THE INVESTMENT EXPENDITURES ON ENVIRONMENT PROTECTION AND WATER MANAGEMENT IN POLAND IN 2003–2017

Katarzyna OSZCZAPIŃSKA *

*MSc; Faculty of Civil and Environmental Engineering, Białystok University of Technology, Wiejska 45A, 15-351 Białystok, Poland
E-mail address: k.oszczapinska@doktoranci.pb.edu.pl

Received: 5.06.2019; Revised: 24.06.2019; Accepted: 24.06.2019

Abstract
The aim of the study was to analyse the investment expenditures on environment protection and water management, taking into account tangible effects created in 2003–2017. The considered time period has been selected to evaluate the impact of Poland’s accession to the European Union on environment protection development. Information about investment expenditures and created tangible effects were collected from Local Data Bank within Statistics Poland [1]. The research included increase in four basic areas within environment protection among nine domains listed in CEPA (Classification of Environmental Protection Activities): sewage and water management, air protection and waste management [2]. Moreover, analysis of funding sources, investment directions in division into environment protection and water management domains as well as the increase in the amount of new fixed assets were presented. While analysing outlays on fixed assets for environment protection it can be noticed that in 2003–2017, the investment costs on wastewater management and water protection represented the highest percentage from all tasks. These expenditures amounted on average PLN 70.6 per capita in Poland in 2017. The second most subsidized domain in terms of investing in fixed assets in 2017 was protection of ambient air and climate (PLN 60.2 per capita), while waste management with PLN 22.6 per capita was in third place.

Keywords: Environment protection; Fixed assets; Water management; Wastewater management; Sewage systems.

1. INTRODUCTION
Water is essential for humans, animals, plants and for the economy. This non-commercial product because of its limited resources needs to be protected. The European Union’s Water Framework Directive [3] establishes a legal framework to protect and restore clean water in the EU and to ensure its long-term sustainable use. The WFD is supported by more targeted directives, i.e. the Groundwater Directive [4], the Drinking Water Directive [5] and the Bathing Water Directive [6], the Nitrates Directive [7], the Urban Waste Water Treatment Directive [8], the Environmental Quality Standards Directive and the Floods Directive [9]. After seven years of negotiations, on May 1, 2004 Poland acceded to the European Union (EU). Since this event Poland like other EU members, transformed its economy through the implementation of the European Union legislation. Environmental policy plays a crucial role in the integration process. The regulations within environment in the EU are obligatory to all members and they must be given immediate force of law. Directives are non-legislative acts of the EU and they have to be transposed into the national legal framework of the EU members. The EU environmental legislation mainly concerns water, air and noise pollution, chemical substances, waste management and nature conservation [10, 11, 12].

The system of financing environmental protection in Poland was designed before integration with the EU. It is based on environmental effects, while the European Union’s regulations are characterized by a technological approach, obliging environmental users to strictly respect product and emission standards [13].
Over the years, EU-28 national expenditure on environmental protection have been steadily rising and in 2017, they amounted to EUR 316 billion. In 2017 in the EU-28, total expenditure of general government on “environmental protection” amounted to 0.8 % of GDP (Gross Domestic Product). Of this, expenditure on ‘waste management’ amounted to 0.4 % of GDP, while 0.1 % of GDP was devoted to expenditure in each of the following groups: waste water management, pollution abatement, protection of biodiversity and landscape and expenditure not elsewhere classified relating to environmental protection [14].

The highest expenditures on environment protection among EU-28 in 2017 have been incurred by Netherland and Greece (over 1.3% of GDP). In turn, expenditures incurred by Poland amounted to less than 0.4% of GDP with the largest share within wastewater management [15].

2. RESEARCH METHODS

The aim of the study was to analyse investment expenditures on environment protection and water management, taking into account tangible effects created in 2003–2017. The considered time period has been selected to evaluate the impact of Poland’s access to European Union on environment protection development.

Information about Polish voivodeships were collected from the Local Data Bank within Statistics Poland [1]. In the paper voivodeships’ expenditures on environment protection and water management, its funding sources, investment domains and tangible effects created in 2003–2017 were analysed. The research included changes at the national and voivodeship level. All data presented in section 3 are related to the purchase or manufacturing value at current prices.

Data from Local Data Bank about value of investment outlays and fixed assets of legal persons, organizational entities without legal personality, natural persons conducting economic activity (excluding private farms in agriculture) and civil law partnerships employing more than nine persons were compiled on the basis of SP (Annual questionnaire of enterprise), F-03 (Report on state and movement of fixed assets and investment activity) and SG-01 (Municipal statistic: fixed assets). According to Statistics Poland, fixed assets are defined as asset components and other objects completed and ready for usage with an expected period of utility exceeding 1 year and outlays on fixed assets include buildings and structures of which, among others, construction and assembly works, design and cost estimate documentations, machinery, technical equipment and tools (including instruments, moveables and other equipment), transport equipment and others, i.e., irrigation and drainage, improvements to land, livestock, long-term plantings, interests on investment credits and investment loans for the period of investment realization (included exclusively in data expressed at current prices), except for interests not included in outlays on fixed assets by units that apply International Accounting Standards (IAS) implemented since 1 I 2005 [16].

Figure 1.
Outlays on fixed assets for environment protection and water management in Poland in 2003–2017 (own study based on [1])
3. EXPENDITURES ON ENVIRONMENT PROTECTION AND WATER MANAGEMENT IN 2003–2017

Funding environment protection includes expenditure on current protection and activities in environmental protection services and financing pro-ecological investments [17].

After analysing the outlays on fixed assets for environment protection and water management, it can be noticed that since 2003, there has been observed a steady increase in expenditures until decrease in 2012 (-16.7% in environment protection and -11.1% in water management in relation to the previous year). Second large decline in 2016 was much more greater, when expenditures were lowered by over 57% in environment protection and by nearly 49% in water management in relation to the previous year (Fig. 1). Average expenditures on environment protection per capita in Poland has risen from PLN 134.6 in 2003 to PLN 177.6 in 2017, and on water management from PLN 44.5 to PLN 53.7.

During the analysed period, the highest investment expenditure on environment protection was incused by Silesian Voivodeship (PLN 21.9 million) and Masovian Voivodeship (PLN 18 million), amounting accordingly to 16% and 13.2% of the total expenditures fixed assets in environment protection in Poland. In turn, the lowest expenditure was incused by Podlaskie Voivodeship with just 2.2% of the total expenditures on environment protection in Poland.

3.1. Funding in particular polish voivodeships per capita in 2003–2017

Environmental protection and water management activities funding is not evenly distributed within the country. The individual voivodeships stand out from the rest. In terms of environmental protection, on average in the years 2003–2017, the highest expenditures per capita was allocated by the Silesian Voivodeship with PLN 315.8 followed by Łódź and West Pomeranian Voivodeships. The lowest funding was in the Lublin Voivodeship (PLN 147.7 pc), Warmian-Masurian (PLN 158.6 pc) and Podlaskie (PLN 167.2 pc) (Tab. 1). The highest expenditures were in Świętokrzyskie in 2011 (PLN 624.15 per capita). In the analysed period, the lowest expenditures on environmental protection were spent in 2016 in Warmian-Masurian Voivodeship (PLN 58.5 per capita) [1].

In comparison to environment protection, expenditures on water management were much lower. On average, the most investments were made in the Lower Silesian (PLN 119.5 pc), Lesser Poland (PLN 103.5 pc) and Opole (PLN 98.9 pc) Voivodeships (Tab. 1). In turn, the lowest expenditures on average in the years 2003-2017 amounted to PLN 35.1 per capita in the Łódź Voivodeship, to PLN 42.9 in Lublin and to PLN 46 in Podlaskie Voivodeships. Similarly to investments in environmental protection, also the lowest expenditures in water management were in 2016, which amounted to only PLN 15.14 per capita (Świętokrzyskie Voivodeship). The highest expenses for this purpose amounted to PLN 266.89 per capita in 2014 in the Lower Silesian Voivodeship.

Table 1.
Outlays on fixed assets for environment protection (EP) and water management (WM) in Polish voivodeships [PLN per capita] (own study based on [1])

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Poland</td>
<td>135.0</td>
<td>32.6</td>
<td>165.6</td>
<td>28.6</td>
<td>239.7</td>
<td>50.0</td>
</tr>
<tr>
<td>Kuyavian-Pomeranian</td>
<td>78.5</td>
<td>29.3</td>
<td>144.5</td>
<td>34.0</td>
<td>202.6</td>
<td>57.5</td>
</tr>
<tr>
<td>Lesser Poland</td>
<td>133.8</td>
<td>80.1</td>
<td>146.2</td>
<td>31.9</td>
<td>222.0</td>
<td>103.5</td>
</tr>
<tr>
<td>Łódź</td>
<td>183.3</td>
<td>18.8</td>
<td>233.1</td>
<td>27.7</td>
<td>297.5</td>
<td>35.1</td>
</tr>
<tr>
<td>Lower Silesian</td>
<td>222.0</td>
<td>60.6</td>
<td>108.7</td>
<td>148.3</td>
<td>224.3</td>
<td>119.5</td>
</tr>
<tr>
<td>Lublin</td>
<td>64.8</td>
<td>48.6</td>
<td>77.2</td>
<td>32.0</td>
<td>147.7</td>
<td>42.9</td>
</tr>
<tr>
<td>Lubusz</td>
<td>281.6</td>
<td>42.5</td>
<td>154.3</td>
<td>49.3</td>
<td>224.8</td>
<td>75.4</td>
</tr>
<tr>
<td>Masovian</td>
<td>90.9</td>
<td>48.7</td>
<td>154.7</td>
<td>51.3</td>
<td>228.3</td>
<td>63.0</td>
</tr>
<tr>
<td>Opole</td>
<td>167.1</td>
<td>31.2</td>
<td>209.8</td>
<td>63.7</td>
<td>295.8</td>
<td>98.9</td>
</tr>
<tr>
<td>Podlaskie</td>
<td>95.4</td>
<td>26.1</td>
<td>137.7</td>
<td>44.0</td>
<td>167.2</td>
<td>46.0</td>
</tr>
<tr>
<td>Pomeranian</td>
<td>118.9</td>
<td>36.1</td>
<td>242.9</td>
<td>31.9</td>
<td>233.4</td>
<td>61.7</td>
</tr>
<tr>
<td>Ślesian</td>
<td>143.4</td>
<td>40.8</td>
<td>254.3</td>
<td>106.7</td>
<td>315.8</td>
<td>60.8</td>
</tr>
<tr>
<td>Subcarpathian</td>
<td>168.4</td>
<td>46.1</td>
<td>177.6</td>
<td>46.4</td>
<td>184.6</td>
<td>58.5</td>
</tr>
<tr>
<td>Świętokrzyskie</td>
<td>78.2</td>
<td>88.7</td>
<td>96.6</td>
<td>33.0</td>
<td>291.0</td>
<td>57.4</td>
</tr>
<tr>
<td>Warmian-Masurian</td>
<td>123.1</td>
<td>31.5</td>
<td>82.4</td>
<td>21.1</td>
<td>158.6</td>
<td>54.9</td>
</tr>
<tr>
<td>West Pomeranian</td>
<td>129.8</td>
<td>30.2</td>
<td>407.3</td>
<td>28.6</td>
<td>295.9</td>
<td>69.6</td>
</tr>
</tbody>
</table>
Interestingly, Łódź Voivodeship with the second place in terms of environmental protection expenditures in the analysed period spent the least funds on water management [1].

3.2. Investment domains and funding sources in environment protection and water management

Expenditures on environmental protection and water management are divided into nine environmental domains as shown in Figure 2. In recent years three domains have played leading role within environment expenditures. The main funding area is wastewater management and water protection, which in 2003 made up over half of the environment expenditures. Over the years, more funds were directed to second and third leading domains: protection of ambient air and climate, and waste management.

There is a concern about low funding levels within other domains, like waste management, soil remediation or noise and vibration abatement. Moreover, since 2015, we can observe large decrease in the environment expenditures, which has significant impact on leading domains.

Apart from expenditures on particular environmental domains, it is worth noting the funding sources which include budget, private and foreign appropriations. Budget funds constitute central, voivodeships’, district’s and communal resources. The amount of state budget funds is determined annually in the budget act. The expenditures on municipal economy and environment protection in 2019 are planned to reach PLN 1.5 billion (0.36% of total Poland expenditures), while income from that area is anticipated for PLN 4.47 billion [18]. That means that only one third of income from municipal economy and environment protection is dedicated again for this purpose in Poland.

Private sources in environment protection include own funds of investors from current funds or loans and credits derived from Bank Ochrony Środowiska (BOS), Bank Gospodarstwa Krajowego (BGK) and from commercial banks. A specific source of financing environmental protection tasks are ecological funds for environmental protection: the National Fund for Environmental Protection and Water Management (NFOŚiGW) and Provincial Funds for Environmental Protection and Water Management (WFOŚiGW) and Forest Fund. NFOŚiGW and voivodeship funds for environmental protection and water management were established on the basis of the Act of 27 April 1989 amending the act on protection and shaping the environment and the Act – Water Law [19, 20].

Expenditures on environment protection and water management during analysed period were mainly financed from national own funds (43.2%). Important role in supporting environment – protection projects in 2003 was played by Environmental Protection Funds (22.4%) and national credits and funds from abroad on similar level. However, after the accession to the EU, funds from abroad reached second place with share 13.55%, while Environmental Protection Funds share decreased to 9.2% (Fig. 3).
Attention should be paid to the amount of financing from abroad, especially during the pre-accession period. This was mainly due to the state of Polish environment, which required enormous resources to adapt it to the requirements of the European Union both in the field of environmental protection and water management. The next increase in funds in this area was after 2005 and is related to the adjustment periods set by the European Union covering water management and water protection [21].

3.3. Fixed assets in environment protection and water management in 2003–2017

Outlays on fixed assets include expenditures on, among others: purchase of land (including the right perpetual usufruct of land), buildings, premises and objects of civil engineering (construction and assembly works, design and cost estimate documentation), technical devices and machines, means of transport, tools, devices, movables and equipment whose aim is to obtain protective effects [22].

Basic areas of environment protection and water management in which the most investments in fixed assets were made were sewage and water management, air protection and waste management.

For both water and sewage management in 2003–2017, Poland’s expenditures reached almost PLN 74 billion, which accounts for 53.9% of total expenditures on environment protection. Almost 26% of expenditures was dedicated to air protection and 11.5% to waste management.

When analysing tangible effects of completed investments in sewage management, a significant decrease can be noted in 2016 and 2017. During the analysed period, the largest number of 193 sewage treatment plants were put into the use in 2003, just before Poland’s accession to the European Union. Since then, the number of annual sewage treatment plants created would decreased and in 2017, it reached 21 (Fig. 4). In total, there were 1309 treatment plants in Poland, of which the largest number in Masovian Voivodeship (165), and the smallest one in Opole Voivodeship (28). The largest number of networks were created in 2010 and 2011 (over 8,000 km per year). In total, in the years 2003–2017 88026 km of sewage systems were commissioned for use, of which over 10000 km in the Podkarpackie Voivodeship, and only 1960 km in the Podlaskie Voivodeship.
In contrast to sewage systems, the largest number of water supply networks was created in 2003 and 2004. There has been created 75095 km of water systems, the most of which in the Masovian Voivodeship and the least in Opole. Higher growth rate of sewerage systems in relation to water supply systems can be explained by the length of networks already built. In 2003, the percentage of residents connected to the water supply network was 85.1%, whereas for sewage systems only 57.4% and for the most part they were networks located in urban areas. In 2017, these ratios amounted to 92% for waterworks and 70.5% for sewage systems.

In addition to the aforementioned water systems, the number of pump stations on collapse and depression cone areas, water reservoirs and flood embankments is also included to the water management (Fig. 5). During 14 years, 141 water reservoirs with total capacity of 164.8 million m$^3$ were commissioned for use in Poland. Most facilities were commissioned in 2004 (23) and in 2003 (18). The largest investment in recent years was the reservoir located in the Silesian Voivodeship, the capacity of which amounted to over 51 million m$^3$. On the other hand, the smallest investments were made in the Warmian-Masurian Voivodeship, where 6 small reservoirs with a total capacity of only 15759 m$^3$ were built. In the case of pump stations on collapse and depression cone areas conceived in 2003–2017 in Poland, 115 were created, among which the largest number in the Warmian-Masurian Voivodeship (22). In the case of flood embankments during the analysed period annual arise from 1.5 km of embankments in 2017 to 19.2 km in 2014, was recorded. In 2003–2017 most flood embankments were created in the Lesser Poland Voivodeship (555 km), while the least in the Podlaskie Voivodeship (2.1 km).

With regards to fixed assets in the air protection, the analysis applies the pollutants reduction capabilities...
of installed devices and systems. There is a division into particulates and gases pollutants, from which the highest new systems reduction was achieved in 2004 in the case of particulates (reduction capability almost 550,000 t/y), and in 2008 in the case of gas pollution systems with reduction capability over 800,000 t/y (Fig. 6). The most investments in particulates pollution reduction systems were made in Lower Silesia Voivodeship (in total 641,163 t/y in 2003–2017), while almost 100 times fewer in West Pomeranian Voivodeship (6,776 t/y). Regarding the gas pollution reduction systems, most investments were opened in Kuyavian-Pomeranian Voivodeship (746,168 t/y), and the fewest in Podlaskie Voivodeship with only 120 t/y of reduction capabilities.

Fixed assets in waste management are measured using the amount of waste disposal facilities and their capacity. It can be noticed clearly higher dynamics in the first years after accession to the EU, when more than 15 waste disposal facilities were put into service each year (Fig. 7). However, during the whole analysed period, the capacity of these facilities was at the similar level and amounted on average to almost 1.8 million t/y, except for 2007, when 12 facilities with a total capacity of nearly 14.5 million t/y were built. The largest facilities were created in 2007 in the Łódz Voivodeship, with a total capacity of 14.15 million t/y.

4. CONCLUSIONS

Poland’s accession to the European Union and full membership changed the whole economy, also in the field of environment protection and water management. The analysis shows that in the years 2003–2017 there was an increase in the amount of expenditure on environmental protection in total and per capita, but
despite that its low level in relation to GDP indicates the need to continue investing in this area for significant improvement the state of the environment and preventing its degradation.

It has to be recognised that over 29% of expenditures on environment protection were allocated in Silesian and Masovian Voivodeships, while the least (2.2%) were allocated in Podlaskie Voivodeship.

1. The accession of Poland to the European Union (EU) has been a significant motivating factor for national policies for the management of natural resources in terms of adapting those policies to EU environmental protection standards.

2. The largest expenditures in analysed period were allocated to wastewater management and water protection (56.7% in 2003 and 39.8% in 2017).

3. Main funding sources were in 2003 own funds and Environmental Protection Funds, while in 2017 own funds and funds from abroad.

4. Tangible evidence of development within environment protection and water management can be observed as an increase in the number of sewage treatment plants and kilometres of sewage systems and waterworks.

REFERENCES