
Public Information Asymmetry and Its Impact on Urban Governance Efficiency

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Abstract:

Purpose: This article has a theoretical character and its aim is to analyze the importance of public information in urban management, with a particular focus on the phenomenon of information asymmetry and its impact on the efficiency of decision-making processes.

Design/methodology/approach: Based on a review of national and international literature, the authors systematize knowledge about the role of information as a key resource in urban governance. The causes, mechanisms and consequences of unequal access to public data are presented, as well as theoretical proposals for strategies to reduce this phenomenon.

Findings: Public information, being one of the basic organizational resources, enables rational decision-making and supports the transparency of city administration activities. The article identifies the main sources of information asymmetry, such as technological barriers, insufficient digital infrastructure, lack of transparency in the administration's operations and limited digital competences. An additional factor is the deliberate concealment of data by authorities and the low level of public interest in public affairs. The consequences of information asymmetry are significant and include inefficient use of resources, decreased public trust and reduced civic participation. Unequal access to information also leads to difficulties in coordinating activities between stakeholders, which hinders the implementation of sustainable urban development strategies. The authors highlight the key role of digital transformation in reducing information asymmetry. The smart city concept presented in the article implies the use of digital technologies to improve accessibility, integration and transparency of public data. Synchronization of information management systems can support efficient decision-making processes and build trust between the administration and stakeholders.

Practical implications: The article proposes concrete actions, including the development of interoperable data systems, enhancing digital competences of officials and promoting public-private partnerships. The authors point out that providing universal access to reliable public information is a prerequisite for democratic governance and sustainable urban development.

Originality/value: The article makes a theoretical contribution by demonstrating the importance of public information in shaping effective and inclusive models of urban governance, while pointing to courses of action to reduce information asymmetry.

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1. Introduction

Information in any organization, and we consider the city to be such, is, along with finance, objects, development, the environment and people, one of the basic resources used in management processes. Its primary function boils down to giving managers the ability to assess the decision-making situation and thus make rational decisions.

The efficiency and effectiveness of the actions taken by the city authorities in the name of guaranteeing the public interest depends on using resources without unnecessary waste, making the right decisions and successfully implementing them. In practice, this depends to a large extent on having an adequate supply of information and the ability to read its meaning, i.e., on knowledge describing a given slice of reality.

Information should be sufficiently accurate (accurately and reliably reflecting reality), timely (available at the time the manager is working out a decision and putting it into action), complete (providing all the facts needed and at the right level of detail) and relevant (giving confidence that it is useful) (Kiełtyka, 2022).

The availability of up-to-date, factual and useful public information should be universal. And the prerequisite for real access to information is the creation of mechanisms that would foster different actors (public and private spheres) to be interested in collecting and uploading information into systems and sharing information with others (Wrana, Kmieć, and Kmieć, 2014).

The concept of information itself does not yet have a single, well-defined definition. Some aspects of this concept are raised by various authors. It is important to emphasize that information ensures communication, connectivity between certain objects, which results in the elimination of indeterminacy and allows them to be controlled, has value for decisions and actions, may influence changes in the behaviour of the recipient of the information, is not suspended in time and space, can be stored and transmitted and, most importantly, is a source of knowledge (Krzakiewicz and Cyfert, 2020; Wojnarowska, 2010). Information is treated as an organizational resource.

The characteristics of information as a resource are: increasing knowledge of the organization and its environment, supporting change processes in the organization, improving communication in the organization, increasing the level of knowledge of the organization's employees, reducing the risk of making wrong decisions, creating an advantage over competitors (Kiełtyka, 2022).

Information is generated by analyzing and processing data relating to a certain state of reality, which in turn will be the subject of a decision-making process. Therefore, we may assume that we are dealing with a sequence of relationships: data - information - knowledge - decision. The process of information management itself involves recognizing what the data will be, collecting that data, making a mental analysis as to the meaning of the data sets acquired, and then storing, retrieving, processing and communicating and, in some situations, its dissemination.

Dissemination primarily refers to the public's access to information of a public nature, which, by definition, should contribute to public sphere organizations (including, of course, the municipal authorities) taking action in line with the expectations of their stakeholders. An adequate supply of information ensures that decision-making centres are able to make decisions under conditions of certainty, which is a guarantee in the most general sense of ensuring the agility, effectiveness and efficiency of management.

Data is collected by different organizations, entities, institutions in different cross-sections, at multiple levels of detail, etc. In each specific case, this is conditioned, for example, by the multiplicity and type of objectives pursued, the scope of activities, contacts with the environment, legal requirements, costs, the assumed usefulness of the resulting information.

They may relate to the situation in which the organization operates, its tasks and problems, the development strategy pursued, marketing activities, relationships with other actors (suppliers, customers), social processes, consumption preferences, election results, regulations, disasters and climate change, innovation, technological and social change, developments in artificial intelligence, events of national and supranational importance, etc.

Despite the acquisition of a great deal of information by organizations and actors, it is in the relations between them that the phenomenon of information asymmetry is often revealed, which translates into a distortion in the operation of the market, through inefficient allocation of resources (Akerlof, 1970; Stiglitz, 2004). Information asymmetry consists of unequal access to information important to both parties to a transaction. It is a situation in which one party, with an information advantage, gains a privileged negotiating position in the transactions being concluded. In such a case, there is a risk of adverse selection, moral hazard, and signaling (Akerlof, 1970; Blajer-Gołębiowska, 2012).

In the public sphere, unequal access to information occurs at the state level, between public organizations operating in a region or city, NGOs, business entities, i.e. services, guards, inspections, responsible for ensuring social order, informal groups of citizens, residents, etc.

The phenomenon of information asymmetry can also be observed within any particular public organization. The causes of this phenomenon can be either temporary or permanent, and the effects may be seen, for example, in transaction costs, unjustified losses for one of the parties, intra-organizational conflicts, lack of coordination, loss of trust among contractors, recipients of public services, residents, etc.

This paper uses a conceptual and theoretical approach to explore the role and importance of public information in effective urban governance. It focuses on analyzing the asymmetry of public information and its impact on the efficiency of city management. It first discusses the importance of public information as a key resource in management processes, pointing out its role in knowledge-based decision-making and ensuring transparency in city administration.

Next, the paper systematizes knowledge about internal and external factors affecting the availability of public information and examines the causes of information asymmetry, both at the systemic and organizational levels. An important element is also a discussion of the practical consequences of inequality of access to information for stakeholders, as well as suggestions for strategies to reduce it in urban governance.

2. Urban Governance and the Importance of Public Information

The main purpose of the city's functioning is to meet the collective needs of its inhabitants, which is determined by its level of socio-economic development. This objective consists of subobjectives from the economic, social, spatial, environmental, cultural areas. The implementation of the main objective and its subobjectives is possible thanks to the resources available to the city and the decisions made by authorized bodies.

A large number of entities with different ownership and organizational and legal forms participate in the implementation of public tasks to achieve the adopted objectives. Obviously, the city authorities have a central role in the management process, but auxiliary structures such as municipal companies, budget centres, budgetary units, neighbourhoods, housing estate councils, services, guards, inspections, government administration units, etc., also play an important role. The city is also a field of activity for many economic entities, guided by different objectives, selection criteria, value systems. When referring to urban governance, it is important not to forget the objectives, priorities, expectations of stakeholders and citizens.

For business entities, stakeholders, many formal and informal groups, residents, the city (municipal authorities) is an area whose condition limits or stimulates the efficiency of their operations. For this reason, a very important factor in achieving the city's main objective is cooperation, coordination and communication between the different activities in the city. This is possible when all parties interested in an issue or topic have access to relevant information.

Urban governance can be seen as activities aimed at ensuring the effective functioning of the entire public sector, in the sense of guaranteeing the effectiveness of public organizations and institutions (of the central and local governments) and NOGs, through proper use of the resources at their disposal in the processes of achieving the set objectives. With this understanding of governance, there is a clear emphasis on the fact that many decision-making entities have a significant influence on the processes and events occurring in the city.

They are not fully alienated entities and therefore their effectiveness also depends on cooperation, coordination and the ability to understand the influences of the wider environment. Working together, coordinating activities, sharing costs and risks, forecasting losses and profits, being able to read signals from the environment, requires access to data and information.

Improving access to and management of public data, those held by city authorities and all their subordinate institutions and organizations, municipal companies, etc., is fundamental to improving administrative and management processes, as well as urban policy-making, strategic management, and the shaping of living conditions in line with residents' expectations.

Access to public information is recognised as a prerequisite for a democratic state, which stems from the need to guarantee the implementation of the principle of openness of public life, enables rational decisions to be taken, counteracts the abuse of public power, enables social control over the actions of the authorities, creates the basis for building a civil society, and influences the reliability and efficiency of public institutions. It is also a guarantor of public participation in social life in the city (Szlachetko and Szlachetko 2019).

The introduction of local self-government is linked to the entitlement of local communities to have knowledge about the basic issues concerning the functioning and development of the city, its main problems, the development policies adopted and implemented by the authorities, the use of physical and financial resources, etc., in simple terms to co-determine the most important matters concerning the city and its users. The active involvement of organizations and residents, all stakeholders in governance in the city, requires that public information be collected and made available.

The management processes in a city consist of decision-making, organizational,

executive and control processes. At each stage of the process, an information resource is essential. The decision-making process in local government (and therefore also in the city) is more complex and lengthy, but more transparent, than in business entities. Municipal authorities are focusing more attention on achieving a given utility objective while minimizing the cost of operations.

The activity of local government is service-oriented, which affects the course of decision-making and executive processes. The city has a number of administrative, economic and social functions and is a heterogeneous, highly complex structure, which is reflected in its management processes. In any understanding of the city and its processes, if we analyze the governance system, it is multidimensional, with numerous decision-making centres, hierarchical or not, complex and always requiring access to public information.

The democratization of urban governance manifests itself in the provision of opportunities for citizens, organizations, businesses, formal and informal groups, etc. to actively participate in decision-making at the city level, including the formulation and implementation of city policies.

However, in order for them to have a significant impact on decisions concerning public affairs, they must have access to public information. Without this prerequisite, co-governance is just a slogan, with no translation into the practice of co-determination on urban issues.

Despite the widespread recognition of the importance of public information for the municipal authorities themselves, as well as its significance for potential investors, future residents, developers, construction companies, tourists, etc., the amount of information a city should have at its disposal is often too modest in relation to the expectations and needs of the various stakeholders.

On top of this, there is the problem of information asymmetry. This phenomenon is often encountered when considering the management of public affairs by both local and central government organizations. An asymmetry of information exists between the expectations of the various entities in terms of public information and the ability of the municipal authorities to respond and realistically engage in this field.

The reasons for this state of affairs can be found in the deliberate withholding of public information, the desire of the authorities to implement their own decisions – which are not always rational and in line with the public interest – with the adherence to an autocratic style of management and the inability of the media, non-governmental organizations and citizens themselves to effectively control the actions taken by government and local authorities, as well as the underestimation by managers of the role and importance of information.

The advantage of governmental authorities, due to the fact of their managerial

powers, in the case of information asymmetry is revealed through disinformation, scarcity (or lack) of information, deliberate concealment of information, giving inappropriate weight to information, steering the decisions of other actors and households, promises of performance, inefficient allocation of resources, or waste of resources at their disposal.

Public information is used to as a means of communication between an organization and its stakeholders. To perform this function satisfactorily, it must be made public. The manipulation of information and the dissemination of low-quality data serve to camouflage the facts, cover up mistakes made and, as a result, reduces the efficiency of public administration.

3. Barriers to Access to Public Information

The development of ICT techniques has made it possible to collect, process, store, transmit and use numerous and thematically diverse data at any time, which does not mean that they are universally accessible. This observation applies to both data (after information is analyzed) from the economic sphere and the public sphere. Data in the city is collected by municipal offices, business entities, institutions and organizations providing public services, NGOs, media, etc.

The widely observed increase in demand for access to public data is due to the fact that it has become a key tool necessary for many stakeholder groups to read the signals of the environment, and to make informed and rational decisions. However, despite widespread recognition of the importance of public data, there are significant differences in access for different stakeholders. Among the many reasons for unequal access to public data, the most frequently cited are:

1. Government policies and regulations restricting access to certain data or for certain stakeholders (including censorship). Such access may be restricted for a variety of reasons, e.g., sensitive defence, intelligence or law enforcement information is often not made publicly available. Similarly, data protection laws impose restrictions on the disclosure of sensitive or personally identifiable information.
2. The digital divide, which refers to the unequal distribution of access to the internet and ICT, also applied to the limited digital competence of professionals who determine the importance and relevance of data, creating collections of information, as well as the lack of specific needs of the recipients of such information. The digital divide is one of the most significant factors contributing to unequal and unfair access to public data. This is due to unequal access to the internet and ICT, which results in some individuals or communities having limited or no access to data. This can create an imbalance in access to information, as individuals or communities without access to technology and the internet may not be able to obtain the

necessary data, analyze it or use it effectively. Indeed, there is a gap related to the control of digital data production tools and the appropriate context for using these tools (Rogers, 2016).

3. Monopolies and “data gatekeepers”, which include large corporations, mobile operators, social media platforms, information search engines and other technology companies that control large amounts of data, controlling access to the information they hold. Data monopolies can arise for a variety of reasons, including network effects, economies of scale and first mover advantage. “Data gatekeepers”, on the other hand, are entities that control access to and use of data within an ecosystem or specific platform. They often have significant influence over the flow of data and can use their control to dictate terms of access, use and pricing to other market participants (Marty&Warin, 2020). Data gatekeepers can be private companies, public institutions or other organizations that exercise control over critical data infrastructure such as ISPs, search engines and social media platforms.
4. Costs associated with the collection, storage, processing and eventual publication of public data. They can be so high that city authorities are not in a position, even with an up-to-date collection of city data and information, to incur the expense of making them public.
5. Inefficiency of management at the City Hall and its subordinate agencies (companies, budgetary establishments, budgetary units), which is due to the lack of knowledge, experience, competence of the staff operating in them. This can result in asymmetry in access to public information. Reasons for asymmetry can be sought in technical, personnel or financial capabilities, clear guidelines on rules for making data and information public. In the practice of organizing and operating public administration (including municipal authorities), we have the politicization of government, the decision-making process and the decisions themselves. The duration of the term of office of the authorities does not stimulate the use of techniques and methods in the city management process, which are considered to be advanced and proven in modern realities. The high degree of formalization of activities within the organization of the public sphere, as determined by regulations, results in officials being concerned about the legitimacy of their decisions and consequently contributes to a bureaucratic approach in solving many problems. Control over the activities of public administration organizations is limited to the activities of the media and third sector organizations (NGOs). Arguably, the very organization of offices, institutions and the staff working in them has a significant impact on the efficiency of management in the public sphere. Assuming that this may be the case, the ability to collect useful data, to manage public information, including making it public, should not be expected.

6. The adopted style of city governance, whereby the authorities are relatively keen to publicise information relating to successes, such as the construction of a road section, the completion of civic budget projects, etc., and are decidedly reluctant to inform the public about delays in investment, missed projects, environmental damage or property management.
7. Low level of public interest in public affairs, in which case there is no pressure from the public on the authorities to make information public.
8. Lack of widespread confidence in data quality. Poor data quality is derived, for example, from measurement error, which may be the result of inaccurate instruments, human error during data collection or entry, non-participation in a study, inconsistencies that make it difficult to combine some data, and from the inherent complexity of some constructs. In this case, information generated from low-quality data is not and cannot be reliable.
9. A significant barrier to building fair access to data is its low interoperability, which in practice means the poor ability of ICT systems and the processes they support to exchange data and share information and knowledge (Law on Informatization..., 2005). Data sources often use different formats and structures to store and represent data, making it difficult to seamlessly integrate or analyze data from multiple sources. Incompatibilities in data formats can hinder the ability to accurately aggregate or match datasets, potentially leading to asymmetries in the combined data. Data sources may use different terminologies, coding schemes or classifications of similar concepts or variables (Malomo&Sena, 2017). As a result, when attempting to combine or analyze data from different sources, discrepancies in definitions and meanings of data elements can cause inconsistencies and asymmetries.
10. Another factor influencing information asymmetry may be contextual, resulting from social, economic and cultural conditions affecting the willingness of individuals or groups to disclose certain information or participate in data collection activities. Additionally, inequality in access to public data will be influenced by insufficient digital competence in offices or insufficient staff involvement in digitization and data management processes.

In summary, the most significant barriers to universal access to public information in the city include: the reluctance of city authorities and structures to share information, the costs of organizing and maintaining an up-to-date data and information system, the ability to manage this system, the digital exclusion of part of the urban population, and the retention of important data and information for selected audiences.

4. Consequences of Asymmetry in Access to Public Information

The consequences of unequal access to public data can, in the long term, reduce the level of efficiency in urban governance and development. It can not only negatively affect the decision-making process in the entities public administration, lower the level of public trust in municipal government, but also deepen social inequalities, hindering progress towards the development of a more democratic and civil society.

The decrease in the level of social capital and in understanding it as a factor exerting a significant influence on economic development processes, is also not without significance here. Its occurrence creates a favourable situation for the rational use of resources in management processes. It refers to such features of society's organization as trust, widely recognized norms, solidarity, cooperation, connectedness, which can result in increased efficiency in society, facilitating coordinated actions.

It is identified with the ability of a community to work together within groups, organizations, institutions to pursue common interests, i.e. actions in line with the public interest. Thus, it will negatively affect the cooperation between organizations, public institutions, the coordination of their activities and, as a result of the duplication of collecting the same data separately by different organizational units in public structures, it will lead to a waste of resources and the generation of excessive costs. Unequal access to public data can also limit the rational location choices of investors and residents, prevent the development of strategic plans for many entities, organizations and institutions operating in the city.

Information spreads through various channels, and by spreading through networks, it reaches its addressees almost as soon as it is created, which can increase its economic value. At the same time, however, it amplifies the effects of informational asymmetry, producing the opposite effect to that intended by the sender (Buhler, 2014).

Information asymmetry distorts financial decision-making. At the municipal level, access to information is important for drawing up investment plans, estimating the costs of municipal investments, seeking sources of funding for investments and selecting contractors. Here, as in the market sector, a dangerous phenomenon of overinvestment is possible as a result of information asymmetry. It also results in an inability to control the efficiency of public sector operations.

Without scrutiny, public authorities, with a sense of infallibility and impunity, may be inclined to pursue particularistic objectives, often not in line with the public interest, using public funds. This results in the alienation of the authorities from society, a lack of trust in the authorities, a weakening of the previously mentioned social capital.

The drive to develop cities in line with the idea of intelligent city of the future is a marker of modern times. It is not possible to govern efficiently in a city without up-to-date and publicly available data on the phenomena and processes taking place in it. As D. Sikora-Fernandez points that knowledge and information are the main factors of functioning in any organization, so the use of advanced information technologies in the process of urban governance allows a much more efficient use of its resources (Sikora-Fernandez, 2018).

The public data that are the basis for the creation of reliable information are produced and collected by public institutions, and are available to the public or access to them is restricted for important reasons. They are owned by public institutions, have a wide range and can come from a variety of sources, such as, for example: CSO data, public registers, reports and statements, official government and local government platforms, Internet of Things (IoT), opinion poll results, and many others (Verhulst and Young, 2022).

There are many factors that can cause asymmetry in access to public data, which can limit its usefulness (also economic value) and affect decision-making. In order to reduce information asymmetry, smart cities should have a synchronised public data system.

5. Conclusions, Proposals, Recommendations

Modern urban governance, in the context of dynamic social, technological and environmental changes, requires the effective use of public information as a key resource. Information asymmetry, resulting from differences in access to data among stakeholders, leads to inefficiency in management, loss of public trust and reduced civic participation. At both the operational and strategic levels, the effectiveness of decision-making depends on the availability, quality and transparency of public information.

As a result of the analysis, key conclusions can be highlighted:

1. Importance of public information - access to reliable and up-to-date public information is a cornerstone of democratic governance and promotes greater efficiency in urban government operations.
2. The reasons for information asymmetry - sources of asymmetry include technological shortcomings, government policies that limit access to information, low levels of digital competence or the cost of maintaining information systems.
3. Consequences of asymmetry - unequal access to information leads to wasted resources, reduced cooperation between stakeholders and lower levels of public trust.

4. The role of technology in digital transformation - the process of digital urban transformation, especially the implementation of smart city ideas, can significantly contribute to reducing information asymmetry by building integrated public data management systems.
5. Recommendations for urban management - key actions include creating transparency mechanisms, investing in the development of technological infrastructure and improving digital competence among both officials and residents.

In conclusion, effective reduction of information asymmetry in urban governance requires a comprehensive approach combining technological development with measures for openness and transparency in public administration. The implementation of these measures is a prerequisite for sustainable urban development, building public trust and strengthening the democratic participation of residents in decision-making processes.

References:

- Akerlof, G.A. 1970. The Market for Lemons: Quality Uncertainty and the Market Mechanism. *Quarterly Journal of Economics*, 84, 488-500.
- Blajer-Gołębiewska, A. 2012. Asymetria informacji w relacjach inwestorskich. *Perspektywa nadzoru korporacyjnego*. Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, 1-147.
- Blomberg, M., Altschwager, D., Seo, H., Booton, E., Nwachukwu, M. 2021. Digital divide and marginalized women during COVID-19: a study of women recently released from prison. *Information, Communication and Society*, Vol. 24, No. 14, 2113-2132. <https://doi.org/10.1080/1369118X.2021.1963462>.
- Buhler, P. 2014. *O potędze w XXI wieku*, Wydawnictwo Akademickie Dialog, Warszawa, 1-516.
- Florida, R. 2005. *Cities and The Creative Class*, Routledge, London.
- Goedhart, N.S., Broerse, J.E., Kattouw, R., Dedding, C. 2019. Just having a computer doesn't make sense: The digital divide from the perspective of mothers with a low socio-economic position, *New Media & Society*, 21(11-12), 2347-2365. <https://doi.org/10.1177/1461444819846059>.
- Kiełtyka, L. 2022. Zarządzanie informacją w organizacji – podejście systemowe. In: *Zarządzanie zasobami niematerialnymi w organizacjach*, (eds. Kiełtyka, L., Jędrzejczyk, W.), Wydawnictwo TNOiK – Dom Organizatora, Toruń, 15-46.
- Komninos, N. 2002. *Intelligent Cities: Innovation, Knowledge Systems and Digital Spaces*, Spon Press, London, 1-320.
- Krzakiewicz, K., Cyfert, Sz. 2020. *Podstawy zarządzania organizacjami*. Wydawnictwo UEP, Uniwersytet Ekonomiczny w Poznaniu, Poznań, 1-320.
- Malomo, F., Sena, V. 2017. Data Intelligence for Local Government? Assessing the Benefits and Barriers to Use of Big Data in the Public Sector. *Policy & Internet*, 9(1), 7-27.
- Marty, F., Warin, T. 2020. Digital Platforms' Information Concentration: From Keystone Players to Gatekeepers. <https://cirano.qc.ca/files/publications/2020s-70.pdf>.
- Rogers, S. 2016. Bridging the 21st Century Digital Divide, *TechTrends* 60, 197-199. <https://doi.org/10.1007/s11528-016-0057-0>.

- Sikora-Fernandez, D. 2018, Smarter cities in post-socialist country: Example of Poland. *Cities*, 78, 52-59.
- Scottish Cities Alliance. 2014. Smart Cities Maturity Model and Self-Assessment Tool. Guidance Note for Completion of Self-Assessment Tool, 1-42.
- Stiglitz, J.E. 2004. *Economics of public sector*, W.W. Norton & Co., New York, London, 1-631.
- Szlachetko, J.H., Szlachetko, K. 2019. Udział interesariuszy w kształtowaniu i prowadzeniu polityki rewitalizacyjnej. Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, 1-197.
- The Power of Gatekeepers Who Control Data and Information in a Digital World. Available at: <https://www.managementstudyguide.com/power-of-gatekeepers-who-control-data-and-information-in-a-digital-world.htm>.
- Wojnarowska, M. 2010. *Koncepcje zarządzania*. Podręcznik akademicki, (eds.. Czerska, M., Szpitter, A.), Wydawnictwo C.H. Beck, Warszawa, 321-341.
- Wrana, K., Kmieć, B., Kmieć, T. 2014. Zarządzanie miastem w chmurze – Cloud City, Pan Kpzk, *Studia Tom CLVII*, Warszawa, s. 91-104.
- Zawieska, J. 2015. Smart city – koncepcja i trendy rozwoju miast przyszłości. In: Gajewski, J., Paprocki, W., Pieregud, J. (eds.), *Megatrendy i ich wpływ na rozwój sektorów infrastrukturalnych*, Publikacja Europejskiego Kongresu Finansowego, Gdańsk, 27-28.
- Ustawa o informatyzacji działalności podmiotów realizujących zadania publiczne z dnia 17 lutego 2005 r., Dz. U. nr 64, poz. 565, z póź. zm.
- Ustawa z dnia 6 września 2001 r. o dostępie do informacji publicznej, Dz.U. 2—1, nr 112, poz. 1198.
- Verhulst, S., Young, A. 2022. Identifying and addressing data asymmetries so as to enable (better) science. *Frontiers in Big Data*, Vol. 5. <https://doi.org/10.3389/fdata.2022.888384>.