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Municipal Companies as Facilitators of Smart and Sustainable Regional Development Policy (SmartRegion)

Spółki komunalne jako moderatorzy polityki inteligentnego i zrównoważonego rozwoju regionów (SmartRegion)

• **Abstract** •

This article presents the role of municipal companies in fostering smart and sustainable regional development (SmartRegion). Drawing from prominent literature in the field, the analysis covered this type of entities. The case study evaluated whether municipal companies in the Kuyavian-Pomeranian region of Poland align with the principles of smart regional development. A pilot study was conducted to identify noteworthy initiatives that extend beyond the jurisdiction of individual local governments while leveraging regional potential to enhance the area's overall attractiveness through optimized municipal policies.

The municipal companies highlighted in this article, informed by international best practices and their own operational expertise, are engaged in ambitious initiatives that effectively contribute to the region's smart and sustainable development policy. Beyond acquiring knowledge, these entities are progressively implementing innovative solutions they have developed. This trend, supported in part by recommendations from European Union programs, is expected to gain further momentum.

• **Abstrakt** •

W artykule zaprezentowano rolę spółek komunalnych w inteligentnym, zrównoważonym rozwoju regionów (SmartRegion). Dokonano analizy podmiotów tego typu w oparciu o często cytowaną literaturę przedmiotu. W ramach *case study* sprawdzono, czy spółki komunalne z polskiego regionu kujawsko-pomorskiego wpisują się w ideę inteligentnego rozwoju regionalnego. Przeprowadzono pilotażowe badania, których celem było wyłonienie najciekawszych inicjatyw wykraczających poza obszary funkcjonowania poszczególnych samorządów lokalnych, a zarazem wykorzystujących regionalny potencjał w celu zwiększenia ogólnej atrakcyjności regionu dzięki zoptymalizowanej polityce komunalnej.

Opisane w artykule regionalne spółki komunalne, korzystając w obszarach swoich działalności z najlepszych wzorców międzynarodowych oraz własnego doświadczenia, realizują różnorodne, ambitne inicjatywy, które z powodzeniem wpisują się w politykę inteligentnego zrównoważonego rozwoju regionu. Oprócz absorbcji wiedzy zaczynają również wdrażać wypracowane przez siebie rozwiązania. Z pewnością trend ten,

między innymi dzięki rekomendacjom programów unijnych, będzie przybierał na sile.

Keywords: SmartRegion; sustainable development; municipal companies; regional policy; municipal policy

Słowa kluczowe: SmartRegion; zrównoważony rozwój; spółki komunalne; polityka regionalna; polityka komunalna

Introduction

The topic of sustainable development has been the focus of interdisciplinary research for several decades. Since the 1980s, the concept has evolved as "an attempt to explore the relationship between development and the environment" (Banerjee, 2003). Numerous definitions have been proposed in the literature, many of which emphasize its regional dimension. However, there is no universally accepted definition of sustainable development. Some scholars even describe it as an "intuitively defined concept" (Kelly, Sirr, & Ratcliffe, 2004). The absence of a precise definition has, paradoxically, enhanced the concept's appeal and popularity. At one point, interpretive differences dominated scientific discourse, initiating what has been described as a "battle for definition" (Hartmuth, Huber, & Rink, 2008).

There is no doubt that achieving sustainable socio-economic development remains one of the most pressing challenges of the modern era. The Brundtland Commission defined sustainable development as a process that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. This concept encompasses environmental, economic, social, and political-institutional dimensions (WCED, 1987).

In Poland, the principle of sustainable development is embedded in Article 5 of the Constitution and further articulated in the Environmental Protection Law. Smart and sustainable regional development represents a form of socio-economic progress that integrates political, economic, and social actions while ensuring the preservation of ecological balance and the stability of fundamental natural processes. This approach aims to fulfill the basic needs of both current and future generations (Ustawa, 2001).

Smart sustainable development should not be narrowly interpreted as merely equipping a region with modern technologies. The concept of a SmartRegion must be understood more comprehensively, encompassing the actions of authorities, social activists, and an informed, creative society.

The second research focus of this paper pertains to municipal companies, an area well-established in academic discourse and local government practice. Simply

defined, a municipal company is a commercial enterprise with full or majority ownership by municipal (local government) assets. These entities fulfill statutory responsibilities assigned to local governments, particularly in areas such as public transportation, municipal housing, water supply, sewage systems, heating, and waste management (Kościelak & Michalski, 2018). Increasingly, these companies have been expanding their operations into additional sectors, including electricity supply, green space management, and telecommunications.

The rationale for examining the role of municipal companies in smart sustainable development policy lies in their dual function as both executors and facilitators of municipal policies established by local government units. On the one hand, they carry out tasks mandated by their owners (local governments); on the other, as experts in their respective fields, they act as facilitators, refining and optimizing these activities. Unlike local government politicians, the boards of these entities often prioritize economic or social interests over political considerations. When warranted, they may challenge their owners' directives, proposing alternative solutions that better address social needs. Additionally, municipal companies frequently seek out smart solutions independently, devising innovative ways to apply them in the pursuit of sustainable regional development, and therefore bringing invaluable contribution to this process.

The research problem explored in this article is twofold: What smart solutions are being developed by municipal companies to advance sustainable development goals? Do Polish municipal companies align with European trends in this regard?

The article aims to analyze smart solutions implemented by municipal companies internationally (drawing from the most highly cited literature on the subject) and to identify noteworthy smart solutions adopted by Polish municipal companies that contribute to achieving regional sustainable development goals. Through a case study approach, the article presents selected insights from a pilot study involving representatives of municipal companies in the Kuyavian-Pomeranian region of Poland.

Literature review

A thorough review of the literature enables the identification of the most frequently cited studies published in reputable journals on topics such as water supply management, waste management, and energy at the regional level. Among these areas, energy management stands out as particularly relevant for Polish regional municipal companies, as they are still in the early stages of engaging with this sector.

Hulst et al. (2009) conducted a comparative analysis of inter-municipal cooperation across eight European countries. Their findings reveal a wide range of institutional arrangements governing local government collaboration. These arrangements are dynamic, evolving in terms of the scope of cooperation, the composition of participating partners, and the degree of organizational integration. In the specific context of inter-municipal cooperation agreements aimed at the joint provision of public services, there is no universally optimal model. Instead, the adopted solutions typically stem from the interplay between local or national institutions, environmental conditions, and local preferences (Hulst et al., 2009).

In the area of water supply management, noteworthy research includes studies on modeling the production structure of urban water utilities, exemplified by local communities in the Bordeaux region of France. These studies contribute to the broader discourse on ownership and regulation of community drinking water supply (e.g., Bhattacharyya et al., 1995; Teeples & Glyer, 1987). The authors suggest that local communities may benefit from integrating with water districts, although such benefits are not universal. The advantages of integration are most pronounced when up to five communities are merged. Beyond this threshold, diseconomies of scale begin to emerge (Garcia & Thomas, 2001).

Some policymakers advocate for the privatization of public water supplies as a means of enhancing the capacity of water sector, particularly in developing countries. However, this is a highly sensitive and complex issue, as it involves balancing private ownership with the imperative to address fundamental social needs. An alternative approach to privatization could involve reforming the public water supply sector. Using the case of Mexico, Anwandter & Ozuna Jr. (2002) illustrate that neither decentralizing water management responsibilities to the municipal level nor establishing an autonomous regulatory body significantly improved the efficiency of water utilities. They argue that such reforms should have been paired with measures to introduce competition and mitigate information asymmetries within the municipal water sector.

In certain cases, the introduction of private capital into the water supply sector has yielded positive outcomes. For instance, in some regions of France, public waterworks are managed by private operators. Under appropriate regulatory frameworks, market mechanisms effectively balance supply and demand. Additionally, privatization can help address some of the inefficiencies associated with publicly managed water systems, such as water losses. However, an essential aspect of this arrangement is the negotiation of water prices between municipalities and private operators. Research conducted on French municipalities indicates that the negotiated price of water is influenced by the specific characteristics of the municipality,

leading to price endogeneity in the demand equation. Setting an expected per capita consumption within the municipality plays a crucial role in pricing strategies, as a measure aimed at reducing water usage. Studies have demonstrated that water consumption is markedly lower in individual residential buildings equipped with meters compared to collective housing. Despite this, the demand for water exhibits low sensitivity to changes in price and income. Therefore, the authors advocate for the adoption of non-price policy measures to promote water conservation. These include subsidies for low-flow devices, implementation of advanced technologies, and information campaigns (Nauges & Thomas, 2000).

Solid waste management policy is a critical public service with significant implications, as it directly relates to twelve of the seventeen United Nations Sustainable Development Goals (SDGs). Research findings indicate that an effective policy in this domain should incorporate a combination of direct regulation, economic instruments, and social instruments. Relying exclusively on any single category is insufficient; instead, it is essential to introduce complementary and well-coordinated measures from all three categories. This approach is particularly crucial in less developed countries, where achieving waste management goals requires innovative strategies. These include reorganizing waste management processes, restructuring financing mechanisms, and transforming the communication and operational practices of municipal departments. Additionally, fostering behavioral changes among local community members is fundamental to the success of such policies (Rodić & Wilson, 2017).

Waste management is a key municipal service that entails significant financial, operational, and environmental costs. These include substantial investments in infrastructure (e.g., vehicle fleets), operational expenses (e.g., fuel and maintenance), and environmental impacts (e.g., exhaust emissions, noise, and traffic congestion). A study by Faccio, Persona, & Zanin (2011) highlighted the practical application of traceability technology to optimize the solid waste collection process. The researchers developed an innovative vehicle routing model integrated with real-time data to minimize these costs, thereby alleviating the burden on local communities and enhancing resident satisfaction. This model was implemented in an Italian city with a population of 100,000. Modern traceability technologies, including volumetric sensors, Radio Frequency Identification (RFID) systems, as well as GPRS and GPS technologies, enable real-time data collection. This data serves as the basis for implementing an efficient and innovative waste collection coordination system. By monitoring real-time information on vehicle locations and garbage container fill levels, municipalities can make dynamic decisions about which containers require immediate emptying and which do not, based on waste generation patterns. This

approach optimizes various aspects, including total distance traveled, the number of vehicles required, and the overall environmental impact (Faccio et al., 2011).

A key question is whether effective waste management is feasible in developing countries. This issue was examined by Wilson, Velis, & Rodić (2013), who explored how cities in these regions address solid waste challenges. Their findings reveal that waste management policies in developing countries differ significantly from the integrated waste management systems employed in developed nations. The research approaches also diverge: while studies in developed countries focus primarily on technological integration, those in developing countries emphasize the traditional components of integrated sustainable waste management. In developing nations, both physical elements (such as waste collection, disposal, and recycling) and management aspects (including the integration of users and service providers, financial sustainability, and the establishment of coherent, proactive institutional frameworks) are analyzed. A review of available data indicates substantial progress in system performance over the past decade. For instance, middle-income cities now commonly achieve collection and controlled disposal rates of 95%, while low-income cities average around 50%. Moreover, informal sectors in many low-income countries achieve recycling rates of 20–30%, often at no direct cost to municipalities. The data underscore that efficient, effective, and affordable systems can be tailored to local needs and conditions, developed with the active participation of service beneficiaries. Despite persistent challenges, the modifications and improvements made in recent years suggest that sustainable solid waste management in developing countries is indeed achievable (Wilson et al., 2013).

Henning (1997) introduced the energy system optimization model known as MODEST, which has been implemented in a typical local Swedish power and district heating plant as well as in the national electricity system. This comprehensive model incorporates numerous parameters on both the demand and cost sides. It accounts for variations across seasonal, weekly, and daily timescales, including fluctuations in demand, costs, and capacity. MODEST serves as a decision-support tool for investment planning, determining the appropriate scale for new installations, and optimizing the operation of all system components. Analyses of the model's outcomes suggest, for example, that at the existing taxation levels, fossil fuels are economically viable for use in heat and power plants. However, biofuels become more advantageous when higher environmental fees for CO2 emissions are introduced. Increasing biomass production capacity could potentially reduce local CO2 emissions by up to 80%. Moreover, the findings indicate that Swedish electricity demand could be met without relying on nuclear power or fossil fuels by

extensively utilizing biomass, wind energy, and implementing energy conservation measures (Henning, 1997).

Several researchers have examined the operations of local electricity distribution companies. Such entities are able to meet a portion of their future electricity demand through independent production and participation in variable spot markets. The remaining demand can be fulfilled via fixed-price futures contracts, a strategy that helps mitigate the inherent risk associated with spot price volatility. Woo, Karimov, & Horowitz (2004) developed a theoretical framework to optimize futures contract purchases for the least developed countries (LDCs), aiming to minimize expected procurement costs. Using a hypothetical municipal public utility company in Florida as a case study, they addressed the questions: "What to buy?", and "How to buy?". Their findings demonstrate that decisions regarding futures contracts in LDC regions align with least-cost procurement principles while adhering to constraints on cost exposure. Additionally, their research showed that a multi-round online auction could yield competitive price bids for targeted futures purchases (Woo et al., 2004).

Filippini (1998) examined the cost structure of Swiss electricity distribution companies to evaluate economies of scale and the potential benefits of competition in electricity distribution. The findings reveal that economies of scale are present primarily in small and medium-sized power companies. Empirical evidence indicates that franchise monopolies, rather than pure competition, represent the most efficient organizational model for electricity distribution. Furthermore, the analysis showed that most of the companies studied did not operate within optimally sized service areas. As a result, the consolidation of small distributors with adjacent service areas is likely to reduce costs (Filippini, 1998).

Social services, encompassing areas such as culture, sports facilities, healthcare, and public housing, have drawn high interest from researchers. Urban municipalities, and to a lesser extent rural ones, frequently allocate substantial public funds to develop large-scale entertainment projects, including stadiums, convention centers, entertainment districts, and festival venues. These facilities are typically managed by municipal companies established specifically for this purpose. Municipal leaders often anticipate rapid returns on such investments, driven by the influx of tourists attracted to these amenities. However, Eisinger (2000) warns that prioritizing city development with a focus on tourists rather than residents can erode trust between authorities and the local community. This approach may also compromise residents' quality of life by diverting resources away from essential municipal services. In regions with significant tourist activity, local residents are increasingly recognizing these challenges and responding with strong opposition (Vinayaka, 2024).

A growing number of regions are prioritizing advanced telecommunications services, particularly high-speed broadband Internet access, as a means to accelerate progress toward sustainable development goals. Gillett, Lehr, & Osorio (2004) proposed a classification of such local government initiatives based on an analysis of communities in the United States. Their study pointed out that municipal energy companies play a leading role in establishing publicly owned communications infrastructure.

The issue of privatizing infrastructure and municipal services has been extensively discussed in the literature. American examples are particularly valuable from the European perspective, as privatization processes in the municipal sector were implemented in the United States several decades ago, allowing a more comprehensive evaluation of their outcomes. Dilger, Moffett, & Struyk (1997) analyzed various aspects of municipal privatization, including the level of government satisfaction with the process, the reasons cities opt for privatization, the extent to which privatization reduces costs and enhances service quality, its impact on employees' remuneration packages, methods cities use to monitor the quality and effectiveness of privatized services, and the lessons municipalities have drawn from their privatization experiences. These questions were directed to officials in major US cities. The researchers concluded that while privatization is generally accepted as an alternative approach to delivering municipal services, it is not regarded as a universal solution to the challenges and inefficiencies facing the sector.

Smart solutions in municipal companies of the Kuyavian-Pomeranian Voivodeship: a case study

It is important to emphasize at the outset that implementing the concept of a smart region does not necessarily rely solely on the integration of advanced technological solutions. While technology undoubtedly serves as a dynamic driver in this process, the critical factors for success often lie in the vision of local authorities, socially conscious activists, and innovative, creative communities. Only such a comprehensive understanding of the SmartRegion concept holds the potential to create cleaner, healthier, more comfortable, and overall better living environments for residents.

The focus of this study includes selected municipal companies from the Kuyavian-Pomeranian region. The activities of these companies extend beyond the boundaries of the municipalities where they are registered, allowing them to be considered regional entities. This paper aims to highlight smart solutions – those

that contribute to the accelerated achievement of sustainable development goals across the region in which they operate.

According to data from the Central Economic Information Bureau, the Kuyavian-Pomeranian region is home to 148 municipal companies. To conduct a pilot study and gather detailed information on some of these entities, a query was performed through the National Court Register. As a result, contact information was obtained for 57 commercial entities involved in municipal activities. While this sample does not encompass all entities within the municipal sector of the voivodeship, it is sufficient for the pilot study. The list will be gradually expanded in subsequent research phases.

To pre-select companies for in-depth research, a concise interview questionnaire was developed, in which representatives of municipal management entities were asked, i.a., if any aspect of their activities aligns with the concept of smart sustainable development for the region. Additionally, they were queried on whether these activities extend beyond the operations of the local government that established the company. The respondents were invited to briefly describe what they considered the most significant area of their activities that aligns with this concept. The initial round of responses yielded a return rate of 17% of the entities surveyed.

The most notable areas of activity that had been identified as aligning with the concept of smart sustainable development in the region included the integrated management of water and sewage systems, the construction of a regional waste incinerator financed through EU funding, and the establishment of a regional airport.

Before delving into specific examples of municipal companies' contributions to smart development within the Kuyavian-Pomeranian region, it is important to highlight the regional government's approach to this issue. In 2013, at the initiative of the voivodeship sejmik (regional assembly), a municipal company named Kujawsko-Pomorska Agencja Innowacji spółka z o.o. (KPAI) was established. The company's primary mission is to promote the region as a hub of knowledge and innovation through fostering effective cooperation between regional authorities, entrepreneurs, scientific institutions, and universities. KPAI's activities also focus on creating a support system for fostering entrepreneurship and business innovation in the Kuyavian-Pomeranian region. Moreover, the agency serves as a collaborative platform for connecting regional entrepreneurs, scientific institutions, universities, business environment organizations, and local and regional authorities.

One of the central activities of the aforementioned company was the development of a regional innovation strategy, which included identifying the so-called smart specializations of the Kuyavian-Pomeranian region. The approach to defining these specializations was based on a model that integrates methodologies traditionally

used in designing business models in the private sector with the principles of planning public interventions. Smart specializations refer to sectors of the economy and fields of science deemed by experts to be critical for the region's development. These areas were identified in order to align various components of regional development policy, thereby enhancing the innovative capacity of the regional economy and consolidating knowledge resources. Beyond the standard economic benefits for the region, such as achieving economies of scale, expanding market offerings, and facilitating knowledge diffusion, smart specializations also offer direct advantages to companies as they simplify access to EU funding opportunities. Regional policy frameworks have integrated this concept by designing regional operational programs that prioritize and promote economic activities within these smart specialization areas.

In the area of water and sewage management, four municipalities in the western part of the voivodeship (Szubin, Kcynia, Nakło, and Sadki) have opted to jointly implement a collective water supply policy. This policy encompasses the activities related to water capture, treatment, and distribution, as well as the collection and treatment of sewage. The municipalities determined that this approach offers economic advantages. They agreed to partially share infrastructure maintenance responsibilities and to develop common policy guidelines for collective water supply. This approach brings several key benefits. First, it enables the distribution of investment costs among the company's shareholders, facilitating the development of the infrastructure required for drinking water supply and wastewater management – investments that are highly expensive. Second, it enhances the reliability of these essential municipal services for residents. Finally, by leveraging economies of scale, the collaboration creates opportunities to offer competitive pricing for municipal services to both residents and businesses within the region. This, in turn, can serve as a catalyst for regional development.

A good example of the outcomes of smart sustainable development policies in the Kuyavian-Pomeranian region is the Municipal Waste Thermal Treatment Plant in Bydgoszcz. This facility is among the first large-scale waste incineration plants in Poland to receive support from EU funds. Following an agreement signed in 2009, the project secured up to PLN 255 million in co-financing from the Cohesion Fund. The agreement involved 17 local government units within the Kuyavian-Pomeranian region, serving a combined population of approximately 750,000. The incinerator, operational since late 2015, generates heat and electricity while addressing a significant portion of regional waste in an environmentally sustainable manner. In an era characterized by increasing waste production, this initiative represents a critical and much-needed advancement. Furthermore, the cooperative efforts among regional

municipalities have enhanced the perception of the project from the government's perspective, fostering hope that continued collaborative initiatives will position the region as a reliable and cohesive partner. The plant's successful operation has also inspired other local governments to pursue similar initiatives.

The final example of municipal policy highlighted here is the regional agreement to establish and operate an international airport in Bydgoszcz. The primary stakeholder in this initiative is the government of the Kuyavian-Pomeranian voivodeship, holding nearly 79% of the shares. The remaining shares belong to local governments, including Bydgoszcz, Toruń, Inowrocław, and Sicienko, which were motivated by the prospect of diverting some air traffic from other regional airports. The involvement of the voivodeship government ensures not only the development of the airport itself but also the expansion of supporting infrastructure, such as rail and road networks connecting to the airport. This transportation initiative, while rooted in municipal policy, extends its influence far beyond the immediate region. Its impact is often felt across neighboring regions, reflecting its broader significance. The project is strategically designed to increase the region's appeal by providing fast and convenient access to its central locations. This improved connectivity benefits logistics for businesses, strengthens the region's economic position, and opens new avenues for tourism development.

Conclusions

The analysis of the subject literature proves that municipal companies play a pivotal role in advancing sustainable development policies within regions. The reviewed entities focus primarily on enhancing the efficiency of municipal policy decision-making processes. Furthermore, the cited examples of studies in waste management, water and sewage management, energy, and telecommunications illustrate how these companies actively explore innovative opportunities to shape and influence municipal policy. The privatization of municipal services remains a significant topic of interest among researchers. Such insights are also highly relevant to decision-makers, particularly in terms of analyzing the outcomes of previously implemented privatization processes.

Examples of Polish municipal companies operating beyond local governments demonstrate that the solutions they implement align with global practices. In an era of widespread information access, regional entities often adopt internationally proven methods. For instance, the waste incineration plant in Bydgoszcz has established a knowledge-sharing agreement with the operator of an Italian facility.

Additionally, during the planning phase of the investment, a study visit to Berlin was undertaken to gather insights from the waste incineration plant operating there.

The findings from the pilot study suggest that the selected research area holds significant promise. A comprehensive examination of regional municipal companies offers not only fundamental research value but also substantial practical applications. It can be anticipated that the role of municipal policy in fostering the smart and sustainable development of regions will continue to grow. This is evidenced by the increasing number of such companies and the progressively ambitious nature of the projects entrusted to them.

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