THE INCORPORATION OF OPEN DATA
IN THE DEVELOPMENT OF THE SMART CITY

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Abstract: The development of technology and the progress of digitization have made smart cities a direction of development for many cities worldwide, including Poland. This concept refers to cities where innovative technologies and data are utilized to enhance the efficiency of city operations and improve the quality of life for residents. In this regard, open data from public administrations are one of the key elements of smart city development, which can be leveraged by programmers and other specialists to create applications and tools that help address urban challenges.

In this study, after providing a theoretical overview of the subject, an analysis of secondary data from reports will be conducted (Dane.gov.pl/…, 2020-2022). The focus was on diagnosing the "open data" processes in Polish public administrations. The aim of the undertaken study was to determine the state of public data availability for reuse in Poland, identifying the reasons behind the current level of data accessibility, and providing forecasts for the near future.

Key words: management, open data, smart city

Introduction

In order to increase efficiency and improve the quality of life for residents through the utilization of modern technologies and data analysis, an increasing number of cities are now focusing on the development towards smart cities. One of the key elements in this process is open data from public administrations, which allow for a more precise and comprehensive approach to city development.

Open data refer to publicly available information that can be used by anyone without restrictions, forming the basis for creating innovative solutions. In the context of smart cities, open data from public administrations enable a thorough analysis of residents' needs and the identification of areas that require improvement. This allows for more efficient city management by delivering public services that are better tailored to the needs of residents.

Open data are also crucial in the context of developing new technological solutions. Access to public data enables a better understanding of how cities function, thereby facilitating the creation of more precise tools and applications that can help address various issues (e.g., optimizing traffic flow, reducing pollution and noise levels, creating queuing systems, etc.) (Tura , Ojanen, 2022; Saʹnchez-Corcuera et al., 2019, p. 9).

It is worth noting that open data bring benefits not only to the public sector but also to private companies and investors. Access to data allows for a better understanding of residents' needs and preferences, enabling the creation of more tailored products and services. Open data also encourage investment in the city, which has a positive impact on its sustainable economic development (Manimuthu, Dharshini, 2020, p. 1).

In Poland, since August 2021, there has been a law on open data in force, which imposes an obligation on public administration units to provide data on the Dane.gov.pl platform in a dynamic manner and through APIs. This is a milestone in the development of open data in Poland, which will help in utilizing them for building smart cities (Dz.U. 2021 poz. 1641).

However, the level of engagement of public administration units in providing so-called open data may vary, which is why the aim of this study will be to determine the current state of affairs in this matter and identify its causes and possible measures supporting the "open data" processes. To achieve these research objectives, secondary data analysis was conducted based on reports prepared by the "Data Management Department Expert Team of the Chancellery of the Prime Minister" regarding the reuse of public data in Poland. (Dane.gov.pl/…, 2020-2022).

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What are open data?

Open data are data that can be freely used, reused, and distributed by anyone, provided that the sources are attributed and the data are shared under the "share and rule" principle.

The data must be available in their entirety and should not exceed reasonable reproduction costs. Ideally, they should be provided in a convenient and modifiable format. Additionally, the data must be provided on terms that enable their reuse and redistribution, including blending with other datasets. No one should be discriminated against based on fields of activity or individuals or groups. Examples of open data include government statistics, weather data, and financial information. It is essential to be clear about the definition of open data to ensure interoperability, which is the ability of different systems and organizations to collaborate, allowing the integration of different datasets to develop more advanced products and services. Focusing on providing non-personal data that do not contain information about specific individuals is crucial. However, certain types of government data may be subject to restrictions related to national security (Open Data Handbook).

In Poland, open data are collected and provided by various institutions and organizations, both public and private. The most important ones include:
1. The Service of the Republic of Poland - https://dane.gov.pl
2. The Central Statistical Office - https://stat.gov.pl
3. The National Digital Archives - https://www.nac.gov.pl
4. The Bulletin of Public Information - https://www.gov.pl/web/bip
5. The Geoportal of Spatial Information Infrastructure - https://www.geoportal.gov.pl

When it comes to data provided by the Central Statistical Office (GUS), Poland holds a very high position in the Open Data Inventory (ODIN) ranking in terms of open data availability. In 2022, Poland once again ranked 2nd in the world out of 192 countries. This ranking takes into account the accessibility and openness of data published by national statistical offices (GUS, 2023).

Legislation regarding open data in the public administration in Poland

EU law has been mandating the provision of open data in member states since the 1990s.

In 2019, the EU Council adopted the latest directive on open data and the reuse of public sector information, which replaces the previous directive from 2013 and introduces more stringent standards regarding openness and the reuse of public sector data (DIRECTIVE (EU) 2019/1024).

In Poland, the process of creating regulations governing the sharing and re-use of data in the public sector has been ongoing since the 1990s, as in the EU. Examples of such laws include the "Code of Practices for Accessible Intranet Offices" and the "Code of Practices for Tax Office Work".

In 2021, the latest laws on the reuse of public sector information (ISP) were adopted. These laws implement EU regulations on open data in Poland. The laws establish rules regarding the provision and reuse of public data and require public entities to create data provision plans. They also introduce the obligation for public entities to publish information about data that is not available in an open manner, along with an explanation of why this is the case. Additionally, the laws introduce new penalties for violations of provisions related to the provision and reuse of public data, such as financial fines or contractual penalties (Dz.U. 2021 poz. 1641).

The most important platform for presenting and sharing open data from administrative units in our country (Local Government Units – LGUs; abbreviation in Polish - JST) is the Republic of Poland Service (portal: Dane.gov.pl).

Data are made available here free of charge in a static manner: in the form of downloadable files with interactive tables, charts, and maps.

The website also enables dynamic data sharing through the use of an API (Application Programming Interface). This is a set of rules, protocols, and tools that enable programs to communicate with each other and exchange data (Standard API, www.gov.pl/…; Manimuthu et al., 2021).

Both EU and Polish legislation in this area aim to facilitate access to public information and increase the use of public data, which are important steps towards improving the quality of life for citizens and promoting a knowledge-based economy.

The idea of a smart city

In Polish, the most commonly used translations are "intelligent city" or "wise" and the English adjective "smart" (Gotlib, Olszewski, 2016; Stawasz, Sikora-Fernandez, 2015). Research conducted in the United Kingdom has shown that only 4% of the surveyed residents were able to name a local initiative that meets the standards of a smart city (Ryba, 2017). The word "smart" in the context of devices is translated as "intelligent," but the concept of a smart city is not limited solely to the technological aspect (Kaur, Maheshwari, 2016, pp. 1-5). Using the original English adjective is justified because it is already widely used and has the potential to become part of the Polish language. With the above in mind, I propose translating the definition of a smart city into Polish as "a city tailored to fit" because the solutions implemented in it should be like a tailor-made suit, as not all IT, technical, and technological solutions are necessary or suitable for a particular city on various scales (ChuanTao et al., 2015, p. 4).

Open data are essential elements of the smart city concept, enabling the collection, analysis, and utilization of information about the city in an efficient and accessible manner for all interested parties. This allows city residents to better understand how their environment functions and identify the problems that need to be addressed (Jara, Genoud, Bocchi, 2014).

In the development of smart cities, various types of data are utilized, such as data on traffic flow, air quality, energy consumption, water consumption, and data on public services like public transportation, healthcare, and education. These data originate from different sources, including sensors, traffic management systems, air quality monitoring systems, as well as Internet of Things (IoT) devices such as smart energy meters and urban transportation-related devices (Azrour, Mabrouki, Guezzaz, Kanwal, 2021).

Sharing this information and data also has a positive impact on citizen participation in the city management process as it allows them to actively engage in decision-making and implementing changes. The openness of data also enables collaboration among different institutions, leading to better resource utilization and coordination of city-level actions (Nuaimi et al., 2015, p. 11).

Research methodology

In this study, a secondary data analysis method was used based on data from three reports prepared by the "Expert Team of the Department of Data Management at the Chancellery of the Prime Minister" on the reuse of public data in Poland (Dane.gov.pl/…, 2020-2022).

Report No. 1 (N=84): A report on a study regarding the provision of dynamic data by cities through Application Programming Interfaces (APIs) - (the study was conducted in 2021 prior to the implementation of the Act on Open Data and Reuse of Public Sector Information - Dz.U. 2021 poz. 1641). The aim was to analyze the extent of dynamic data provision by Polish cities through Application Programming Interfaces (APIs) (Report No. 1, 2021);

Report No. 2 (N=96): Experiences of Local Government Units (LGUs) in data provision and utilization - a report on a study conducted in Local Government Units (carried out from October 3 to November 10, 2022, i.e., after the implementation of the Act). The aim of the study was to assess the level of advancement in the process of opening data in LGUs at the level of county offices and voivodeship assemblies (Report No. 2, 2022);

Report No. 3 (N=384): Evaluation of the Dane.gov.pl portal - a report on a study conducted among users of the portal. The online research was carried out from May 22, 2020, to January 18, 2022 (the survey was placed on the Dane.gov.pl portal) (Report No. 3, 2020-2022);

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The purpose of this study is to indicate the state of availability of public data for reuse in Poland, to identify the reasons for the current levels of data availability, and to provide forecasts for the near future.

The state of availability and the dynamics of the data opening process, as well as the identification and description of actions taken in the area of sharing and reusing public data in Poland, will be determined by comparing the Research Reports before and after the implementation of the "Act of August 11, 2021 on Open Data and Reuse of Public Sector Information." On the other hand, the size of the market as well as the trends and preferences of users regarding the Dane.gov.pl portal will determine the path of forecasts for the future.

Research analysis of Reports No. 1, 2, and 3

Based on the data presented in the reports from the research conducted on municipal public administration (regarding the provision of open data in API) and LGUs (provision in API and on the Dane.gov.pl portal, as well as dynamically), it can be concluded that:

- the majority of cities and LGUs do not provide their data through APIs: less frequently in cities (about 60%) and more frequently in LGUs (over 80%) when considering the combination of 53.1% 'no' responses and 29.2% of surveys with no responses;
- there is an observed trend that the larger the population served by the units, the more often they provide their public data through APIs (e.g., in cities with over 300,000 residents), 100% of units provide access; in cities with 40,000 to 299,999 residents, it ranges from 33.3% to 39%; whereas in LGUs, it is only 17.7%);
- in cities with a population of 40,000 residents or more, the most commonly provided data categories include: public transportation, air quality, address points, local spatial development plans, geodesy and cartography, environment, map services, tourism, and recreation. On the other hand, in LGUs, access is indicated for geodetic data (Geoportal), company teleaddress information (BIP), and queue management systems (kiosk-style ticket machines);
- in light of the new August 2021 Act on Open Data and Reuse of Public Sector Information, researchers from cities declare the following: 18.4% state that actions enabling the provision of dynamic data through APIs are already being implemented in their cities; 30.6% plan to take actions that will enable the provision of dynamic data in accordance with Article 24 of the Act; 40.8% express a desire to work towards the goal of data provision through APIs without specifying specific solutions; 10.2% do not have any planned actions; regarding the surveyed LGUs units that currently do not provide dynamic data: only one in twenty (5%) has taken actions towards providing dynamic data; 10.2% do not plan to take any actions to enable the provision of dynamic data through APIs (In the case of three cities, the reason was not specified);
- among the most frequently mentioned barriers (reasons) for non-provision of data by LGUs, the following are cited: lack of suitable tools, knowledge, and finances, as well as the demand for data. 90% of offices utilize their own data resources, while only about 10% of the surveyed units access data posted on the Dane.gov.pl portal;
- users of the Dane.gov.pl platform consider PDF as the most useful data format for them (47.7%), followed by: XLS, XLSX (38.3%), CSV (35.4%), JPEG, PNG format (26.6%), JSON (25%), XML (25%), and DOC, DOCX (23.4%). HTML (12%), RDF (5.7%), ODS (3.4%), while other formats received a combined 16.1%;
- 58.3% of users of the Dane.gov.pl portal consider access to data through APIs as significant; 14.4% of respondents find APIs less significant but still use them; and 27.3% do not consider APIs important as they do not utilize this method of data retrieval.

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Summary

The concept of a smart city initially referred to cities utilizing intelligent technology in urban services. This concept has been supplemented with additional dimensions, such as: Smart People or Citizens; Smart Governance; Smart Environment and Resource Management; Smart Homes, Buildings and Living; Smart Education; Smart Transportation, Parking and Traffic Lights; Smart Healthcare; Smart Grid and Energy; Emergency and Public Safety; Cybersecurity Management (Sarker, 2022). The implementation of smart products and services necessitates the development of additional dimensions.

Open data have the potential to support innovative technological solutions and increase citizen engagement in decision-making processes. Examples of smart cities show that they are cities with high mobility of residents, the adoption of solutions conducive to reducing carbon dioxide emissions and other pollutants, as well as green cities where people live healthier lives; in other places, by providing crime maps to the police, social engagement has contributed to a decrease in crime rates (Haarstad, Wathne, 2019).

The implementation of the smart city concept varies across different cities, influenced by a range of factors, including the availability and utilization of public data. However, it is worth noting that for the maximum benefit of residents from the development of smart cities, appropriate policies from authorities are necessary. To make data-driven decisions, authorities must move towards data sharing (Neves, de Castro Neto, Aparicio, 2020).

City managers, when selecting and deploying smart products and services, must think beyond inclusivity and avoid closing off their data to external businesses and individuals. Doing so would hinder their engagement in the development and life of these cities. Open data provide opportunities not only to respond to the needs of city residents and local businesses but also to facilitate the coordination of various activities, leading to cost reduction and profit maximization (Sarker, 2022, p. 6).

Even with limited financial resources, especially in smaller cities, local authorities should focus on implementing modern technology in urban products and services while considering long-term financial forecasts regarding available budgetary resources. An important tool for developing strategic city management for smart city development is access to public data. Obtaining information about the city, its population, and the functioning of public systems can support the development of more effective public policies and better organization of transportation and environmental protection (Bibri, 2018, pp. 2-3).

In conclusion, open data from public administrations play a crucial role in the development of smart cities. However, to effectively utilize this data, it is necessary for public administration entities to widely share it in accordance with applicable laws. Nevertheless, simply sharing data by public administrations is not sufficient for smart city development. Broad social engagement and collaboration among the public, private, and academic sectors are also required to maximize the efficient and beneficial use of this data for the well-being of city residents.

The implementation of an open data policy should be preceded by appropriate training for residents to understand the benefits and significance of data sharing. Additionally, adequate tools and processes should be provided to ensure the effective and ethical utilization of this data.

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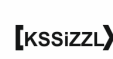
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