

INNOVATIVE ACTIVITIES IN THE WATER AND SEWAGE INDUSTRY

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Abstract: The purpose of this study is to analyze and present the results of research devoted to the development and intentions of water and sewage companies operating on the Polish market in the context of innovation. The data collected and analysed in the research has not been published yet. The specific purposes of the study is to describe the state of innovation of water and sewage companies operating across the country, and to indicate the directions for their development, their barriers and problems in the context of implementing innovation. The first part of the study focuses on the theoretical aspects of innovative activities of municipal companies, and characterizes the notions of innovation and innovativeness. In its subsequent part, the study describes the object, subject, purpose of the study, the research methods and techniques applied in the paper. The analysis and discussion of a selected research part is included in the last part of the study, which is closed by the final conclusions.

Keywords: innovations, sewage, sewerage, water industry.

1. Introduction

To ensure effective and dynamic growth, contemporary municipal companies should strive to increase their competitive advantage by implementing innovations. The EU Water Framework Directive defines water protection as one of the greatest challenges for the European Union, which calls for greater involvement of citizens and other actors in the search for new solutions. These challenges call for significant improvements in water resources, in terms of both quantity and quality, and underline the need for joint action by public and private entities to effectively reduce water intensity in production processes, and to improve water recycling and reuse to the benefit of industry and society (Gabrielsson et al., 2018). Improved capacity to generate and absorb innovative solutions is a strategic challenge, to which the organization should be prepared by ensuring the necessary resources and organizational solutions. Innovativeness is currently one of the imperatives for companies oriented at developing and raising their competitiveness in the sector of municipal services. Spiller and

others emphasize that innovation in technology and organizations is key to enabling the water sector to adapt to major environmental changes such as climate change, land degradation or drinking water pollution (Spiller et al., 2015). The essence of business is to stimulate innovation and constantly improve various areas of activity. Companies aim to dynamise the process of creating value for all stakeholders, particularly for clients, by diversifying and better penetrating the market, and by pursuing various market niches.

The notion of “innovation” comes from the Latin word *innovates*, which means a renewal. As such, the term stands for introducing something new, a newly introduced thing, a novelty or a reform (Janasz, and Koziół, 2007). The notion has been perceived in different ways in literature. Innovation can include: the process of transforming a creative idea into a useful product, service or a way of acting (DeCenzo, and Robbins, 2002); each idea or item which is new, as it is qualitatively different to any existing, familiar forms (Burnett, 2010); creating results by doing something new (Miller, and Wedell-Wedellsborg, 2014); implementing new ideas (Karlik, 2014); converting inventions into material reality (Bogdaniecko et al., 2004); introducing new products and techniques; as well as introducing new raw materials, management forms and gaining new outlets (Nowacki, 2010); an extraordinary tool for entrepreneurship, by which changes create opportunities for the commencement of new production activity or the provision of new services (Weiss, 2011); a creative change in a social system, in an economic structure, in a technique and in nature (Marciniak, 1997); changes to the product’s pattern, marketing method, price offered, service provided to the client, or changes in organization and management methods which apply to all areas of the company’s activity (Drucker, 1992); everything that is perceived by the individual as new, regardless of the objective newness of a given idea or item (Rogers, 2010); the first commercial application of a new product; the first application of an invention (Bielski, 2000); any good, service, idea which is perceived by someone as being new (Kotler, 1994). In turn, literature defines innovativeness as: the tendency and ability to create new and enhance the existing products, new technologies and organizations, as well as management and motivation systems (Kotowicz-Jawor, 1997); the tendency and ability of a company, the economy or a region to implement innovations consisting of resources and methods applied in using them, remaining at their disposal (Nowacki, 2010); the ability of a company to create and implement innovation and the actual ability to introduce new and improved products, new or possibly altered technological or organizational and technical processes (Weiss, 2011). Levidow and others point to the concept of eco-innovation, which includes various innovative practices combining economic and environmental benefits. As an example, renewable energy or biomass can be given as an input substitute for fossil fuels. Moving forward, modernization of production processes has reduced the burden on resources, eg by replacing less harmful chemicals, internal wastewater treatment, re-use of water and/or waste, etc. (Levidow et al., 2016). Therefore, innovation should be understood as the implementation of a new or significantly improved solution devoted to a product (a commodity or a service), a process, marketing or organization

in a company. In the case of introducing a product solution, its essence is that it is offered on the market, whereas for the remaining innovations, the primary premise is that they are applied in the company's activities.

Four types of innovative solutions can be distinguished. There are marketing innovations, which entail introducing new or improved solutions in the product, its equipment, brand, packaging, positioning, pricing policy, promotional activity or business management model stemming from a new marketing strategy in the company's marketing activities. Product innovations entail the marketing of a new tangible or intangible product, or a significant improvement in characteristics or intended purpose, implemented in products offered so far. Process innovations mean the implementation of new or significantly improved production or delivery methods in the company's activities. Organizational innovations entail the application of a new business organization concept, a new workplace organization or a new organization of relations with outside partners (Niedzielski et al., 2007). In today's business reality, innovation has great impact on economic development, as it stimulates the continuous improvement of quality of products and services, and, ultimately, the level of business competitiveness. As a notion, innovativeness indicates the results of a company's innovative activity in time and place (Weiss, 2011). The essence of innovation is a complex process, comprising mutually interconnected phases. It is a social phenomenon, by which old behavioral models are challenged and learning is promoted. It requires expenditure and involves risk. Sometimes, it tears down the current order of the company (Jurczyk-Bunkowska, 2014).

The purpose of innovations is to develop societies, which would have not been possible otherwise. Intent on surviving, companies are forced to take the challenge and shift to developing their products, technological and business processes, as well as their organizational methods, in order to satisfy the client's requirements better. The present consumer prioritizes the quality of products and services, as well as the quality, with which they are served. Price is no longer the decisive factor (Jurczyk-Bunkowska, 2014).

The need to lower costs and search for new possibilities has also been a driving force behind innovation. The solutions proposed can often be radical. Another factor which stimulates the search for new products is their shorter life cycle, caused by easier access to new technologies. Innovations also emerge as a result of changing laws, such as increased environment protection requirements. Demographic and social changes are also very important. Aging societies in Europe and growing wealth of the lowest social classes in Asia result in a need to find solutions to satisfy newly emerging needs. Widespread competition results in the need to find a stabilizing point. Promoting the image of the company is a good way to guarantee customer loyalty. Innovations are perfect for this role, since they are generally noticeable, eagerly discussed and positively received (Knosala et al., 2014). In conclusion, there are many definitions of innovation, and many attempts have been made at interpreting its essence. Therefore, innovation can consist in the transformation of an idea into material objects or, in a narrower sense, it can be defined as a new product or the process of creating it. In a different

approach, innovation can be understood as a significant change of value and an emphasis on what is new: information, outlooks and social phenomena.

The sources of innovation can be diverse. They are often the response to current problems encountered in one's environment, in which case the chances of their commercial success are higher, compared to innovations which create new needs. Furthermore, determination in the pursuit of innovative solutions increases in crisis conditions, in which case we are dealing with desperate search (Lundvall et al., 2014). First, such search is limited to alternative solutions, close to the familiar processes, products and markets. Subsequently, the alternatives pursued are more and more distant. This approach is indicative of companies which were forced to change their production profile fast. Very often, measures such as this are inspired by a close look at the works carried out by the employees and identifying those as semi-legal, unregistered, official external commissions (Mamica, 2014). Another factor which can stimulate the pursuit of innovation can be shortages in production factors, such as high warehouse rental prices, which will stimulate the emergence of organizational innovation – a “just in time” delivery method. Therefore, the emergence of innovation is often the effect of a dispersed search for potential possibilities of offering a new product or service, alternatively forms of their effective delivery. The type of information sources used for this purpose is wide and, apart from own or ordered research and development works, includes, among others, suppliers and clients, as well as universities and public institutions. Entering in interaction is therefore a natural method of looking for innovative solutions (Mamica, 2014). Participation in a cooperative chain is an effective way of taking advantage of interaction in increasing the level of business innovation, particularly in smaller companies. Supplying parts or providing services to large consortia leading on the market, is a way to acquire new technologies and implement new quality standards in a relatively cheap manner. It is also often a way to obtain certificates to confirm it. This way, developing a network of cooperators, large corporations become diffusion centers for innovations, including organizational, in their environment. Insofar as these relations were initially based on a system of simple purchases, with time, this relationship transformed into a form of subcontracting, often related to the exchange of production technologies. Due to high transaction costs, when the number of suppliers is high, companies which offer more advanced subassemblies in cooperating with their suppliers are naturally formed. Competitiveness and innovativeness of companies has been increasingly determined by the network of connections, in which they participate. Innovative strategy is a certain way of thinking, determining the framework for decisions made with respect to the scope and direction of innovative activities. Adoption of an innovative strategy is an expression of a natural switch, so popular today, from a product – market organization development concept to a development concept based on innovation, i.e. innovation – product – market (Pichlak, 2012).

Strategies in innovative activity can be divided into four types. Active, applied by leading companies on the market, companies that are intent on conducting their own research activity. To acquire knowledge, they use various sources of innovation. The innovations implemented

are radical in nature (e.g. they change the character of products and services). This type of innovations involves risk, but the success is often worth the risk. The second type is passive strategy, which consists in making changes to meet the expectations and needs of the clients. This applies, among others, to the automotive industry. The next active strategy is based on the protection of current markets and technologies, and involves a bold movement when it is necessary to introduce an innovation into the market. Companies adopting this strategy are exposed to a lower risk, but are also forced to keep watch and react when access to research infrastructure becomes necessary. The fourth strategy is reaction. Here, companies run their own operations and wait for a specific reaction to implement changes (Jurczyk-Bunkowska, 2014).

2. Materials and methods

The object of this study is innovativeness in water and sewage companies operating in Poland, and specifically their directors and selected employees of middle management. The purpose of the study is to:

- Characterize the state of innovation in water and sewage companies across the country;
- Indicate the direction for development of water and sewage companies in Poland;
- Indicate barriers and problems in the context of introducing innovation in Polish water and sewage companies.

The research methods used are: questionnaires, direct observations and interviews. A survey questionnaire containing 25 questions was developed in September 2016. The research questionnaire was created on the basis of experience in innovative activities related to water and sewage management of Sewage and Water Supply Ltd. Rybnik. The questions referred to the development and intentions of water and sewage companies. The survey was sent out to 250 water and sewage companies across Poland. Their senior management was asked to submit their responses.

To select companies to participate in the study, the authors identified 250 largest cities in Poland in terms of population, with active water and sewage companies. Out of all 250 surveys sent, 78 were returned, which constitutes approx. 31%. Their majority – 50 companies – are medium-sized enterprises (specified in the survey as employing from 50 to 250 people). The next 20 companies are largest companies (specified in the survey as employing more than 250 people). The smallest number of responses – 8 – were received from small companies (specified in the survey as employing 10 to 49 people). Micro-companies (specified in the survey as employing 2 to 9 people) did not express a wish to participate in the study.

Interviews with top management were carried out from January to June 2017, followed by observations of innovative activities in 34 companies which consented to it. This aimed at confirming the results obtained in the analysis of questionnaires and at helping the authors identify any problems encountered in the implementation of an innovation strategy.

3. Results and discussion

In the first points of the survey and the interview, the respondents were asked if the companies they managed engaged in any innovative activities, or whether they planned to introduce innovations in their short-term strategies with a 3-year perspective. A great majority of the respondents answered that their companies had already conducted innovative activities (87%), whereas (92%) of the companies intended to introduce or continue innovative activities in their upcoming 3-year strategies.

The respondents who answered yes to the preceding questions were further asked about the areas in which innovations were implemented. Figure 1 below presents the areas, in which innovations are implemented.

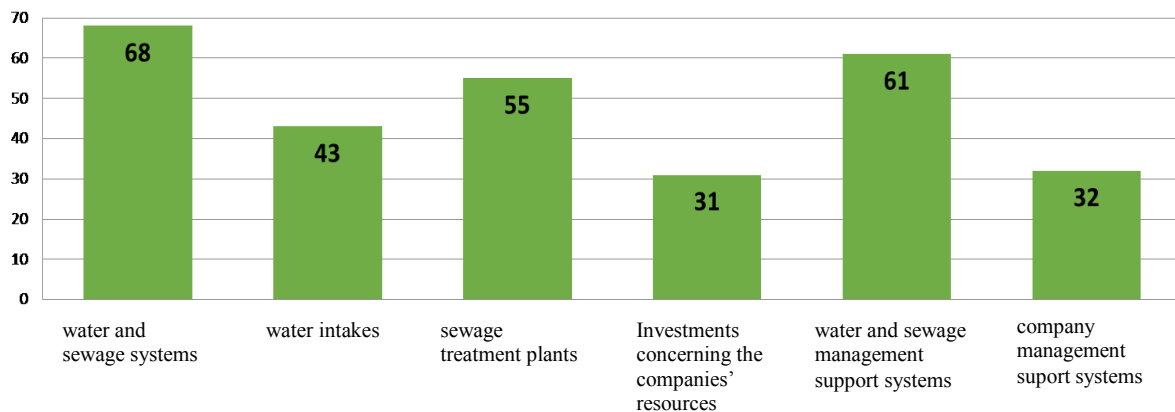


Figure 1. Innovation areas in water and sewage companies across Poland. Own study based on research.

According to the diagram above, the water and sewage systems and the water and sewage management support systems are the largest innovation areas, followed by systems facilitating management of the company, and investments concerning the companies' resources.

One of the next questions concerned the finances the company managers intended to spend on innovations. Their replies are illustrated in Figure 2.

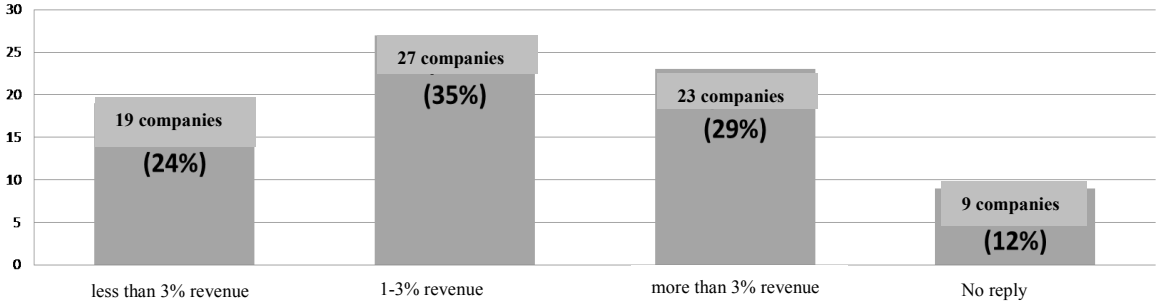


Figure 2. Planned resources to be spent on innovation in water and sewage companies across Poland as part of their 3-year strategies. Own study based on research.

The above graph shows that the majority of enterprises participating in the survey intended to spend 1 to 3% of their revenue (27 companies) on innovation. 23 companies intended to spend more than 3% on innovation, and 19 companies intended to spend less than 1% of their income. In the survey, 9 companies did not mark any field, which means that they did not intend to spend any sums on innovation in the next 3 years.

In the next questions, the respondents were asked about the sources of technological innovations, either planned or currently implemented by the companies. Their responses are presented in the diagram below (Figure 3).

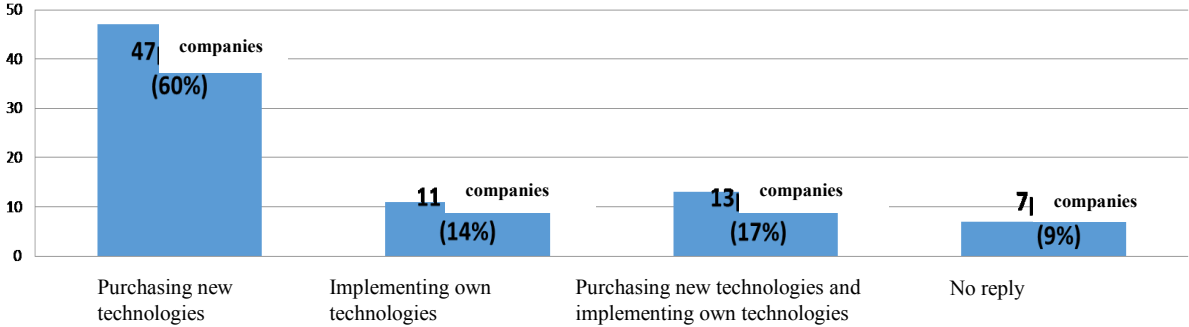


Figure 3. Sources of new innovative technologies in water and sewage companies across Poland, in their 3-year strategy. Own study based on research.

According to this diagram, companies primarily focused on purchasing new technologies – 47 companies (60% of the respondents), 13 companies (17%) were interested in buying ready-made technologies and implementing their own technologies, and 11 companies (14%) intended to implement their own technologies only. 7 companies (9%) did not mark any response.

The next questions were devoted to the type and availability of systems which facilitate the monitoring and management of the water distribution system. The availability of these systems on the market, according to the respondents, is illustrated by the following diagram (Figure 4).

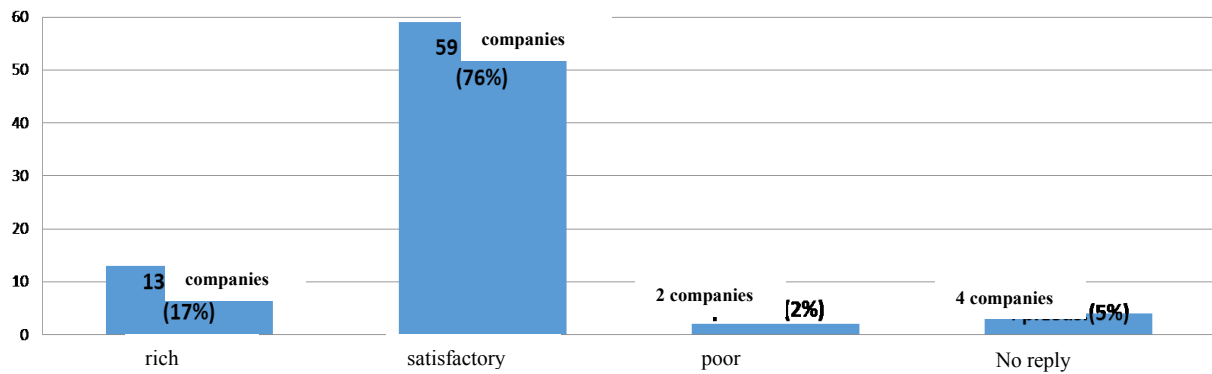


Figure 4. Market offer of systems which facilitate the monitoring and management of water supply systems. Own study based on research.

According to the diagram above, the market offer of supporting and monitoring of water supply system management systems is satisfactory – 76% (59 companies), rich – 17% (13 companies), poor – 2% (2 companies), no reply – 5% (4 companies).

Furthermore, according to the respondents, the types of offered systems which facilitate and monitor water distribution systems are:

- integrated systems combining multiple functionalities, such as expert modules – 28 companies,
- mainly measurement and metering systems – 11 companies,
- various systems, which would require integration to fulfill your expectations – 39 companies,
- it is easier to find suitable technologies abroad – 0 companies.

Among the 78 surveys which were sent back, 43 companies listed the factors which would increase their innovativeness. In turn, 53 surveys were sent back without specifying any factors. The factors which could increase the innovativeness of companies are the following:

- financial resources, external financing – 31 companies,
- cooperation with schools, qualified personnel – 7 companies,
- reduction of fiscal burden, legal regulations – 4 companies,
- reduction of negative impact on the environment – 3 companies,
- integrated information system – 3 companies,
- staff motivation – 1 company.

4. Conclusions

Innovative activity is currently a necessity and should not be treated as supplementary or secondary in a company. The Polish market is still relatively absorbent and the sector of municipal services has not filled it with new solutions. Few examples of service innovations

confirm this regularity. Despite the risk connected with innovative activity, the lack of activity in this respect means sentencing the company to gradual decline. A strong pro-innovation stance of top management and the inclination for risk-taking is the domain of developing companies, oriented at ensuring long-term competitive advantage in a knowledge-based economy. The following conclusions can be drawn based on the research:

- The majority of water and sewage companies operating in Poland have been implementing innovations and plan to take such measures within the next 3 years – the trend is clearly increasing, compared to a study carried out for this industry in 2013.
- Unfortunately, only few of the companies declared their will to implement own innovative technologies – we can therefore conclude that few companies are planning to conduct their own innovative technological activities, focusing on purchases from the external market instead.
- On the Polish market, the availability of systems which support and monitor water supply networks is satisfactory, but they must be integrated with other units to fulfill the expectation of the management of water and sewage companies.
- The basic direction for development is the extension of the water and sewage systems. An identical number of companies declared their plans to extend their water and sewage systems plus their systems to facilitate their management.
- Insufficient financial resources are identified as the main barrier to the implementation of innovations.
- According to interviews conducted with top management, among the barriers to implementing innovations is the lack of legal stability in the municipal sector in terms of long-term investments through innovations. Apart from the technological risk related to the success of a given innovation, innovations require financial stability of the enterprise.

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