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INFORMATION INEFFICIENCIES IN THE DIGITAL AGE – A CASE STUDY OF THE MUNICIPALITY OF KRAKOW

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Purpose: The research aims to analyze on a selected example the differences in the occurrence of individual types of information inefficiencies in organizations implementing digital solutions. To achieve this goal, it was necessary to identify information inefficiencies occurring in the selected organization (Municipality of Krakow), to identify and evaluate the digital solutions used to eliminate these inefficiencies and to assess the degree of preparation of employees to use them.
Design/methodology/approach: The article in the theoretical part contains a description of the results of the literature review within the framework of the problem undertaken and in the practical part the presentation and discussion of the results of empirical research. The study was conducted using the survey technique (CAWI), and the results of the study results were developed using descriptive statistics.
Findings: The research carried out in the Municipality of Krakow showed the occurrence of all types of information inconveniences, with employees indicating a moderate frequency of their occurrence. The study identified and analyzed digital solutions used to counteract information failures. In this respect, research has shown an insufficient level of their use and high needs in terms of the digital competencies of employees using them.
Research limitations/implications: The limitations of the conducted research mainly relate to their scope, because the surveys were conducted only in selected organizational units of the Office. It would be necessary to develop the undertaken research in the context of expanding the sample, preferably by employees of all organizational units of the City Hall, and in the future to undertake research in other city offices.
Practical implications: Research conducted at the Municipality of Krakow allows us to conclude that the current level of digitization of information understood as a product and process does not allow us to avoid phenomena related to information malfunctions. A comprehensive approach to the digitization of information, a more conscious selection of its tools, and an intensification of employee education in order to improve their digital competencies are suggested.
Social implications: Reducing the incidence of information failure through the introduction of digital information and communication solutions is a practical problem. However, it involves a long and difficult process of introducing digital changes and adapting to them for the people who use them.

Originality/value: The presented research results on the implementation of digital solutions aimed at counteracting information inefficiency in the Municipality of Krakow are part of the current trend of research related to various aspects of the digitization of business in today's world. An important advantage of the research is its unique character both in terms of the research area, which is the City Hall, and the subject of the research.
Keywords: information inefficiencies, public sector, information overload, information ambiguity, information anemia, information retention, information distortion, information infarction.
Category of the paper: Research paper.

1. Introduction

The conditions for the operation of modern organizations related to their functioning in the information environment, in which the number of information sources is constantly increasing, information is becoming more and more diverse, and information streams are becoming more and more intense, making it necessary to use modern digital solutions in the area of information and communication. Changes related to the dynamic development of new digital technologies concern almost all areas of human activity and contribute to better meeting the information needs of both the economy and society.

In the practice of modern information management, which aims to meet information needs, a number of inefficiencies appear relating to both information as a product and information as a process. Their appearance usually results in a decrease in the value and an increase in the cost of information. Such a situation gives rise to specific areas and problems related to the proper selection and processing of the necessary information. An attempt to determine and classify information malfunctions was made in Poland by Z. Martyniak. The author lists the following as typical malfunctions of information products: information overload, ambiguity, and information anemia. On the other hand, the main inefficiencies of the information process are retention, distortion, and information infarction (Martyniak, 2000). A decade later, A. Włodarski supplemented this list by adding inconsistency and inadequate presentation to the inefficiency of the information product, and "memory loss" and lack of feedback to the inefficiency of the information process (Włodarski, 2011).

From a theoretical point of view, the solutions implemented by modern organizations related to the digitization of information (both in the context of the product and the process) should significantly reduce the likelihood of information failures. Correct identification of information needs combined with the use of digital, on-demand, appropriately organized databases reduces both the phenomenon of information anemia and the opposite of information overload. The use of appropriately designed digital information carriers reduces the risk of ambiguity and distortion of information, as does the use of information processing software (e.g. intelligent text translation tools).

The aim of this article is to analyze on a selected example the differences in the occurrence of individual types of information failures in organizations implementing digital solutions.

The article in the theoretical part contains a description of the results of the literature review within the framework of the problem undertaken and in the practical part the presentation and discussion of the results of empirical research. The study was conducted using the survey technique (CAWI), and the results of the study results were developed using descriptive statistics.

2. Information in the digital economy and society

Modern society functions in an era of intense technological changes, which contribute to a profound economic and social transformation. Digitization, understood as the widespread adaptation of Information and Communication Technology (ICT), redefines the traditional ways of working, education, communication, and the daily functioning of individuals. This topic has been discussed by many authors (Kryzhanovskij et al., 2021; Kotarba, 2017; Nevado-Peña et al., 2019; Ali et al., 2020; Alhassan, Adam, 2021; Sherman et al., 2023), who pointed to the importance of the evolution of digital technologies for the development of today's socio-economic system. It is clear that information, which in the 20th century played an auxiliary role in many economic processes, is now the foundation of economic activity. Collected in the form of data (big data), it is used in decision-making processes, designing innovative solutions, and stimulating technological development. New technologies – such as artificial intelligence, cloud, the Internet of Things, autonomous robots, or blockchain – accelerate the process of datafication, i.e. the creation of digital representations of subsequent areas of the real world, intensify networking and foster personalization (Śledziewska, Włoch, 2020). Information has become a strategic resource, key to creating value, and building a competitive advantage in the global market. The process of digitalization affects all sectors of the economy, from industry to public services, as well as society, which is forced to adapt to new forms of interaction and communication. Digital transformation generates significant economic benefits, but it also comes with many challenges. The adoption of digital technologies enables increased operational efficiency, cost reduction, and acceleration of decision-making processes. The digital economy, characterized by an unlimited spatial and temporal flow of information, creates new trade and investment opportunities, enabling global cooperation and access to extensive knowledge resources. Thanks to digital tools, sectors related to big data analysis, artificial intelligence, automation, robotics, and mobile technologies are developing, which further stimulates innovation and increases the competitiveness of the economy. In addition, digitalization fosters sustainable development by supporting the processes of monitoring and optimizing the use of natural resources and reducing pollutant emissions.

As a result, digital technologies contribute to environmental protection, which is one of the priorities of contemporary development strategies at the national and international levels.

Technological changes have an impact on all aspects of social and economic life, especially in the context of the digitization of the economy and the growing role of information. Information, as a strategic resource, has achieved the status of a key factor of economic and social development. The European Union, recognizing the importance of this transformation, has initiated several actions to support Member States in adapting to the digital reality. From the Digital Agenda for Europe to the Digital Decade, these initiatives aim to improve citizens' quality of life by developing digital infrastructure, strengthening digital competencies, and stimulating innovation (Laitsou et al., 2024). The European Union's ambitions in this regard are expressed in the report "eGovernment Benchmark 2020. eGovernment that works for the people" (2020), and as part of the Europe 2020 strategy, which introduced a digital agenda to create a digital single market that supports competitiveness and innovation at regional and international level. Digital transformation plays a key role in the development of modern economies and societies, especially in the context of the increasing role of information as a strategic resource. Digitalization is changing the way citizens and businesses use public services, enabling many of them to be fully implemented online. The European Union puts the pursuit of transparency and accessibility of online services as the foundation of its strategy. The concept of "user-centricity", taking into account the needs and convenience of users, is one of the key directions for the development of digital services. In addition, the implementation of solutions such as eID and eDocuments increases the possibilities of secure and effective identification and authorization of users, which supports the idea of interoperability at the European level and enables the provision of cross-border services. Therefore, it can be concluded that digital transformation is a fundamental aspect of the modern economy and society, exerting a significant impact on various areas of life and work. Advances in information and communication technologies such as cloud computing, artificial intelligence, and the Internet of Things have been a catalyst for global development. The growing importance of digitalization is reflected, among others, in the Digital Economy and Society Index (DESI), which assesses the digital progress of Member States in five main dimensions: connectivity, human capital, use of online services, integration of digital technologies and digital public services, which assesses the degree of digital maturity in EU Member States. Studies show that an increase in DESI values correlates with higher Human Development Index (HDI) scores, suggesting a positive relationship between digital progress and quality of life (Laitsou et al., 2024). The analysis of the DESI reveals significant differences in digital maturity between Member States, highlighting the importance of investment in digital education and infrastructure development. Higher-performing countries, such as Finland and Denmark, invest heavily in human capital and innovation, which has a positive impact on their position in the digital market. For countries with lower scores, actions supporting the development of digital competencies and access to advanced technologies are necessary, which is the basis for

reducing disparities in the level of digitalization and promoting socio-economic cohesion in Europe (Masoura, Malaysia, 2023).

Digital transformation, which is the basis of the modern economy and information society, is associated with the growing importance of access to digital technologies, and digitization is a key element of the modern economy. Its integration with innovation and environmental policies contributes to the achievement of sustainable production goals. Research (Guaita Martínez et al., 2022) They point out that digitalization supports more environmentally friendly solutions in socio-economic structures, responding to the challenges of climate change and the exploitation of natural resources. The information generated and processed by digital management systems is therefore becoming a key strategic asset. They enable the monitoring and optimization of production processes, supporting informed business decisions and promoting innovations, focused on sustainable development. Thus, the role of information in the digital economy is not only operational but also strategic, providing a foundation for creating value and building a competitive advantage, while taking into account economic, ecological, and social aspects. It should be emphasized that although the digital economy currently plays a huge socio-economic role, its importance will continue to grow as generations who cannot imagine a world without the Internet enter the productive age (Moroz, 2017).

Digital transformation directly affects the way society functions. Digitalization processes are shaping communication methods, consumption patterns, and access to cultural and educational resources. The digital society, using services such as e-banking, remote education, e-commerce, or digital access to cultural goods, gains greater autonomy, but at the same time becomes more dependent on technology. While easier access to information creates new development opportunities, it also raises the risk of data overload and pressure to process it properly. In this context, the problem of information asymmetry arises, where access to information and the ability to interpret it become key determinants of social and professional position. On a global scale, digital transformation requires international coordination and cooperation. Due to the multidimensional nature of the digital economy and the complexity of the processes shaping it, it is necessary to develop appropriate regulations and standards to support sustainable development. The European Union, among other things, is emphasizing the twin digital and green transitions to integrate the benefits of digitalization with the need to protect the environment. Setting standards for data protection, AI ethics, digital sovereignty and the sustainable use of technology is a key element of today's development strategies at the European and global level.

3. Information failures and their consequences

As mentioned earlier, information inefficiencies (also referred to as "information diseases") are phenomena relating to both information understood as a product and to information understood as a process, causing several negative consequences for the organization, such as extension of the time of implementation of information and communication processes, higher costs of their implementation, reduction of motivation of their participants, delays in providing information to its users, incorrect or late decisions, reduced motivation of participants in the information process, etc. For this article, the division of information inefficiencies according to Z. Martyniak was used, who (as mentioned in the introduction) lists information overload, ambiguity, and information anemia as typical inefficiencies of information as a product, and retention, distortion and information infarction as the main inefficiencies of the information process (Martyniak, 1997).

Information overload occurs when "a person receives much more information than they can or want to use" (Lesca, Lesca, 1995). Information overload has a negative impact on the quality of decisions made (this applies to the precision of decisions made) and the quality of the decision-making process (manifested as the duration of the decision-making process). In particular, this disability results in a longer time of searching for information, increased costs of its processing, increased inconsistency of information, and reduced user motivation. As the reasons for the occurrence of the phenomenon of information overload, Z. Martyniak cites the imprecise determination of information needs and the lack of positions in the structures of management boards responsible for assessing the usefulness of disseminated information and eliminating useless information. This qualitative defect in information is a measurable quantity. As criteria for assessing information overload, Z. Martyniak proposes the necessity and timeliness of information. The degree to which the criterion of necessity is met can be measured by the share of redundant information in the total volume of information. The measure of timeliness is the share of outdated information in the total volume of information (Martyniak, 1997). Modern digital solutions make it possible to significantly reduce the likelihood of information overload. Starting with the simplest solutions based on e-mail, which is today protected against unwanted and unnecessary information, through data warehouses and cloud data enabling access to information at the time it is needed, to Intranet-based solutions granting employees access to information based on the permissions resulting from the scope of their position.

According to the French researchers cited above, ambiguity of information occurs "when a person can interpret the same information in different ways without being able to determine which interpretation is good" (Lesca, Lesca, 1995). The reasons for this information inefficiency lie in the increasingly common use of abbreviations and jargon and imprecise data reporting (e.g. giving numbers without names). As measures to counteract the ambiguity of information, Lesca cites the following solutions:

- development and use of special dictionaries in the company, containing unambiguous definitions of various types of information,
- introduction of the custom of returning ambiguous information to its sender for verification,
- the use of appropriately adapted information carriers that exclude or at least limit their ambiguity (Lesca, Lesca, 1995).

The criterion for assessing the ambiguity of information may be its unambiguity. The first question that should be asked at this point is: is the information unambiguous? If the answer is affirmative, the quality of the information due to this criterion is unblemished. If the answer is negative, an unambiguous interpretation of the information under investigation should be achieved. Such proceedings are associated with a loss of time and the need to incur costs. The size of these expenditures can be an auxiliary measure in assessing the quality of information as a product. Digital solutions reducing the ambiguity of information include the use of digital versions of the procedures carried out along with dictionaries of terms used within them, the use of appropriately designed digital information carriers (systems for submitting queries, applications, applications, etc.), as well as intelligent tools for translating the text of information.

The concept of information anemia was introduced to the Polish literature on the subject by Z. Martyniak, who contrasts it with information overload. As the cause of informational anemia, the author cites a lack of information, also known as a weakening of the field of vision. The field of view is understood in the literature on information management as a set of information that a company has on a given topic. Informational anemia can occur in several degrees of severity. Its least painful variety is characterized by the fact that the information is relatively rich, but not always up-to-date. The more burdensome form manifests itself in the diversity of information, but scattered and incomplete. Finally, the most severe form of information anemia is characterized by extreme information poverty and leads the company to quasi-blindness (Martyniak, 1997, 2000).

The authors of "Gestion de l'information" consider poor management style to be the main cause of information anemia. Some managers believe that their level of knowledge, skills, and the related "feel" for decision-making situations allow them to make decisions without relying on detailed reports, especially if they are formalized. Without denying the role of intuition in decision-making, it should be said that managerial "intuition" can only be effective to a certain extent. After exceeding them, information anemia occurs, which sooner or later creates troublesome problems for the managerial staff. Other causes of information anemia include excessive fragmentation of tasks in the management process and lack of a comprehensive view of the information held by the company. The criterion for assessing this malfunction is the completeness of information, which either occurs or does not occur. Supplementing the information, as is the case with its unambiguity, requires time and material or financial resources. The total expenditure relativized to a unit of volume can be a measure

of the quality of information (Martyniak, 1997). Digital solutions that can result in the reduction of information anemia include, m.in, digital data sets and sources available to the employee in real time, managerial information systems, and digital internal communication systems between employees (e.g. chat, chatbot).

The information process is often identified with the information production process, which performs the following functions: generating information, gathering information, storing information, transferring information, processing information, sharing information, interpreting information, and using information (Oleński, 2003). Each information process performs all of the above functions. Usually, one or more of them are basic functions, while the others are auxiliary functions. The information process can perform several basic functions. In this case, it is necessary to define a function that is superior to the others, i.e. to establish a hierarchy of basic functions. In socio-economic systems, we are dealing with the functional specialization of information processes, consisting of the fact that these processes specialize in the implementation of one or several specific functions. The functions in the implementation of which a given information process is specialized determine the scope of information and the ways of its representation, methods, organization, technology, and economic principles of this process. In the economy, many information processes are interrelated and complement each other. They are usually specialized in one or more functions and make up the so-called information system.

The information process may show several inefficiencies affecting the quality of its implementation. The basic information malfunctions understood as the Lesc process include: information retention, information distortion, and information infarction.

Based on research conducted in the eighties of the twentieth century by specialists in the field of information management of the Siemens concern, it was found that in this company 95% of the duration of information processes is the time of information retention. This means that only 5% is the time associated with their processing and use (Potocki, 1990). Similar results were also obtained in national surveys on the implementation of administrative procedures in local administration institutions[1] (Czekaj, Teczke, 1998). The time of backlog therefore significantly extends the time of the entire information process. Shortening the time of detention, and thus at the same time the time of implementation of the entire information process, is of particular importance in the situation of mass implementation (as is the case in information economies). The reasons for information backlog can be varied. One of the most serious is the so-called information overload, which is particularly dangerous at those points of the information process that are equipped with decision-making powers. Another reason for information retention in information processes is their excessive fragmentation. In such a case, incompleteness of information found in one of the organizational units results in the need for

[1] These studies have shown that the share of information retention time in the entire cycle of the information process is about 70%.

another unit to supplement it, which not only incurs additional costs but also extends the time of backlog. This quality defect can and should be evaluated. The criterion for assessing the quality of the information in this case is the so-called information patency, measured by the ratio of the sum of the dwell times to the total time of the process, expressed in relative numbers.

Information retention can be eliminated by the appropriate design of information processes. In the digital era, you can use numerous tools to support business process management based on the BPMS process management paradigm, offering functionalities for modeling, analysis, simulation, and evaluation of processes (e.g. ARIS or Adonis).

Information distortion is understood as a situation in which two or more people interpret the same information in different ways. Information distortion is therefore a more complex variation concerning information as a product of information ambiguity. Its reasons in this case are identical to the reasons for the ambiguity of the information product. Distortion can also be a conscious or unconscious deformation of information during its flow in the information process. In this case, it is caused by the modification of the meaning of the information transmitted in the process between one circulating point and another. The assessment of the distortion of the information process can be carried out analogously to the assessment of the ambiguity of information as a product, except that in this case, the criterion is the unambiguity of the information (Czekaj, 2000). Digital solutions to reduce information distortion include digital versions of the procedures carried out with dictionaries of the terms used within them, digital document templates with explanations of the rules for their completion, online training covering the implementation of procedures, and filling in documents.

An information infarction occurs when the flow of information does not keep up with logistical flows. For example, when information related to the ordered physical product reaches its recipient after the delivery date. It turns out that at a time when systems such as just in time or zero stock are more and more commonly used, information very often does not keep up with logistics flows (Information management..., 2000). The reasons for this phenomenon are seen in the lack of integration of three factors within the information process: human, technical and organizational. The criterion for assessing the diffusion of information may be delays in the transmission or reception of information. A sufficient evaluative procedure is the gradation of delays (insignificant, significant, significant, large, and very large). Simple, digital solutions to reduce the possibility of information infarction are methods of direct communication such as e-mail, instant messaging, chats, and mobile telephony. More complicated, but also more effective solutions include methods of modeling and analysis of business processes (e.g. the already mentioned ARIS or Adonis).

4. The Municipality of Krakow as an area of research

An important premise for the democratic exercise of power in local government units is the active participation of the local community in public life (Wojciechowski et al., 2014). The City Hall is a public administration unit operating at the local level, responsible for the management and implementation of administrative tasks within a given city. It is a local government body acting based on the provisions of the Act on Municipal Self-Government or other legal acts regulating the functioning of the city. The City Hall, functioning as an organizational unit of local government administration at the local level, is established to carry out public tasks of a local nature, aimed at meeting the needs and expectations of the local community (Grzebyk et al., 2019). The basic functions of the City Hall include the management of municipal affairs, the provision of administrative services for citizens on current issues, and the organization of cultural events and events. The Municipality of Krakow is the central administrative unit responsible for managing the affairs of the municipality of Krakow. The basic legal acts defining the system, organization, principles of operation, and competencies of local government bodies are:

- Constitution of the Republic of Poland of 2 April 1997.
- Act of 8 March 1990 on Municipal Self-Government.
- Act of 5 June 1998 on Poviat Self-Government.
- Act of 5 January 2011 – Electoral Code.
- Act of 27 August 2009 on Public Finance.
- Act of 11 September 2019 – Public Procurement Law.

The basic task of the City Hall is to implement the resolutions of the Krakow City Council and to ensure the effective functioning of public services provided to residents. The Office is headed by the Mayor of Krakow. The organizational structure of the Municipality of Krakow is complex and includes 39 administrative units, including departments, offices, and other organizational units specializing in various areas of city management. The City Hall is indicated as the central decision-making body in the structure of local authorities, because its employees, including directors of various levels and specialists managing local affairs, establish various types of regulations. As Grzebyk points out (2017) within the City Hall there is usually a division of staff into two main groups. The first group consists of senior managers who create the conceptual and information basis for strategic decisions and implement the policy established and approved by the city authorities. The second group consists of staff responsible for performing administrative functions of a routine nature, which mainly concern the service of citizens and the provision of public services.

The scope of activities of the Municipality of Krakow is wide and includes the management of the city's finances, including budget planning and implementation and obtaining external funds; spatial planning through the development of local spatial development plans;

maintenance of infrastructure and transport, including road maintenance, development of public transport and investments in transport infrastructure; environmental protection through pro-ecological activities, management of urban greenery and implementation of programs aimed at improving air quality; promoting culture and tourism through the protection and promotion of cultural heritage, the organization of cultural events and the support of tourism initiatives; as well as education and sport, supervising the functioning of educational institutions, supporting sports initiatives and implementing programs aimed at the development of physical culture among residents.

The Municipality of Krakow provides administrative services to residents, such as civil registration covering births, marriages, and deaths; issuing identity documents, including ID cards and driving licenses; servicing entrepreneurs by registering a business, issuing permits, and providing information and support; Registration matters, such as check-in and check-out; and implementation of social programs, including social benefits, support for families, seniors and people with disabilities. As part of initiatives and projects, the Municipality of Krakow is involved in numerous activities aimed at the sustainable development of the city and improving the quality of life of its residents. Such initiatives include "Smart City" programs, involving the implementation of modern information and communication technologies in city management; environmental programs promoting renewable energy sources, reducing greenhouse gas emissions and increasing energy efficiency; development of infrastructure through investments in the road network, public transport, cycling infrastructure, and public space; and supporting entrepreneurship by creating business incubators, economic zones and programs supporting innovation and development of the SME sector.

The Municipality of Krakow places great emphasis on transparency and dialogue with residents, which is achieved by organizing public consultations, enabling the participation of residents in the decision-making process regarding key issues of the city's development; use of digital platforms, such as e-office and mobile applications, enabling access to administrative services and reporting problems and suggestions; running residents' service offices available in various parts of the city, ensuring direct contact with officials and obtaining the necessary information; and organizing information and educational campaigns aimed at informing about planned investments, changes in the functioning of the city and promoting pro-social and pro-ecological attitudes.

5. Research Methodology

The research carried out at the Municipality of Krakow involved 245 employees from organizational units that in the past reported the most problems related to broadly understood information and communication. The surveyed units included:

- Entrepreneurship and Innovation Department.
- Department of Vehicle and Driver Records.
- Department of Spatial Planning.
- Department of Administrative Enforcement and Debt Collection.
- Investment Planning and Monitoring Strategy Department.
- Department of Education.
- Department of Social Communication.
- Department of Tourism.
- Department of Municipal Economy and Climate.

The survey was conducted using the survey technique (CAWI) in the days from September 30 to October 14, 2024. Its main objective was to identify and analyze information inefficiencies that occur in the information and communication processes of the City Hall despite their partial (and in some cases complete) digitization. The research was to answer the following questions:

1. Does the digitization (total or partial) of processes in the area of information and communication eliminate the phenomenon of information inefficiencies?
2. Does the Office implement digital solutions to eliminate or reduce information inefficiencies?
3. What digital solutions are used to eliminate or reduce information inefficiencies by the Office?
4. Do the employees of the Office have digital competencies enabling the use of their digital tools to eliminate or reduce information inefficiencies?

The above questions allowed us to specify the following research hypotheses:

H1. The digitization of information and communication processes reduces, but does not eliminate, the phenomenon of information deficiencies.

H2. A significant reduction in the risk of information inefficiencies is possible thanks to the use of appropriate digital solutions as part of information and communication processes.

H.3. The persistence of the phenomenon of information inefficiencies despite the digitization of processes results from inadequate digital competencies of employees.

To verify the H1 hypothesis, the questions contained in 3 parts of the questionnaire were used: the first part assessing the occurrence of information inefficiencies in the Municipality of Krakow, the second part analyzing the level of digitization of the City Hall, and the detailed digital solutions used, and the third part characterizing the level of digital competence of the City Hall employees.

To verify the H2 hypothesis, questions from the second part of the survey were used on the level of digitization of the Office and the detailed digital solutions used.

To verify the H3 hypothesis, the answers to the questions from the third part of the survey on the digital competencies of the Office's employees were used.

6. Analysis and discussion of research results

The first part of the questionnaire contained questions allowing for the identification of four basic information inefficiencies appearing at work: information overload (heart attack), ambiguity (distortion) of information, information anemia, and information retention. Respondents had the option of answering using a five-point Likert scale, where a score of 1 meant "definitely not" and a score of 5 meant "definitely yes". Assuming grade 3 as a "moderate" frequency of symptoms of information overload, it can be concluded that employees of the surveyed organizational units of the Municipality of Krakow encounter this phenomenon relatively rarely (Table 1). The study shows that the employees of the City Hall most often encounter the phenomenon of duplication of the same information by sending it from different sources (e.g. the same message sent to employees from more than one e-mail box). The average response to the question about the occurrence of this form of information overload was 3.39. Other forms of overload occur slightly less frequently, according to the respondents. Reaching an employee with a lot of information at the same time received an average score of 2.84. Slightly less, i.e. 2.80, was obtained for the phenomenon of reaching the employee with information unnecessary from the point of view of the activities carried out by him. Very close to the answer "rather not" was the question about reaching employees important for the performance of their duties too early (2.32).

Table 1.
Answers to questions related to information overload and information infarction

Question	Number of responses	Average response	Standard deviation
Do you receive unnecessary information from point 1 in the course of the performance of employee tasks? To see the tasks being carried out?	245	2,80	1,17
Does it happen that as part of my duties, I receive such a large amount of information at the same time that you are not able to effectively do it?	245	2,84	1,21
Does it happen that the same information related to your work reaches you from several sources at the same time?	245	3,39	1,23
Does it happen that information reaches you too early and you have to come back to it after a long time?	245	2,32	1,07

Source: own study.

The next block in the survey consisted of questions relating to the phenomenon of information ambiguity (distortion). In this respect, the respondents indicated that it is more common for them to receive information that is difficult to interpret due to the way it is formulated. This form of ambiguity is most often caused by linguistic errors made by the senders of information. The average assessment of this form of ambiguity by the surveyed employees was 3.16, which indicates moderate admission. The possibility of receiving mutually exclusive information from various sources was ranked lower, here the average score was 2.71. In the block of questions devoted to the ambiguity of information, there was also a question to

which respondents could answer "yes: or "no". It was a question about whether they encounter information in languages other than Polish as part of the performance of their duties. Of the 245 people in the survey, 93 answered yes and the remaining 152 denied such events. Then, 93 people who answered affirmatively were asked whether the need to use information in a language other than Polish was a problem for them. It turned out that for the majority of respondents (58 people) this is not a problem. 35 people were of the opposite opinion. It can therefore be concluded that this form of information ambiguity is less common, and even if it does occur, it is not a problem for most respondents (Table 2).

Table 2.
Answers to questions related to ambiguity and distortion of information

Question	Number of responses	Average response	Standard deviation
Does it happen that as part of the performance of your duties/tasks, you receive information that is difficult to interpret?	245	3,16	1,13
Does it happen that as part of the performance of your duties, you receive mutually contradictory (mutually exclusive) information?	245	2,71	1,18

Source: own study.

In the further part of the survey, the respondents answered questions devoted to the phenomenon of information anemia. The results of the survey indicate a similar probability of events consisting of failure to perform obligations due to the lack of necessary information (2.82), making an incorrect decision as a result of the lack of necessary information (2.88), and delaying the decision as a result of the lack of necessary information (2.86). It should be noted that all three scores did not exceed the value of 3 (Table 3).

Table 3.
Answers to questions related to information anemia/information deficiency

Question	Number of responses	Average response	Standard deviation
Is there a risk of failure to perform employee tasks due to the lack of necessary information?	245	2,82	1,20
Does it happen that during the performance of employee tasks, there is a risk of making a wrong decision as a result of the lack of information?	245	2,88	1,12
Does it happen that as a result of the lack of information, you make late decisions?	245	2,86	1,20

Source: own study.

The last block of questions relating to information inadequacies concerned the phenomenon of information retention. Respondents were asked about the possibility of one of two events: the retention of information important for the performance of their duties by other positions and the retention of information needed by other positions. An interesting fact about the answers to these questions is that when asked about the possibility of storing information needed by other employees, the respondents answered that such situations do not occur (average 2.01). On the other hand, in the opposite situation, i.e. when they kept information needed by other employees, the average response was higher (3.11), which should be interpreted as a moderate occurrence of such events (Table 4).

Table 4.
Answers to questions related to information backlog

Question	Number of responses	Average response	Standard deviation
Are there cases where the information you need is held by other positions?	245	3,11	1,25
Does it happen that for some reason you are forced to keep information, despite knowing that someone else is waiting for it?	245	2,01	1,16

Source: own study.

The conclusion from this part of the survey is the moderate occurrence of all types of information inefficiencies in the Municipality of Krakow.

Another element of the research was the analysis of the level of digitization of the Office and the detailed solutions used to reduce the phenomenon of information inefficiency. The respondents could answer the questions posed in this block using the five-point Likert scale, already known from the part devoted to information disabilities. The use of digital information resources necessary for the performance of tasks by the Office was rated the highest (average 3.49) and the availability of procedures and instructions enabled the use of these resources (3.36). The functioning of the electronic information and communication system in the Office was rated slightly lower (3.30) and the specific digital tools used within it (3.16). The respondents rated the level of implementation of digital work organization solutions the lowest (2.96). Answers to this question were submitted in Table 5.

Table 5.
Digital solutions to eliminate or reduce information inefficiencies

Question	Number of responses	Average response	Standard deviation
Does the Office have implemented digital solutions in the area of information and communication?	245	3,16	1,02
Does the Office have implemented digital solutions in the area of work organization?	245	2,96	1,09
Has the Office implemented an electronic information and communication system?	245	3,30	1,10
Does the Office have digital, integrated information resources needed to perform employee tasks?	245	3,49	0,99
Are there procedures and instructions for managing digital information assets in the Office?	245	3,36	0,96
Are there any electronic solutions in the Office to reduce the amount of incoming unnecessary information?	245	2,99	1,15

Source: own study.

Subsequently, the respondents were asked about the use of detailed digital solutions supporting information and communication processes and reducing the risk of information deficiencies. In the question about closed answers, respondents were asked to indicate those digital solutions that they use daily as part of their duties. Respondents could choose more than one correct answer to this question. The answers show that in addition to such a common and currently constituting minimum standard in the field of information and communication processes as e-mail (used by 96.31% of respondents), the Office mainly uses inward-facing

solutions such as the Intranet (95.49% of respondents), the electronic document circulation system dedicated to the work of the Office (76.64%) and the internal electronic communication system based on MS Teams software (65.98%). The remaining solutions are indicated by less than 40% of the surveyed employees (Table 6).

Table 6.
Digital solutions used by employees to support information and communication processes

Digital support for information and communication processes	Number of responses	Response rate
Intranet	233	95,49
Internal electronic communication system (MS Teams, Zoom, chat)	161	65,98
Dedicated electronic document workflow system	187	76,64
Electronic system for submitting applications and comments	7	2,87
E-mail	235	96,31
Virtual teams	17	6,97
Access to external, dedicated databases	54	22,13
Access to the office's internal digital assets	88	36,07
Access to digital versions of administrative procedures	83	34,02

Source: own study.

The obtained answers to general questions concerning the areas of implementation of digital solutions along with answers to specific questions about specific forms of implemented solutions in this area allow us to confirm the H2 hypothesis.

The last block of questions used in the survey concerned the assessment of the level of digital competencies of the Office's employees necessary for the proper use of the tools supporting information and communication processes. It contained three questions with the possibility of answering in the previously presented five-point Likert scale. On this basis, the respondents assessed the degree of digital competence of the Office's employees, the availability of training to improve digital competencies, and the support by the management of employee initiatives aimed at developing digital competencies. The results show that the Office still has a long way to go in terms of digital competencies. Respondents rated their level of digital competence at 2.93, which is below the "moderate" level (Table 7). The level of motivation of employees to develop digital competencies on the part of the management was rated even lower (2.80). According to the respondents, training for employees in the development of their digital competencies is at a relatively satisfactory level (3.10).

Table 7.
Digital competencies of employees

Question	Number of responses	Average response	Standard deviation
Do the employees of the Office have sufficient digital competencies?	245	2,93	1,04
Does the Office provide training for employees in digital competencies?	245	3,10	1,10
Does the management of the Office actively motivate employees to develop digital competencies?	245	2,80	1,13

Source: own study.

The analysis of answers to questions about employees' digital competencies allowed us to confirm the H3 hypothesis. Despite the use of digital solutions by the Office, some of them may not be available to employees as a result of their insufficient digital competencies.

The answers to the questions contained in the three parts of the survey show that the Municipality of Krakow has digital solutions that reduce the risk of information inefficiencies. At the same time, the employees of the Office encounter these phenomena. An analysis of the areas of implementation and the detailed digital solutions implemented and used shows that they are not always used by all employees. According to the respondents, the assessment of the digital competencies of the Office's employees was also quite low. To conclude – the implementation of digital solutions itself reduces to some extent but does not eliminate information malfunctions, which allows us to confirm the H1 hypothesis.

The analysis of the literature on the subject indicates that research related to the digitization of public administration offices and the context of information inefficiency was the area of research by various authors. Erkkilä (2020) addresses the issues of access to information and transparency of the functioning of public institutions in the digital era. The author analyzes transparency as a mechanism for building public trust, indicating that access to information about the activities of public institutions can affect the level of citizens' trust in state authorities. At the same time, it emphasizes the complexity of this relationship, which is not always unambiguously positive. The impact of digitization on access to information is indicated, highlighting the possibility of increasing transparency through technologies, but also the challenges associated with it are emphasized. Digitalization is seen in the context of global pressure for transparency and the resulting tensions between transparency and privacy. Information is also considered to be a key resource, the proper management of which determines the effectiveness of public institutions. B. Hysa (2012) points out that the excess of data and problems related to its proper selection and processing can interfere with the decision-making process, which in turn has a negative impact on the efficiency of the organization. The author's considerations are focused on the issue of information quality in the decision-making processes of public administration. Analyzing the importance of information as a key resource in public institutions, he emphasizes that its quality has a direct impact on the effectiveness and accuracy of decisions made. Particular attention is paid to the attributes of information quality, such as timeliness, reliability, completeness, and availability, which are necessary to ensure the proper functioning of offices. The research presented in the cited article reveals similar challenges related to information overload, which can complicate the decision-making process and lead to information overload. The author emphasizes that maintaining high-quality information requires systemic management methods, including the implementation of procedures and instructions based on quality standards and the use of technical safeguards in information systems. In addition, it points to the key role of employee competencies, where training is important in the process of ensuring the quality of information. As part of the study, the author also described the most commonly used methods to improve the quality of

information in public administration, such as electronic document workflow, information security systems, and practices related to regular data updates. The results of the research suggest that appropriate information quality management is not only a matter of technology but also requires the involvement of employees and the application of consistent quality standards within the organization, which is consistent with the general conclusions of this article. A similar scope of considerations also appeared in the report "Digitization of City Offices" presenting the results of a study conducted by the Institute of Urban and Regional Development, which indicates the importance of effective information management as one of the basic factors affecting the quality of public services and the effectiveness of decision-making processes. A detailed analysis of the level of advancement of digitization processes showed that even though 84% of offices use electronic document management systems (EDMS), only 25% of them treat EDMS as the primary method of documenting cases. The use of advanced e-services and electronic document circulation is not fully optimized, especially in smaller offices, which results in a limited possibility of complete transfer of administrative processes to digital forms. The survey also revealed that the lack of a coherent digitization policy and insufficient competence of employees in the use of digital tools hurt the efficiency of the implementation of e-services and exacerbate problems related to information overload (Miazga et al., 2022). The conclusions presented in the report are in line with the results of the study and are consistent with the beliefs of the authors of these considerations that digitization without systemic support and an appropriate level of employee competence may lead to a situation in which information problems, such as excess data or difficulties with their proper processing, are only intensified. The lack of implementation of a well-thought-out digitization strategy and the development of digital qualifications of civil servants is a common problem in many city offices, which in practice limits the effectiveness of digital information management and makes it difficult to improve public services. A broad analysis of this issue is also presented in the article "The Impact of Digitalization in the Public Sector: A Systematic Literature Review" (Fischer et al., 2021). The text presents an analysis of the impact of digitalization in the public sector through a systematic review of empirical research from the last decade. The authors point out that despite the potential of information technology to improve administrative processes, research on the real impact of digitalization is relatively scarce and usually focuses on short-term effects. The review includes 93 studies on digitalization in various areas, such as e-government, open governance, and the digitalization of internal processes. The authors point to the need to increase interdisciplinarity in research on the digitization of public administration, especially through the integration of results relating to different dimensions of public value. In addition, they point to the lack of research on the internal effects of digitization, which suggests the need to examine the impact of technology on administrative employees and organizational structures. It can be assumed that the results of the study presented in this article meet the articulated expectations, paying attention not only to utilitarian and instrumental values, especially in the context of the provision of public services but also to the internal effects

of digitization and to the study of the impact of the technology used on public administration employees. A very interesting look at the changes taking place in innovation, including digital, of public administration offices was presented by A. Wodecka-Hyjek (2023) who pointed out that the processes in which public organizations become similar to the organization of the business sector are expression of a rational strategy based on the assumptions of modern concepts of public management. Such imitation and its key features are revealed in the implementation of management methods in public organizations, often directly taken from the practices of enterprises. It also seems that institutional isomorphism, undoubtedly dominant among public organizations in recent decades, is the result of a certain pressure to increase the rationality, effectiveness, and efficiency of the functioning of the public sector. These conclusions prompt the authors to continue their research, because the pressure to improve the efficiency of offices will continue to increase, and the only way to reduce it is the continuous implementation of solutions to reduce the level of digital inefficiencies.

7. Conclusions

Information has always accompanied the management processes of organizations, but it has never been as valued as it is today. The contemporary reality is dominated by information and technologies used to acquire, process, and transmit it. Information becomes the most valuable of any organization's strategic assets. At the same time, it is a unique resource and cannot be replaced by other resources: it supports various processes, enables communication between employees and management, increases employee knowledge, helps to make decisions, and facilitates contact with the environment. Increasingly easy ways of producing and supplying it also generate certain risks. On the one hand, the amount of information provided far exceeds the capacity to process it, on the other hand, it is increasingly difficult to find the information that is needed in a given situation in the mass of information reaching people. Another problem is that the quality of the information provided is getting worse, so the quality of decisions made on its basis is also at risk. The existing methods of information management, based on the exchange of paper documents containing specific information, are becoming inefficient, imprecise, and difficult to implement. Their place is taken by methods of electronic exchange of information and data. Digitization in information and communication processes is one of the main directions in which modern information management is developing. Digital solutions allow for the management of large sets of information while maintaining its usability and quality, understood as the degree of adaptation to the needs and requirements of the user. Information inefficiencies identified almost thirty years ago, as research indicates, still occur in modern reality, causing several negative effects on both the economy and society. The digitization of information, both as a product and a process, is today one of the most

effective ways to counteract these inefficiencies. Technologies referred to as ICT or information and communication (ICT) have revolutionized the entire modern world and influenced the way we work, the economy, and the functioning of enterprises and people. The development of modern organizations today is closely related to the use of this type of solution. Of course, for them to work, many conditions must be met, such as m.in, their adaptation to the conditions of operation of a specific organization, or the appropriate competencies of employees related to their use.

The research on the impact of the implementation of digital solutions in the field of information and communication management has certain limitations, resulting primarily from the limited range (the surveys were conducted only among selected organizational units of the Municipality of Krakow). Therefore, these results cannot be generalized, and their analysis should be critical. Next, the research should be expanded in the context of expanding the sample, preferably by employees of all departments of the Municipality of Krakow. It would be interesting to diversify the study not only depending on the faculties but also to confront the results obtained by extending the study to other public sector institutions.

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