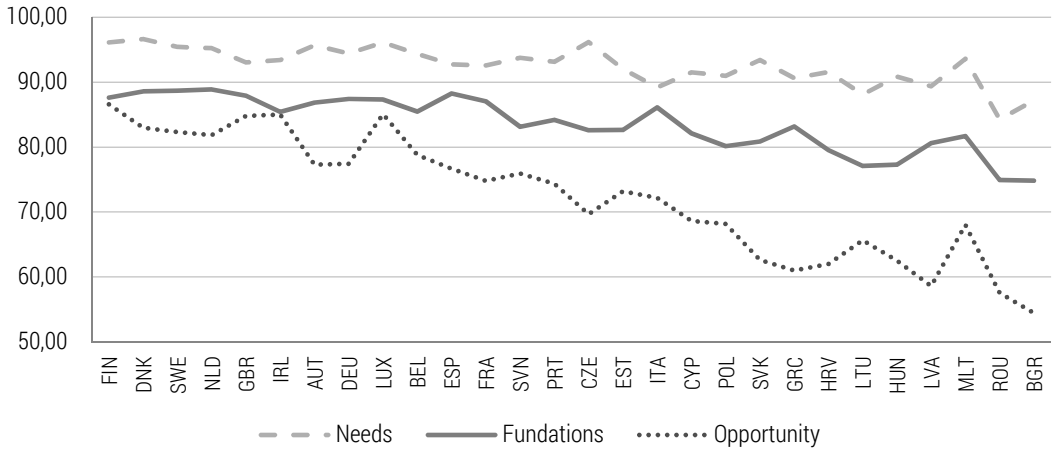

Figure 2. EU-SPI dimensions for 2016

Source: author's own work.

Overall, EU-28 countries performed best on *Basic Human Needs* (Needs), with a score above 84 and variation of ca.3%. Cross-country divergence is also low on *Foundations of Wellbeing* (Fundations), that is ca.5%, with the minimum score of 74. *Opportunity* (including personal rights, upwards social

mobility and inclusion) is the worst performing aspect of social progress for the whole EU, and shows the highest variation with the range of ca.32 points.

Figure 2 presents SPI for EU-28 countries with by the three dimensions.

Sustainable Society and Social Progress

Social development is understood as a certain direction for socio-economic growth is a way to build a sustainable society. A sustainable society is one that enjoys economic wellbeing, environmental protection and social cohesion. These values are captured by the three wellbeing sub-indexes of the Social Sustainability Index, whereas social progress is measured by the Social Progress Index. figure 3 presents the EU-28 countries grouped in clusters according to the above indexes' scores.

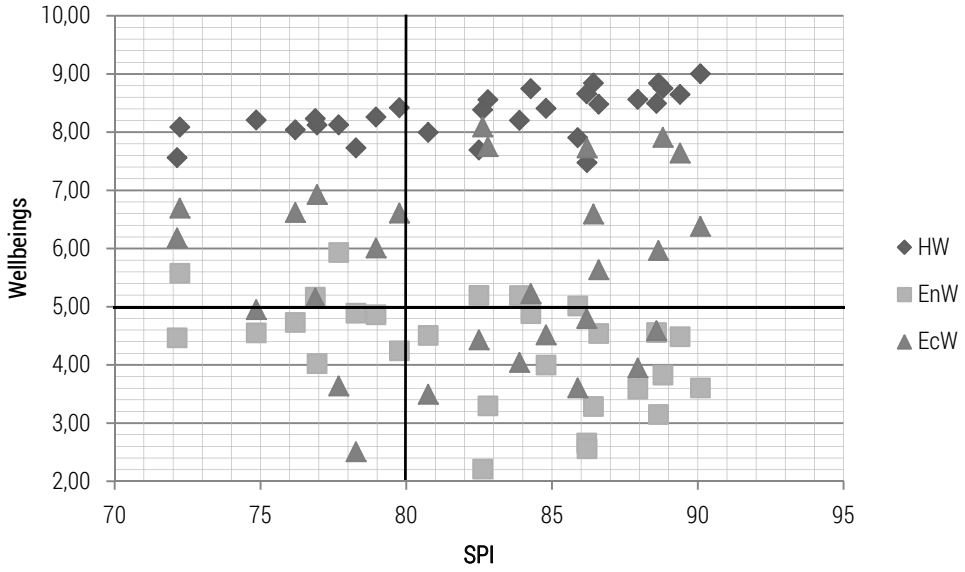

Figure 3. EU countries clusters by SSI wellbeing dimensions and SPI score for 2016

Source: author's own work.

In the countries surveyed social progress had a high, above average, score. SPI score above 80 stands for the highest social progress. Wellbeing SSI sub-indexes above 5 indicate above average values. Classes 3 and 4 represent negative score in the wellbeing dimension.

Table 7 presents clusters of EU-28 countries by SPI classes and SSI sub-indexes.

Table 7. EU-28 countries broken down by SPI classes and SSI wellbeing sub-indexes

Dimensions	Classes	SPI	
		80 – 100	60 – 79
HW	1	FIN, DNK, SWE, NLD, GBR, IRL AUT, DEU, BEL, ESP, FRA, SVN, PRT, CZE, EST, ITA, CYP	POL, SVK, GRC, HRV, LTU, HUN, LVA, MLT, ROU, BGR
	2	LUX	–
EnW	1	–	–
	2	ESP, PRT, ITA	HRV, HUN, ROU
	3	FIN, DNK, SWE, NLD, GBR, IRL AUT, DEU, BEL, FRA, SVN, CZE, CYP	POL, SVK, GRC, LTU, LVA, MLT, BGR
	4	EST	–
EcW	1	DNK, SWE, LUX, CZE, EST	–
	2	FIN, NLD, AUT, DEU, SVN	POL, SVK, LTU, HUN, LVA, ROU, BGR
	3	GBR, IRL, BEL, ESP, FRA, PRT, ITA, CYP	GRC, HRV, MLT,
	4	–	–

Key to the Chart: country codes are provided in table 5.
Source: author's own work.

EU-28 countries were grouped in class 1 (with the exception of Luxembourg) of the *Human Wellbeing* dimension, with the traditional EU members being more predominant in class 1 of *Social Progress* than the recent joiners. New EU members (since 2004) were grouped in class 2 of SPI.

As it comes to *Environmental Wellbeing*, none of the countries achieved the top rating, and only 6 countries were classified in class 2. In this dimension Spain ranked the lowest (class 4).

Class 1 of *Economic Wellbeing* contains only five countries: 4 old EU members and the Czech Republic. Recent EU joiners were grouped in class 2 – 7 countries, and class 3 – 3 countries.

No EU-28 countries were ranked in class 4.

Conclusions

Social development is a process of social changes occurring one after the other which are also related to advancement in the sense of a direction of socio-economic development. The main goal of sustainable development is to upgrade the general quality of life to satisfy the needs of the present generation without diminishing the prospects of future generations to meet their needs, involving the need to form a sustainable society.

A sustainable society is one in which economic wellbeing, environmental conservation and social cohesion are ensured. These values are captured in form of three wellbeing dimensions – sub-indexes of the SSI, whereas social progress is measured by the Social Progress Index.

Analysis of the SSI sub-indexes leads to the conclusion that the EU-28 countries are performing very well on Human Wellbeing (scores above 7,4), and in this dimension convergence of all the countries is evident. Alas, in the other two dimensions, there is a wide variation in performance across countries (up to ca.40%), which indicates divergence both with regard to Environmental and Economic Wellbeing.

Analysis of the SPI sub-indexes shows that Basic Human Needs are best provided for since they received the highest score (average of 94 per 100). Average performance on Foundations of Wellbeing is slightly worse (average of 83). Opportunity, including personal rights and upwards social mobility, with an average of 72, is the worst performing dimension, and shows bigger variance (ca.9).

The level of sustainability in the surveyed countries is far from ideal. Basic Needs is the best performing dimension, especially in terms of personal development as captured by the Human Wellbeing sub-index.

Assessment of the condition of natural resources, including Climate & Energy, allows to conclude that the Environmental Wellbeing dimension needs improvement, and particular attention should be given to Renewable Energy (indicator score in the range from 1,0 to 3,7 per 10 max). As it comes to Economic Wellbeing, Employment – with an average score of 3,9 – is the area that most needs urgent action.

Analysis of the Sustainable Society Index and the level of indicators allows to monitor the country's progress towards sustainability, and to set priorities and adjust the country's policy. Moreover, SSI can be used for comparative, educational and development purposes.

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Agnieszka ABRAMOWICZ

ANALYSIS OF THE STATE OF DEVELOPMENT OF THE PROVINCE OF PODLASIE

Agnieszka **Abramowicz**, MSc – *Bialystok University of Technology*

Correspondence address:
Faculty Of Civil And Environmental Engineering
Wiejska Street 45 E, 15-351 Bialystok, Poland
e-mail: simran05@wp.pl

ABSTRACT: The article presents the applied method ratio analysis as the best tool for analyzing the development status of the province of Podlasie in relation to the selected comparative group. Based on the collected source data – selected indicators of sustainable development, described the state of development of the province of Podlasie comparing it with other territorial units. On the basis of the obtained results, the state of development of the podlaskie voivodship in relation to other voivodships was presented.

KEY WORDS: ratio analysis, status of development of the province

Introduction

Broadly understood development is desirable in every area of social, economic or spatial life. In order to make best use of the available means of stimulating growth, it is essential to determine the current state of development at any given time in order to plan further action in such a way as to bring the most rewarding benefits of short and long term. This was a prerequisite for the subject of an analysis of the state of development of the province of Podlasie, which focused on the analysis of the various development areas that are collectively understood as sustainable development.

The aim of the article is to present the results of the assessment of the development status of the podlaskie voivodeship as compared to other selected voivodships „eastern wall" using the indicator method as part of the audit of sustainable development. The relevant sustainability indicators were analyzed, which described the state of development of the analyzed territorial unit in two periods of time – 2004 and 2012, due to the availability of the most comprehensive data set and the willingness to examine the changes that have taken place since the accession of Poland to the European Union.

An overview of literature

Sustainable development, as defined in the Environmental Protection Act of 27 April 2001, is a „socio-economic development in which the process of integrating political, economic and social activities takes place, preserving the natural balance and the sustainability of basic natural processes to guarantee the ability to meet the basic needs of individual communities or citizens of both the present and future generations."

There are many methods and indicators of development that can be found in literature. In many ways they define this development with an emphasis on different levels, one more in the social sphere, the other economical and the other more in the environment, and thus each of them focuses on a few other qualities, factors and values through why they can be used depending on their needs.

Among the many methods available for assessing the quality of life or development, the method chosen for the analysis must take into account components of sustainability. The most appropriate and used method for evaluation, development analysis is 'Sustainability development audit', which enables one to analyze and solve a problem simultaneously for several spheres of development, namely: social, environmental and economic.

The most important features of a sustainable development audit include:

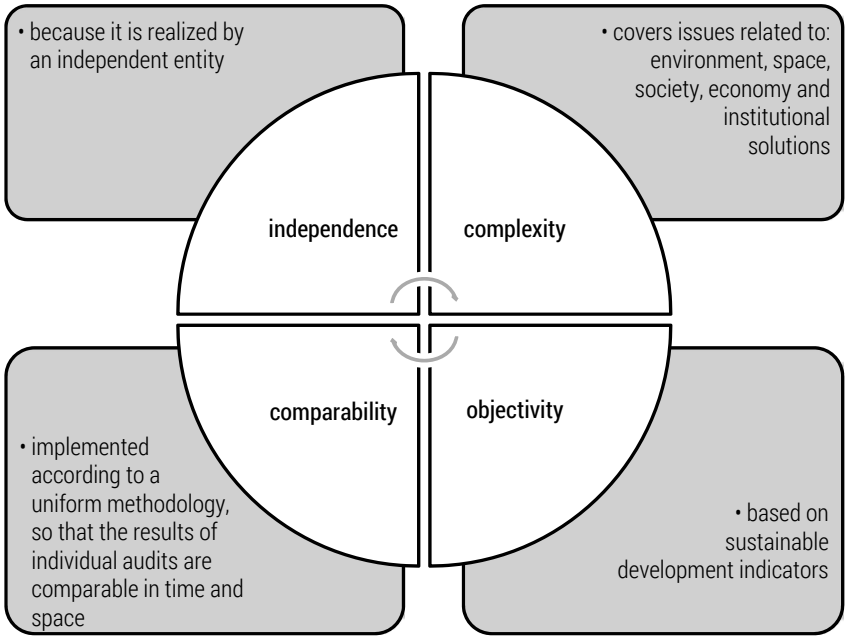

Figure 1. The features of a sustainable development audit

Source: (Fundacja Terra Humana (2003), Audyt zrównoważonego rozwoju powiatu otwockiego).

The sustainability development audit is based on certain principles based on such elements as:

- use of data available in the Central Statistical Office (GUS);
- develop a list of indicators on the basis of data available in GUS;
- use of the comparative method (with other comparable territorial units);
- analysis of change of indicators over time.

Research method – ratio analysis

The calculation procedure

Audit of sustainable development is based on a set of indicators that serve as diagnostic tools – information showing the situation of the current state of the environment, society and economy. What is more, it allows to assess the degree of progress of the work to implement the principles of sustainable development (Borys, 2005). A tool used to assess the state of development, is a ratio analysis, which is based on indicators of sustainable development.

Sustainable development indicators, in the form of 4 groups and with suggestions whether they are stimulators, destimulators, are located on the main website of the Central Statistical Office – www.wskaznikizrp.stat.gov.pl.

The first stage of comparisons, consisting in the construction of evaluation of indicators in a comparative group, is the transformation of specific values of indicators obtained from GUS into a uniform scale of scores in the range of 1 to 100.

Statistical analysis uses the following formulas:

for stimulating indicator:

$$O_p = [(W - W_{min})/(W_{max} - W_{min})] \times 100,$$

for destabilizing indicator:

$$O_r = [(W_{max} - W)/(W_{max} - W_{min})] \times 100,$$

$$\text{or } O_r = 100 - \left[[(W - W_{min})/(W_{max} - W_{min})]\right] \times 100.$$

By contrast, to calculate average values:

for stimulating indicator:

$$O_{p-śr.} = [(W_{śred.} - W_{min})/(W_{max} - W_{min})] \times 100,$$

for destabilizing indicator:

$$O_{r-śr.} = [(W_{max} - W_{śred.})/(W_{max} - W_{min})] \times 100.$$

where:

O_p or O_r – point rating of the W value for a given territorial unit,

$O_{p\text{-}śr.}$ or $O_{r\text{-}śr.}$ – a point-to-point assessment of the average value of indices for a comparable group of territorial units, which is dependent on the distribution of the indicator,

W – value of the indicator,

W_{min} – the minimum value of the indicator for a given sample,

W_{max} – maximum value of the indicator for a given sample,

$W_{śred.}$ – average value of the indicator for a given sample.

The second phase of comparison is to refer the unit value to the average level of indicators in a comparable group of territorial units using the formulas:

for stimulating indicators:

$$\left[\left(O_p/O_{p-śr.}\right) \times 100\%\right] - 100\%,$$

for destabilizing indicators:

$$[(O_r/O_{r-śr.}) \times 100\%] - 100\%.$$

Another important element which should be calculated is the variability of the sustainability index across the whole set of the compiled territorial units by calculating the coefficient of variation according to the formula:

$$Z = \frac{S(W)}{W_{śred}} \times 100\% \, , S(W) = \frac{1}{n}\sum_{i=1}^{n}(W - W_{śred.})^2,$$

where:
S (W) – standard deviation of indicator value,
n – number of units in the comparative group.

The values of this indicator should be interpreted by assigning it to one of the three groups indicating the magnitude of the variation, ie:

- 0-0,3 – low variability,
- 0.3-0.6 – significant variation and,
- > 0.6 – strong variation.

The next step is to assess the dynamics of the indicator change in the form of medium-term growth rates, which tells of what percentage the phenomenon has increased or decreased over the period considered compared to the level of the reference period.

The first step is to calculate the geometric mean „g" according to the following formula:

$$g = \sqrt[n-1]{\frac{i_n}{1}} \text{ or } g = \sqrt{\frac{W_{2001}}{W_{2000}} \times \frac{W_{2002}}{W_{2001}} \times \frac{W_{2003}}{W_{2002}}},$$

where:
g – geometric mean value,
n – test period,
in /1 – single period.

The second step is to calculate the medium-term rate of change in the periods studied as the difference according to the following formula:

$$\overline{T_n} = g - 1,$$

or as a percentage value:

$$\overline{T_n}[\%] = (g \times 100) - 100,$$

The level of change in the value of the indicator is visualized by calculating the level of change of the phenomenon of the period studied compared to the base according to the following formula:

$$D(\%x) = [W_{br.}/W_x] \times 100\%,$$

where:
$D(\%x)$ – level of the phenomenon of the period in question compared to year x,
$W_{br.}$ – value of the indicator in the period under review,
W_x – value of index in year x.

At a later stage, the whole area of sustainability indicators is assessed as the sum of the value of the individual indicators of the analyzed area divided by the number of indicators that have been assessed. This evaluation is made according to formula:

$$O_D = \frac{W_1 + W_2 + \ldots + W_n}{n} = \frac{1}{n}\sum_{i=1}^{n} W_i,$$

where:
O_D – assessment of the area of order,
W_n – value of the indicator for a given year,
n – number of years included in the analysis.

The last computational step is the evaluation of order, determined on the basis of the evaluations of particular domains of the order according to the following formula:

$$O_{ZR} = \frac{1}{N}\sum_{i=1}^{r} O_D n_i),$$

where:
O_{ZR} – evaluation of order,
N – sum of the numerals of indices in all r-domains of order,
O_D – evaluation of a specific field,
r – number of domains in the order,
n_i – the number of indicators included in the field evaluation.

The evaluation of the phenomenon – radar charts

In order to present the results of the analysis in the most readable and transparent way are used radar charts. They represent the value ratio of the individual indicators for the surveyed territorial unit to the average value. It is significant that they do not indicate specific numerical values, but they express this relationship in relation to the average value of the indicator.

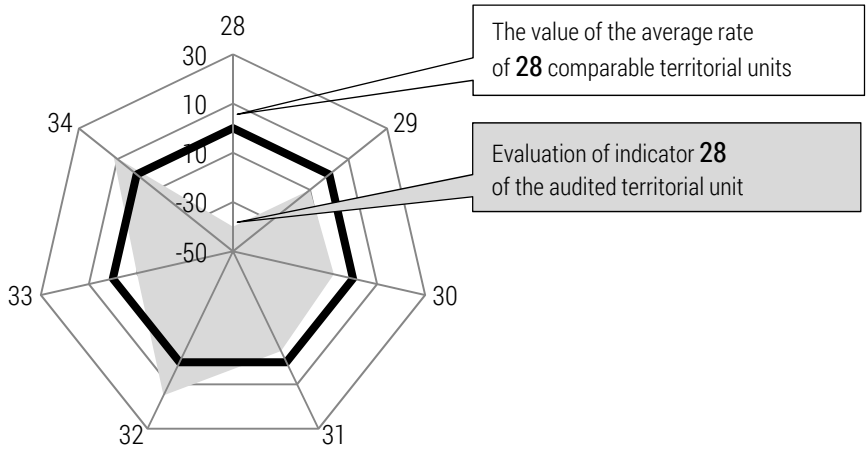

Figure 2. An example of radar chart

Source: author's own work based on UNDP Organizacja Narodów Zjednoczonych ds. Rozwoju. (2004). Audyt zrównoważonego rozwoju Gminy Miejskiej Ostrów Wielkopolski, Warszawa.

The dynamics of the phenomenon – bar charts

The second method of presenting the results of the indicator analysis is the bar graphs, which illustrate the dynamics of changes in the value of indicator data over time. On the bar chart, the reference point is the value of the index in the baseline year and shows the change dynamics over several years.

The graph shows the percentage increase or decrease of the sustainability index.

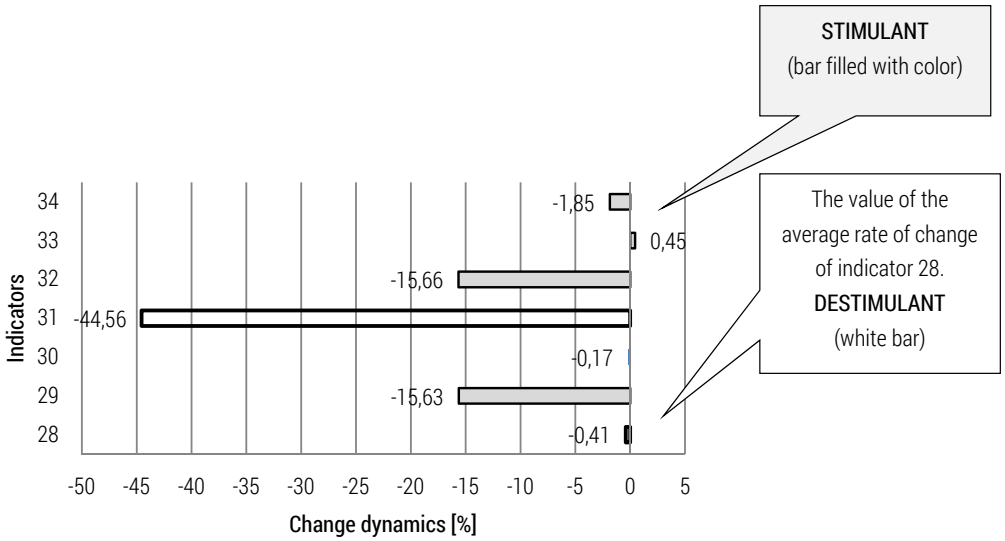

Figure 3. An example of a bar chart

Source: UNDP Organizacja Narodów Zjednoczonych ds. Rozwoju. (2004). Audyt zrównoważonego rozwoju Gminy Miejskiej Ostrów Wielkopolski, Warszawa.

The course 'analysis of the state of development'

The analysis of the development status of the odlaskie voivodship was carried out in accordance with the algorithm, presented in figure 4, which includes the following stages:

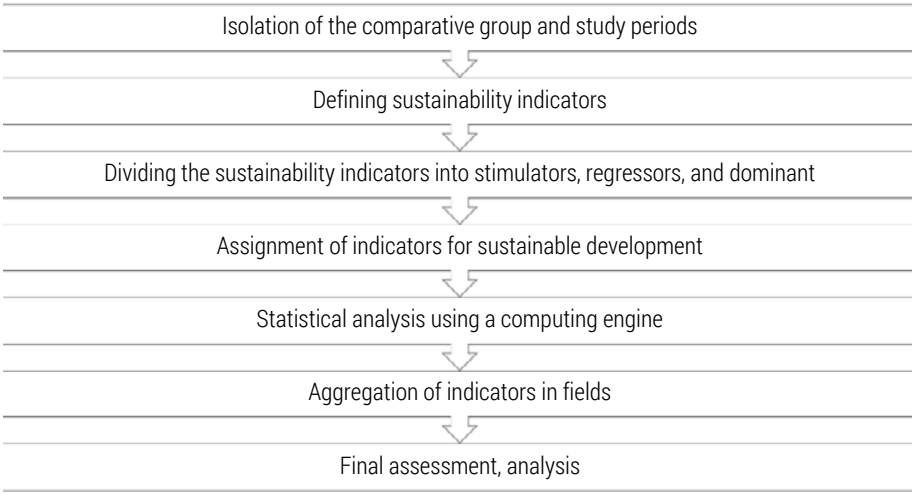

Figure 4. Procedure for carrying out analysis of development status

Source: author's own work.

Choosing the voivodeships for analysis, the similarity resulting from the natural, economic and historical conditions was followed. It is still said about the division of Poland into „Poland A" and „Poland B", so for comparison with the podlaskie voivodeship, in order to be reliable, the voivodeships were selected from the eastern wall, namely:

- lubelskie,
- podkarpackie,
- świętokrzyskie,
- and warmińsko-mazurskie.

The analysis was carried out for selected sustainable development indicators for the years 2004 and 2012, as they reflect the state of development at the time of Poland's accession to the European Union and the state of affairs after several years of EU funds being affected.

Of the nearly 80 available indicators, 24 indicators were selected for the analysis, available on the GUS website: http://wskaznikizrp.stat.gov.pl/, due to their importance for sustainable development. Their names, numbering, assigning to 1 of 3 orders and information whether it is a destimulant or stimulant, are presented in the following table 1.

Table 1. The analyzed indicators of sustainable development

Number of indicators	Indicator name	Stimulant / Destimulant
ECONOMIC ORDER → 6		
1. (1.1.; 1.2.)	Gross Domestic Product per capita (current prices)	S
2.	Investment expenditure by sectors per capita (current prices)	S
3. (3.1.; 3.2.; 3.3)	Employment rate by age	S
4. (4.1.; 4.2.)	Employment rate by sex	S
5.	Natural persons conducting economic activity per 100 people of working age	S
6.	Expenditures on research and development in relation to GDP	S
SOCIAL ORDER → 11		
7. (7.1.; 7.2.; 7.3.)	Consumption of household media per capita per year	D
8.	Number of passenger cars per 1000 population	D
9.	Average monthly disposable income per person in the household	S
10. (10.1.; 10.2.; 10.3.)	Unemployment rate (LFS)	D
11.	Employment rate of people with disabilities	S
12.	The fertility rate	S

13.	Natural increase per 1000 population	S
14. (14.1.; 14.2.; 14.3.)	Demographic burden indicators	D
15.	Average monthly gross pension from the non-agricultural social security system in relation to the average gross monthly salary	S
16.	Average life expectancy at birth at birth	S
17.	Victims of traffic accidents per 100 thousand. registered vehicles	D
ENVIRONMENTAL ORDER → 7		
18.	Emissions of carbon dioxide from plants that are particularly burdensome	D
19.	Share of legally protected areas in total area	S
20.	Groundwater exploitation resources – increase or decrease compared to the previous year	S
21.	Share of area of agricultural land in total area	S
22.	woodiness	S
23.	The share of municipal and industrial waste water purified in general wastewater requiring treatment	S
24. (24.1.; 24.2.)	Emission of air pollutants from plants that are particularly burdensome	D

Source: author's own work based on *Wskaźniki zrównoważonego rozwoju Polski* (2011). Główny Urząd Statystyczny, Katowice.

Results of the research

The calculations show that some indicators did not show the desired direction of change, that is, the stimulants attained a negative dynamics of change, while the positive ones were positive in the analyzed years. In the general assessment, they did not cause significant negative impacts, but nevertheless this gives us an idea of why their values behave contrary to the sustainable development of this requirement.

For example, indicator 1.2., Ie the share of GDP generated by the Podlaskie Voivodeship in the country's GDP, which indicates that it decreased in 2012 by about [-] 1.43% compared to 2004.

The same applies to the indicator 5. "Natural persons conducting economic activity per 100 people of working age", which as a stimulant should achieve a positive change in value, this value decreased by [-] 2.48%. Indicators of the social order 7.1.- 8. also, despite the desired direction of changes in value, recorded positive changes, contrary to the recommendations of the Central Statistical Office (GUS). Another indicator that has reached the oppo-

site of the recommendations for change in value is the indicator 11. Employment rate of people with disabilities".

This is a small change [-] 1.01%, but it does not change the fact that less and less disabled people are employed in the Podlaskie Voivodeship despite numerous facilities and support methods.

The next indicators that do not show the desired changes from a sustainable development point of view are: 13. „Natural increase per 1000 population", 14.1. and 14.3. referring to the demographic burden. Unfortunately, the 13 indicator over the years 2004 and 2012 has shown a negative dynamics of change, which is quite high, [-] 18.09%, what is a disturbing phenomenon resulting from the change of the family model, pursuit of a professional career and only later, establishing a family. Indicators 14.1. with [+] 2.37% and 14.3. [+] 15.92% increase in value is also not optimistic because they indicate that the number of people in working age per 100 working-age and pre-working age population is increasing, thus indicating an aging population, which together with decreasing natural growth do not create an optimistic scenario of demographic changes in the podlaskie voivodeship.

In comparison to earlier indicators, the decline in the value of index 15. "Average monthly gross social contributions other than agricultural to average wages" of [-] 0.93%, instead of growth, is not optimistic, as it seems that overall economic growth, should results in an improvement in the financial situation of all social groups.

Of the group of environmental indicators, only one indicator showed a change in value in the undesirable direction, namely the index of 21. „Share of agricultural area in total area", obtaining [-] 0.98% lower value in 2012 than in 2004. This may be due to the demand for land for investment, obtained at the expense of agricultural land.

As can be seen from the above list of indicators that did not change in the desired direction, there are 10, which is about 1/3 of all analyzed indicators. Also remember that some indicators have different variants and their numbering is the same as for example 1, which is broken down into indicators 1.1. and 1.2.

From the presented graph (figure 5) and analyzes, it can be concluded that in 2004, the economic order [+] 43% and the environment order [+] 23% of podlaskie voivodeship outperformed average growth in the comparative group. Growth below the average of social order [-] 12%, was worse off with respect to the averaged value of the assessment of the order.

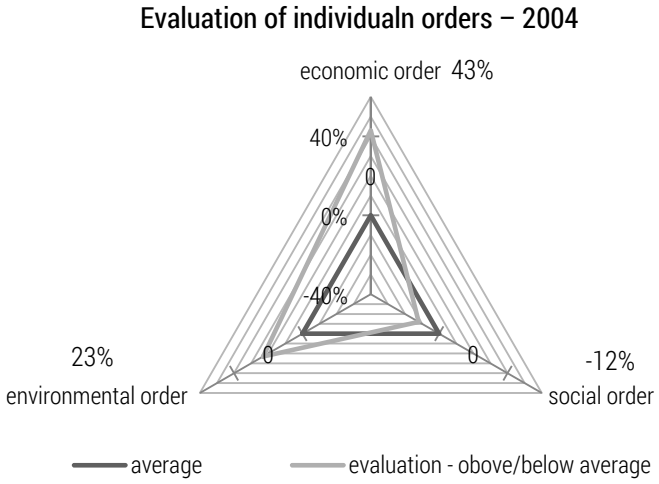

Figure 5. Evaluation of individual orders – 2004

Source: author's own work based on the author's ratio analysis, state of development of the region of Podlasie.

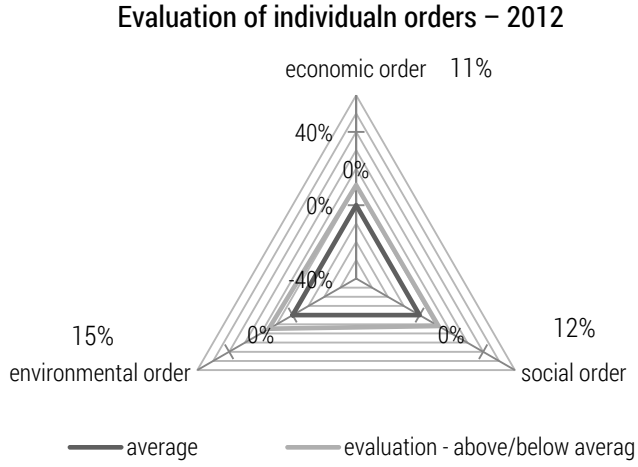

Figure 6. Evaluation of individual orders – 2012

Source: author's own work based on the author's ratio analysis, state of development of the region of Podlasie.

However, over the years, the situation has changed, as shown in figure 6. Economic and environmental development has remained above the average in the comparative group and amounted to [+] 11%, [+] 15%, respectively, but improvement in the social order improved and from [-] 12% (2004)

relative to the average in 2012 was already [+] 12%. This may be due to an increase in the activity of various environments in the sphere of social development of the society of the podlaskie voivodeship, investing in the social sphere, which is the basis for proper functioning of both economy and the environment.

Accordingly, it can be stated that the podlaskie voivodship, in comparison with the lubelskie, podkarpackie, świętokrzyskie and warmińsko-mazurskie voivodships, performs well because it shows development above average.

Moreover, it can be stated that the podlaskie voivodship is developing in a sustainable manner and therefore realizes the assumptions of sustainable development.

Conclusions

On the basis of a review of literature, the calculations made under the indicator analysis can be formulated as follows:

- The Sustainability audits formula, with the indicator analysis tool, identifies areas with favorable development situations and where changes are in the wrong direction, thus providing a multi-faceted analysis and noting the value of individual sustainability indicators.
- Complementary to the calculations are very helpful and readable in the radar and bar graph readings.
- As a result of the application of such methodology – indicator analysis, it was possible to comprehensively and multifacetly diagnose the development status of podlaskie voivodeship in relation to the selected comparative group by establishing relations, and examining the differences between the values of the indicators set over two years and in different categories.
- Choosing the right set of sustainable development indicators can serve as a tool for integrating the development of a given territorial unit or area and highlighting the potential and vulnerabilities of different categories of local life, and it is certainly a comprehensive information for the actors and institutions involved. Development processes as well as information or chosen, planned direction of development is realized in a timely manner and pace. Therefore, sustainable development audits as a tool for assessing development are widely used because of their comprehensiveness, independence and objectivity.

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Tadeusz PINDÓR

INNOVATIVE METHODS OF NATURAL GAS EXPLOITATION AS A FACTOR OF SUSTAINABLE DEVELOPMENT OF WORLD ECONOMY

Tadeusz **Pindór,** Prof. – *AGH University of Science and Technology*

Correspondence address:
Faculty of Management
Gramatyka Street 10, 30-067 Krakow, Poland
e-mail: tpindor@zarz.agh.edu.pl

ABSTRACT: The paper identifies unconventional techniques and technologies of exploitation of natural gas contained in shale rocks, i.e. drilling directional wells and hydraulic fracturing, against the background of the importance of natural gas for the world economy. The crucial importance of the innovative methods of extracting shale gas has been shown through the example of the impact of exploitation of unconventional gas deposits on halting the process of pushing the energy intensive industries out of the United States. The paper also highlights the importance of the dynamic increase in financial expenditure incurred by many countries on all continents on recognising and analysing gas deposits contained in rocks, hydrates or aquifers. As a result of geological exploration, the volume of global proven geological resources of unconventional gas is by 66% greater than the global resources of conventional natural gas deposits recognised over a period of many decades. The paper characterises the consequences of utilising the innovative methods of natural gas exploitation for raising the level of the sustainability and balance of the world economy development and also for the radical reduction of the cost of gas transport in the global scale.

KEY WORDS: unconventional gas, directional drillings, hydraulic fracturing, sustainable development

Introduction

Natural gas is a mixture of gaseous hydrocarbons, mainly ethane, methane and propane and also liquid hydrocarbons, carbon dioxide, nitrogen, hydrogen, hydrogen sulphide and noble gases, in particular argon and helium. The content of each constituent varies and depends on the extraction site but the predominant constituent is always methane – its content in natural gas is 90-98%.

The importance of natural gas for the world economy stems from the fact that applications of natural gas cover a constantly growing number of processes and facilities that are essential for sustaining the development of industry and the municipal and household sector with regard to energy and raw material supplies. The most important ones include:

- public power plants and combined heat and power plants;
- industrial heating furnaces;
- industrial production processes, particularly in factories manufacturing ceramics and building materials;
- iron and steel industry for the production of excellent quality steel as well as non-ferrous metallurgy;
- glass-making industry for the production of window and domestic glass as well as various types of technical glass;
- production of nitrogen fertilisers, chloromethanes, acetylene as well as many other organic compounds;
- obtaining hydrogen, used inter alia in refineries, in the processes of purifying and refining crude oil;
- as fuel in cars and other vehicles, especially in public transport;
- individual heating of residential and farm buildings;
- heating water and preparing meals;
- plant and animal breeding; drying cereals and seeds.

The fastest developing field of application of natural gas is currently cogeneration, i.e. generation of electricity and heat in the combined system, which allows for a considerably higher degree of utilising the primary energy of gas than in the traditional power plants and combined heat and power plants (CHPs). A very effective fuel in the cogeneration and microgeneration systems is liquefied petroleum gas (LPG), which is a mixture of propane and butane. It is used as gas but stored in cylinders under pressure it is a liquid. LPG is obtained from natural gas deposits and also as a by-product during the refining of petroleum.

Beside LPG, also liquefied natural gas (LNG) is more and more commonly used. It is gas in liquid state, stored at temperatures below -162°C. Over 30%

of natural gas in international trade is transported in the liquid state. Liquefied gas is an extremely pure fuel with an octane number of 130.

Natural gas does not contain large amounts of sulphur or heavy metals and therefore no dusts or other solid wastes are generated in the process of its combustion. The volume of emissions of sulphur compounds and nitrogen is also insignificant.

Utilisation of natural gas in technological processes involves a lot of benefits:

- smooth adjustment of production processes;
- high level of occupational safety;
- reduction or elimination of losses in the start-up phase of the production process;
- possibility of quickly stopping the manufacturing process;
- clean and simple maintenance of gas devices.

Innovative techniques and technologies of natural gas exploitation

Natural gas was formed over millions of years as a result of anaerobic decomposition of organic substances. Deposits of natural gas occur on their own or in association with petroleum and hard coal deposits.

Natural gas can be broken into:

- gas from conventional deposits;
- gas from unconventional deposits.

The term *unconventional* does not only refer to the sort of gas but also to the natural gas extraction techniques and technologies in which two processes are used: directional drillings and hydraulic fracturing. Both directional drilling and hydraulic fracturing have all the characteristics of innovative methods (Unconventional, 2016; Fundamentals, 2017).

A breakthrough in the process of extracting gas with the use of hydraulic fracturing was the mastering of the technique and technology of directional drilling, i.e. drilling wells that inclined in space as a result of deliberate human intervention. Directional wells are drilled both on land and under the seabed and ocean bottom. Directional wells are a very cost-effective and environmentally safe technique of completion drilling for deposits of natural gas or other hydrocarbons located under an urbanised area or under the seabed at a small distance from the coastline. Investment expenditure necessary for the purchase and installation of an offshore drilling rig as well as its running costs are much higher than capital expenditure and running costs related to

drilling a directional well or even of group thereof from a device located on the land (Artymiuk, Bednarz, 2011; Journal, 2016).

Hydraulic fracturing (also: fracking, hydrofracturing or hydrofracking) is a technological process designed to improve drilling efficiency by injecting a fracking liquid, i.e. a mixture of water with chemical additives and sand under high pressure in order to create, maintain or expand cracks in rocks. The fracturing process is used on a large scale for extracting natural gas from shales in the United States.

Issues concerning exploration of unconventional gas deposits and also exploitation of such deposits as well as transport and storage of the extracted gas are the subject of scientific research, both basic and applied, innovations and implementations of new techniques and technologies. The planning, programming and designing of these ventures is the subject of numerous conferences, symposia and seminars, often of a global character.

There is a dynamic growth in the number of literature items concerning the environmental, legal, technological, economic, financial and social determinants and factors associated with management of unconventional deposits of natural gas on all continents (Fundamentals, 2017; Natural, 2008-2017; Oil&Gas, 2010-2017).

Many studies stress the fact that investments in exploration and extraction of shale gas may significantly contribute to increasing the GNP growth rate, creating new effective jobs as well as increasing tax revenues, both at the level of states budgets and the local budgets (Annual, 2016).

There are also extensive international statistics concerning geological and industrial resources of natural gas and its deposits, as well as the production, consumption, export, import and prices of gas (Reserves, 2016; British, 2017; World, 2016).

Global resources of non-renewable primary energy

The structure of non-renewable primary energy resources in the world in 2015 has been presented in table 1 and in figure 1. The top position in the global ranking of resources of primary energy carriers, with regard to the category of proved reserves: geological knowledge in the United Nations Framework Classification (UNFC) is occupied by hard coal, with a share of 79.4% of total global resources of non-renewable primary energy (Energy, 2016; Pindór, 2016a; Pindór, Preisner, 2013).

In total, geological resources of natural gas deposits including both conventional and unconventional gas deposits, accounted in 2015 for 5.9% of the total global resources of primary energy carriers recoverable from the deposits in the geosphere (World, 2010-2017).

The total geological resources of natural gas, in energy units, were by over 65% greater than the total global resources of petroleum, both from conventional and unconventional deposits. It is also important to observe that the total geological resources of natural gas – with regard to energy – were by over 228% greater than the global geological resources of uranium and thorium together.

Table 1. The structure of non-renewable geological resources of primary energy in the world in 2015

Primary energy carrier	Primary energy resources	Share in global resources
	[EJ]	[%]
Hard coal	438,705	79.4
Lignite	52,019	9.4
Natural gas	32,695	5.9
Petroleum	19,059	3.5
Uranium and thorium together	10,047	1.8
Total world	552,524	100.0

Source: Reserves, 2016.

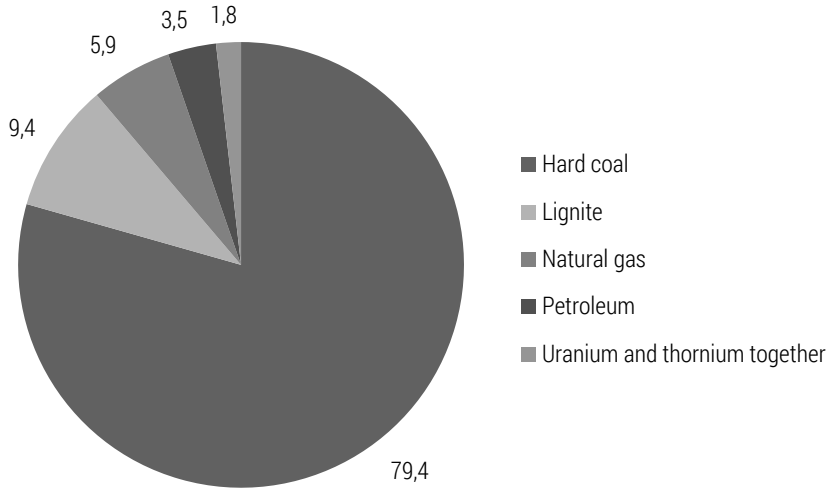

Figure 1. The structure of non-renewable geological resources of primary energy in the world in 2015

Source: Reserves, 2016.

The resources of unconventional gas are distributed exceptionally uniformly in the global scale. Large reserves of this gas have been discovered and proven in Latin America and in Africa where reserves of conventional natural gas, as well as of other primary energy carriers, are many times smaller (Pindór, 2016b; World, 2017).

Structure of global geological resources of unconventional gas

The structure of geological resources of unconventional natural gas in the world in 2015, in volume units and in energy units, has been presented in table 2 and in figure 3 while figure 2 shows the structure of total natural gas resources in the world in 2015 broken down into resources of conventional and unconventional deposits. Analysis of the data contained in table 2 provides a lot of essential conclusions concerning the utilisation of natural gas in the context of the criteria of balanced and sustainable development. The most important of them can be formulated as follows:

- geological resources of unconventional natural gas are by 66.2% greater than the conventional resources;
- the greatest shares in the global geological resources of unconventional natural are accounted for by resources of shale gas – 40.0%, and gas hydrates – 34.3%; a significantly smaller shares are accounted for by resources of tight gas – 11.7%, coalbed methane – 9.5%, and aquifer gas – 4.3%.

Table 2. The structure of unconventional natural gas resources in the world in 2015

Kind of gas	Resources of natural gas	
	[trillion m^3]	[EJ]
Conventional gas	323	12,293
Total unconventional gas	537	20,402
Shale gas	215	8,162
Gas hydrates	184	6,992
Tight gas	63	2,385
Coalbed methane	51	1,950
Aquifer gas	24	912
Total natural gas	860	32,695
Total non-renewable primary energy carriers	-	552,523

Source: Reserves, 2016.

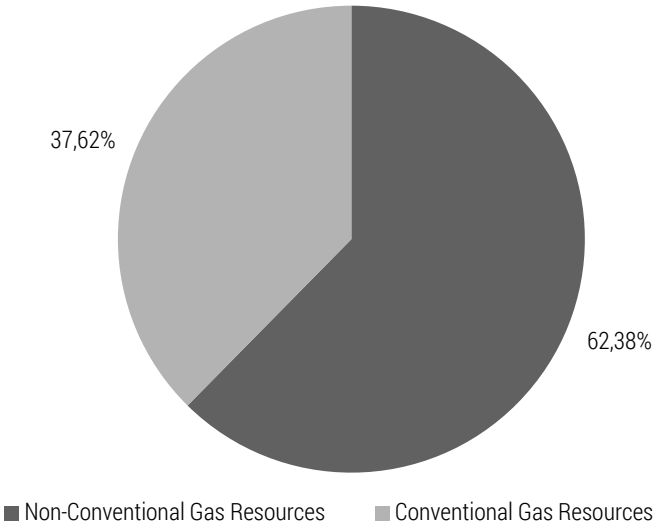

Figure 2. The structure of total natural gas resources in the world in 2015

Source: Reserves, 2016.

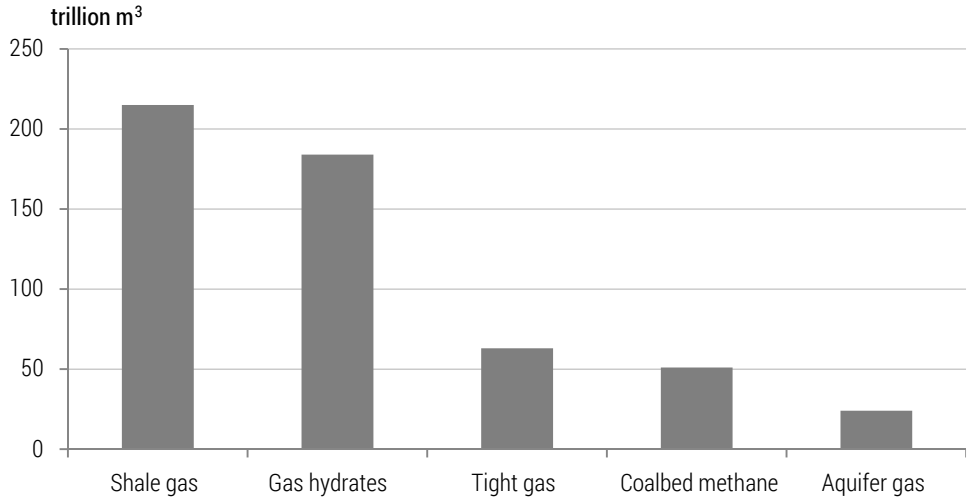

Figure 3. The structure of geological resources of unconventional natural gas in the world in 2015

Source: Reserves, 2016.

Production of natural gas in the world

Extraction of natural gas in selected countries in 2015 has been shown in table 3 and in figure 4. The world ranking of natural gas producers clearly reveals the impact of the development of extraction of unconventional natural gas in the United States as this country become the world leader in 2009 after the hegemony of producers from Russia, and formerly the Soviet Union, which had lasted since 1983.

According to the United States Energy Information Administration (US EIA), production of natural gas in the United States will rise up to approximately 1 trillion m^3 in 2040, which means an increase by over 30% compared with the 2015 level (Annual, 2016). The increase of production will be almost entirely the result of the increase in unconventional gas extraction, in particular from shale deposits, and also from tight gas deposits. Extraction of gas from deposits of gas hydrates will also increase significantly as well as of coalbed methane, undertaken in the United States on an industrial scale already in the 1990s. It is also expected that the coming years will see commencement of unconventional exploitation of aquifer gas. According to a US EIA forecast, extraction of natural gas from resources of all the unconventional deposits will reach the level of 472 billion m^3 in 2040 (World, 2017; Energy, 2016; Journal, 2016).

Among other major producers of conventional natural gas, it is Russia, Iran, Qatar, Saudi Arabia, Iraq, Turkmenistan and Algeria that have significant growth potential. In these circumstances, it is of decisive importance that there are plans to embark on extraction of unconventional natural gas in regions that have so far been bound to import gas, in particular China, Argentina, Brazil, Australia, Indonesia, India, Ukraine as well as countries of Central and South Africa. Significant geological resources of unconventional natural gas have already been discovered and proven in all of these areas.

Extraction of natural gas from shale rocks by means of hydraulic fracturing requires constant monitoring of the impact of this process on the components and functions of the environment. Hydraulic fracturing in Poland is being monitored by a lot of institutions, in particular such as: the Chief Inspectorate for Environmental Protection, the Chief Inspector of Environmental Protection, the National Water Management Authority and the State Mining Authority. A comprehensive project, commissioned by the Ministry of Environment, is being carried out with respect to in-depth monitoring of various environmental aspects of shale gas exploration. These efforts are considered to be the so far most extensive research in Europe on the impact of the process of hydraulic fracturing on the environment (Energy, 2015-2017; Strategia, 2017).

Table 3. Production of natural gas in selected countries in 2015

No.	Country	Production	Share in global production
		[billion m³]	[%]
1	United States	768.1	21.5
2	Russia	636	17.8
3	Iran	183.9	5.1
4	Qatar	171.3	4.8
5	Canada	154.8	4.3
6	China	138.2	3.9
7	Norway	121.3	3.4
8	Saudi Arabia	106.4	3
9	Algeria	82.3	2.3
10	Turkmenistan	80.2	2.2
	other countries	1131.2	31.7
	The world	3573.7	100

Source: Reserves, 2016.

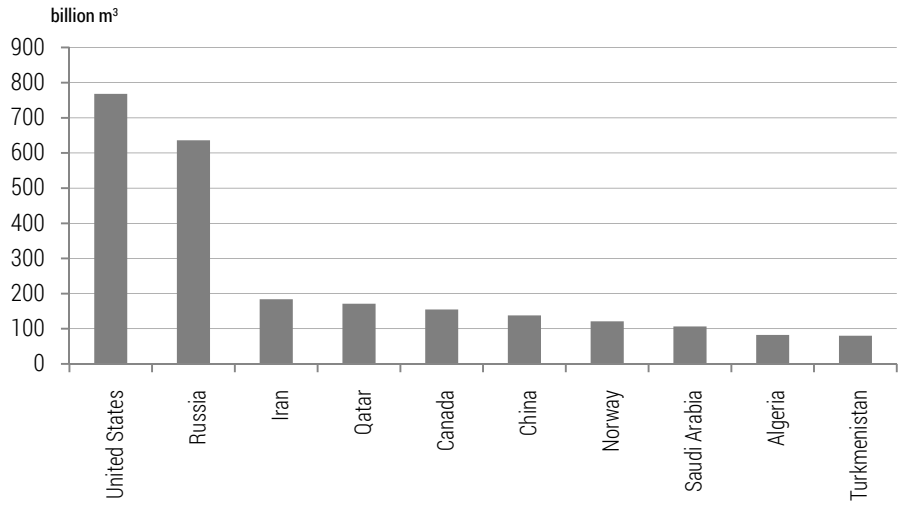

Figure 4. Production of natural gas in selected countries in 2015

Source: Reserves, 2016.

Consumption of natural gas in the world

Consumption of natural gas in selected countries in 2015 in volume units and the shares of the consumption by these countries in the global consumption have been presented in table 4 and in figure 5. This listing reveals the consequences of the introduction of gas from unconventional deposits to supply the economy of the United States. The dynamically growing utilisation of this gas, considerably cheaper than that imported and reckoned one of the best sources of supply, has substantially transformed the sector of extraction and exploitation of fuels and energy in the United States and has been the main factor in halting the process of *pushing* the most energy intensive industries *out* of the United States (Global, 2017).

Table 4. Consumption of natural gas in selected countries in 2015

No.	Country	Consumption	Share in global consumption
		[billion m^3]	[%]
1	United States	777.6	21.8
2	Russia	461.5	13
3	China	191	5.4
4	Iran	182.7	5.1
5	Japan	114.1	3.2
6	Saudi Arabia	106.4	3
7	Canada	102.5	2.9
8	Germany	96.5	2.7
9	Mexico	83.2	2.3
10	UAE	69.1	1.9
	other countries	1377.1	38.7
	The world	3561.7	100

Source: Reserves, 2016.

The increase of shale gas production brought about the situation in which the United States became independent of foreign suppliers and consequently was the decisive factor in making the American economy independent of the effects of natural gas price fluctuations in the international markets and also of the frequent supply disruptions related to the functioning of the thousands-of-nautical-miles-long transport and logistic chains connecting the Middle East exporters with import harbours in the United States (International, 2017).

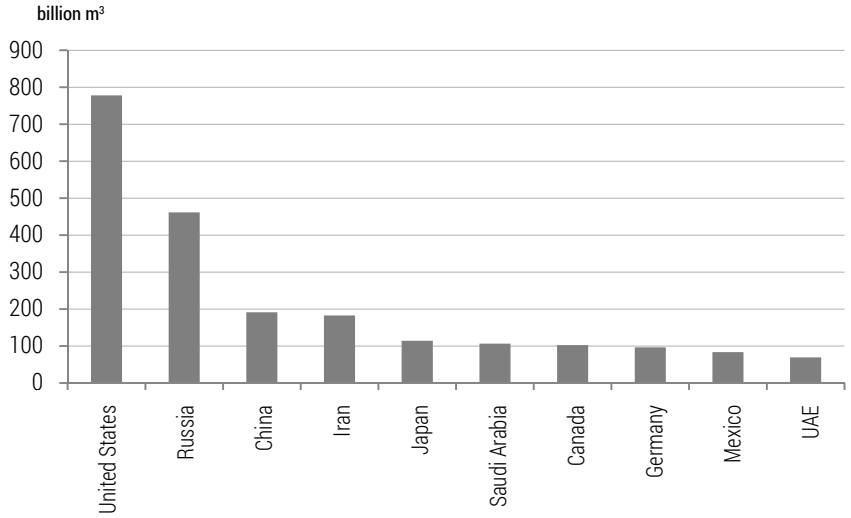

Figure 5. Consumption of natural gas in selected countries in 2015

Source: Reserves, 2016.

An analysis of the distribution of geological resources of unconventional gas in the world indicates that they are located very close to the main centres of consumption of primary energy. Significant shortening of transport routes in the global scale due to exploitation of unconventional gas implies a corresponding reduction of energy needed to provide gas to the consumers, which significantly improves the sustainability of the utilisation of the total gas resources for global development.

Summary

In the summary of the paper, the most important conclusions have been formulated as well as final statements.

The importance of natural gas in the world economy stems from the numerous uses of natural gas as a primary energy carrier and also the key raw product or semi-finished product in many sectors of material manufacturing.

Utilisation of natural gas does not cause significant pollution of any component of the environment nor does it restrict the environment in fulfilling its natural and economic functions.

The application of unconventional methods, i.e. drilling of directional wells and hydraulic fracturing, have opened up previously unknown possibilities in the exploration of natural gas deposits in shale rocks and proving the

volume and structure of the natural deposits of shale gas, and consequently – also exploitation of these gas deposits.

The possibility of exploiting natural gas by unconventional methods caused – on all continents – a dynamic growth in financing recognition and analysis of gas reserves contained in rocks, hydrates or aquifers. The volume of global proven geological resources of unconventional gas after over a dozen, and in the majority of countries just a few, years of exploration efforts is by 66% greater than the global resources of conventional natural gas deposits recognised over a period of many decades. As a result of discovering and proving deposits of unconventional gas, a new item appeared in the balance of resources in many countries, both in volume and energy units, and that was natural gas.

Utilisation of unconventional methods of exploitation of natural gas deposits in the industrial scale means most especially:

- extension of the service life of the global resources of natural gas, i.e. an increase in the sustainability of development through the use of natural gas resources;
- balancing the global economy development due to diversification of resources of a significant source of energy and methods of transport of this primary energy carrier to secondary energy consumption centres;
- the possibility of taking advantage of natural gas to develop those areas of the world where the use of gas was only possible through imports;
- radical shortening of gas transport routes in the global scale resulting from launching exploitation of unconventional natural gas deposits located in the proximity of the major global centres of primary energy consumption, which implies a significant reduction of energy use in the processes of gas transport, and consequently a significant reduction of the costs associated with transporting gas to its users.

A significant increase in the production of unconventional gas implies a rise in the level of global energy security as well as a diversification with regard to the types and the geographical structure of the primary energy balance on the demand side, which provides a solid fundament for sustainable economic and social development in the global scale.

Acknowledgments

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Monika **UTZIG**

URBAN AND RURAL CONSUMPTION PATTERN – CONVERGENCE OR DIVERGENCE? DELIBERATIONS AGAINST SUSTAINABLE DEVELOPMENT

Monika **Utzig,** PhD – *Warsaw University of Life Sciences – SGGW*

Correspondence address:
Faculty of Economic Sciences
Nowoursynowska Street 166, 02-785 Warsaw, Poland
e-mail: monika_utzig@sggw.pl

ABSTRACT: The aim of this study is to identify rural and urban patterns of consumption expenditure and to evaluate whether convergence occurs between them. The results based on Household Budget Surveys data from the years 2006-2015 prove that the rural consumption pattern is less sustainable compared with the urban one and that they are akin to each other. The value of expenditure on higher needs (restaurants and hotels, leisure and culture) in rural households grows faster than in urban households, which proves some convergence between them.

KEY WORDS: consumption expenditures, rural and urban areas, convergence, sustainable development

Introduction

Convergence is the idea that poorer countries or regions develop faster than the richer ones, which gives rise to a decrease in disparity between them. It comprises beta convergence (a negative dependency between an average growth rate of the analysed phenomenon and its initial rate) and sigma convergence (dispersion of the phenomenon decreases in time) (Barro, Sala-i-Martin, p. 223-251). Therefore, the convergence may be considered as the phenomenon in which countries or regions become similar to each other. In this context, the convergence may also be considered as the process in which consumption expenditure patterns of rural and urban households become similar to each other, particularly in the context in which consumption patterns are akin to the more sustainable ones.

The aim of this study is to identify patterns of consumption expenditure of rural and urban households and to determine whether they are akin to each other, hence whether in this case there occurs convergence or divergence.

This study is theoretical and analytical. It is based on the Central Statistical Office's secondary data from the Household Budget Surveys for the years 2006-2015. There were identified consumption expenditure patterns and the greatest differences between expenditure on particular categories of consumption goods and services between urban and rural households. It was analysed whether with respect to a category of consumption goods and services with the greatest differences in expenditure per capita between urban and rural households, those differences are greater or smaller. Further, a synthetic measure of the structure similarity based on the Bray-Curtis measure was applied to determine whether structures of consumption expenditure in rural and urban households are getting similar to each other.

An overview of literature

The aim of sustainable (permanent) development idea is to integrate the three essential aspects of development: environmental, economic and social. But the reality of life today is that the economy dominates environment and society (Giddings et al., 2002, p. 189-190).

According European Union there are ten sustainable development headline indicators, and sustainable consumption and production is one of them (EU 2015, p. 9).

Sustainable consumption and production is defined as "the use of services and related products, which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardise the needs of future generations" (Norwegian Ministry of Environment, Oslo Symposium 1994). Sustainable consumption and production objective is to promote resource and energy efficiency, sustainable infrastructure and to provide access to basic services, green and decent jobs and a better quality of life for all (UNEP 2010, p. 12).

Eurostat analyses sustainable consumption patterns by using the set of indicators (Eurostat):

- electricity consumption by households,
- final energy consumption by sector,
- motorisation rate.

Eurostat also uses two contextual indicators of sustainable consumption and production (Eurostat):

- number of persons in households,
- final consumption expenditure of households, by consumption purpose.

The Central Statistical Office of Poland's *Sustainable Development Indicators for Poland* study specifies the following indicators of sustainable development measuring consumption patterns (GUS 2015):

- the structure of passenger cars by age groups,
- the consumption of electricity in households per one resident,
- the structure of average monthly per capita expenditures in households by their kinds.

The structure of households' consumption expenditures illustrates their life quality as well as it is associated with welfare. For more sustainable consumption it is important to increase the share of expenditures on the less-environmentally damaging purposes, such as: leisure, culture and communication.

Some of the consumers are trying to be more sustainable and responsible. There are different responsible consumers attitudes (Jastrzębska, 2017, p. 202-203):

- no wastage,
- not seeking to satisfy artificial needs,
- green consumerism,
- ethical consumerism,
- political consumerism.

But for big corporations sustainable development goals are less important than economic profit (Zimniewicz 2016, p. 71). So it is naive to assume that consumers appreciate more ecological than economical aspects of their consumption.

The most important factor that determines the size and structure of consumption expenditure of households is their incomes which following the accession of Poland to the European Union increased faster in rural areas compared to the urban ones (Utzig, 2014, p. 151). Differences between consumption pattern of Central and Eastern European Countries and EU-15 decrease (Mikuła, 2017, p. 209), the sigma convergence at the country level occurs. Rural households are characterized by average lower incomes and an average higher number of persons in the household, which leads to lower income per capita and a lower level of satisfaction with their material situation compared to the urban ones (Hanusik, Łangowska-Szczęśniak, 2014, p. 71). In the structure of consumption expenditure of rural households expenditure on basic needs (food and non-alcoholic beverages, transport) is significantly greater in comparison with urban households, whereas expenditure on goods and services that meet higher needs (clothing and footwear, health, communication, recreation and culture, education, restaurants and hotels) is observed to be lower (Utzig, 2016, p. 169). The lifestyle change in rural areas is considerably affected by families predominantly generating their income from non-agricultural sources and since the accession of Poland to the European Union an increase in expenditure of rural households on recreation and culture as well as on restaurants and hotels has been observed (Chmielewska, 2013, p. 21-22). Consequently, there are observed certain symptoms of shifting the rural consumption expenditure pattern towards the urban one which is more sustainable.

Rural and urban households considerably differ from each in the field of the food consumption pattern. Rural households consume more basic and cheaper food products and natural products, whereas urban households consume more highly processed products which are usually more expensive and of higher quality (Kwasek, 2010, p. 44-45). Considering the identical income per capita rural households spend more money on food per capita compared to urban households. This may indicate that differences in income per capita in rural and urban households are, to some extent, equalized by natural consumption of food by rural communities and that rural communities, including agricultural one, rank the food consumption higher in the hierarchy of needs and are willing to incur relatively higher expenditure on it compared to the urban ones (Gałązka, 2013, p. 27-28).

Research methods

Consumption expenditure patterns in rural and urban households were identified and assessed in terms of sustainability.

Beta convergence is negative dependency between an average growth rate of the analysed phenomenon and its initial rate. To asses if beta convergence between urban and rural consumption patterns occurs categories of consumption expenditures of the biggest differences between rural and urban households were identified. Next, growth rate of consumption expenditures in urban and rural households was calculated.

Sigma convergence occurs when dispersion of the phenomenon decreases in time. Measures based on the multi-dimensional statistical analysis are used to assess structural changes. Since the structure of households' consumption expenditures is shown as shares, its differentiation between urban and rural households is measured by using the Bray-Curtis metrics with the formula (Malina, 2006, p. 11-12):

$$p_{BC} = 1 - \frac{\sum_{j=1}^{m} \left| q_{1j} - q_{2j} \right|}{\sum_{j=1}^{m} \left| q_{1j} + q_{2j} \right|}.$$

In this formula individual structure factors are provided as vectors q_{ij} *(i=1,..., n, j=1,...,m)*, where *n* means a number of objects and *m* means a number of structure factors. This measure takes values from 0 to 1, where 0 is for completely dissimilar structures and 1 is for identical structures.

All the calculations were based on Household Budget Surveys data. The analysis covers the span of 2006-2015.

Results of the research

Table1 presents monthly per capita consumption expenditures in zlotys.

The average monthly expenditure per capita in rural households in 2006 and 2015 was lower than in urban households in almost all expenditure categories. The exception is pocket-money in 2015 comprising consumption expenditure with respect to which it is impossible to determine what products and services were purchased. The lowest relation between rural and urban expenditure in 2006 applied to expenditures on restaurants and hotels (38%), education (42%) and recreation and culture (46%). In 2015 differences decreased, with the lowest ratio for expenditures on education (44%), restaurants and hotel (47%) and recreation and culture (56%). The highest ratio between rural and urban expenditure level applied to expenditures on food and non-alcoholic beverages (93% in 2006 and 88% in 2015), transport

(84% in 2006 and 87% in 2015) and pocket-money (84% in 2006 and 126% in 2015). The relatively high expenditure on transport in rural households comprising means of transport and their use and transport services may be caused by a low accessibility to public transport in rural areas and, consequently, by necessity to have own means of transport and incur expenditure on its operation (Utzig 2016, p. 139).

Table 1. Average monthly per capita expenditures on consumer goods and services in zlotys

Expenditures	Rural areas 2006	Rural areas 2015	Urban areas 2006	Urban areas 2015
food and non-alcoholic beverages	192.59	242.77	208.03	274.84
alcoholic beverages, tobacco and narcotics	16.25	21.62	22.32	30.54
clothing and footwear	31.45	48.73	45.62	65.94
housing, water, electricity, gas and other fuels	112.09	169.04	168.64	251.79
furnishing household equipment and routine maintenance of the house	30.84	44.40	42.39	60.92
health	28.17	43.59	41.80	66.59
transport	58.61	87.58	69.46	101.08
communication	28.17	43.26	44.70	62.37
recreation and culture	30.74	49.58	67.19	88.78
education	5.67	6.34	13.41	14.27
restaurants and hotels	7.36	26.91	19.16	57.18
miscellaneous goods and services	27.33	46.81	44.62	75.57
pocket-money	7.94	20.19	9.50	16.06

Source: author's own work based on GUS (2007), *Household Budget Surveys in 2006* and GUS (2016), *Household Budget Surveys in 2015*.

More sustainable consumption pattern is determined by higher level of expenditure on non-environmentally damaging purposes and expenditure meeting higher needs. So it can be stated that urban households' consumption with the higher level of expenditure on recreation and culture and restaurants and hotels is more sustainable than rural one.

In the years 2006-2015 the nominal expenditure on all categories of consumption goods and services increased. The smallest increase was observed for expenditure on education (by 6% in urban households and by 12% in rural ones), whereas the highest one was noted for restaurants and hotels

(by 198% in urban households and by 266% in rural ones). This small increase in average expenditure on education per capita may result from the change of the demographic structure of households in that period. While in 2006 an average number of persons in a household in Poland was 3.05, in 2015 this number was only 2.72 (GUS 2007 and GUS 2016). Expenditure on the remaining categories for which the largest differences between rural and urban households were observed (recreation and culture as well as restaurants and hotels) increased faster in rural households compared to the rural ones. It may therefore be concluded that between consumption expenditure of rural and urban households there occurred the beta convergence, particularly with respect to expenditure on non-basic needs such as leisure, culture, restaurants and hotels.

The table 2 presents the ratio between consumption expenditures in rural and urban households in 2006 and their growth rate between 2006 and 2015.

Table 2. Relationship between rural and urban consumption expenditure and its growth rate in the span of 2006-2015 [%]

Expenditures	Rural/urban ratio in 2006	Growth rate – urban households	Growth rate – rural households
Food and non-alcoholic beverages	93	32	26
Alcoholic beverages, tobacco and narcotics	73	37	33
Clothing and footwear	69	45	55
Housing, water, electricity, gas and other fuels	66	49	51
Furnishing household equipment and routine maintenance of the house	73	44	44
Health	67	59	55
Transport	84	46	49
Communication	63	40	54
Recreation and culture	46	32	61
Education	42	6	12
Restaurants and hotels	38	198	266
Miscellaneous goods and services	61	69	71
Pocket-money	84	69	154

Source: author's own work based on GUS (2007), *Household Budget Surveys in 2006* and GUS (2016), *Household Budget Surveys in 2015*.

The highest differences between rural and urban expenditure growth rate were observed in categories: pocket-money, restaurants and hotels, recreation and culture. So it can be stated that there is beta convergence between rural and urban consumption pattern because in the categories of highest differences of consumption expenditure level growth rate was higher in rural households.

The sigma convergence provides for a decrease in dispersion between the phenomena. The difference between an average consumption expenditure in rural and urban households in the years 2006-2015 decreased with respect to expenditure on most categories of consumption. Those differences have increased only with respect to expenditure on food and non-alcoholic beverages (rural/urban ratio decreased from 93% to 88%), alcoholic beverages, tobacco and narcotics (rural/urban ratio decreased from 73% to 71%), and health (rural/urban ratio decreased from 67% to 65%). It can thus be concluded that for most categories of consumption expenditure there occurred the sigma convergence between the urban and rural pattern of consumption expenditure.

The Bray-Curtis similarity structure measure of consumption expenditure of rural and urban households is shown in table 3.

Table 3. Similarity structure measure between urban and rural consumption expenditures pattern

Similarity measure	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
p_{BC}	0.911	0.913	0.926	0.926	0.926	0.929	0.921	0.923	0.920	0.923

Source: author's own work based on GUS (2007-2016), *Household Budget Surveys in (2006-2015).*

The structures of consumption expenditure of rural and urban households are very similar to each other. In the period from 2006 to 2011 they were similar to each other, in the subsequent years this similarity slightly decreased but at the end of the analysed period it was higher than in the beginning. Thus, it can be stated that the structures of consumption expenditure of rural and urban households were slightly akin to each other.

Conclusions

Rural households are characterised by the less advantageous and less sustainable consumption pattern and by the smaller expenditure on basic needs. In the analysed period, the expenditure on restaurants and hotels per

capita grew the fastest, whereas it increased quicker in urban households. The expenditure on recreation and culture in rural households was close to the urban ones. Therefore, it may be stated that the disparities with respect to the expenditure on non-basic needs decreased. On the other hand, the differences have slightly increased with respect to the expenditure on food and non-alcoholic beverages, alcoholic beverages, tobacco products, drugs and health.

The results of the calculation of the structure similarity show the slight similarity to the structure of rural consumption expenditure to the urban one. In response to the question raised in the beginning it may be stated that there occurs the convergence between the rural and urban consumption pattern but not in each area. The positive phenomenon is that urban households are caught up by the rural ones with respect to expenditure on non-basic goods whose higher share is characterised by the more sustainable consumption pattern.

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Janusz Leszek **SOKÓŁ**

ANALYSIS OF THE ACTIVITIES OF AGRITOURISM FARMS IN THE AREA OF NAREW NATIONAL PARK

Janusz Leszek **Sokół,** Prof. – *Pope John Paul II State School of Higher Education in Biała Podlaska*

Correspondence address:
Sidorska Street 95/97, 21-500 Biala Podlaska, Poland
e-mail: janusz.l.sokol@gmail.com

ABSTRACT: It was assessed the possibility of developing agritourism in the Narew National Park. The assessment is based on the survey conducted in the months of May and June 2015 with the participation of 96 owners of agritourism farms from this area. Most of the respondents started their own agritourism business using foreign funding sources, such as European funds and bank loans rather than their own means. Financial resources were mainly spent on the development of investments connected with new agritourist undertakings or the extension of existing facilities or their modernization and adaptation, mainly concerning accommodation.
Farmers see the biggest limitations in the development of agritourism in the underdevelopment of its infrastructure, the lack of own capital as well as incomplete knowledge in the field of catering, promotion and marketing as well as the principles of keeping the accounts.

KEY WORDS: the Narew National Park, agritourism farms, tourist activity

Introduction

Agritourism as a form of spending free time on a farm enjoys a growing popularity among tourists (Jalinik, 2016, p. 64; Sikora, 2016, p. 9; Zawadka, 2015, p. 279). It offers individualized forms of rest, primarily for individual tourists, families or small tourist groups. It does not require extensive accommodation or food facilities as it can successfully develop based on existing housing stock of agricultural farms, unutilized livestock facilities or recreational space within the farm (Sokół, 2012, p. 127).

The purpose of the study is to evaluate the possibilities of agritourism development in one of the most attractive places in the country, that is in the Narew National Park. The assessment was made based on the opinions obtained from the owners of agritourism farms in Podlasie Voivodship.

An overview of literature

The Narew National Park is in the sub-region of the Upper Narew Valley. The landscape of the Narew National Park was created by the cooperation of the forces of nature and human activity. Extensive agricultural use of the land in this part of the region contributed to the creation of immense biodiversity (Nietupska, 2010, p. 12). The results of research work carried out in 1979-1981 were the basis for the protection of the fragment of the Narew River Valley between Suraż and Żółtki. They have documented the state of the nature in the valley and have shown its outstanding natural values, including its natural state, the uniqueness of its habitat systems and the richness of fauna and flora associated with it (Banaszuk, 2000, p. 4). On September 30, 1985, the Voivodship National Council in Białystok, and on March 31, 1989 the Voivodship National Council in Łomża set up the Narew Landscape Park. The Narew National Park was established on July 21, 1996 (Adamski, 2000, p. 12). The park is situated in Podlasie Voivodship, in the following districts: Tykocin, Choroszcz, Turośń Kościelna, Suraż, Łapy, Sokoły and Kobylin Borzymy (map 1). It covers the wetlands of the Narew Valley between Suraż and Rzędzian with an area of 7350ha (Suchocka, 2006, p. 11). Across the park, most of its area of about 5500ha is wasteland, while the remaining land is water, meadows and pastures. The area of forests in the park is of about 1000 ha, so afforestation rate is insignificant (Bielonko, Laskowska, 2002, p. 8).

Map 1. The area of the Narew National Park
Source: (Gierasimiuk, Karczewski, 2009, p.10).

Just a few years ago the whole area of the park was privately owned. State Treasury land was created because of farmers passing their farms for agricultural pensions. After the park was established its land became lawfully owned by the State Treasury. The distinctive feature of the park property is its fragmentation. The park owns about 1500 plots, including state waters. There are about 12,000 plots within the park boundaries and they belong to about 2,500 owners. Park ownership, that is state ownership, accounts for 20,5% of its total area (Deptuła, 2004, p. 17).

In the past, almost all the valley in today's borders of the National Park was used in agriculture. Mowing and grazing prevailed. Today mowing has almost been abandoned, and grazing is done in the south part of the Park having the character of gregarious pasturage. The loss of mowing and changes in water relations are likely to cause the spread of reeds. This leads to impoverishing the biodiversity in the world of animals and plants.

The seat of the Narew National Park is in the historical manor house in Kurow. It was built in the late nineteenth century as a one-storey building. In 1920, it was extended with one more wing and one-storey section with a terrace and tower topped with a crenellation. Next to the manor house there is a historic park, where 51 trees are monuments of nature. The most valuable specimens include a sessile oak, a California fir, red maple, a lime alley and a spruce alley leading to the marina. The manor house is separated by a

stone wall from the rest of the village. The building has a small natural exposition depicting the values of the river valley and showing traditional fishing tools used by the villagers of the area (Bielonko, 2010, p. 12).

Research methods

The study included agritourism farms located in the Narew National Park and its buffer zone. It was carried out in May and June 2015. 96 agritourism farm owners took part in the research. A diagnostic survey was used as a method to collect information using a properly prepared questionnaire consisting of a relevant section and a metric. The relevant section contains both closed and open questions concerning agritourism, its profitability and its potential for further development. In turn, in a metric section the respondents are asked about their gender, age, education and language skills.

Some of the surveys provided for the owners of agritourism farms were delivered personally, while the rest of the were sent by e-mail.

The results are presented in a descriptive form and in graphs.

Results of the research

Most of the owners of agritourism farms were people aged 30-45 (50%) and 46-55 (25%). They were mostly females (66.7%), with upper secondary education (58%) and higher (33%). More than 40% of respondents could communicate in Russian, and nearly 30% in English. Few of them (less than 10%) confirmed their knowledge of German of French.

The clear majority of agritourism farms has an area of no more than 20ha (50%) and less than 10ha (25%). There is a dozen or so percent of farms with an area between 20 and 50ha, and those above 50 ha only 8%.

Agricultural production of the analyzed farms is two thirds used for agritourism and one third for their own needs and the market.

Arable land dominates in the farms constituting over 50% of all land, as well as meadows and pastures – nearly 30%.

The basic service of agritourism farms is the provision of accommodation and food. The largest number of farms have between 2 and 4 rooms at their disposal, formed mainly after the reconstruction of a house. Some of them offer rooms after the reconstruction of outbuildings, and still others provide their guests with tourist cabins.

Food is offered to tourists in over 90% of the farms. However, it is important to note that not all tourists are ready to use this service, as some of them prefer preparing their own meals in a kitchen provided by the farm owner.

In addition to basic services, that is accommodation and catering, the several types of recreational activities also play a key role in the agritourism activities of the discussed farms (figure 1).

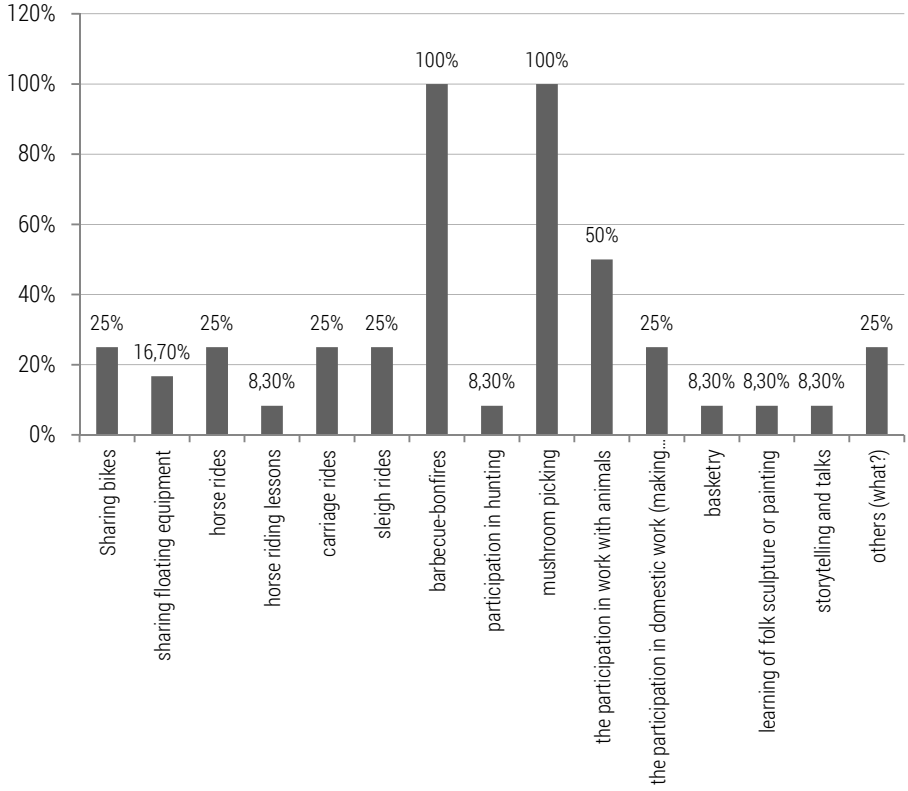

Figure 1. Attractions offered tourists on a farm

Source: authors' own work.

All the farms provide their guests with a barbecue/bonfire and the possibility of mushroom picking. The possibility to participate in work with animals is available in half of the surveyed farms. Quite popular services provided on farms are also horse riding, cycling, sleigh rides and the participation in domestic work.

The great advantage of the agritourism farms is their location in the Narew National Park buffer zone, which makes it possible for tourists to have

additional natural attractions such as hiking and biking trails and an access to bathing rivers.

The sale on site of their own food is also a promising idea to diversify the offer of agritourism farms. The data is shown in figure 2.

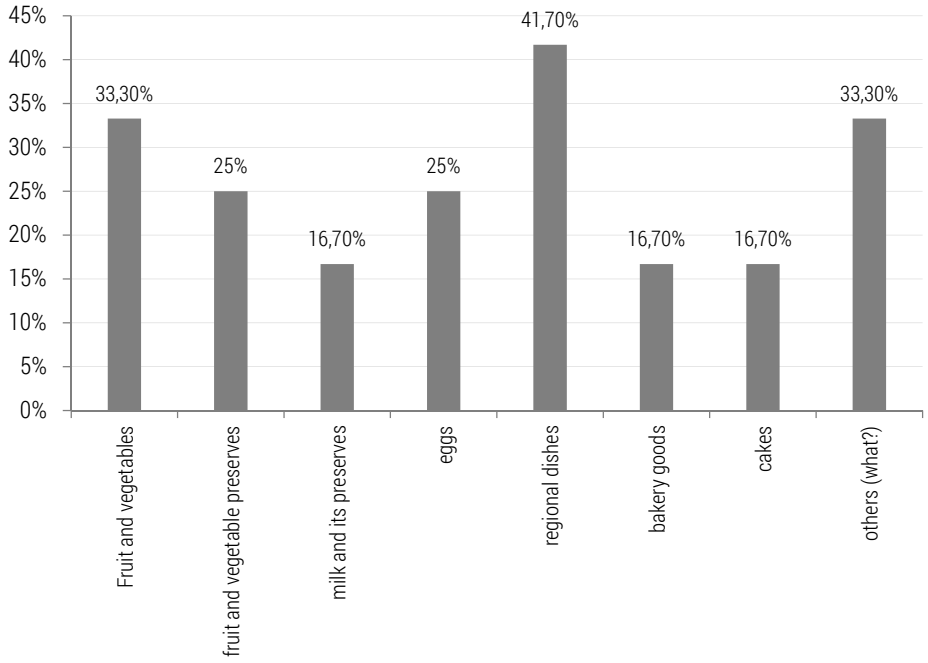

Figure 2. The possibility to buy food products produced on the farm

Source: authors' own work.

It turned out that more than 40% of the surveyed farms offer tourists regional dishes. In addition, in more than 30% of the farms it was possible to purchase domestically grown fruit and vegetables as well as other products such as honey or handicrafts. In every fourth farm fruit and vegetable preserves and eggs were offered.

It is well known that the development of agritourism may be an opportunity for the growth of farm incomes. This especially applies to farms located in areas of high natural value. The farms analyzed in the research are in such areas. In this work, therefore, an attempt was made to carry out an overall analysis of them in terms of the functioning and profitability of their agritourism activities. Starting each activity involves a certain amount of effort.

In the case of the analyzed farms, these very mostly expenditures on fitting and equipping buildings to receive guests.

Nearly all farms needed to buy modern furniture (cabinets, beds, etc.). More than 90% of them had to invest in household appliances and electronics, and 80% of their owners had to make major repairs to their buildings, which required substantial financial resources. These funds came mostly from foreign sources, mainly they were European funds (41.7%) and bank loans (33.3%), and only 25.0% came from their own resources.

Most farms, almost 70% of them provided year-round services, and only slightly more than 30% rented rooms for tourists only in the summer. The share of annual income generated from agricultural activity for almost 60% of farms was between 50 and 75% and only for less than 10% of the farms this activity did not exceed 25% of their total income. These results show that agritourism plays a significant role in the functioning of the examined farms.

In the analysis of the prospects for the development of agritourism within the Narew National Park and its surrounding area, it was also important to draw attention to its limitations or barriers identified the people conducting this activity (figure 3).

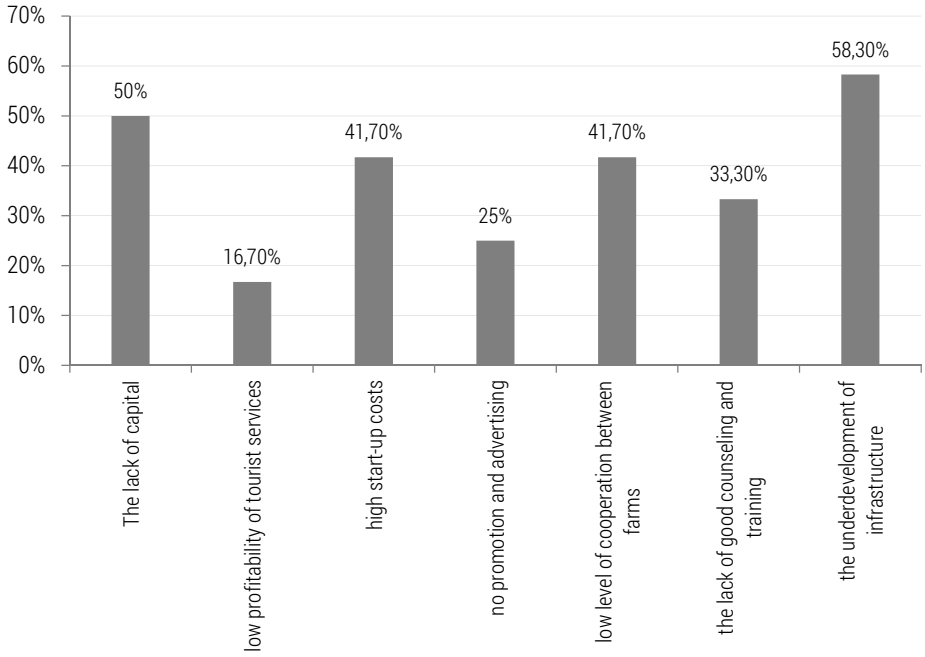

Figure 3. The limitations in running the agritourism business

Source: authors' own work.

It turned out that almost 60% of agritourists face the biggest restrains in the underdevelopment of infrastructure and the lack of their own capital (50%). In addition, the respondents pointed to the low level of cooperation between farms, high start-up costs and the lack of counselling and training. It can therefore be assumed that some of the farm owners would see better prospects for the development of agritourism if they had fuller knowledge of agritourism. Hence, they were asked what kind of knowledge they would expect mainly from advisory and educational institutions. It turned out that first they need knowledge related to catering, marketing and promotion as well as the knowledge of the principles of accounting (figure 4).

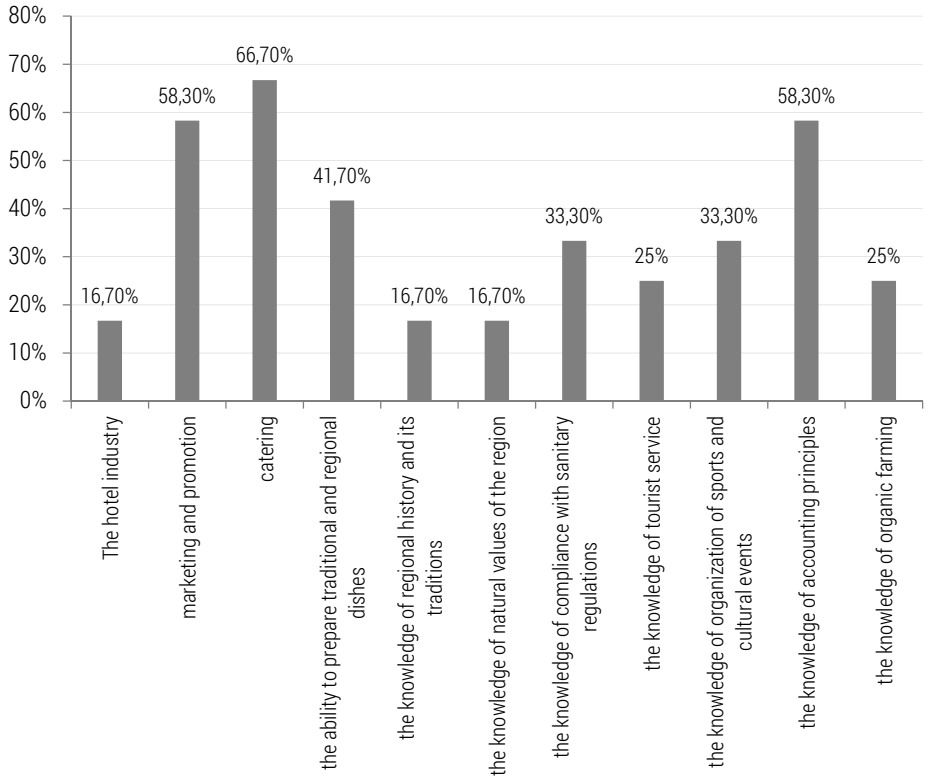

Figure 4. The range of knowledge needed to run agritourism business

Source: authors' own work.

Conclusions

The area of the Narew National Park is one of the most attractive tourist areas in Poland and even in Europe. Its landscape values (unique water areas), the occurrence of rare bird species, numerous tourist routes and many forms of proposed tourism, such as hiking, biking, horseback riding, and water and culture tourism, are the reasons behind this. Agritourism is also becoming more and more popular here.

In the work, it was assessed the possibilities of agritourism development in the Narew National Park based on the opinions obtained from the owners of agritourism farms. Most of the respondents, when deciding to start their agritourism business used foreign sources of funding, such as European funds and bank loans, and to a lesser extent, they also used their own capital. Financial resources were mainly spent on the development of investments connected with new agritourism undertakings or the extension of existing facilities, their modernization and adaptation, mainly concerning accommodation.

Farmers see the biggest limitations in the development of agritourism in the underdevelopment of infrastructure, the lack of their own capital and incomplete knowledge in the fields of catering, promotion and marketing as well as accounting principles.

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Anna K. MAZUREK-KUSIAK

CHARACTERISTICS OF DEMAND FOR RECREATIONAL ACTIVITY ON CYCLING ROUTES IN LANDSCAPE PARKS OF LUBLIN PROVINCE

Anna K. **Mazurek-Kusiak,** PhD – *University of Life Science*

Correspondence address:
Department Tourism and Recreation,
Akademicka Street 15, 20-950 Lublin, Poland
e-mail: anna.mazurek@up.lublin.pl

ABSTRACT: The aim of the research was to determine the group of inhabitants of Lublin province as users of cycling routes in the landscape parks of Lublin province and frequency of this activity. Recreational activity in this respect was analyzed in terms of gender, age, education, place of residence and occupational status.

The research was carried out using the direct survey method, which was carried out among 1203 inhabitants of the Lublin province, who were able to ride a bicycle. Statistical computations were performed applying Statistica ver. 13 PL software, using non-parametric tests: the Mann-Whitney U test, the Kruskal-Wallis test, and the median test. Following conclusions have been drawn from the research: a typical user of cycling routes is a young person up to 30 years of age, still learning and/or pursuing a freelance occupation. Therefore, when developing new bicycle routes in the landscape parks, they should be adjusted to this age group of participants. Young people going on a bike tour are expecting to download mobile applications that will allow to get acquainted with the most interesting attractions on the itinerary, as well as QR code images on the information boards. There are pensioners who can be attracted to cycling routes in the landscape parks, providing them with the necessary infrastructure (benches, information boards, fireplaces/BBQs, relaxation areas) and organizing guided bike tours with trainers or animators.

KEY WORDS: demand, bicycle tourism, landscape parks, Lublin province

Introduction

Currently, in the era of civilization development, landscape parks located especially in forested areas constitute an increasingly important tourist and recreational space (Marszałek 2000, p. 8-16). The forest environment is widely regarded as a healthy and attractive holiday destination. The favorable impact of the forest is manifested in the mitigation of solar radiation, noise suppression, wind and water erosion prevention. Due to the favorable microclimate, which is beneficial for the regeneration of physical and mental forces, forest areas are readily visited by cyclists (Pawlikowska-Piechotka, 2009, p. 135).

Providing landscape parks with appropriate cycling infrastructure tailored to the needs of visitors will allow tourists to travel to the municipality for up to a few days, thereby generating demand for accommodation and catering services, as well as increasing ticket sales for museums, cultural and entertainment facilities.

In order to attract bikers to landscape parks, a universal and unified marking system should be used and infrastructure adapted to the preferences of individual user groups. It is good if the bike tracks are adjusted to the age and expectations of potential users. It is also important to designate routes of different difficulty levels and to introduce a system of information on handicaps for more sensitive and demanding groups. Organization of cycling routes in landscape parks should include links to surrounding areas in the immediate vicinity and to the region. This applies both to tourism and transport infrastructure (Cieszewska, 2015, p. 53-60).

On the other hand, it is important to note that the tourist activity occurring in the landscape parks should take place in accordance with the principles of sustainable development (Sawicki, Harasimiuk, 2014, p. 5). In addition, it should be borne in mind that the trails should be marked in places showing the most attractive natural and cultural values, while not damaging these values (Paryka, 2010, p. 11).

Objective, Material and Research Methods

The purpose of the study was to determine the group of inhabitants of Lublin province that is the user of cycling routes in landscape parks in Lublin province and the frequency of this activity. Recreational activity in this respect was analyzed in terms of a gender, age, education, place of residence and occupational status.

The research was conducted by means of the diagnostic survey method using the direct questionnaire technique. The survey used a questionnaire, which was conducted among 1203 inhabitants of Lublin province in 2016, who were able to ride a bicycle.

Characteristics of the research area

Lublin province is characterized by valuable natural virtues, both landscape and biological. Protected enclaves occupy an area of 570 425.1 ha, which accounts for 22.7% of the province area (Gonera, 2015, p. 18-20). Nature conservation in this area is implemented in 2 national parks with a total area of 18 245 hectares, 17 landscape parks with a total area of 241 182 hectares, 17 protected areas of 310 310 hectares, 86 nature reserves of 11 560.5 hectares, including 457.7 hectares under strict protection and 148 ecological areas with the total area of 4 107 hectares. The diversity and abundance of nature is the result of the Lublin region location on the physiographic border of Eastern and Western Europe (Łapińska et al., 2011, p. 5). Landscape parks occupy as many as 41% of all areas of special natural heritage protected by law and have landscape diversity that is a rich mosaic of habitats for flora and fauna and related to biodiversity in the world of plants and animals. They are a magnet attracting tourists to Lublin province. The largest area in the landscape parks of that area is covered by forests (about 47.4%), then agricultural land.

There are designated and marked 31 cycling trails in the Lublin province with a total length of 740 km, of which 76% run through landscape parks (Ćwik, 2007, p. 20).

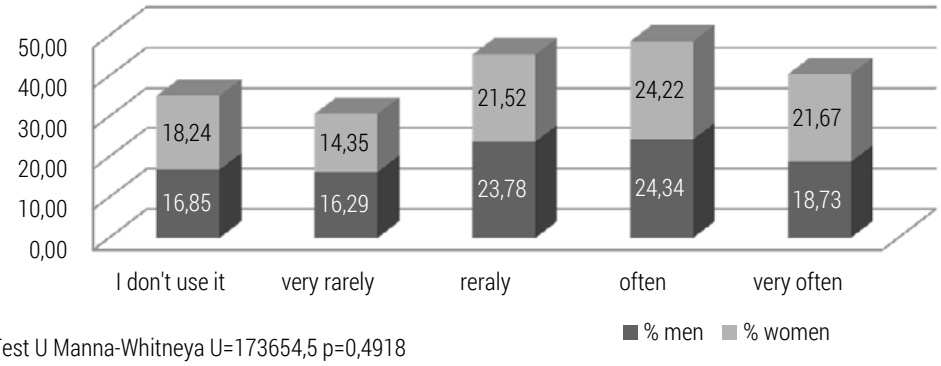
Results

Prior to analyzing, multivariate normality was verified by examining each variable for normal distribution. The data did not show a normal distribution, because the W. Shapiro-Wilk test was W = 0.89112, and the level p = 0.000 was lower than $\alpha = 0.05$, thus the hypothesis of normal distribution was rejected.

At first, following hypotheses were made:

H_0: frequency of cycling tours in landscape parks is not gender-related;

H_1: frequency of cycling tours in landscape parks is gender-related.



Test U Manna-Whitneya U=173654,5 p=0,4918

Figure 1. Frequency of bicycle tourism depending on gender

Source: authors' own work based on the research.

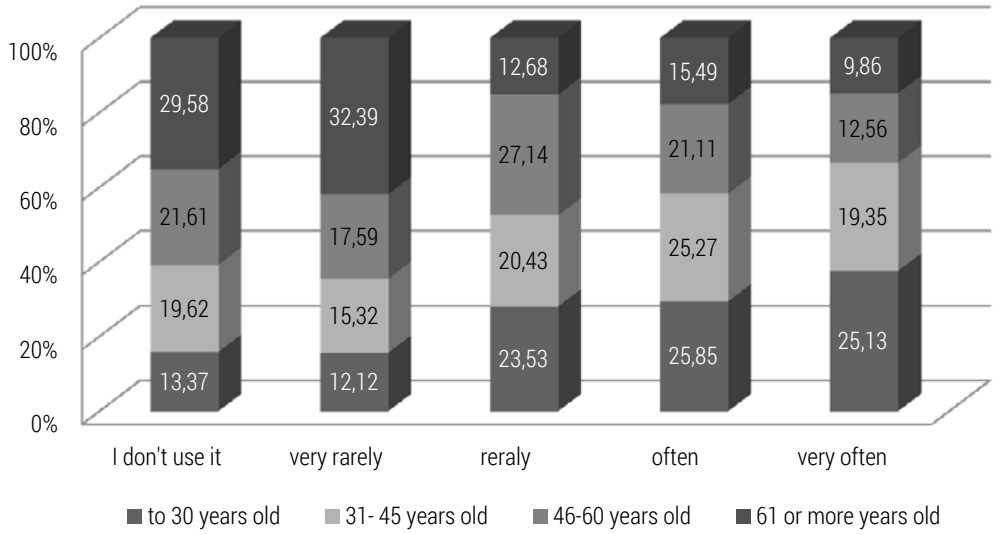
From the analysis of data presented in figure 1, it was found that 18.24% of women and 16.85% of men do not use recreational cycling in landscape parks in Lublin province. On the other hand, cycling tourism is very popular among 21.67% of women and 18.73% of men. However, as evidenced by the Mann-Whitney U test U = 173 654.5; level p is 0.4918, which is greater than the assumed significance level of $\alpha = 0.05$, therefore there is no reason to reject the null hypothesis, i.e. the differences in frequencies of tourism between men and women are not statistically significant.

Then the frequency of cycling tourism in the landscape parks was taken into account, considering the age of respondents, and there were two hypotheses put:

H_0: frequency of cycling tours in landscape parks is not age-related;

H_1: frequency of cycling tours in landscape parks is age-related.

On the basis of data presented in figure 2, it can be seen that cycling in landscape parks is the most popular among young people up to 30 years old (25.13% of people in this age group often use cycling trails in bicycle parks and 25.85% often). Second place is the 31-45 age group, among which up to 19.35% of the representatives often take cycling trips in landscape parks and 25.27% often. The people, who are aged 61 and over, are the least likely to take the cycle routes in landscape parks. There is a general conclusion here that, along with people age, the frequency of respondents' use of cycling routes in landscape parks decreases.



Total median = 3.0
Chi square = 29,507821 df = 3 p = 0.0000
Kruskal-Wallis test: H (3, N= 1203) =43,22461 p =0,0000

Figure 2. Frequency of bicycle tourism depending on age
Source: authors' own work based on the research.

Table 1. Multiple comparison of mean ranks for all samples based on age

Respondent's age	The p value for multiple (bilateral) comparisons Independent variable (grouping): age Kruskal-Wallis test: H(3, N=1202) = 92.39138; p = 0.000			
	Up to 30 years R: 657.73	31-45 years R: 590.50	46-60 years R: 52.86	61 years and older R: 429.75
Up to 30 years	-	0,022816	0,000035	0,000001
31-45 years	0,022816	-	0,240435	0,002120
46-60 years	0,000035	0,240435	-	0,246413
61 years and older	0,000001	0,002120	0,246413	-

Source: authors' own work based on the research.

Based on multiple comparisons of mean ranks for all samples, it was demonstrated that significant differences occurred between age below 30 years and the remaining age ranges (table 1). Young people up to 30 years of age have more often used bicycle tourism in landscape parks than the rest of

Lublin province inhabitants. Also important statistically significant differences appear between cyclists aged 31-45 years and cyclists aged over 61 years. The oldest people rarely do cycling in landscape parks.

The frequency of cycling tourism in the areas legally protected according to the place of residence was then examined. Two hypotheses were put forward:

H_0: bicycle activity of Lublin province inhabitants in landscape parks does not depend on the place of residence;

H_1: bicycle activity of Lublin province inhabitants in landscape parks depends on the place of residence.

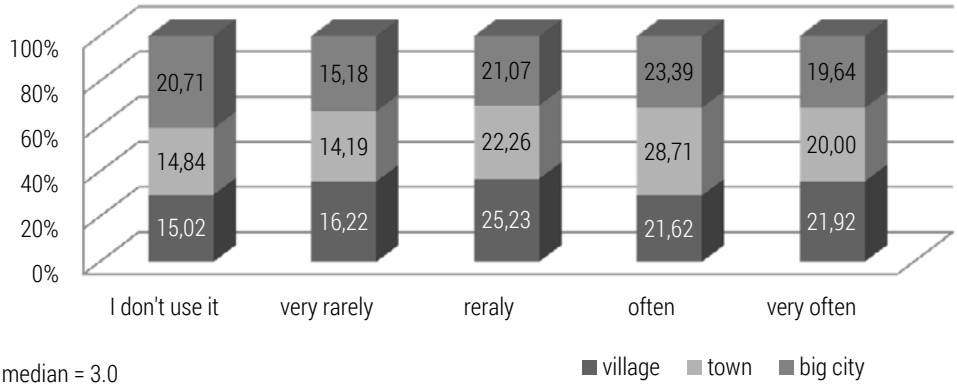


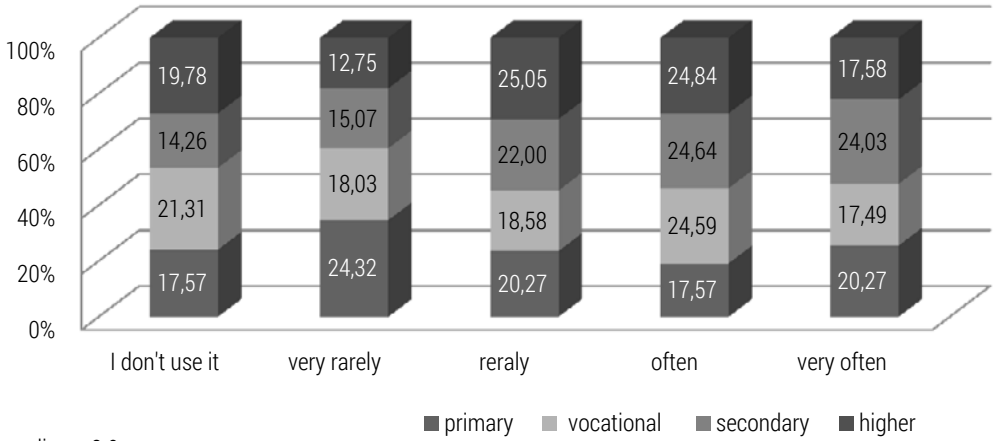
Figure 3. Frequency of bicycle tourism depending on place of residence

Source: authors' own work based on the research.

As can be seen in figure 3, cycling is often enjoyed in the landscape parks by 21.92% of the rural population, 20.00% of the inhabitants of small towns and 19.64% of the inhabitants of large cities, and often use bicycle routes located in legally protected areas is declared respectively by 62%, 28.71% and 23.39% of the respondents. 15.03% of rural respondents do not use such cycling activity, 14.84% of people living in small towns and 20.71% of inhabitants of large cities. However, the statistical significance level for the Kruskal-Wallis test is 0.1533, which is greater than 0.05, thus there is no reason to reject the null hypothesis. Likewise, the median test can be interpreted as meaning that the activity of Lublin province inhabitants on cycling routes in landscape parks does not depend on the place of residence.

The bicycle activity of Lublin province inhabitants depending on education was subsequently examined, and the results are shown in figure 4.

H_0: frequency of cycling routes use in landscape parks does not depend on education;
H_1: frequency of cycling routes use in landscape parks depends on education.

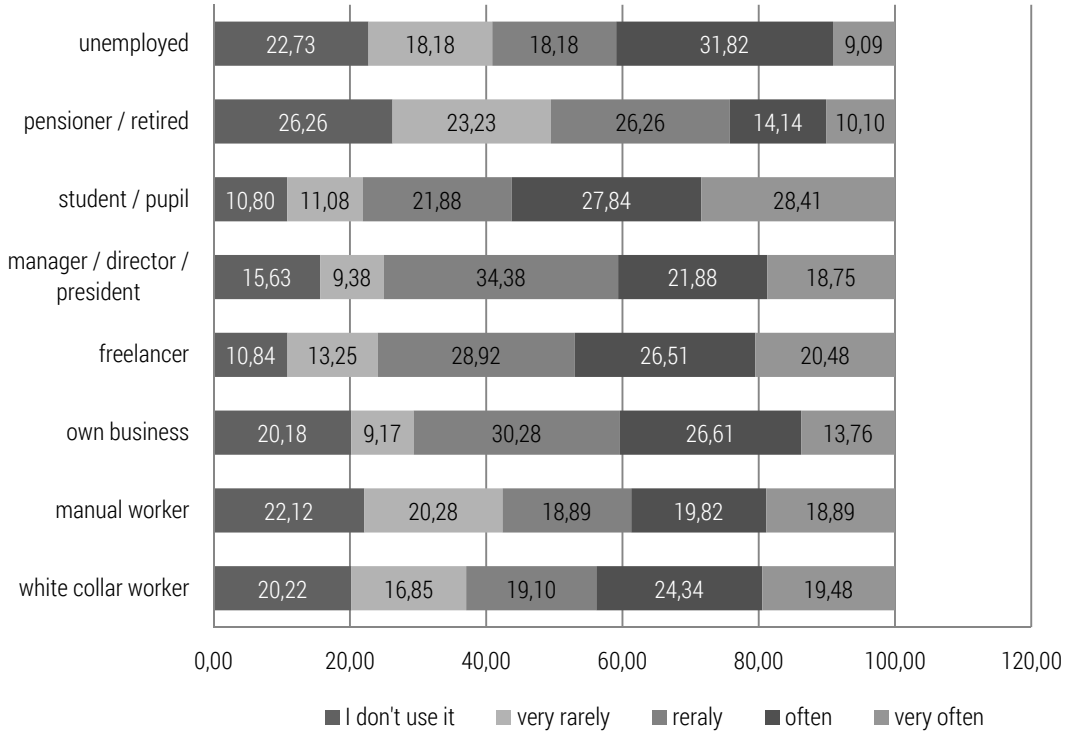


Total median = 3.0
Chi square = 6,018223 df = 3 p = 0,1107
Kruskal-Wallis test: H (3, N= 1203) =9,819941 p =0,2020

Figure 4. Frequency of bicycle tourism depending on education
Source: authors' own work based on the research.

Bicycle routes are very often used by 20.27% of the surveyed people with primary education. 17.49% of respondents with vocational education, 24.03% of those surveyed with secondary education and 17.58% with higher education. 17.57% of respondents with primary education, 23.31% of respondents with vocational education, 14.26% of respondents with secondary education and 19.78% of people with higher education do not practice this type of recreation. However, for the Kruskal-Wallis test, the statistical significance level is 0.202 and is greater than 0.05, hence there is no reason to reject the null hypothesis. Similarly, the median test can be interpreted as meaning that the cycling activity of the inhabitants of the Lublin province does not depend on education. Differences between groups are statistically insignificant.

Then the hypothesis was based on the professional status:
H_0: frequency of cycling routes use in landscape parks does not depend on professional status;
H_1: frequency of cycling routes use in landscape parks depends on professional status.



Total median = 3.0
Chi square =40,47501 df = 7 p = 0.0000
Kruskal-Wallis test: H (7, N= 1203) =52,41104 p =0,0000

Figure 5. Frequency of bicycle tourism depending on occupational status

Source: authors' own work based on diagnostic survey and statistical analysis.

Based on the data presented in figure 5, students and pupils (28.41% of respondents – very often) and freelancers (20.48% of respondents – very often) the most often used cycling routes in landscape parks. Such activity is not used by 26.26% of pensioners, 22.73% of the unemployed and 22.12 of the physically employed. The level of p for the Kruskal-Wallis test as well as the median test was 0.00, therefore the bicycle activity of Lublin province inhabitants on the landscape park routes is dependent on the occupational status of inhabitants, as the test p level is less than the assumed significance level of 0.05.

Multiple comparison of mean ranks for all samples has shown that significant differences in the use of cycle trails in landscape parks occur between students and pupils vs. mentally and physically employed, and between students and pupils vs. own business owners as well as pensioners. Significant differences also exist between freelancers and pensioners, as shown in table 2.

Table 2. Multiple comparison of mean ranks for all samples depending on occupational status of respondents

Variable: Rope parks	The p value for multiple comparisons; Independent variable (grouping): education Kruskal-Wallis test: H (7, N = 1203) = 52.41104 p = 0.0000							
	white collar worker R:582,53	manual worker R:550,77	own business R:575,08	freelance R:642,15	manager/ director/ president R:608,09	student / pupil R:694,6	pensioner / retired R:462,14	unemployed R:532,82
White collar worker		1,000000	1,000000	1,000000	1,000000	0,001960	0,090446	1,000000
Manual worker	1,000000		1,000000	1,000000	1,000000	0,000045	0,991948	1,000000
Own business	1,000000	1,000000		1,000000	1,000000	0,047352	0,537903	1,000000
Freelancer	1,000000	1,000000	1,000000		1,000000	1,000000	0,013964	1,000000
Manager / director / president	1,000000	1,000000	1,000000	1,000000		1,000000	1,000000	1,000000
Student / pupil	0,001960	0,000045	0,047352	1,000000	1,000000		0,000000	0,100224
Pensioner / retired	0,090446	0,991948	0,537903	0,013964	1,000000	0,000000		1,000000
Unemployed	1,000000	1,000000	1,000000	1,000000	1,000000	0,100224	1,000000	

Source: authors' own work based on diagnostic survey and statistical analysis.

Discussion

According to the Polish Gerontological Association (1993), for health reasons, systematic physical activity should be the duty of every human being, not just a choice. In opinion of Chen and Shoemeker (2014), tourism and leisure activities must be adapted to the age, mobility and health status, interests, financial status and occupational status (Chen, Shoemaker, 2014).

During physical activity and tourist trips, tourists should use both natural and cultural resources (Losada et al., 2016), as the human and natural environment are inextricably intertwined, and there is the most effective rest and regeneration of the body (Pilis et al., 2010). The sun, the snow, the forest, the sea, the lakes, the rivers, the mountains are protective for everyone (Kim, Lee, Preis, 2016).

Formation of tourism products usually begins with the recognition of the natural and cultural conditions of a given region. It is also important to analyze the tourist services that are already available. In the case of cycling tourism, the physical and health conditions of the users, often dependent on their age, are the determining factor. Therefore, understanding the needs of different user groups is a prerequisite for the proposed products to have not only high tourism potential, but also to be products expected by tourists (Developing 2006, Olszewski et al., 2010). In landscape parks, the first step in shaping the cycling routes is the initial determination of natural values, to which the actual product conforms.

According to Nikitin, Vorontsov (2015), due to the health reasons, attracting elder people to cycling routes is important. Cycling for the elderly is a good way to keep the body in good physical and mental health, but one should keep in mind that older people require special treatment, because they have specific needs and expectations (Hudson, 2010). The intensity of this activity and type of trails, where older people move, can be adjusted to the health and age of each person.

Conclusions for practice

1. Frequency of cycling tourism in landscape parks by inhabitants of the Lublin province depends on age and professional status. It is not dependent on gender, education or place of residence. Most cyclists are young people up to 30 years of age (50.98% of frequent and frequent indications). The demand for bicycle tourism decreases with age. The elderly are the least likely to participate in this activity, at the age of 61 and over (29.58% of people in this age group did not practice cycling in landscape parks). Considering the occupational status of respondents, the most frequent users of cycling routes in landscape parks are students and pupils (56.28% of the most often and often) and self-employed (46.99%). Pensioners use the bicycle routes most rarely.
2. A typical user of bicycle routes is a young person up to 30 years of age still learning or performing a freelance occupation. Therefore, when developing new bicycle routes in the landscape parks, they should be adjusted to the age group of participants. Young people going on a bike tour are expecting to download mobile applications, which would allow to get acquainted with the most interesting attractions on the route, also QR code images on the information boards are important.
3. Pensioners who can be attracted to cycling routes in landscape parks are the market niche. To do this, they should be provided with adequate infrastructure in the parks. Organized guided bike tours, developed rest-

ing places (benches, information boards, place for fireplace/barbecue, relaxation area), are important for this group.

4. Further research should concern the use of trails in landscape parks by people who practice other forms of recreational activity.

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Katarzyna **WIERZBICKA**

CROWDFUDING AS A METHOD OF FINANCING ECOLOGICAL PROJECT

Katarzyna **Wierzbicka**, PhD – *University of Bialystok*

Correspondence address:
Faculty of Economics and Management
Warszawska Street 63, 15-062 Bialystok
e-mail: katarzynawierzbicka.uwb@gmail.com

ABSTRACT: Crowdfunding is a method of financing new ventures, enabling individual founders of commercial, cultural or social projects to demand financing for many people, often in return for future products or actions. Crowdfunding projects can vary considerably in both purpose and size, from small art projects to entrepreneurs. It should be emphasized that crowdfunding successfully enters the field of environmental projects. Not infrequently, it achieves a higher success rate than other ideas funded by the online community. Other platforms are being created in the world dedicated to financing „green" investments.

The aim of the article is presenting the concept of crowdfunding, its essence and assumptions in the context of acquiring capital for ecological projects. The first part of the article presents the essence of crowdfunding, a typology of crowdfunding models, the second part presents the state of global crowdfunding, while in the third part the results of research on crowdfunding platforms operating in the world that operate in the area of environmental protection and examples of the most interesting ones. A study of crowdfunding platforms operating in the world was carried out. The research involved identification of platforms, crowdfunding models and their classification. After the selection, platforms have been distinguished that deal with the financing of ecological projects. As a result of the study, 29 operating world crowdfunding platforms have been identified that operate on the basis of a donation, loan and share model.

The article raises a new but important aspect of financing activities, especially organic. It should be noted that there is still little knowledge about the role of crowdfunding in financing environmental projects in the world. The article examines how many crowdfunding platforms support ecological projects, to what extent and by what model.

KEY WORDS: crowdfunding, lending, ecological project

Introduction

Economic entities, individual states, strive for continuous development through searching for better, modern, risky solutions to be able to meet the expectations that the market and the environment create. Increasing competition forces in a way the pursuit of constant search for sources of competitive advantage. Enterprises, in relation to the above, are constantly looking for new opportunities that generate the need to incur high financial outlays. In this context, flourishing is experiencing crowdfunding, a response to the need to access capital outside of traditional financial systems.

The undertaken projects can be financed from various sources, such as the organization's own funds, funds obtained from cooperation with other organizations (open innovation) or financed by the internet community, by crowdfunding. Crowdfunding is a new method of financing new ventures, enabling individual founders of commercial, cultural or social projects to demand financing for many people, often in exchange for future products or actions. Crowdfunding projects can vary considerably in both purpose and size, from small art projects to entrepreneurs who are looking for hundreds of thousands of dollars in seed capital as an alternative to traditional venture capital investments (Schwienbacher, Larralde, 2010, p. 4,5).

Ecological projects are aimed at achieving sustainable growth of enterprises by limiting the negative impact on the environment and protection of the existing natural environment, which is why they are very risky, which entail huge financial outlays. According to many literature sources, the main obstacle to sustainability is the shortage of own funding and insufficient access to external financing. This conclusion was confirmed in 2011 by the Eurobarometer survey conducted by the EU company carried out by the Gallup Institute. It was found that the dominant barriers for eco-innovation for Polish companies are fund shortages (38%), uncertainty of return investments in eco-innovation (37%), uncertain market demand (35%) and lack of external financing (33%), (The Gallup Organization, 2011, p. 22-52). In addition, liberalization and climate change policy has driven the paradigm shift in systems for a cleaner environment. This caused, on the one hand, the need for further investments in devices supporting its cleaning up, and on the other hand, a fairly radical change in the role of consumers. In relation to the above, the aim of the article is to present the concept of crowdfunding, its essence and assumptions in the context of acquiring alternative capital for ecological projects (Candelise, 2015, p. 1).

The definition and the essence of crowdfunding

New ventures require resources to be successful, and financing is one of the most critical of them. In recent years, crowdfunding has proved to be a new way of entrepreneurial ventures to secure funds without having to look for venture capital or other traditional venture investment sources (Mollick, 2014, p. 1-16).

Crowdfunding has been defined in the European Commission's communication of 14/03/2014 as a crowdfunding related to an open invitation addressed to the public, while the aim is to obtain funds for the implementation of a specific project. These invitations are published and disseminated via the Internet, so they are only valid for a certain period of time[1]. Crowdfunding draws inspiration from concepts such as microfinance and crowdsourcing (Poetz, Schreier, 2012, p. 24-256), but it represents its own unique fundraising category, supported by the growing number of websites dedicated to this topic. Schwienbacher and Larralde (Schwienbacher, Larralde, 2010, p. 4) define crowdfunding as „an open invitation, mainly via the Internet, to provide financial resources in the form of donations or in return for some form of reward and / or voting rights to support initiatives for specific purposes". Dziuba, (Dziuba, 2012, p. 84), in Polish literature, defines crowdfunding as any form of raising funds through a computer network (broader approach), also indicates a narrower definition, defining the process of collecting funds by enterprises, artists or non-profit organizations for the implementation of projects, organization of ventures, as well as for investments

The basic idea of crowdfunding is to raise money through a relatively small contribution made by a significant number of people (Bradford, 2012, p. 119). Using the Internet, an entrepreneur can communicate with potential investors who can show small expenses for a specific purpose. Companies do not have an intermediary: anyone with a good idea can become an entrepreneur, anyone who has a small amount of money can become an investor.

Crowdfunding is a type of collection and allocation of capital transferred for the development of a specific undertaking in return for a specific return service that involves a wide range of capital providers, characterized by the use of ICT and a lower barrier to entry and better transaction conditions than generally available on the market" (Król, 2014). Etymologically derives from English, from merging the words crowd (crowd) and funding (financing). Specifies the collection of funds from the (Internet) crowd. The goals, types

[1] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions of 27/03/2014 "Freeing the potential of crowdfunding in the European Union" (http: // eur-lex. Europa.eu/legal-content/EN/ALL/?uri=- COM: 2014: 172: FIN).

and nature of collections are different, and in practice, several types of crowdfunding have developed (Kordela, 2016, p. 145).

It should also be mentioned that crowdfunding as a new mechanism for obtaining funds is distinguished by certain features that allow it to be distinguished from public collections, donations and other traditional forms. The first feature is the transfer of cash, as a consequence of raising capital, always in a dematerialized form, i.e. using ICT solutions. The goal of the crowdfunding funded project is clearly defined, the appropriation of the funds and the effects of their spending are clearly defined. Crowdfunding does not require the consent of any state body and may be run for personal, business or public purposes. The terms of raising capital under crowdfunding are beneficial to the recipient due to the lack of bureaucratic constraints, making it accessible to the average citizen. Another feature is the existing wide community of message recipients. This is followed by another feature, i.e. no restrictions on access to project support. The possibility of project support is presented in an open manner, addressed to an unmarked addressee. The last very important feature that distinguishes crowdfunding is the existence of a returnable benefit for providing financial support (Kozioł-Nadolna, 2015, p. 672).

Practice has developed several types of crowdfunding (Raport z prac..., 2017, p. 139). The most common model of the functioning of the crowdfunding platforms is the donation model, which consists in supporting the support of patients, but also artistic projects, sporting events, cultural events or social campaigns. In a traditional donation model, participants are not rewarded; in a modified (sponsor) model, they receive material prizes, for example, CDs, books, for support. In this model, one can distinguish the model without rewarding participants (non-rewards model) and rewarding participants (reward-based model). Another is the lending model, which consists in granting loans, generally in small amounts, between persons, one of whom is interested in investing money (lender, investor), and the other most often obtaining short-term capital from external sources (borrower, beneficiary). Transactions take place via online websites without the participation of financial institutions. In the last, investment model, funds are transferred in exchange for a promise of participation in the enterprise or in profits. As the first in this area, one can distinguish the model investment for participation, also known as share crowdfunding or equity crowdfunding, the investor transferring funds receives shares or shares in an enterprise implementing a financed project and another, collective (collective) investment model, the investor receives the right to participate in profits or income generated by the financed project, but does not receive shares (stocks) in the enterprise implementing the project. The bonus model is a submodel and based on prizes. In this case, the sponsor in exchange for the transferred The

funds receive gifts that they canhave meaning measurable (ticket, plate,the game or the possibility of a final purchaseproduct at a promotional price) or purely symbolic, autograph, photoartist. However, it is worth emphasizing that oftenthis reward is lowerthan the financial contribution to the project (Kędzierska-Szczepaniak, 2016, p. 33). The mixed model is a mix of the models mentioned

Crowdfunding in the world

It should be noted that the importance of crowdfunding increased along with the development of the Internet and various types of social platforms. Market prosperity dates back to 2009, when it launched one of the largest crowdfunding platforms in the world – Kickstarter. The development of social media, such as MySpace, Facebook, Instagram or Twitter, was also important in the development of crowdfunding (Kordela, 2016, p. 145).

At the end of 2015, the value of transactions carried out on the crowdfunding market amounted to over USD 34 billion. The US market is a leader because it covers over 56% of all transactions. China occupies the second position in the world in terms of the number of registered transactions. In 2014, the value of crowdfunding in Asia increased by 320% compared to 2013, and thus the continent became the second largest transaction value after North America, although already in 2015, the increase compared to the previous period was 201%. It should be added that in all analysed periods the United States remains the leader of crowdfunding platforms with more than twice the value of transactions in relation to China in 2014 and over 1,5 more in value for 2015.

The share of North America and Asia is over 90% of all transactions. Europe's share in global social finance is 16%. The smallest share in the crowdfunding market includes areas of Oceania and Africa. It should be mentioned that Australia, which belongs to the area of Oceania, does not have a greater share in crowdfunding financing, while Africa remains at a low level of economic development. The structure of the crowdfunding market is shaped primarily by the US, Asia (mainly China) and Europe (mainly Great Britain) market (Kozioł-Nadolna, 2015, p. 676), which according to the state of 2015 is a leader among European countries (www.crowdexpert.com/crowdfunding-industry-statistics).

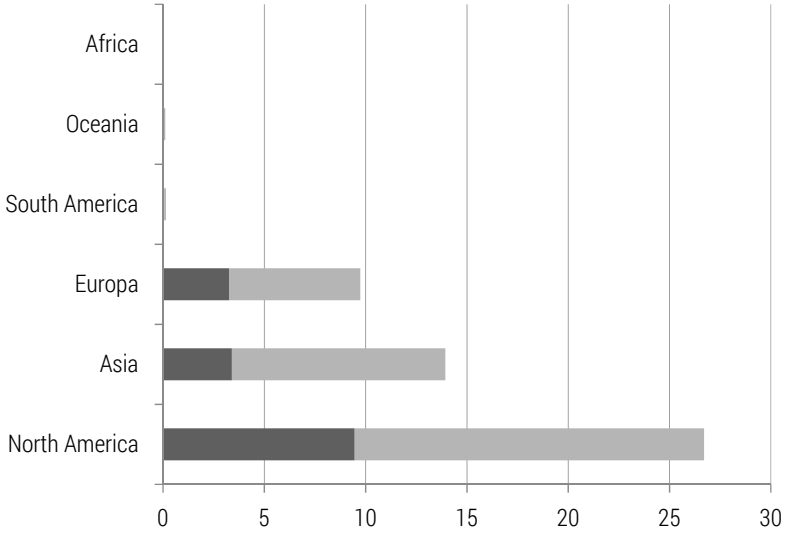

Figure 1. The value of crowdfunding transactions in individual regions of the world, in billion USD

Source: authors' own work based on www.crowdexpert.com/crowdfunding-industry-statistics [20-09-2017].

With the development of the crowdfunding market, the structure of using individual models has also changed significantly. At the beginning of the functioning of the discussed market, the model based mainly on charitable actions, with a small share of investment models, predominated. The aforementioned situation was justified in the absence of legal regulations regarding the functioning of platforms, investors did not make investments using the crowdfunding method (Raport z prac..., 2017, p. 130). Initially, the shareholders were focused on participation in crowdfunding on non-returnable and charitable help. It was not until the introduction of legal advisors in 2012 and subsequent in 2014 (Report Crowdfunding, 2014). they changed layout in platform models available on the market. With the development of the market, the loan model of crowdfunding, which is currently the most important model among those available, started to gain importance.

Table 1. Share of individual crowdfunding models in 2010-2015 [%]

The model of the functioning of crowdfunding platforms	2010	2011	2012	2013	2014	2015
The donation	54,65	48,93	36,81	22,05	11,96	8,28
Bonus	1,86	4,45	14,41	11,95	8,20	7,79

The investment model	5,92	6,44	4,35	6,50	6,84	7,44
The lending model	37,57	40,18	43,97	56,61	68,31	72,95
Hybryd	0,00	0,00	0,47	2,90	4,69	3,53

Source: authors' own work based on http://crowdexpert.com/crowdfunding-industry-statistics [20-09-2017].

On the European market, the first crowdfunding platforms started to be created in 2010. Among the European countries, the United Kingdom is their leader. France ranks second, while Germany ranks third in terms of the market value of market crowdfunding.

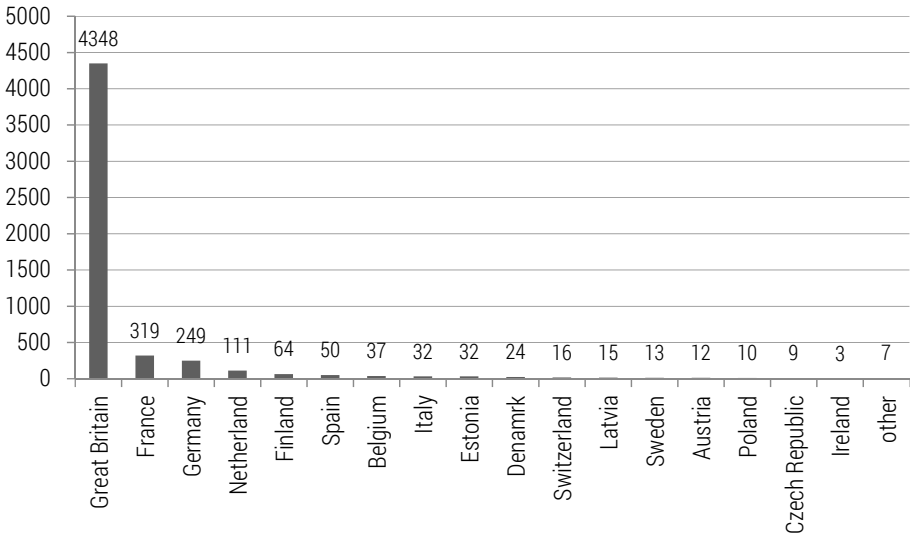

Figure 2. European states and the value of crowdfunding transactions, as at the end of 2015 [in billion USD]

Source: authors' own work based on www.crowdexpert.com/crowdfunding-industry-statistics [20-09-2017].

On the European market, alternative methods of financing projects grew very quickly, and the market size exceeded EUR 5,4 billion in 2015.

Crowdfunding as a method of financing ecological projects

Crowdfunding successfully enters the field of environmental projects. Not infrequently, it achieves a higher success rate than other ideas funded by the online community. Other platforms are being created in the world dedicated to financing „green" investments.

Community investors like to support projects that improve the natural environment, especially near their place of residence. In many countries, new social platforms are created dedicated to financing such projects. From the London report, in the section on social financing of the environment, we will find out that in 2016 all of the 121 energy-related crowdfunding campaigns were successful. A total of 118 million euro was collected, and the average return for the investor was 7,36%. This is another proof that environmental crowdfunding is characterized by a higher success rate.

Projects for the environment supported through social funding platforms are being created more and more. The platforms themselves, however, have not yet noted a massive interest in supporting projects for environmental protection. According to the Massolution company (Report Crowdfunding…, 2015, p. 345), which monitors social platforms, projects of this type constitute only 1.5 percent. all campaigns (the total crowdfunding market is estimated at approx. USD 16,2 billion).

This table lists 29 projects for environmental protection. Countries in which platforms for environmental protection are located:

- United Kingdom 5 projects,
- Germany 6 projects,
- France 6 projects,
- The Netherlands 4 projects,
- USA 8 projects,
- Portugal 1 project,
- Switzerland 1 project.

The model that occurs most often is the lending model.

Table 2. Social funding platforms oriented towards environmental protection

Platform	Country	Foundation year	Platform oriented	Orientation technologies	Model	Profits for the investor	Number of projects	Success rate	Average returns	
									[%]	[EUR]
Abundance Generation	Gr. Britain	2012	renewable energy sources, (RES)	mixed	lending	% of revenue or profits from the project	23	0,61	7.49	13526367
Bettervest	Germany	2013	RES and energetic efficiency	mixed (with the predominance of energy efficiency)	lending	% of revenue or profits from the project	31	0,9	7.21	1774240
Clean Reach	USA	2014	RES	energy from the oceans	donation	-	6	0	-	5698
CollectiveSun	USA	2013	RES	sunny	Loan (for non-profit projects)	% of revenue or profits from the project	4	0,75	6.20	254769
Coopernico	Portugal	2015	RES	mixed	Investment (Social Shares)	Profits proportional to the shares held	7	0,86	-	2676
Crowdenergy	Germany	2012	RES	słoneczną	Investment (Social shares)	Profits proportional to the shares held	5	0,8	-	1818
Diwy	USA	2013	RES	mixed	Donation with prizes	-	4	0,5	-	10423
Duurza-amln-vesteren	Netherlands	2014	RES	mixed	Lending	% of revenue or profits from the project	9	0,78	5.68	2892000
Econeers	Germany	2013	RES	mixed	Lending	% of revenue or profits from the project	10	0,9	5.34	3915150
Enerfip	France	2014	RES	mixed	Lending	% of revenue or profits from the project	1	1	-	60

Gen Community	Gr. Britain	2013	RES	mixed	I Investment (Social shares)	Profits proportional to the shares held, plus the surplus of income invested again for the real estate	2	1	7.00	1351516
Greencrowd	Netherlands	2012	RES	mixed	Mixed, lending, investment	Variable profits depending on the choice of the investment tool (loan, shares)	23	0,96	4.88	2097 040
GreenVesting	Germany	2009	RES	sunny	lending	% of revenue or profits from the project	9	1	5.33	97095
GreenXmoney	Germany	2013	RES	mixed	lending	% of revenue or profits from the project	13	0,85	4.54	27755
GridShare	USA	2015	RES	mixed	Lending (for electrification of rural areas)	Benefits depending on:% of revenue or profits from the project (lending), dividend, or awards provided (with prizes)	14	0	6.38	54874
LeihDeiner-UmweltGeld	Germany	2014	RES	mixed	lending	% of revenue or profits from the project	19	0,89	5.25	4029050
Lendosphere	France	2014	RES	mixed	lending	% of revenue or profits from the project (higher% returns for investors living in the investment area)	16	0,94	5.42	1446990
Lumo	France	2012	RES	mixed	lending	% of revenue or profits from the project plus consumption of generated energy	6	0,67	3.00	185
Microgenius	Gr. Britain	2011	general	mixed	investment	Profits proportional to the shares held	2	1	-	1436458
Milaap	India	2010	general	sunny	Lending		15	Nd	-	338

Mosaic	USA	2013	RES	sunny	lending	% of revenue or profits from the project	20	Nd	-	5785414
Re-Volv	USA	2014	RES	sunny	Donation (plus Renewable Fund)		3	1	-	106448
Solar Schools	Gr. Britain	2014	RES	sunny	donation		65	0,82	-	691976
SunFunder	USA /Tanza-nia	2012	RES	sunny	Lending (for electrification of rural areas)	% of revenue or profits from the project	34	1	3.52	986238
Trillion Fund	Gr. Britain	2013	RES	mixed	Hybrid (Bonded, Investment, Social Shares)	Variable profits depending on the choice of the investment tool (bonds, social shares, shares, funds)	29	0,97	7.60	102095794
Veolis	Switzerland	2014	general	mixed	mixed	Benefits depending on:% of revenue or profits from the project (loan) and provided prizes (with prizes)	3	1	2,50	77498
Village Power	USA	2013	RES	mixed	Investment (social shares)	Profits proportional to the shares held	13	0,62	Nd	5202674
We share Solar	Netherlands	2013	RES	sunny	lending	% of revenue or profits from the project	8	0,63	5.75	1075574
WindCentrale	Netherlands	2012	RES	wind	Investment (social shares)	% of revenue or profit from the project plus consump-tion of generated energy	9	-	3-8	14300000

Source: (Candelise, 2015, p.12-15).

As previously mentioned, the United Kingdom, France and Germany are countries where crowdfunding has developed best in terms of number of transactions and number of platforms. In the case of crowdfunding platforms dealing with the protection of the environment, it is also worth noting those originating in the above-mentioned countries. One of the examples of social financing support can be distinguished by the charity organization Growing a Greener Britain, founded by Idverde UK and the crowdfunding platform Spacehive (www.spacehive.com/about), launching the crowdfundmypark 2017[2] information campaign. Its aim is to mobilize local communities from all over Great Britain to finance green areas. Positive experiences from this social campaign caused that local communities are more and more willing to support green investments, which in turn attracted the attention of companies such as Stihl and Greentech, who announced that they would support non-financial (by donating tools and materials) those projects that would refer to successes (www.obserwatorfinansowy.pl).

The second example of an interesting financial commitment of the local community for environmental protection, which is worth showing, can be found in France. The Champs Chagnots (www.thewindpower.net) wind farm project located in the municipality of La Chapelle Montreuil (in New Aquitaine) is being implemented there. The undertaking aims to meet the energy needs of the local community. The implementation of the project will also avoid the emission of carbon dioxide equivalent to 1539 tons per year. The total value of the project is estimated at EUR 1,5 billion. 86% from the costs will be covered by a bank loan, Sergies, a partner of the project, and will spend 11,2%. It is important, however, that the inhabitants also want to have their financial participation in the project – the Énergie Partagée civil movement will cover 2,8% costs. Énergie Partagée (www.energie-partagee.org) is an association whose purpose is to finance social and implementation of energy projects, mainly related to renewable energy. It was established that the minimum payment of each member of this association will be 100 euros.

Another example is the launch of a program called 1000 roofs (1000-Dächer-Programm), which aims to increase the satisfaction of energy needs from solar energy (solar collectors and photovoltaic cells), which is implemented in the third country where crowdfunding, Germany is growing rapidly. This project also financed the community through the bettervest environmental platform. In total, a much larger amount than the minimum assumed was

[2] CrowdfundMyPark2017 is a campaign started by charity Growing a Greener Britain (GGB) to promote crowdfunding. The GGB Movement enables local people, Community, projects, projects and projects. Projects that crowdfund using GGB can also access Green-Tech and Stihl. https://about.spacehive.com/crowdfund-my-park-2017-encouraging-people-to-love-and-improve-their-local-parks/

obtained for this purpose – 194,7 thousand euro with the minimum threshold of 136,3 thousand (www.photovoltaik-web.de).

Conclusions

International organizations, global companies and politicians pay attention to the need to support projects related to environmental protection. Public finances are not able to meet these requirements. Co-financing by citizens can become indispensable. Ecological projects are aimed at achieving sustainable growth of enterprises by limiting the negative impact on the environment and protection of the existing natural environment, which is why they are very risky, which entail huge financial outlays. According to many literature sources, the main obstacle to sustainability is the shortage of own funding and insufficient access to external financing. In many highly developed countries, public awareness of climate protection is already well advanced and in small countries, citizens are willing to engage in projects that support green solutions. In recent years, the protection of the environment in which we operate plays an important role. At the same time, it should be remembered that it is a very expensive process that we can finance with the participation of crowdfunding, which has been developing very dynamically in recent years. As the statistics described above show, crowdfunding as a method of financing becomes more and more important in the world. The greatest benefit for capital seekers is the ease of access to potential investors, while in the case of capital donors, the opportunity to make a profit, in this case even a small one. It should be mentioned that crowdfundng is a relatively new method of financing projects of an ecological nature, but gaining more and more popularity

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DISCUSSION AND REVIEWS

RECENZJE OMÓWIENIA, PRZEGLĄDY

Book review

Green Philosophy. How to Think Seriously about the Planet

Roger Scruton

Zysk i S-ka Wydawnictwo, Poznań 2017, 413 pages

Roger Scruton is a British philosopher, writer and commentator, as well as an academic lecturer, He wrote more than thirty books. He is concerned with political and cultural essay writing and ethics. He is also a novelist. As he himself admits, he is a conservative. The book under review has been widely acclaimed in the British press.

It is worth ensuring those readers who associate the term philosophy with difficult language that the book is written in a comprehensive way, to which certainly contributed its Polish translators – Justyna Grzegorczyk and Rafeł Paweł Wierzchosławski.

Scruton's message is clear: he wants to show the contribution of the conservatives to the environmental debate. Due to the complexity of this issue, different opinions and proposals appear in the discussion. They are expressed in attitudes of skepticism, extreme pessimism or catastrophism. One may often come across the opinion that government resources are needed to solve environmental problems.

Roger Scruton believes that if the implementation of major projects is in the hands of bureaucrats, it tends to be out of control. This solution results in negative side effects and the deterioration of the environment. According to the author, no major project will succeed *if it is not rooted in practical local reasoning of small-scale* (p. 8). Thus, the author believes that environmental problems should be transferred to the local level, because only then they can be considered "their own" and adequately solved in conjunction with appropriate oral values. *That is, I think, the constant message of conservatism* (p. 9).

Scruton clearly advocate limiting the role of the state in solving environmental problems. Whereas the state should create the conditions for the protection of the environment and generate a positive motivation of the society. He calls this motivation oikophilia, which can be defined as loving home (the environment). Spoiling the environment begins when people stop treating it as a home and hand it over to bureaucrats.

It is difficult to present in this review the whole wealth of problems and arguments presented by R. Scruton in his book. Therefore, the focus is on those issues that the reviewer believes are worthy of attention and discussion. In the first chapter, "Local

Warming", the author points to a conflict between economic balance and ecological balance, because these are not the idea of the same order. He has a discussion here on the differences between the "left" and the "right". He believes that only the right can generate in a society non-egotistic motives that will serve environmental objectives well in the long term (p. 15). Such motives can only be raised at local level, hence the title of the chapter.

In the second part of his book, R. Scruton deals with the climate. Tis section of the book is entitled "Global alarm", which emphasizes the significance of the problem. This is not a new problem because it has long been of interest to scientists, but it was only at the turn of the twentieth and twenty-first centuries that climate change was introduced into the daily debates, frightening us catastrophic visions. R. Scruton mentions the names of many the "gurus" of the global warming, including, among others, A. Gore, and he wonders whether this problem can be solved through international agreements and research.

Already at the beginning of chapter three entitled "The Search for Salvation" noted that *the discussions on climate change teach us one thing, that science does not destroy the difference in opinions, even if this discussion is about facts.* This phenomenon is explained by different attitudes of people: an individualist, an egalitarian, a hierarchy supporter and a fatalist. This is what makes people basically and permanently divided in terms of assessing the risk of a climate disaster. This in turn shows that the assessment of climate change is an extremely complex issue. And ecologists, on the other hand, argue that any solution to this problem, which is ideal from the point of view of theory, collapses when it comes to the government – bureaucrats. Environmental regulations are stifled on the basis of the precautionary principle.

In the next chapter entitled "Radical Precaution", the author of the reviewed book elaborates on the issue of caution. In this chapter the reader will find, for example, considerations on the origin and interpretation of the precautionary principle. This principle is linked to the decision-making theory. The uncertain situation is the most difficult one for a decision-maker. Having limited insight into as to the future state of affairs he or she cannot predict the consequences of his or her decisions.

The precautionary principle, apparently rational, also acts as a brake on the development of science and innovation. R. Scruton sees certain solutions in risk management, which can "weaken" the caution of the decision-maker. In the conclusion of the chapter, the author writes: *We must do our best to avoid a catastrophe (climate), no matter how unlikely it may be to come"* (p. 152).

Here the question should be asked – what to do about it? The answer to this question can be found in the next chapter, entitled "Market Solutions and Homeostasis". As befits the philosopher, the two proposed solutions have a very general overtone and there are many controversial issues. The first solution is to describe the climate problems in terms of crippling disaster. This approach should radically change the way of life. This means that the government importance is growing and political and economic regulations are being introduced. R. Scruton, who is a conservative, believes that such a solution is ineffective.

On the other hand, is the proposal of a "common state" by Elinor Ostrom, which is well-known in economic literature. Here, the use of the environment, i. e. the common good consists in the existence of a negative feedback, i. e. a kind of homeostat. Thanks to this, e. g. the amount of CO_2 emissions to the atmosphere would be kept within certain limits.

"*Heimat* and Habitat" – the attachment to land and home, strict observance of tradition, respect for the dead, but also care for those who have not yet been born, are the leading problems of chapter seven. I think it is worthwhile to read this chapter, because the author writes a lot about the concept of oikophilia here, and the notion is characterized in the following wide and illustrative way: *… the left and right should unite in the fight against consumerism to conclude an environmental alliance that would also heal the split in our civilization. When the critics of the ecological movement call it disrespectfully "nostalgia" or "technophobia", they are right – only that is not a criticism, but a real recognition of the thing we long for and which only awaits us to recover it if we are encouraged. This is oikophilia* (p. 234). Oikophilia perfectly corresponds to one of the principles of sustainable development, namely it is essential to combine fairly the developmental and environmental needs of present and future generations.

In the next (eighth) chapter, entitled "Beauty, Piety and Desecration" R. Scruton ponders on the relationship, or perhaps on feeling of beauty and the environment. Beauty encourages respect, and loving beauty should be an incentive for all environmental protection movements. Beauty is associated with taste, piety, aesthetics, natural devotion and respect for sacrum. Beauty, piety, aesthetics and sacrum "call" to save the environment from craving for exploitation and pollution. Is this possible? On a global scale, this is only possible if the interests of individual countries are pushed to the back.

In the ninth chapter entitled "Getting Nowhere" R. Scruton presents a picture of the world that is full of contradictions, the world that is incapable of agreeing and implementing any kind of environmental policy. The author shows, for example, the failure of Kyoto Protocol, international conferences (e.g. the conference in Copenhagen in 2009) and other consensus attempts. The author believes that the only way of saving from an environmental catastrophe is to abandon the belief in restrictive international treaties, to "profess" it individual countries do not have a strong incentive. So what to do? The author proposes that countries should pursue a policy that puts research and entrepreneurship above global regulations and control (p. 303).

"Begetting Somewhere" is quite a strange title of the tenth chapter. Only one issue has been chosen from the content of this chapter, namely the role of courts in contemporary social life. R. Scruton believes that the primary task of the courts is to settle disputes and not to formulate a policy of good governance of the community. Meanwhile, in the name of internationalist ideals, people are forced to observe these ideals. To prove the rightness of his thinking he gives two examples. The first concerns the judgment of the European Court of Human Rights, which has ruled that crosses in Italian schools are a violation of human rights and should be removed. The second example concerns Poland. R. Scruton criticized the European Commission's decision on the right to abortion. This right reflects the traditional identity of the Catholic population, but

the Commission has recognized that it should be amended in order to comply with the European Convention on Human Rights.

At the end of this chapter, the author returns to climate change, and develops this issue in the last, eleventh chapter of his book, entitled "Modest Proposals". In this chapter, once again the aim of conservative policy is set out, and then the author goes on to the evaluation of energy policy. He analyses the advantages and disadvantages of major energy sources in terms of CO_2 emissions. The author's deliberations can be summarized as follows: a climate catastrophe can be avoided by allocating huge funds spent on the study of climate change, under the auspices of the UN and the European Union on the research into energy sources that do not pollute the environment. This is not a matter of renewable (such as wind, solar or biomass energy) or nuclear energy, but it is about reliable, generally available and cheap energy. However, here the question arises whether the "mighty" of this world will be ready for such a gesture. At the end of the book there are two short appendices: "Global Justice" and "How should we Live", as well as a bibliography and a personal index.

To sum up, I would like to thank the publisher for making the book of R. Scruton available to the Polish reader. This can allow to see and understand the conservative approach to the environment. It turns out that this is a very different view from the revolutionary slogans of the Greens, which promote and impose an immediate change of lifestyle, and the abandonment of the existing values in the name of saving the planet from a global catastrophe. Conservatives want to achieve the same goal by promoting oikophilia, that is caring for the common good, for the home and its surroundings, for the family, for cultivating the memory of the deceased and for those who will be born. Conservatives are familiar with aesthetic impressions, beauty and culture. In their opinion, the role of the state should be to create conditions for oikophilia and motivate for it.

***Kazimierz Zimniewicz**, Prof.*
University of Social Sciences

Enhancing urban resilience through sustainability science research

On the 12th of October 2017 the Faculty of Economics and Sociology at University of Łódź hosted a Polish-Japanese Symposium on Urban Resilience and Sustainability Science. The Symposium was co-organised by the Faculty of Economics and Sociology and the Integrated Research System for Sustainability Science, a Research Centre at the University of Tokyo.

The Symposium aimed to facilitate exchange of knowledge on the latest models of urban resilience in Eastern Asia and Central Europe and to lead to the creation of a Polish-Japanese, interdisciplinary research group, working in the area of urban resilience and sustainability science. It was also meant to contribute to the popularity of the concept of urban resilience in the practice of managing cities (actually poor implementation of the principles of urban resilience and sustainability science in the practice of urban governance remains a common problem in Poland and Japan). Finally, the Symposium was organized to highlight the area of sustainability science as something more than „sustainable development" – an area of research associated with extensive scientific justification for the concept of sustainable development and the search for mechanisms of its implementation.

The Integrated Research System for Sustainability Science (IR3S) at the University of Tokyo is the world's leading center of research in sustainability science. Another particularly prominent research institution represented at the Symposium was Stockholm Resilience Centre from Stockholm University which is the leading institution in the area of resilience research and which has close research collaboration established with both the IR3S and the Faculty of Economics and Sociology at University of Łódź.

Keynote presentation on the role of sustainability science for achieving Sustainable Development Goals was delivered by Professor Kazuhiko Takeuchi, Director of the IR3S, former Assistant Director General of United Nations, and former Senior Vice-Rector of the United Nations University.

In the first plenary session which featured the theoretical and general issues related to sustainability science and urban resilience, Professor Akimasa Sumi from the University of Tokyo gave the introductory presentation connecting these two research areas. This was followed by Professor Kensuke Fukushi, also from the University of Tokyo, who focused on sustainable urban water environment and in particular on the enhancement of resilience against water-related crisis. The last speaker in this session was Professor Erik Andersson from Stockholm Resilience Center, Stockholm University, who

talked specifically about urban resilience, focusing mostly on the context of ecosystem services and biodiversity.

The second plenary session focused on three examples of specific research questions addressed in the context of sustainability science. The first presentation was given by Dr. Alexandros Gasparatos from the University of Tokyo who talked about several research projects carried out in Africa, connecting different topics related to energy, food security and environmental protection. Then, Dr. Kinga Krauze from the European Regional Centre for Ecohydrology, the International Institute of Polish Academy of Sciences, talked about the broader context of sustainable development research with the focus on experiences from her work in the Long-Term Ecological Research Network. Finally, Dr. Piotr Matczak, Associate Professor at Adam Mickiewicz University in Poznań, focused on the awareness component of sustainability, and in particular on the role of traditional knowledge and common sense as complementary sources of information to be used in planning sustainable development.

Another part of the Symposium was a panel discussion moderated by Dr. Marcin Jarzębski from the University of Tokyo. The topic of the discussion was "How to promote sustainability science research in Poland?" and it was motivated by the relatively low international visibility of this area of Polish research. Five discussants exchanged opinions on their own experience in setting up research projects, establishing collaboration with other stakeholders and promoting research results: Professor Kazuhiko Takeuchi; Dr. Małgorzata Stępniewska from Adam Mickiewicz University in Poznań; Dr. Iwona Wagner from the Polish National Commission for UNESCO; and Dr. Anna Kalinowska and Dr. Kamil Kwiatkowski, both from the University of Warsaw, University Centre for Environmental Studies and Sustainable Development. The panel was preceded by an introductory speech by Dr. Jakub Kronenberg, Associate Professor at University of Łódź.

The Symposium was attended by over 100 participants, many of whom took active part in discussions and who had the opportunity to exchange contacts and discuss potential research collaborations. Additionally, one day before the Symposium, a smaller group of researchers took part in a seminar meant to promote academic collaboration between Polish and Japanese researchers. Participants indicated their research expertise and collaboration needs, and within smaller groups they considered what collaboration opportunities emerged for the future.

One of the specific issues which were raised many times during the Symposium and which definitely need more attention in Poland was the UN 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs). The different presentations delivered during the Symposium demonstrated the broader relevance of this Agenda and the different contexts in which the SDGs need to be addressed.

More practically, the Symposium offered Polish participants opportunities to obtain information on international publishing opportunities in the area of sustainability science. In particular the Japanese guests highlighted opportunities to publish in the journal entitled Sustainability Science and published by Springer, of which Professor Kazuhiko Takeuchi is the Editor-in-Chief. An additional workshop on academic writing led by Dr. Alexandros Gasparatos and Dr. Marcin Jarzębski helped 15 young research-

ers, mostly Ph.D. students, to improve their writing skills and obtain knowledge about publication and review processes.

Altogether the events related to the Symposium took place during the whole week and – apart from the abovementioned meetings – included field visits and additional academic discussions. In particular, the guests visited study sites of the ENABLE project (Enabling Green and Blue Infrastructure Potential in Complex Social-Ecological Regions), within which Łódź is one of case study cities. The ENABLE project field visit focused on the topic of creating green corridors on the basis of the relatively little known rivers in Łódź – as a means of supporting urban resilience in this city.

The Symposium was part of a broader project focused on enhancing research collaboration between Polish and Japanese researchers in the area of sustainability science and urban resilience. The project was funded through the Scientific Cooperation Funding Opportunity jointly offered by The Polish Academy of Science and The Japan Society for the Promotion of Science.

***Jakub Kronenberg**, Assoc. Prof. – University of Łódź, Poland*
***Marcin Jarzębski**, PhD – University of Tokyo, Japan*
***Kensuke Fukushi**, Prof. – University of Tokyo, Japan*

The 5th Symposium "Ecosystem Services as transdisciplinary approach"

We are pleased to announce that the Department of Integrated Geography of the Adam Mickiewicz University in Poznań is organizing the **5th Symposium "Ecosystem Services as transdisciplinary approach" – ECOSERV 2018**.

The novum is the international formula of the Symposium, which will be held under the patronage of the Ecosystem Services Partnership. In addition, one of the sessions devoted to urban ecosystem services will be co-organized by the Central European Chapter of the Society for Urban Ecology (SURE-CE).

Our Special Guest will be Prof. Dr Benjamin Burkhard from Leibniz Universität Hannover, the coordinator of ESMERALDA – the most important pan-european project on implementation of mapping and assessment of ecosystems and their services (MAES) in policy and practice.

We hope that ECOSERV 2018 will be a place for a discussion on MAES process in Central Europe.

Please, save the date September 17-18, 2018, Poznań, Poland.

More information about the event we will provide on the website
www.es-partnership.org/community/regional-chapters/europe/poland/.

The Organizing Committee of the ECOSERV 2018

Authors are invited to submit Academic Papers on theoretical and empirical aspects of Sustainable Deve¬lopment and Environmental Management as well as on Environmental Economics and Natural Resources. Papers submitted for review should be in the form of Articles, Research Reports, Discussions or Reviews of Books, information on Academic Conferences, Symposia or Seminars.

Submissions should have up to 20.000 chars, with a clearly defined structure (Introduction, Chapters, Sub-chapters, Ending/Conclusions). They should include an Abstract and "Key-words" in Polish and English.

Articles should be sent by e-mail to: czasopismo@fe.org.pl, in compliance with the official form published on the website of the journal (www.ekonomiaisrodowisko.pl). A model form can be found in Template (file: Template.docx). The references cited have to be in alphabetical order, unnumbered. Plans, Drawings and Schemas (black & white only) should be prepared using Microsoft Word with all elements grouped in a single element group. Graphic Elements (e.g. JPG) and schemas (e.g. in Excel) should be submitted additionally as separate files.

Papers will be submitted to Peer Review and only original (previously unpublished) papers will be accepted. Papers not complying with Editorial Recommendations will be returned to the Author for correction.

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Journal "Ekonomia i Środowisko"
22 Sienkiewicza St. 15-092 Białystok, POLAND
e-mail: czasopismo@fe.org.pl
tel. (+48) 85 744 60 96

Correspondence addres:
skr. poczt. 37, 15-436 Bialystok 9, POLAND