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Original Research

Value Chain Analysis of Environmental Management in Urban Areas – Case Study: Metropolitan Association of Upper Silesia

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Abstract

Environmental management in urban areas is a complex issue involving problems of natural resources conservation as well as general issues concerning the processes of urbanization and development. The wide range of these problematic aspects requires a strategic approach, relevant to the sustainable development principles along with the complex analysis of a given potential. Here, value chain analysis is used, which allows a holistic approach to the analyzed problem.

This article presents a methodology, principles, and effects of the use of value chain analysis of environmental management in urban areas. On the basis of the Metropolitan Association of Upper Silesia, the expected values in the environmental field as well as entities involved in value creation were defined. Moreover, the model of value chain was presented and development stimulators were identified.

Keywords: value chain, environmental management, sustainable development, metropolitan area

Introduction

Environmental management is a broad concept that refers to using, protecting, and shaping the environment according to the principles of sustainable development. It applies to all spheres of political, economic, and social activities, and is part of a local management system, accomplished in cities within public utilities and land use planning. Public utilities involve executing tasks of local government's own utility. Their aim is to satisfy the collective needs of the population in a current and continuous way through the commonly accessible service provision [1]. According to local government acts, meeting the community needs is part of a district's own responsibilities and a county's, in turn, in cases of public municipal responsibilities. In the environmental field these tasks include issues [2, 3] of real estate management; environmental protection, water economy, water supply system, sewage system, sewage treatment and waste disposal, maintaining cleanliness and order; sanitation; landfill and municipal waste neutralizing; provision of electricity, heat, and gas energy; green areas; and afforestation.

Provision of these services occurs in conjunction with the inability to store the vast majority of services and, at the same time, the necessity to ensure the continued accessibility, ensure the reliability of the entire system, and to maintain adequate health and environmental standards [4]. Therefore, an appropriate organization of service provision as well as the use of a strategic approach is essential. According to A. Dacko and M. Dacko [5], the method to

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record higher economic results without losing the prospect of attaining higher environmental results consists in proper deformation of the depiction described – the cycle of the predator (economic values) and the victim (environmental values).

Basic strategic goals of environmental management in urban areas covers the high quality of services offered to the public as well as reasonable resource management. This are possible to reach only with the cooperation of the public and private sectors, participation of private sector in creating metropolitan services, and awareness augmentation as well as shaping the proper social attitude toward environmental protection. Common activity of all entities to protect the environment forms a value chain, the process of creating the potential that considers both inter-sectoral and inter-operational linkages and their impact on the results achieved. Value chain approaches have been utilized by development practitioners and researchers alike to capture the interactions of increasingly dynamic (and complex) markets in developing countries and to examine the inter-relationships between diverse actors involved in all stages of the marketing channel [6]. It is a tool that can also be successfully used for industrial upgrading, economic development, employment creation, and poverty alleviation [7].

The purpose of this article is to identify existing problems, potential, development stimulators, and key actions for environmental management in urban areas on the basis of value chain analysis.

Methodology

The value chain is a sequence of related activities carried out within the manufacturing process of the final product or service that allows you to obtain value added [8]. M. Rainbird [9] defined it as a network structures, or confederations, that develop from traditional corporations.

Value chain is used to identify and coordinate activities directed to offering high quality products and socially useful services. Following M. Romanowska and M. Trocki [10], it includes components and functions of value creation, from shaping the product or service, through material and logistic transformational function to servicing. Value chain analysis is of great importance in analyzing the strategic position of the organization [11, 12] and, what is more, it is a way to achieve competitive advantage [13]. Moreover, regardless of the core competencies, the strategy of the organization ultimately has to provide what the customer wants [14].

Value chain analysis was first described by M. E. Porter [15] in 1985, and the model he offered is still used in its broadest range. It finds application in the process of creating public services. This is due to the ability to present a clear structure and meaning of services offered along with the network of linkages in creating them. Porter's model of value creation in relation typical to territorial marketing, adapted by A. Szromnik [16], is shown in Fig. 1.

The combination of both basic and support activities helps to identify weaknesses in providing public services

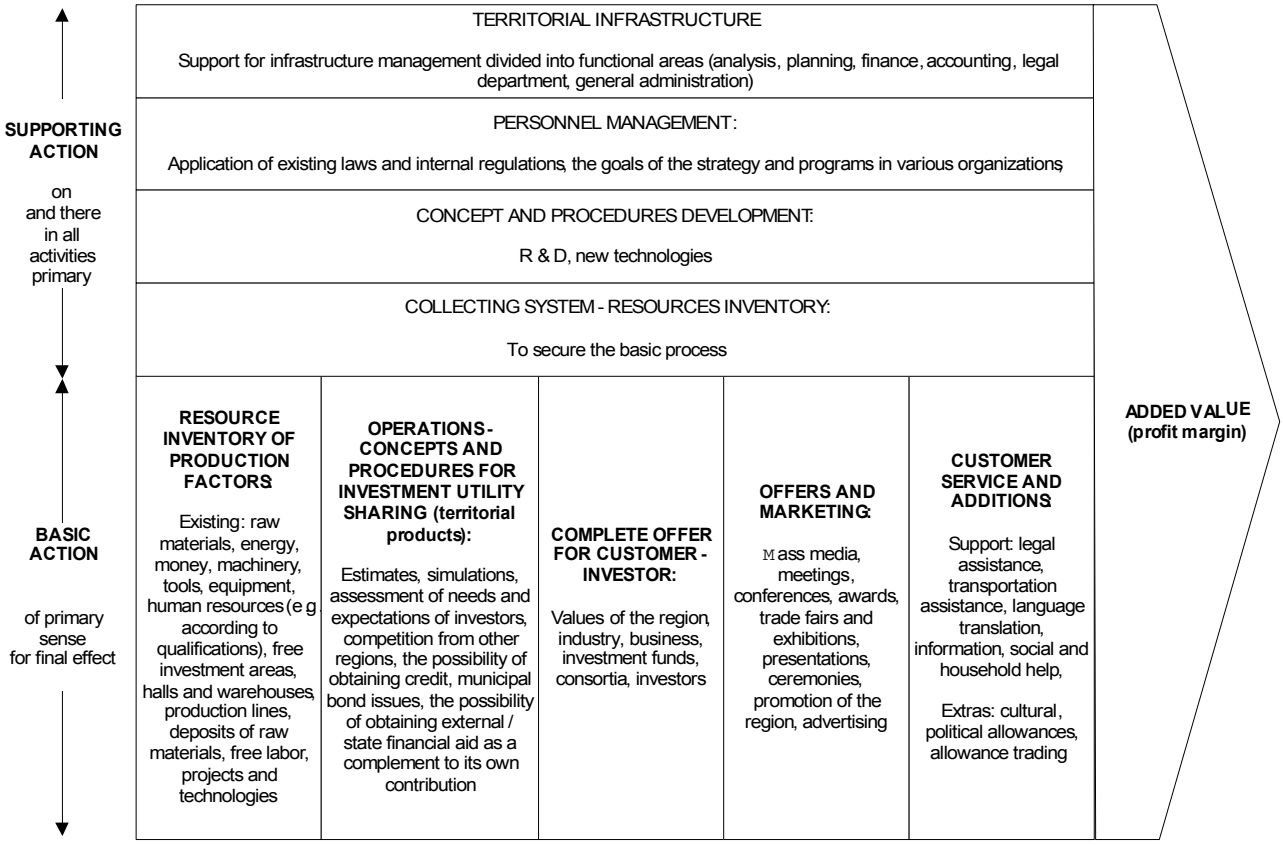

Fig. 1. City/region value chain project according to M. E. Porter [16].

and, on their basis, undertake the appropriate venture. The value chain analysis process involves the following stages:

- identifying the expected value in a given problematic area
- identifying entities involved in value creation in a given problematic area, participants of a given value chain (such as NGOs, civil society, private sector, business organizations, associations, research and development units, etc.)
- mapping linkages between value chain participants and their segmentation (grouping), which helps to understand the value creation process, analyze compounds (derived benefits, interests, benefits) of each chain with an assumed value
- constructing value chain model: identifying its potential
- identifying development stimulators

Value chain analysis is used in a number of fields. For instance, it can be used in the analysis of capital expenditure return and in the analysis of the quality of services offered, the introduction of innovations [17, 18] in the analysis of the effectiveness of technology transfer [19, 20] and knowledge [21] or information [22] management. Y. Zhang and M. Gregory [23] used value chain analysis in studies concerning the aerospace, automotive, and defense sectors to identify mechanisms for increasing project efficiency and effectiveness. P. Kess et al. [24], in turn, by means of value chain analysis, eliminated errors in the communication process. Q.H. Soon and Z. M. Udin [25] claim that the balanced business performance related to improvement of inventory turnover and delivery metrics is a result of flexible infrastructure value chain. This analysis has been successfully used in a project, conducted in Norway, to assess the impact of risk factors for capturing and storing carbon dioxide. Its use has enabled us to explain key issues by answering the following questions [26]:

- What are the expected investment cost and main uncertainty drivers?
- What is the financial robustness of the carbon capture and storage project?
- What are the main uncertainty drivers for the net present value of the carbon capture and storage project?
- What is the value of investing in additional capacity in pipelines and storage sites?
- What is the value of including multiple storage sites?
- What is the value and uncertainty associated with alternative technologies or development concepts?

In general, management of the natural environment value chain analysis can help to identify problematic areas, take actions essential for their elimination in relation to available resources, and improve their undertakings.

Value Chain in Environmental Management in Urban Areas

Each city or even agglomeration constitutes a socio-economic organization and its residents are customers, the sum of whose needs makes up the needs of the organization. These needs include, among others, health protection, education, culture, housing and public utilities, transport, and land management. Meeting the basic community needs is a priority in town and city management. It is supported by the definition of city, according to the French architect Le Corbusier [27], which is expressed in the following equation:

$$\text{city} = \text{flat} + \text{work} + \text{leisure} + \text{public utility} + \text{communication}$$

The pursuit of regular improvement of all factors included in the equation above forms the basis for city management. In terms of environmental management, urban basic problems that negatively affect the individual elements of the equation are: land degradation and pollution, overproduction of waste and sewage, emission of hothouse gasses, and noise [28-30]. Elimination of these threats requires a strategic analysis and action plans supported by analysis of the monitoring of environmental pollutants, according to J. Namieśnik [31-33].

Z. Wysokińska and J. Witkowska [34] quote OECD/EUROSTAT groups of goods and products designed to aid in environmental protection, which consist of:

a. Goods and products designed to aid in environmental management: includes goods and services created exclusively with the aim of environmental protection and having a significant impact on pollution reduction and the identification and collection of statistical data.
b. Cleaning products and technologies: includes goods and services that reduce or eliminate environmental harm. These are sometime used for other purposes as well, and their identification and classification in relevant statistical data is difficult, expensive, and controversial.
c. Management and avoidance: includes goods, products, and services that may have significant positive environmental effects but are designed and implemented for other purposes (such as energy-saving technologies, creation of alternative energy sources, etc.).

Identification of the above-mentioned components is enabled by value chain analysis, which assumes that regular enhancement requires reaching a number of detailed goals. For their purposes environmental management includes mainly:

- reduction of water consumption
- increase urban sewage system
- reduction of sewage that needs treatment
- increase the quality of surface and groundwater
- surface water management
- reducing the risk of flooding
- management of snowmelt and rain water for municipal and technological purposes
- increase the range of selective waste collection
- increase recycling
- reducing of the amount of waste produced
- reducing of waste neutralized by storage
- increasing the use of modern technologies in the waste neutralization process

Table 1. Examples of indicators within environmental protection in cities.

Indicators for water and sewage management	Indicators for waste management	Indicators in the maintenance of green areas
▪ water consumption for industrial purposes [hm^3]	▪ the amount of waste produced [thousand tons]	▪ unreclamed waste storage areas [ha]
▪ water consumption to operate the water pipe network [hm^3]	▪ the amount of waste collected [thousand tons]	▪ surface area of postindustrial urban degraded areas, urban [ha^2]
▪ population using the sewage treatment plants [% of total population in the region]	▪ the amount of recycled waste [thousand tons or % of all waste produced in the region]	▪ green areas [ha^2]
▪ sewage requiring cleansing discharged into water or soil – cleaned [hm^3]	▪ the amount of waste neutralized by storage, composting, thermal conversion [% neutralized waste, thousand tons]	▪ area of special natural value [ha^2]
▪ sewage requiring cleansing discharged into water or soil – contaminated [hm^3]	▪ waste collected so far [thousand tons]	▪ nature monuments [no]

- increasing the use of municipal waste for economic and energy purposes
- the progressive lowering of the surface area occupied at the landfill and their reclamation
- reclamation of degraded and devastated lands
- enhance natural resources
- increase the number of attractive recreational and leisure areas of high natural value
- increase the surface of green areas
- improve the natural system.

The detailed objectives listed above can be analyzed with the use of measurable indicators, examples of which are presented in Table 1. Indicators shown in the table constitute a basis for the analysis of changes in the environment and they enable us to assess the achievement degree of targets assumed, which mostly depends upon the cooperation of entities creating value chain. Within the area analyzed, the linkage chain creates a series of substantially independent entities, which include:

- public administration (for example, regional administration, complex and non-complex administration, council districts and municipalities, governors, mayors, and the Provincial Fund for Environmental Protection and Water Management, Regional Management and Water Reclamation)
- service providers (for example water and sewage company, municipal enterprises, green establishments, waste treatment facilities, utility companies)
- subsidiary entities, such as research and development units (R & D units), non-governmental organizations (NGOs), business environment organizations
- services recipients: industrial corporations, construction companies, service companies, individual customers, managers of public buildings, housing associations and cooperatives
- media (newspapers, television, radio)

Value chain environmental management contains the same elements as the overall chain. All tangible and intangible factors used in the municipal economy in order to protect the natural environment are a collection of resources. The procedure for sharing these resources include assessment of needs and expectations, opportunities for financial assistance, and all operations associated with their sharing. These include capital expenditures, potential sources of funding and legal requirements. The next element in the value chain is a comprehensive client - investor offer. It is represented by any activity that may positively affect the projects in the field of environmental protection. Its supplement is an offer and marketing activation that includes the promotion of the region and the system of communicating with investors, both current and potential. It allows us to present value and offer of the region. In the environmrntal field, offers and marketing activation includes education and information campaigns and media, exhibitions, and contact with similar regions, promotion of the region, events, campaigns, and rewards for the activities for the benefit of the natural environment. The final element is the basic activities and customer service additions. Included here are activities associated with additional benefits for companies and institutions and making investments for environmental protection. They include supporting activities, connected with both organizational and legal as well as social and living support. Their goal is to offer more attractive services.

Supporting activity includes elements as follow:

- territorial infrastructure (i.a. environmental policy, waste management water and wastewater management plans, development and modernization plans)
- management of staff in various organizations
- development of concepts and procedures based on the existing research and technology potential
- data collection system, based on environmental legislation [35], which established the obligation to monitor and spread information about the state of the environment.

The 'environmental value chain' moved into the focus of public interest, the perception of consumers has increased, and the environmental impact of products has become a major aspect of environmental policy programs [36].

Model of the Environment Value Chain in the Metropolitan Association of Upper Silesia – Case Study

The Metropolitan Association of Upper Silesia is a union of 14 cities with county rights, lying within the Upper Silesian Urban area, whose emergence was caused by the development of metallurgy and mining. This area is characterized by a high degree of anthropogenic transformation and land degradation. This is mainly due to intensive urbanization processes, a high level of industrialization, and natural resource exploitation. One of the goals during the creation of the Metropolitan Association of Upper Silesia was tending to balanced development of the region. Following the global trends, sustainable development, manifested in appropriate management, is the precondition for maintenance of prosperity achieved [37-41]. In accordance with V. E. Udo and P. M. Jansson [42], sustainability calls for a balanced technology-society-environment relation with a focus on Replenishing the earth, or there will be neither earth nor human beings that inhabit it in the long run. In addition, creating a metropolitan association helps to strengthen actions taken, and thereby contributes to faster regional development [43-46]. Taking into account the priorities of the Metropolitan Association of Upper Silesia, presented problems, the Country Strategy Papers (CSPs), and the commercialization of services in the area of "Environment," in the analysis of value chain includes: water and sewage management, waste management, and maintenance of green areas.

As far as environmental protection is concerned, the main problem of the Metropolitan Association of Upper Silesia is the presence of 'wild dumps' and a vast number of industrial waste dumps [47], which results in the need to eliminate gaps and failures in waste management. Likewise, with regard to the amount of waste produced, there is a lack of installation for waste recovery and disposal in biological and thermal conversion processes [48]. The most common way to neutralize waste is storage. There is also a lack of possibilities to verify the provincial information databases registered by the CSO Katowice, as well as poor control of units authorized to collect waste. Additionally, as for the collection of data on waste, the main problems include lack of proper management system of medical and veterinary waste, small-sized batteries and accumulators, as well as the lack of reliable information regarding the quantity of disposed vehicles.

Water management in the Metropolitan Association of Upper Silesia, in turn, is based on the bulk water supply system operated by the Upper Silesian Waterworks Plc., which has eight Water Main Branches, 900 km of main pipelines watered from eleven stations, nine Water Treatment Stations, and two Water Treatment Plants. Water is supplied mainly from tanks located outside the Metropolitan Association of Upper Silesia, i.e. Dziećkowice and Kozlov Mountain. Basic problems of water management include [49]:

- water pollution from urban wastewater, and industrial wastewater and water pollution in rural areas because of the unresolved wastewater management
- the risk of flooding intensified by ground deformations caused by coal mine exploitation and improper agrotechnical and drainage operations as a result of deforestation, poor river regulations, and reduced retention capacity of river basins
- progressive construction of river valleys, limiting terrain retention in connection with logging
- the risk of water quality in intensively used agricultural areas
- the negative impacts of salt water discharges from mine water.

The Metropolitan Association of Upper Silesia has an extensive sewage network. Nevertheless, it requires extension, attaching to the whole community and, what is more, part of these networks needs modernization. As far as water management is concerned, it is also worth mentioning that the Metropolitan Association of Upper Silesia has a significant potential for groundwater, the network of watercourses and the diversity of stagnant water. However, both surface and groundwater is of poor quality (fourth or fifth grade), and the basins of the river water bodies are at risk.

Moreover, the Metropolitan Association of Upper Silesia also faces numerous problems associated with potential environmental use. These, among others, include the following items [47]:

- weak law enforcement in environmental protection
- poor integration of supralocal activities to protect the environment, including planning
- lack of plans and programs on environmental protection prepared for all cities in the area
- lack of coherent institutional solutions and standards of procedures concerning degraded lands
- limited use of innovative technologies of land remediation and revitalization
- lack of consistency of supralocal planning in shaping the natural environment
- low investment expenditure in waste management as compared to expenditures for other environmental components
- lack of system solutions for waste management
- inadequate technical infrastructure necessary to achieve assumed levels of the recovery and recycling of waste.

An analysis of strategic documents and needs within environmental management in the Metropolitan Association of Upper Silesia as well as the level of service commercialization and the results of research conducted during completion of individual tasks within the project 'Technology foresight of the development the public sector services in the Metropolitan Association of Upper Silesia,' would help to determine the primary goals and value added in the field of 'Environment.' It states that the systematic improvement of service quality in metropolitan areas within 'Environment' field is based on the improvement of water and sewage management, waste management and natural resources strengthening. The assessment of the level of goals reached is possible with indicator

Table 2. Summary of key indicators within the 'Environment' field.

City	MAIN INDICATORS													
	water consumption for industrial purposes [hm3]	water consumption for the purpose of operating the water supply network [hm3]	wastewater requires cleaning [hm3]	treated wastewater [hm3]	untreated wastewater [hm3]	population benefiting from treatment plants [% of total population]	waste produced during the year [thousand t]	recovered wastes [thousand t]	disposed wastes [thousand t]	temporarily stored wastes [thousand. t]	previously collected wastes [thousand. t]	not reclaimed waste storage area [ha]	area of natural sites [ha]	monuments of nature [ha]
Bytom	2,0	7,8	28,5	27,0	1,6	87,8	661,2	650,3	9,0	1,9	82,3	8,8	92,3	1,0
Chorzów		5,6	4,6	4,5	0,1	97,1	307,1	271,6	31,5	4,0			283,0	1,0
Dąbrowa Górnicza	9,9	4,7	15,0	14,9	0,1	91,2	1820,4	1659,6	15,7	145,1	4886,5	31,2	3663,0	16,0
Gliwice	1,7	8,9	13,1	9,7		91,6	1007,4	972,0	33,9	1,5	99976,8	240,5	56,6	9,0
Jaworzno	23,0	4,5	39,4	39,3	0,1	94,7	1459,6	1442,8	16,8		16201,8	189,8	380,4	23,0
Katowice	8,1	18,0	33,2	24,6	8,6	81,9	2955,2	2883,0	9,7	62,5	3451,4	48,2	232,0	33,0
Mysłowice	1,6	3,8	9,5	7,1	2,4	9,7	371,2	370,6		0,6	4035,8	18,4		15,0
Piekary Śląskie	1,4	2,2	5,2	5,0	0,2	90,6	354,4	345,5	8,9		464,0	3,3		
Ruda Śląska	7,1	6,1	14,8	13,3	1,5	82,3	1936,7	1930,5	5,3	0,9	24045,8	155,3		5,0
Siemianowice Śląskie	0,1	3,2	9,8	2,8	6,9	99,0	8,6	8,4		0,2			141,0	12,0
Sosnowiec	0,2	10,5	29,0	29,0	5,3	92,1	122,3	117,1	0,5	4,7	1927,1	37,4	38,0	70,0
Świętochłowice		2,2	2,0	2,0		97,6	18,1	14,2	3,9		1,5	1,0	31,3	3,0
Tychy	2,6	8,2	9,8	9,8		83,8	319,9	315,0	4,6	0,3		5,1	19,9	2,0
Zabrze	1,3	7,2	16,1	15,8	0,3	92,1	715,4	714,8		0,6	576,1	35,8		
Metropolitan Association of Upper Silesia (sum)	59,0	92,9	230,0	204,8	27,1	1191,5	12057,5	11695,4	139,8	222,3	155649,1	774,8	4937,5	190,0
Metropolitan Association of Upper Silesia (the average value)	4,9	6,6	16,4	14,6	2,5	85,1	861,3	835,4	12,7	20,2	14149,9	64,6	493,8	15,8
Metropolitan Association of Upper Silesia (median)	1,9	5,9	14,0	11,6	1,5	91,4	516,2	510,5	9,0	1,5	3451,4	33,5	116,7	10,5

analysis, in which indicators are examined in processes of monitoring the environmental stage and are next provided by the Central Statistical Office (Table 2). The value of indicators in a given year constitutes a base amount for the following year. It helps to determine whether the conditions for achieving the goals have been met. The achievement of these goals is impossible without cooperation between the entities creating the value chain in the 'Environment' field. This network is shown in Fig. 2, and the summary of the characteristics of the Metropolitan Association of Upper Silesia in all areas analyzed in the value chain model is shown in Fig. 3. The detailed characterization of basic and value-added in the value chain model is given in Table 3.

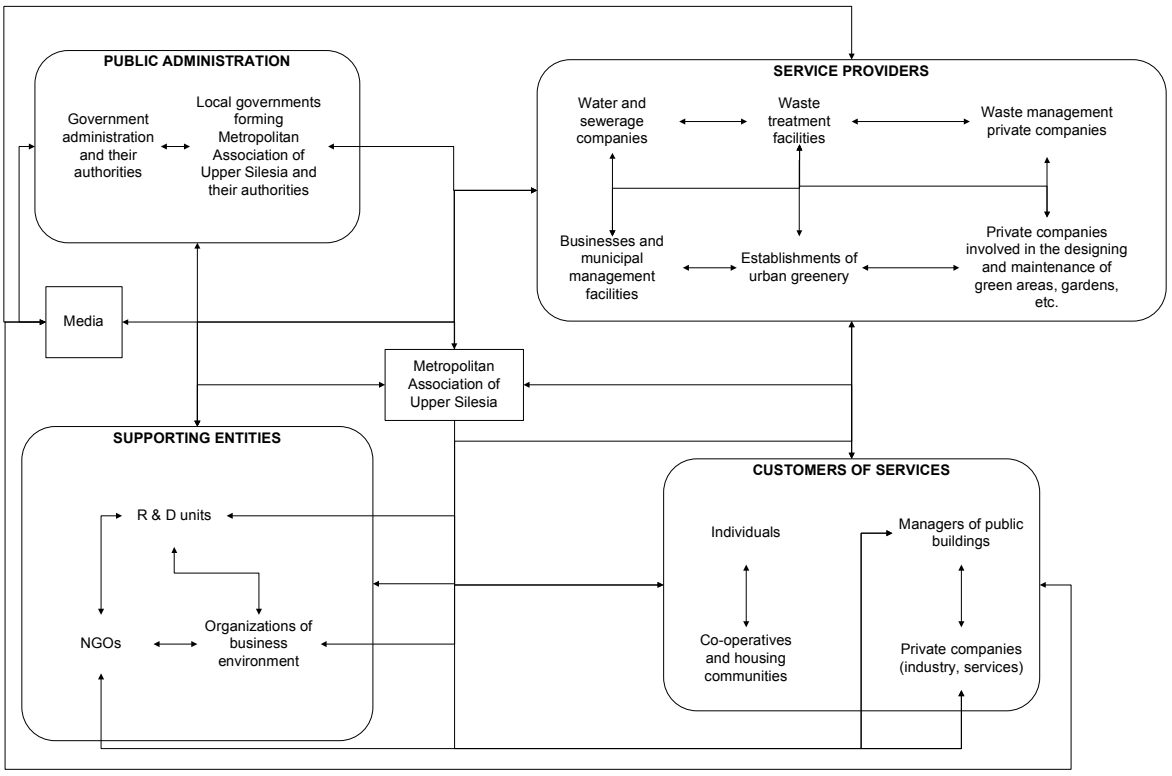

Fig. 2. The network of links between entitles in the 'Environment' field in the Metropolitan Association of Upper Silesia.

TERRITORIAL INFRASTRUCTURE:

Environmental policy
Promotion of environmental attitudes
Extensive legal grounds, waste management plans, plans for water and wastewater management, regulations maintain cleanliness and order
Plans for development and modernization of water supply and sewerage facilities in various cities of the Metropolitan Association of Upper Silesia
Potential consolidation of the member cities, socio-economic linkages, spatial-functional and infrastructural
Successful development and modernization of municipal infrastructure and industrial
Successive regeneration of degraded areas, including brownfield
Suburbanisation,
Existence of specific requirements for operators of waste management, water supply and sewage disposal

PERSONNEL MANAGEMENT:

Environmental awareness
Convergent strategies for the development of communities in environmental protection, water and sewage and waste management
Development Strategy for the development of Upper Silesia and Basin Metropolis "Silesia" by 2025, in accordance with applicable laws and internal regulations of individual cities
Extensive system of training and information campaigns

CONCEPT AND PROCEDURES DEVELOPMENT:

Strong base personnel, educational, scientific research in the field of environmental protection (concentration approximately 10% of R & D potential of the country) - 28 Universities, 80 different types of R & D units, 38 training and consulting and information centers,
Development of information technology
Development of waste management concepts, such as the project "Waste Management System for the cities of the Metropolitan Association of Upper Silesian (MAoUS), together with the construction of thermal waste treatment plants"
Growing prosperity in the economic utilization of waste from coal mining
Improvement, industry towards environmental protection

COLLECTING SYSTEM - RESOURCES INVENTORY:

Statistical Office in Katowice - Centre for Environmental Statistics
Environmental Protection Inspectorate in Katowice
Offices of local government units - Planning Departments, Departments of Environmental Protection
Polish Chamber of Commerce Water Supply

RESOURCES INVENTORY:	**OPERATIONS - CONCEPTS AND PROCEDURES FOR UTILITY SHARING INVESTMENT (territorial products):**	**COMPLETE OFFER FOR CUSTOMER - INVESTOR:**	**OFFERS AND MARKETING:**	**CUSTOMER SERVICE AND ADDITIONS:**
Waste management Space occupied by the former Landfill Supply system Extensive network of sewage Network diversity of stagnant water Forest areas and parks Areas subject to protection	Investment in environmental protection The budget of the region Government funds EU funds Specific requirements	Working people Structure of employment in individual sectors Economic entities Economic potential Operation of NGOs in the field of pro-Ecological activities Business institutions Attractive location Extensive spatial-functional structure Brownfields revitalization and possible to use Major industrial center in the country Cooperative networks organized around large enterprises	Education and information campaigns Media campaigns Contacts with other regions Promotion of the region in other provinces Competitions Celebrations	Information Help Tourist attractions Mass events Leisure and recreation areas Potential of sports

ADDED VALUE

Fig. 3. Value chain in the 'Environment' field in the Metropolitan Association of Upper Silesia, by M. Porter.

Table 3. Basic action in Environment value chain in the Metropolitan Association of Upper Silesia.

Basic action	Characteristics
Resources inventory:	▪ waste management: 10 landfills for non-hazardous and inert ▪ 7 waste sorting, 7 composting plants, a waste treatment plant for solid fuel ▪ space occupied by the former landfill (approximately 16.1 km^2 MAoUS) ▪ bulk water supply system operated by the cities of Upper Silesia agglomeration Water Supply SA (WSE system includes: 8 Branches main network, 900 km of pipelines and mains fed water from eleven stations, water retention capacity of trunk water mains is about 800,000 m^3, 9 Water Treatment Plants, Water Treatment Establishments 2) ▪ extensive network of sewage – the use of municipal sewage treatment plants that were fed by wastewater sewers (CSO Katowice): Świętochłowice 98.3%, Gliwice, 97.8%, Sosnowiec 97.4%, Chorzow 97.3%, Jaworzno 94.5%, Zabrze 91.8%, Bytom 91%, Dabrowa Mining 90.8%, Siemianowice Silesia 90%, Tychy 83.8%, Piekary Slaskie 81.6%, ore Silesia 76.1%, Katowice 72.5%, Mysłowice 9, 7% ▪ significant potential for groundwater, watercourses and network diversity of stagnant water ▪ forest areas and parks and recreational walkers (24% GZM) ▪ areas subject to protection under the Nature Conservation Act (36.2 km^2, 3% GZM): Natura 2000 areas (13.9 km^2), parks (4 km^2), nature reserves (2.7 km^2), ecological sites (6 km^2), nature and landscape (6 km^2), protected landscape areas (3.6 km^2).
Operations	▪ high investment in environmental protection and management of water (approximately 30% of the province), low on waste management ▪ potential sources of funding: regional and sectoral operational programs and other foreign sources of funding (EEA), the budget of the region, GZM budget, means government funds: National Fund and WFOŚiGW, PFRON ▪ EU funding for activities related to waste management ▪ specific requirements for operators applying for a decision in the collection of municipal waste from property owners ▪ specific requirements for water supply and sewage disposal by the operators.
Complete offer for customer – investor:	▪ 66% of the total population consists of working age people ▪ structure of employment in individual sectors of the economy: services (market and non-marketable) - 58.7%, industry and construction – 41.1%, agriculture, hunting, forestry and fishing – 0.2% ▪ approximately 194,000 economic entities ▪ economic potential: 2 academic business incubators, technology incubators 5, 9 technology parks, two logistic centers, sub-KSEZ (15 Sosnowiec-Dąbrowa, 5 Gliwice, 2 Tychy) ▪ operation of NGOs in the field of pro-ecological activities (in 2010, 60 organizations collaborated WFOŚiGW) ▪ Business institutions – management activities and services such as financial, advisory, training ▪ Attractive location: high density of road and rail routes, close to three international airports (Pyrzowice, Kraków, Ostrava), 2 disposable sports airports (Katowice, Gliwice), Gliwice Canal (41 miles) inland waterway and port (transhipment options: 2.5 million Mg), public transport by bus, tram, trolleybus, and rail, urban centers in the vicinity of attractive tourist ▪ extensive spatial-functional structure ▪ brownfields revitalization and possible use ▪ major industrial center in the country: mining, metallurgy, automobile, chemical, machinery and military ▪ cooperative networks organized around large enterprises, especially enterprises of traditional sectors.
Offers and marketing:	▪ education and information campaigns on the proper handling of hazardous waste ▪ media campaigns, such as “Life after garbage” ▪ exhibitions (4 exhibition areas) ▪ contacts with regions in Poland and Europe ▪ promotion of the region in other provinces ▪ competitions, celebrations, prizes for the activities on the environment, such as “green checks” and “EcoActive” ▪ Information Help

Table 3. Continued.

Basic action	Characteristics
Customer service and additions:	▪ Information Help
	▪ tourist attractions, for example: 16 monuments and industrial architecture, landscape elements, 72 historic places of worship
	▪ mass events (sports and entertainment)
	▪ leisure and recreation areas: 24 main recreation centers, two ski resorts, 2 campsites, Silesian Zoological Garden, 2 mini-zoos, 4 botanical gardens and palm house
	▪ potential of sports: 27 indoor swimming pools, 2 diving centers, 32 sports halls, six-year-round ice rinks, 61 stadiums and larger fields, a playground for field hockey, two ski tracks, 14 equestrian centers, 50 tennis courts, 8 climbing walls, a field course, a bicycle track, cycling
Added value:	▪ management of surface water
	▪ management of snowmelt and rain water
	▪ reduction in water consumption
	▪ implementation of system solutions to reduce the risk of flooding
	▪ increase urban sewage system
	▪ reduction of wastewater require purification, and of uncleaned
	▪ improve the quality of surface and groundwater
	▪ increase the scope of selective waste collection
	▪ increase recycling of waste
	▪ use of municipal waste for the purposes of economic and energy
	▪ reducing the amount of waste generated
	▪ reduction of waste to be disposed of by storage
	▪ increasing use of modern technologies in the process of disposing of waste
	▪ progressive lowering of the occupied area landfills, degraded and devastated, and their rehabilitation
	▪ improvement of the natural system
	▪ increasing the number of attractive recreational and leisure area of high natural value.

Conclusions

Value chain analysis for environmental management in the Metropolitan Association of Upper Silesia enabled the complex recognition of its potential and capabilities of the strategic development of this area. As a result it was found that:

1. The basic need for environmental management in the Metropolitan Association of Upper Silesia is the development of infrastructure for water and sewage related to waste management. This infrastructure, developed in comparison with the whole country, requires modernization, full investment, and updating. It is proved by the degree of sewer system installation (14.9 of urban population of the Metropolitan Association of Upper Silesia does not use sewage treatment plants), and the surface area of the territories for unreclamed waste storage (almost 775 ha). Surface and groundwater in the Metropolitan Association of Upper Silesia is of 4th or 5th class quality, and watersheds of the rivers water bodies are at risk. It is primarily influenced by discharges of poorly treated or untreated sewage, the presence of large areas waste stockpile and long-term industry impact. Within the Metropolitan Association of Upper Silesia there are also land deformations and large degraded postindustrial areas requiring reclamation. Land deformation is the result of exploitation of coal mines, deforestation, irrigation processes, and progressive development of river valleys. The actions mentioned are also causes of flooding risks.
2. Additional problems are insufficient expenditures on research and development activity, insufficient number of environmental technologies in relation to the needs of the market and their transfer. These problems require intensive and extensive operations in cooperation with all entities creating the value chain in the field of 'Environment.'
3. The existing potential forms substantial opportunities for both absorbing technical knowledge and developing solutions for introducing environmental technologies.

An additional advantage is the possibility of acquisition of substantial funds from the European Union for research and development activities within environmental technologies. In addition, the restricting of industry affects the growth of private sector interest in ecological technologies, which constitutes additional stimulus to the development of concepts and procedures in this regard.

4. Stimulus for improvements in environmental management in the Metropolitan Association of Upper Silesia may be the consolidation of urban policies and integrated organizational operations. Integration of activities can contribute to eliminate or minimize weaknesses in environmental management and achieve the expected values. It can also trigger the mechanism to support pro-ecological initiatives and behaviors.
5. The analysis of key actions includes:
   - formulate the metropolitan plan of land development
   - create an integrated waste management system
   - introduce sewage sludge management system
   - use modern technologies for waste disposal
   - introduce an integrated environmental information system (building databases with spatial visualization)
   - develop a technical infrastructure for surface and groundwater protection
   - intensify reclamation of degraded postindustrial areas
   - increase expenditures on research and development activity and technology transfer
   - informational and educational actions within environmental protection – the creation of metropolitan pro-ecological culture

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