# *Multidimensional public sector organizations' digital maturity model*

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**Abstract:** *The aim of this study is twofold. First, this study develops a model of an organization's digital maturity that is adjusted to public sector organization. Second, based on the proposed model, digital maturity of several types of public sector organizations is diagnosed. The proposed model includes six dimensions, namely, digitalization-focused management, openness to stakeholders' (partners') needs, digital competencies of employees, digitalization of processes, digital technologies, and e-innovativeness. This model was tested on a sample of 136 public sector organizations operating in Malopolska Region in Poland. The results indicate that, among the six dimensions of digital maturity, the use of digital technologies and digitalization-focused management scored the highest (equivalent to a high and moderate degree of digital maturity). Employees' digital competencies also represent a moderate level of digital maturity (but still significantly lower). The remaining dimensions, namely, e-innovativeness, digitalization of processes, and openness to stakeholders' needs, represent a low level of digital maturity. The results show that the examined types of public sector organizations differ in terms of digital maturity. The observed characteristics regarding digital maturity are sufficient to indicate the direction of future development for each type of organization. The proposed model can be used for the diagnosis of digital maturity on the level of a single organization as well.*

**Keywords**: digital maturity; model; public sector organization; digitalization; e-government.

**JEL:** L30, L38, M15, O30

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## Introduction

The rapid development of public services, implied by the increasing use of digital technologies, has significantly increased the social use of new technologies and the expectation for their absorption in the area of public sector organizations. The process of implementation of digital solutions in public administration is reflected in the concept of e-Government. This term has been in use for more than

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20 years (Heeks & Bailur, 2007), however, the utilization of digital technologies in public services was considered even before (see Kraemer & Dedrick, 1997). Sharif and Irani (2010) state that e-Government "[...] seeks to provide public services, information, and knowledge to citizens, utilizing existing and emerging information technologies." Digitalization enables efficiency improvement of public sector organizations (Axelsson et al., 2013) and is perceived as an important area of innovation (El Ammar & Profiroiu, 2020). The European Commission has been monitoring the digitalization progress of the Member States through reports on the Digital Economy and Society Index (DESI) (European Commision, 2020). The Member States are diverse in terms of digital development (Androniceanu et al., 2020).

The digitalization of public services has been a widely described issue among researchers in the subject area for more than the last two decades (Androniceanu, A.M. et al., 2021). The basic aspect of the analysis is to show the use of digital technologies (service automation, data mining, machine learning) as well as modern tools and methods of communication and information transfer (e.g., social media, applications, podcasts, chat, etc.) to improve the quality and efficiency of public services by shortening the time of their implementation, increasing the existing offer, improving the transparency or liquidity of their provision (e.g. Norris & Reddick, 2011; Meijer & Bekkers 2015, Matheus et.al, 2018).

The development of automation and the use of information technologies in the production and distribution of public services is a key issue both in the concept of New Public Management (NPM) (Hood, 1991) and in the concept of Public Governance. While the point of reference in New Public Management is citizens as consumers, in Public Governance the action focuses on citizens as stakeholders (Izdebski, 2007). The basic assumption of Public Governance is the inclusion of citizens in the governance processes to obtain public value that allows the needs of various groups of stakeholders to be addressed. The assumption about the network nature of the social world and the potential of network mechanisms of public management is axiomatic for governance. A positive perception of the network approach to public affairs management is a result of, among others, the digital revolution enabling real-time interaction (Goldsmith & Eggers, 2004; Mazur, 2015).

The digitalization of public services at the state level is the subject matter of numerous studies. Within these studies, the measurement methodology has been developed, such the E-Government Development Index (EGDI) proposed by the United Nations (United Nations, 2020), or those implemented by the European Commission in the eGovernment Benchmark 2020 report (eGovernment Benchmark, 2020). They are used for ranking countries in terms of digital development, but also steer policies towards this development (Hogeveen, 2020). However, the digitalization process is also realized at the level of a single organization. Despite numerous studies on digitalization in public sector organization, sparse publications focus on the organizational level. Nonetheless,

managers of public organizations need indications and tools that can help them to implement digital solutions and increase the level of digitalization in their organizations. The available models of digitalization are dedicated to business enterprises and they do not meet the requirements and conditions typical of public organizations. In particular, we lack methodologies that enable us to measure the degree of public organizations' digital maturity.

This study aims to propose a public sector organization's digitalization model along with its operationalization. This model enables the diagnosis of digital maturity and indicates any areas that require improvement. The second aim of our study is to assess the characteristics of digital maturity of different types of public organizations and indicate the directions of their development. In this study we survey a sample of 136 public sector organizations, comprising several types, namely, local government units (LGU), units of the Labour Office (LO), National Revenue Administration (NRA), Social Insurance Institution (SII), Social Welfare Centres (SWC), Sanitary-Epidemiological Stations (SES), and Police (P). The organizations represented in our sample operate in the Malopolska Region in Poland. This study intends to contribute to the methodology of researching public sector organizations as well as the body of knowledge on the digitalization of public sector organizations.

The structure of the article is as follows. First, we review the existing literature on digitalization in public sector organization and digital maturity measurement. Second, we develop a model of public organization's digital maturity and a measurement instrument. Third, we present the results of our survey based on the proposed model and indicate the direction of digital development of the examined public organizations. Finally, we discuss the limitations of our model and propose the lines for its development in the future.

## 1. Review of digital maturity models in the business and the public sector

The concept of digitalization is accompanied by the problem of achieving digital maturity, which is understood as a state of complete digital development. The concept of the enterprise's digital maturity is often perceived only through the prism of technology – robots, systems, and algorithms. In a digitally mature company, the employees' competences are of key importance, while technologies are only an auxiliary tool (Nosalska, 2020). A digitally mature company just knows how to use digital solutions to gain competitive advantage. Śledziewska (2020, 20) suggests that "the best way to measure digital maturity is to check whether the data in the company are integrated and new services are created or certain processes are automated on the basis of these data, or rather the data flow between different company "silos" (different departments) without creating any added value".

The determination of the characteristics indicating full digital maturity is of particular importance in the digitalization process. A literature study on digital maturity research and the so-called readiness to introduce digitalization indicates

certain dimensions (areas) that are of key importance in the digitalization process. For example, Infocomm Media Development Authority & Boston Consulting Group propose Digital Acceleration Index, which includes six dimensions, namely, business strategy driven by digital, digitise the core, new digital growth, changing ways of working, leveraging the power of data and technology, integrating ecosystems (Boston Consulting, 2020). Deloitte proposes Digital Maturity Survey (for the financial sector), which comprises cyber security, digital channels and sales, experience, strategy, data and insights, innovation, technology openness, and digital marketing (Delloite, 2020; Androniceanu et al., 2020). Other models also include dimensions related to organizational culture, such as: ambition (Bain & Company, 2019), culture and organization (Forrester Research, Inc., 2016), leadership (Oracle, 2021). Yet further models, in turn, pay attention to such dimensions as digital customer engagement and digital operations (Innovation Value Institute, 2021), cloud capabilities and strategy (CISCO, 2021; Oracle, 2021).

Despite numerous models of digital maturity dedicated to businesses as well as concepts and models that refer to digitalization in a public sector organization at the state level (see Iannacci et al., 2019), we lack models facilitating digital development in public sector organization at the organizational level. When analyzing the digitalization on an organizational level, the general e-government framework should be considered along with public organization digitalization models at the macro-level (which have been presented above). Valdés et al. (2011, p.182) include the dimensions of e-government strategy and IT governance (along with process management and organization and people) in the scale of organizational maturity. E-government strategy comprises vision, strategy, and policy; enterprise architecture strategy; IT management and organization. IT governance comprises IT architecture; portfolio and risk management; IT service delivery; and assets utilization. The level of their development influences the degree of organizational maturity. However, there are also examples of organizational digitalization indicators. For example, Koh et al. (2008) have proposed a way of assessing the readiness of a government organization to transform itself into a provider of fully integrated e-government services, which they used within municipal government. Balaban et al. (2018) proposed Framework for Digitally Mature Schools (dedicated to pre-tertiary educational institutions), which includes 38 indicators of digital maturity grouped into five dimensions: planning, management, and leadership; ICT in learning and teaching; development of digital competence; ICT culture; and ICT infrastructure.

The above-presented review of the concepts of digital maturity at the organizational level indicates that the measurement of a public organization's digitalization should focus on the place of digitalization in the institution's strategy, digitalization of processes (both internal and external), digital technologies (both software and hardware); digital competencies of employees. Other issues include stakeholders' expectations (regarding digitalization), and e-innovativeness as a general background of digitalization.

## 2. Measurement of public sector organization's digital maturity

Based on the literature studies and a preliminary survey, six key dimensions have been proposed to assess the digital maturity of a public sector organization. These are: digitalization-focused management (public sector organization's vision, mission and management strategy), openness to stakeholders' (partners') needs, digital competencies of employees, digitalization of processes, digital technologies (information and communication technology, IT architecture and systems, cloud data, process automation, network speed), and e-innovativeness. There was a set of questions developed to assess the degree of digitalization in the entire organization. The respondents' task was to assess to what extent they agreed with the statements characterizing the particular dimensions of digitalization concerning the entity they worked at. The survey adopted a 7-point Likert scale (where 1 meant "definitely no" and 7 meant "definitely yes"). Based on the answers given by the respondents representing individual entities, the digital maturity levels of the surveyed unit were assessed according to the rating scale that is presented in Table 1. The overall rating for a single organization is calculated as a sum of the average ratings of the particular dimensions divided by 6 (which is the number of the dimensions considered in the study).

**Table 1. Scale of public sector organization's digital maturity**

| Range | Degree of the organization's digital maturity |
|-------|------------------------------------------------|
| 7.00–5.67 | Full digital maturity (FDM) |
| 5.66–5.00 | Very high degree of digital maturity (VHDM) |
| 4.99–4.34 | High degree of digital maturity (HDM) |
| 4.33–3.67 | Moderate degree of digital maturity (MDM) |
| 3.66–3.00 | Low degree of digital maturity (LDM) |
| 2.99–2.34 | Very low degree of digital maturity (VLDM) |
| 2.33–1.00 | Insufficient degree of digital maturity (IDM) |

(*Source:* authors' own elaboration)

To determine the digital maturity level of a public sector organization, an additional condition was also adopted, under which, if the score in at least one dimension (out of six) fell below the minimum score for the directly lower level (following the adopted scale), the maturity level had to be lowered by one level. In addition, the authors propose the principle that the transition to a higher digital maturity level requires improvement in the activities, especially in the dimension that scored so low. These activities can be considered a priority in the public sector organization's digitalization.

A score between 7.00 and 5.67 on the digital maturity scale meant that the organization had reached full digital maturity. This state was identified by the authors of the study as a model organization with full digital maturity, a kind of a pattern worth following. The organization's development towards this model meant that its managers had to take actions within the framework of each of the six analyzed dimensions. Table 2 presents the description of the conditions typical of full digital maturity.

**Table 2. Characteristic of public sector organization's full digital maturity**

| | |
|---|---|
| digitalization-focused management | - modify processes so as to facilitate their digitalization,<br>- treat the digitalization strategy as a key element of the organization's development strategy,<br>- cyclically allocate a significant part of the budget to the institution's digitalization,<br>- systematically implement the digitalization strategy, striving for more effective use of public funds (e.g., reducing the cost of service per 1 applicant). |
| digital competencies of employees | - treat digital competence as an important criterion for employee evaluation,<br>- systematically develop employees' digital competences<br>- develop a positive attitude of public sector organization's employees towards process digitalization<br>- implement a system of acquiring and retaining employees with a high level of digital competencies ("digital talents"),<br>- disseminate information technology in information and communication processes among employees. |
| openness to stakeholders' needs | - involve stakeholders (including customers) in the process of improving/designing the way the public sector organization provides e-services,<br>- continuously monitor the effects of digitalization (efficiency, cost) by means of indicators related to, e.g., procedure implementation time, customer satisfaction, etc.<br>- strive for a state in which clients can process the majority of interactions via the Internet,<br>- use modern IT infrastructure, e.g., automated self-service devices for clients, so-called touchpoints<br>- use external assistance/opinion from experts in the field of digitalization,<br>- increase the accessibility of services provided by the public sector organization and expand the group of clients (e.g., persons with reduced mobility, recipients of benefits, recipients of "tourist voucher" and similar benefits). |
| process digitalization | - digitize primary data and processes related to customer service,<br>- automate customer service processes, so that most of them are carried out with minimum employee involvement<br>- digitize most of the internal (auxiliary) data and processes (e.g. human resources, fixed assets records, data archiving),<br>- automate internal processes (auxiliary processes, e.g., HR, fixed asset records, data archiving) so that most of them are performed with minimum employee participation,<br>- monitor processes related to customer service and all internal processes using specific indicators,<br>- strive to systematically reduce the costs of process/procedure execution utilizing process digitalization and automation. |

| | |
|---|---|
| digital technologies | - fully integrate IT systems used in public sector organizations,<br>- introduce remote work mode as a standard for performing certain groups of tasks,<br>- provide all employees with unlimited access to IT support,<br>- use dedicated software (customized for the needs of the office),<br>- conduct systematic activities related to the protection and security of digital solutions,<br>- use the data stored in the "cloud" (or on proprietary virtual drives) to improve the effectiveness of remote work. |
| e-innovativeness | - implement innovative solutions based on the latest digital technologies (also use the so-called breakthrough innovations such as smart services),<br>- systematically conduct work directed at the development of process digitalization with the use of internal and external resources (including start-ups, hackathons)<br>- search for e-innovations at all levels of the public sector organization - according to the approach "we do not have to be ashamed of our ideas",<br>- implement digitalization and automation to contribute (where possible) to higher levels of cashless payments for benefits,<br>- use data analytics software (using, e.g., artificial intelligence, so-called Big Data Management, Business Intelligence Tools) to better adapt to partners' expectations (offer individualization),<br>- strive for continuous growth in the use of digital technologies |

(*Source:* authors' own elaboration)

The implementation of the above indicated activities at such a high level gives a kind of picture of the authors' digital maturity model of the public sector organization.

### 3. Digital maturity of public sector organizations in the Malopolska Region

To verify the applicability of the proposed digital maturity model and the relevant measurement tool, we assessed the degree of digital maturity of different types of public organizations operating in the Malopolska Region in Poland. In particular, we analyze eight types of public organizations, namely, local government units (LGU; municipality and community level), Labor Office (LO; sometimes called "unemployment office"), National Revenue Administration, Social Insurance Institution (SII), Social Welfare Centers (SWC), Sanitary-Epidemiological Stations (SES), and Police (P). In total, our sample consists of 136 public organizations. The profile of the sample is presented in Table 3.

**Table 3. Sample characteristics**

| Sub-sample | Number of units | Number of units at province and district level | Number of units at community level | Number of employees | Average number of employees |
|---|---|---|---|---|---|
| LGU | 54 | 12 | 42 | 7117 | 131.80 |
| LO | 15 | 15 | 0 | 1277 | 85.13 |

| Sub-sample | Number of units | Number of units at province and district level | Number of units at community level | Number of employees | Average number of employees |
|---|---|---|---|---|---|
| NRA | 34 | 29 | 5 | 8205 | 241.32 |
| SII | 5 | 2 | 3 | 942 | 188.40 |
| SWC | 13 | 3 | 10 | 1280 | 98.46 |
| SES | 7 | 7 | 0 | 187 | 26.71 |
| P | 8 | 8 | 0 | 2162 | 270.25 |
| **Total** | **136** | **76** | **60** | **21170** | **155,66** |

(*Source:* authors' own study

The data was collected in January and February 2020 with an on-line measurement tool. Our respondents represented a top management level (town/city mayors or organization managers) and a high management level (deputy organization managers or department managers). The results of our analysis are presented in Table 4.

**Table 4. Digital maturity of the examined public organizations**

| Sub-sample | Digitalization-focused management | Openness to stake-holders' needs | Digital compe-tencies | Process digitali-zation | Digital techno-logies | E-innova-tiveness | Total |
|---|---|---|---|---|---|---|---|
| **LGU** | MDM (4.01) | LDM (3.40) | MDM (3.89) | LDM (3.08) | MDM (4.29) | LDM (3.09) | **LDM (3.63)** |
| **LO** | VHDM (5.03) | MDM (4.29) | HDM (4.34) | MDM (3.89) | HDM (4.74) | LDM (3.54) | **MDM (4.30)** |
| **NRA** | HDM (4.34) | MDM (3.74) | MDM (3.75) | MDM (4.16) | MDM (4.32) | LDM (3.43) | **MDM (3.96)** |
| **SII** | VHDM (5.89) | VHDM (5.60) | VHDM (5.31) | VHDM (5.54) | VHDM (5.46) | VHDM (5.40) | **VHDM (5.53)** |
| **SWC** | MDM (3.73) | LDM (3.20) | LDM (3.57) | LDM (3.31) | MDM (4.14) | VLDM (2.90) | **LDM (3.47)** |
| **SES** | MDM (3.84) | LDM (3.33) | MDM (3.82) | LDM (3.37) | MDM (3.88) | VLDM (2.84) | **LDM (3.51)** |
| **P** | HDM (4.39) | VLDM (2.98) | MDM (3.82) | LDM (3.52) | MDM (4.25) | LDM (3.46) | **LDM* (3.74)** |
| **Total** | **MDM (4.26)** | **LDM (3.61)** | **MDM (3.92)** | **LDM (3.59)** | **HDM (4.35)** | **LDM (3.30)** | **MDM (3.84)** |

*Notes:* FDM – full digital maturity; VHDM – very high degree of digital maturity; HDM – high degree of digital maturity; MDM – moderate degree of digital maturity; LDM – low degree of digital maturity; VLDM – very low degree of digital maturity; IDM – insufficient degree of digital maturity.

* due to VLDM in terms of "openness to stakeholders' needs"

(*Source:* authors' own study)

According to the data presented in Table 4, the degree of digital maturity in the entire sample is moderate (3.84). The units of SII represent a very high degree of digital maturity (5.53), which is the highest level among all types of the examined public organizations. A moderate degree of digital maturity (4.33–3.67) has been achieved by units of LO (4.3), NRA (3.96), Police departments (3.74). A low degree of digital maturity (3,66–3,00) has been observed among LGU (3.63), SES (3.51), and SWC (3.47); the latter scored the lowest among the examined types of public organizations. The presented results indicate a significant variety in the degree of digital maturity among the examined types of public organizations.

Among the six dimensions of digital maturity, the use of digital technologies and digitalization-focused management received the highest score (4.35 and 4.26, respectively; these values indicate a high and moderate degree of digital maturity regarding these two dimensions). Employees' digital competences also represent a moderate level of digital maturity (3.92). The remaining dimensions are at a low level of digital maturity; specifically, e-innovativeness (3.30), process digitalization (3.59), and openness to stakeholders' needs (3.61). This observation indicates a significant variety in the degree of digital maturity among the six dimensions of digital maturity within the examined sample of public organizations. This variety is observed within particular types of public organizations as well.

Based on the results of our examination, we can recommend some directions of further improvement regarding digitalization. LGUs need to focus on e-innovativeness, process digitalization, and inclusion of stakeholders' perspectives in their digital activities; these dimensions still represent a low degree of digital maturity. LO units should focus on e-innovativeness, which is at a low level; then developments in the area of process digitalization, openness to stakeholders' needs, and use of digital technologies enable them to achieve a high degree of digital maturity. In the case of NRA units, e-innovativeness is the weakest dimension (currently at a low level of development) and needs improvement. Further, employees' digital competencies, process digitalization, openness to stakeholders' needs, and use of digital technologies need to be developed to achieve a high level of digital maturity. SII achieved a very high degree in all dimensions of digital maturity. Further development can lead to full digital maturity. However, we should remember that the requirements typical of this degree are expected to grow in the future; thus, despite a very high level of digital maturity, further, continuing development is necessary. The remaining types of public organizations represent a low degree of digital maturity. To achieve a moderate degree, SWCs need to improve in e-innovativeness (which is currently at a very low level), and then digital competencies, process digitalization, and openness to stakeholders' needs. SES needs improvement in terms of e-innovativeness (which is currently at a very low level), and then process digitalization and openness to stakeholders' needs. Police departments achieve an overall score of 3.74, which indicates a moderate degree of digital maturity. However, due to a very low degree of openness to stakeholders' needs, the Police departments have been evaluated as representing a low degree of

digital maturity; thus, this dimension requires improvement, along with e-innovativeness and process digitalization, which are at a low level.

Our results are in line with the study of Balaban et al. (2018), who observed a low degree of digital maturity of schools in Croatia. Additionally, their study shows some indicators that play an important role within dimensions of digitalization. These areas needs to be improved to raise the maturity of the dimension and, consequently, of a school. Similarly, in our study we have discovered that openness to stakeholders' needs is one of the dimensions that require a special attention in our sample. Our observation can be useful in the process of implementing the EU Digital Single Market Strategy in the public sector. This is especially important in the context of challenges raised by the COVID-19 crisis. The successful exit strategy from the current pandemic will require robust digital public services, including e-health, and the use of advanced technologies to improve public services, for example through big data or AI (European Commision, 2020).

## 4. Conclusions

This study develops a model of digital maturity that can be used to assess the degree of digital maturity of public sector organizations. The diagnosis based on the proposed model can be used to indicate the dimensions of digitalization that require improvements. Within this study, the model was tested. The achieved results have proved that the proposed model can be implemented within different types of public sector organizations.

However, some limitations need to be considered when applying the proposed model and generalizing the results of this study. First, the proposed model includes six dimensions of digitalization. Despite the inputs from previous studies and pilot studies, not all relevant factors are included in the model. We do not consider such dimensions as internationalization, which may be considered as a factor for maturity. In the digital context, the internationalization can be manifested by a multilanguage interface and implementation of international digital services standards (like Point of Single Contact (PSC) in the EU member states). Further dimensions omitted in our model are mobility, localizability, and personalization; they are positively associated with perceived value (Wang et al., 2020) and may be considered as a manifestation of e-government development or its extension. We omitted the challenge of digital services accessibility to handicapped users. In the Polish context, public organizations are obliged by law to implement relevant solutions in this area. However, in other legal environments, this issue may be essential to assess digital maturity. We do not analyze the development of e-government from the users' acceptance perspective (however, the stakeholders' perspective is reflected). Although the proposed model has been adapted to the conditions typical of public organizations, these organizations are diversified, for example, in terms of the number of citizens served, number of employees, level (local, regional, country-level), and type (state and self-governmental); this diversification can require further adjustments. Additionally, there are significant

differences in the adoption of e-government practices across the world. Thus, when constructing models and tools for the diagnosis and improvement of public sector organization digitalization, the development context should be taken into consideration (Shareef et al., 2011). According to the presented results and the revealed differences in terms of digital maturity and the recommended directions of further development, the limitations related to the sample need to be considered. The sample examined in this study represents one country region, with its cultural and legal characteristics. Consequently, within other samples representing other locations (and the related conditions), digital maturity can be different and other steps to increase digital maturity can be necessary. Thus, it is recommended to test the proposed model in other contexts. It is also recommended to develop the model by augmenting it with other dimensions or items.

This study has implications for managers in public sector organizations. This study suggests that the digitalization process can be unbalanced – some areas can be more, while others can be less developed. The proposed model can help to identify such differences and propose actions leading to the achievement of a higher degree of digital development. The proposed model can be directly implemented to the diagnosis of digital maturity (and identification of organizational weaknesses in this aspect) of public sector organizations (as completed for public sector organizations from the Malopolska region in Poland). However, this model can be used to construct other tools dedicated to public sector organizations in the digitalization context.

This study contributes to the New Public Management development in the scope of modern methods of management application, namely related to digitalization. It also contributes to Public Governance by indicating digitalization as an accelerator of stakeholders' involvement in the design of public services. Additionally, this study contributes to the methodology of organizational research; it proposes a model of digital maturity adapted to public sector organizations. The study presents the key areas of digitalization in public sector organizations being an input to the body of knowledge about digitalization and e-governance.

### Authors Contributions

The author/authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

### Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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