10.2478/nispa-2022-0012

# Digital Transformation of Slovenian Urban Municipalities: A Quantitative Report on the Impact of Municipality Population Size on Digital Maturity

*Arian Debeljak*[1], *Mitja Dečman*[2]


## Abstract

Rapid technological progress and its concomitant need for new skills, ways of working and collaborating, paired with dynamic socio-economic change, have highlighted the main challenge facing Europe's urban municipalities. Being the part of the public sector closest to citizens and their needs, the challenge addresses digital transformation's goals to support and promote broader growth in the digital domain optimally and to realise digital transformation benefits such as user-friendly and citizen-centred services, increased quality of life and better business environments. Urban municipalities must identify local strengths, priorities and needs, including performance and digital maturity assessment, and define strategic goals and implementation roadmaps to implement digital transformation optimally. Furthermore, they must increase city administration, decision-maker and citizens awareness of the opportunities and benefits digitally enabled solutions offer.

A comprehensive digital maturity self-assessment is the first step towards successful digital transformation. An example of a framework for such an assessment is the framework of the European Commission's Intelligent Cities Challenge (ICC), the EU's bespoke support programme for coaching, facilitation and inspiration, and successor to its Digital Cities Challenge. Therefore, the objective of our research was


1 University of Ljubljana, Faculty of Public Administration, Ljubljana, Slovenia and University of Rijeka, Faculty of Economics and Business, Rijeka, Croatia.

2 University of Ljubljana, Faculty of Public Administration, Ljubljana, Slovenia.



© 2022 Arian Debeljak, Mitja Dečman. This is an open access article licensed under the Creative Commons Attribution-onCommercial-NoDerivatives 4.0 License (https://creativecommons.org/licenses/by-nc-nd/4.0/).

to analyse the digital maturity self-assessment results undertaken by eleven Slovenian urban municipalities utilising ICC's assessment methodology framework for government services and social connectivity, which includes indicators sets of digitising public services, digital connectivity and open data. We further focused on the potential impact of municipality population size on its digital maturity. According to the existing research, this is one of the significant potential explanatory factors why municipalities differ in terms of digital transformation implementation and adaptation.

One would *a priori* expect larger municipalities to be digitally more mature than smaller ones because they have more resources at their disposal, however, our results prove that this is not the complete picture. There is, however, a relationship between municipality population size and digital maturity, including indicators of open data sharing and security, but not entirely in the manner expected. Furthermore, our analysis has shown that municipality population size does not influence overall digital maturity but individual digital maturity indicators, highlighting the need to develop more detailed and accurate individual digital maturity indicators. Although the influence of municipality population size on overall digital maturity could not be demonstrated, its partial influence on individual sets is essential when endeavouring to achieve efficient digital transformation.

**Keywords:**
digital maturity, digital transformation, intelligent cities challenge, size, urban municipalities

## 1. Introduction

The private sector's exhaustive offer of digital services raises expectations for equally attractive and functional digital services in the public sector (Mergel et al., 2019), triggering a rise in demand for more innovative (da Rosa & de Almeida, 2017), real-time, value-added digital services (Mergel et al., 2019), increased democracy, direct interaction and increased citizen participation in decision-making. Furthermore, more accountable, transparent, agile and entrepreneurial administrations playing more significant roles in the digital economy are expected (Hanna, 2018). Consequently, this requires national and local governments to respond in a timely fashion and comprehensively adapt to the constant change taking place in uncertain environments by better developing and introducing more efficient and accessible services based on contemporary digital technology (Meijer & Bekkers, 2015). Digital transformation (hereafter DT) is the term that best encapsulates the change engendered by digital technology on all aspects of human life and its responses to it, encompassing the radical change engendered by the rapid development of information and communication

technology (hereafter ICT) and the increasing use of digital technology in the public and private sectors (Vial, 2019). DT represents a radical step in societal evolution because previous technological development was never as rapid as it is now and never influenced social change and people's habits as much and as quickly (Schwab, 2016). DT's influence is strongly felt in the private sector but much less so in the public sector, especially in local communities (hereafter LCs). Therefore, DT in LCs is a necessary step for their further development. Accordingly, many European rural and urban LCs have recognised the need for DT, which has fostered broader growth in the digital field to reap benefits such as user-friendly and citizen-centred digital services, increased quality of life and better business environments.

Slovenian urban municipalities took their first steps towards DT by recognising and participating in the European Commission's Intelligent Cities Challenge (hereafter ICC), the EU's special incentive for DT, by forming a SiMOS consortium in 2020. The ICC is a bespoke support programme, which better enables coaching, facilitation and inspiration delivery, administered by the European Commission (2020). The focus of our research was to analyse and evaluate data pertaining to the self-assessment of digital maturity (hereafter DM) by eleven Slovenian urban municipalities participating in the ICC to evidence the main reasons for DM diversity in terms of their response to government services and social connectivity. A survey conducted as part of the ICC project, in which the aforementioned municipalities participated, was used. The primary focus was whether and to what extent a municipality's population size affects its level of DM. Furthermore, we wished to verify the general level of DM in the individual Slovenian urban municipalities concerned, particularly in relation to individual DM indicators and the following DM topics: DPS - digitisation of public services, DC - data connectivity, and OD - open data.

Section 1 introduces the research area, namely urban municipality DT; Section 2 presents detailed explanations of DT, Slovenian urban municipalities' DM and the ICC; Section 3 evidences our methodology, research procedures and questionnaire used to collect data; Section 4 presents our research results on DM in terms of Slovenian urban municipality government services and social connectivity; and Section 5 is composed of a discussion on our research results and concluding thoughts.

## 2. Municipality digital maturity and the ICC's digital maturity model

DM, which represents an organisation's ability to adapt to change by using different digital solutions, is based on a psychological definition of 'maturity' related to the learned ability to respond to the environment in an appropriate manner (Kane et al., 2017). Although DM models have been criticised for their simplicity, their lack of empirical grounding, the considerable number of such models and their similarities, and lack of documentation on the back-end processes of the models themselves

(Becker et al., 2009; McCormack et al., 2009; and Thordsen et al., 2020), they provide a simple and effective means for understanding and measuring the digital readiness of organisations when addressing and exploring DT (Lahrmann et al., 2011). Therefore, the need for quality maturity models will continue to grow (Mettler, 2010).

Even though Fath-Allah et al. (2014) evidence that a large number of similar maturity models have emerged in the past twenty years in the field of public administration, mainly for assessing the DM of online e-government services (Meijerink, 2016), e-participation (Maciel et al., 2008; United Nations, 2020) and interoperability (Gottschalk, 2009), Eaves & Lombardo (2021) state that we have not seen many quality models that address the maturity of digital services in the public sector. It is also important to note that even though there are well-established mechanisms for assessing national e-government development progress, assessing local e-government maturity is in its early stages and remains relatively rare (United Nations, 2020). From an academic perspective, the best-known models for this are Layne and Lee's and Andresen and Henriksen's (Fath-Allah et al., 2014).

A critical look at said maturity models proves that current self-assessment mainly focuses on technology, which Kane et al. (2017) argue is not crucial for DT, but organisational mentality, strategy and processes and the like are. Similarly, Berghaus & Back (2016), in their study of maturity models, state that DT leaders first need to identify their current level of DM and be cognizant that it simultaneously but differently affects different dimensions within their organisations. A more comprehensive approach to assessing DM is offered by models used in the private sector, where maturity models are also increasingly evolving due to the rapid adoption of digital technologies in business, enabling organisations to adapt effectively to DT in a timely fashion. Unfortunately, these models are usually strongly associated with ICT management and software development (Ertan, 2018). Forrester's Digital Maturity Model 5.0 is one of the more comprehensive and useful maturity models (Gill & VanBoskirk, 2016; VanBoskirk et al., 2017), as it evaluates how well users have incorporated digital into their operating models and how effective they have been at executing digital initiatives; moreover, Forrester's model is constantly evolving and currently enables the measurement of DM across four dimensions, these being cultural, organisational, technological and experiential.

Compared to the EU average, Slovenian municipality DM in digital interaction with citizens, companies and other public organisations is low (ESPON, 2020). However, the rapid development of new tools and technology, as well as the COVID-19 pandemic, have fostered Slovenia's municipalities' better identification of their most important goals for the near future, that is, time efficient municipality DT to support employees, citizens and businesses, broader development and economic growth in the digital sphere, and resilience in the face of social extremes. And if municipalities wish to achieve these goals, and satisfy the demands of the digital age and successfully fulfil their missions by engendering public sector DT (European Commission, 2016), they must have a good understanding of DT. We must

importantly bear in mind that DT is a long-term process that affects organisational structures and capabilities, and existing information technology infrastructures and systems (Davenport & Westerman, 2018); furthermore, it must be recognised that this will only be achieved by utilising the appropriate combination of technology, human skills and agile organisational structures (Marchand & Wade, 2014), and that DT is primarily a story of rapid change with limited time for reflection, planning, adaptation and error correction (Bavec et al., 2019). To optimally reap the rewards of DT, organisations must analyse and evaluate their digital readiness using thorough DM self-assessments (Ertan, 2018), keeping in mind that the rapid shift from conventional to purely digital interaction in public service delivery has highlighted the long-known but still unresolved problem of the digital divide (Dečman, 2017).

Further to DM self-assessment and DT strategy development and implementation, the question arises of contextualising individual municipality progress and comparing it with other municipalities. It is not easy to make progress in a new area, which municipality DT undoubtedly is, and to set and achieve long-term goals if individual municipalities cannot assess their relative progress compared to other municipalities (Eaves & Lombardo, 2021). Furthermore, DT constantly and simultaneously evolves in tandem with business strategy and processes, technology and information system change (Wagire et al., 2021), so it must be continuously evaluated. Given the evolving process of DT, the measurement of progress should consider not only the fact that digital technologies are being used in public service delivery or regulatory enforcement but also the extent of digital maturity at the end of processing citizen requests (Dobrolyubova, 2021).

As evidenced by various research studies, the municipal size represents another, if not one, of the most crucial impact factors in DT implementation. For example, Meijerink (2016), in his research on Dutch municipality e-governance maturity levels, which analyses the concerned municipalities' websites, finds that municipality size influences overall digital maturity level scores (SUM). Burke & Molitorisová (2018) evidence that e-Government development is accorded higher priority in the larger municipalities and that priority levels decrease accordingly as municipalities diminish in size: the smaller the population of the municipality, the less likely it is that it will implement advanced services, which often demand the deployment of larger-scale resources and more robust ICT systems. Furthermore, Zuiderwijk et al. (2018) researched how municipality size influences municipality motivation perspectives when opening up municipality data. Although their findings do not support the statement "the smaller the municipality, the less motivated it is to open up its data", municipality resource type and amount influence the motivation to share data or not. Jakob & Krcmar (2018) find, in their research on the barriers that hinder small and medium-sized Bavarian municipalities when developing up-to-date digitalisation, that municipality size significantly, positively and simultaneously affects the number of people working in ICT departments and know-how; they also suggest that a maturity model that measures actual e-government or digitalisation status in terms of a

municipality or local authority size would be of great benefit. However, some researchers, such as Soukopová et al. (2014), have shown that economies of scale for local services cannot be clearly identified in the municipalities of each country (the study focused on the Czech Republic) and that the size of a municipality is not a key factor influencing the provision of local services. Nemec (2018) also points out that there is no optimal size of a municipality and that, according to the available academic research, the economies of scale (savings thanks to larger size) cannot be confirmed for the entire block of municipal services.

An example of a framework for such an assessment is the framework of the European Commission's Intelligent Cities Challenge (ICC), the EU's bespoke support programme for coaching, facilitation and inspiration, and successor to its Digital Cities Challenge. The ICC programme brings together a community of cities with untapped potential, clear aspirations and strong commitments to grow. Using digital and advanced technology, these cities can improve performance, provide a higher quality of life for their citizens and improve their competitive environments. The two-and-a-half-year programme builds on the success of its predecessor, the Digital Cities Challenge (European Commission, 2018), which helped 41 EU cities develop strategic visions and roadmaps for their DT. From the DT perspective, ICC envisages the implementation of DM self-assessment in relation to digitisation of public services and digital connectivity, which includes digitising public services, digital connectivity, open data, citizen participation and local industry. The ICC provides support for four main phases:

1. Preparation and Assessment – Determining urban municipality DM, how to better develop it and who should be involved.
2. Ambition and Roadmap – Developing concrete plans to achieve improvement, collaborating with communities and promoting action that immediately benefits urban municipality stakeholders.
3. Implementation – Taking giant steps and evidencing results.
4. Review and Way Forward – Measuring success and commitment to maintaining connection and improvement.
5. The research presented in this paper focused on Phase 1, in which municipalities used the ICC self-assessment tool to determine their existing technology DM level. The results of the self-assessment enable municipalities to understand better their technology maturity, which is the foundation for DT.

# 3. Empirical research

## 3.1 Research background

The basic organizational form of local self-government in Slovenia is the municipality. The first forms of local self-government in present-day Slovenia date back to the mid-19th century, when the first municipal councils were elected in 1850. Since then, municipalities have existed in various forms and sizes at different times. A century later, in 1955, municipalities were abolished and replaced by socio-political communities by the regime at that time. After Slovenia's independence and the adoption of the new constitution, 147 municipalities were established based on Article 3 of the Act on the Establishment of Municipalities and Municipal Boundaries (EMMBA, 1994) in October 1994, in accordance with the European model, including all 11 urban municipalities that were the subject of our study. Four years later, the number of municipalities increased to 192 and 193 in 2002. In 2006, the number of municipalities in the Republic of Slovenia reached 210, and the last two municipalities were established in 2011, namely the Municipality of Mirna and the Municipality of Ankaran.

Slovenian municipalities vary considerably from each other. They bring together approximately six thousand settlements, of which one in a hundred has no inhabitants. Out of 212 Slovenian municipalities, more than half have fewer than five thousand inhabitants, and only a sixth of the entire population of Slovenia lives in these municipalities. On the other hand, almost a fifth of all Slovenian citizens live in two urban municipalities, Ljubljana and Maribor. Every third municipality borders one of Slovenian's four neighbouring countries (Portal GOV-SI, 2022).

According to the Local Self-Government Act of 1994 (LSA, 1994), a municipality could obtain the status of urban municipality if it had at least 10,000 inhabitants and was the geographical, economic and cultural centre of its gravity area. In the Local Self-Government Act (LSA, 2020) in force today, Article 16 stipulates the following as a condition for the status of urban municipality: "According to the law, a municipality may be granted the status of urban municipality if in its territory there is a city with at least 20,000 inhabitants and 15,000 jobs, and is the economic, cultural and administrative centre of the wider area."

Today, 12 of the 212 Slovenian municipalities have the status of urban municipality. According to the Slovenian Constitution (Republic of Slovenia, 1991), this is a constitutional category within local self-government and has a special or different status from other municipalities. The constitutional arrangement of the municipality is based on the assumption that there are two types of municipalities in Slovenia, namely, the ordinary municipality and the urban municipality. The urban municipality performs the same tasks as any other municipality, in addition to the legally established functions from the state jurisdiction, which relate to the development of cities (Article 141(2) of the Constitution) or enable the functioning

and integration of all functions of the city, such as urban, communal, transport, spatial and regulatory units and as centres of cultural, educational, scientific, health, social and other institutions important for several municipalities or for the region. Thus, it is a question of functional autonomy of urban municipalities. The original scope of urban municipalities differs from the scope of other municipalities, because, in reality, it is about the specificity of the tasks and problems of the urban municipality, which arise from its connection to the urban environment and the connection through the daily migration of the population. As a result, municipalities are facing problems such as the problem of insufficient public transport in cities, poorer air quality, higher energy consumption, an increasing number of spatial and environmental changes in the city, the provision of digital technologies involving the public, proper involvement of the people in the development of the city, preparation for the development of so-called smart and inclusive cities, and the implementation of sustainable urban development projects, etc. All this means that urban municipalities have to satisfy more and more needs due to the increasing number of people and the larger scale of activities, which increases their administrative, cost, investment and development efforts (AUMS, 2021). Because urban municipalities are trying to solve more and more problems with the help of modern digital solutions, monitoring the DM of urban municipalities is even more relevant.

The last municipality to receive the status of urban municipality was the municipality of Krško, in November 2021. Because our study took place in the spring of 2021, this municipality was not included. The 11 Slovenian urban municipalities presented in our study are home to more than a third of Slovenia's population, the largest being its capital Ljubljana, with approximately 290,000 permanent residents, the smallest being Slovenj Gradec, with approximately 16,600 permanent residents. Apart from Ljubljana and Maribor, other Slovenian urban municipalities are home to less than 50,000 permanent residents. Because of being relatively small in terms of population (OECD, 2012), their proximity to the biggest municipalities and high levels of population migration, both permanent and daily for work and education, they should conduct DT collectively and in a coordinated fashion.

All 11 urban municipalities began participation in the ICC programme by establishing a SiMOS consortium in 2020.

## 3.2 Methodology

Data collection was conducted using a questionnaire defined by the ICC, which was emailed to the appropriate representatives of all the urban municipalities concerned. Said questionnaire is a question-augmented version of the Tractebel 360 City Assessment Tool, which the preceding Digital Cities Challenge used and is currently available online (Tractebel, 2020). The questionnaire comprises a series of questions addressing city performance regarding digital and advanced technology maturity.

The survey was conducted in June 2021, emailing the questionnaire to the

appropriate representatives of all the municipalities concerned and, if necessary, complemented by phone call to record their responses. In this way, we gained reactions from all the urban municipalities involved. In principle, it was anticipated that our questionnaire be completed by those well acquainted with the internal operations of the municipality and the services it delivers to its citizens and abreast of the general development of their municipality.

To ensure the validity of the answers given as much as possible, we have taken some data directly from the official records, and some have been additionally verified, namely:

- Data about the population size of municipalities were obtained from the official website of the Statistical Office of the Republic of Slovenia.
- Data on available digital services, presence and coverage of wireless Wi-Fi networks and mobile network coverage of were checked through the municipalities' websites. However, we found that verifying factual data in digitisation via the municipalities' websites is only possible to a minimal extent because they are either not published or too general.
- The existence of open data sets of individual municipalities, in particular the verification of answers to the questions OD1 (contribution to open data) and OD3 (sharing of data), was verified on the national portal for open data OPSI (OPSI, 2020). On the OPSI portal, the number of data collections (contribution) is published separately for each municipality, as well as the number of times each data collection was accessed (shared).

Some of the responses given were subsequently verified verbally, specifically with the department heads of IT (e.g. CIO, CTO, CDO) and the leaders of the project offices or project managers of individual municipalities.

In line with the literature review, in which the authors indicate that municipality size matters as a significant potential explanatory factor when determining why municipality responses differ when implementing digitalisation or DT, we have included data about Slovenian urban municipality population size (statistical data for the year 2020) and investigated its potential influence on DM. The list of urban municipalities by population is shown in Table 1.

**Table 1:**

Slovenian urban municipality population

| Urban municipality | Population |
|---|---|
| Ljubljana (LJ) | 294,050 |
| Maribor (MB) | 112,395 |
| Kranj (KR) | 57,130 |
| Koper (KP) | 52,770 |
| Celje (CE) | 49,070 |
| Novo mesto (NM) | 37,430 |
| Velenje (VE) | 33,640 |
| Nova Gorica (GO) | 31,880 |
| Ptuj (PT) | 23,640 |
| Murska Sobota (MS) | 18,680 |
| Slovenj Gradec (SG) | 16,610 |
| Average | 66,117.73 |

Source: Statistical Office of Slovenia, 2020

### 3.3 Instruments used

We used the part of the ICC questionnaire that addresses 'digitisation of public services, digital connectivity and open data' to obtain the data, as it explicitly refers to digitalisation in three of its four question sets. Accordant with our research on digitalisation, we removed the questions that address citizen participation and local industry. 14 closed-ended (with pre-defined answers) questions remained grouped into three sets (
Table 2). The first set of questions addresses the digitisation of public services. It is composed of four short questions to verify whether the municipality offers a significant part of its services digitally and actively supports universal access to public e-services, including technical support and communication campaigns, or not; these questions are concerned with how many new digitised services had been introduced by the municipality in the preceding three years and whether citizens are digitally-literate enough to use them, or not. The second set of questions addresses digital connectivity and availability in the municipality. The third set of questions addresses Open Data. It is composed of six questions to verify whether public sector institutions and organisations provide open data and whether the use of open data for policy-making is widespread, whether data sharing among city stakeholders and other cities is the

norm, whether data overload through different channels makes it difficult to prioritise key issues and establish effective dialogue with citizens and businesses, and whether citizens, in general, have confidence in the ICT architecture in terms of privacy, security and ethics, or not.

**Table 2:**

Part of ICC survey questionnaire indicator sets that explicitly refers to digitalization

| Set | Indicator | Description |
|---|---|---|
| Digitisation of public services (DPS) | DPS1 | Availability of digital services |
| | DPS2 | Digital services uptake |
| | DPS3 | Digital services push |
| | DPS4 | Citizen digital service skills and knowledge |
| Digital connectivity (DC) | DC1 | Extent of urban municipality mobile internet coverage |
| | DC2 | Free wireless internet availability in public spaces |
| | DC3 | Citizen expectations related to information, service and interaction to be digitally available 24/7 |
| | DC4 | Extent of smart infrastructure coverage, including public lighting, roads, energy, waste management and smart buildings |
| Open data (OD) | OD1 | Open data contribution |
| | OD2 | Open data use |
| | OD3 | Open data sharing |
| | OD4 | Open data benchmarking |
| | OD5 | Open data overloading |
| | OD6 | Open data security |

Source: Authors

Each question had three potential pre-defined answers that indicate the key stages of digital maturity:

1. digitally less advanced (0);
2. digitally transforming (1); and
3. digitally mature (2).

Accordant with the closed-ended questions, the qualitative responses (response codes) for statistical analysis for each indicator were assigned, as shown in the Table 3.

**Table 3:**

Response coding

| Question | Answer No. 1 | Answer No.2 | Answer No.3 |
|---|---|---|---|
| **Does the city provide a significant part of its services digitally?** | No, services are predominantly available offline/or only information is available online. | Services are predominantly available online. | Yes, services are predominantly digitalised. |
| **Quantitative value / response code (RC)** | 0 | 1 | 2 |

Source: Authors

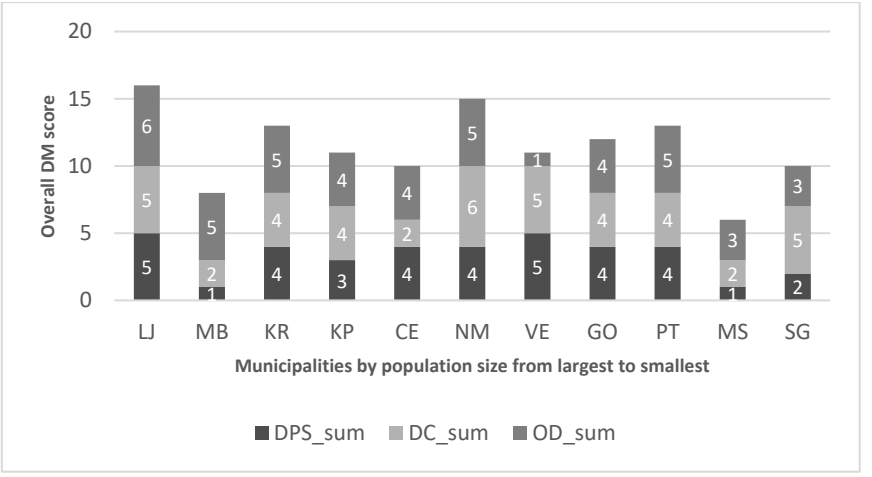
In this way, we evaluated the answers to each municipality's three sets of questions. The maximum overall DM value (score) that the municipality could achieve was 28 (14 indicators x 2 points = 28). The maximum possible value of the overall DM of all urban municipalities for a single indicator is 22 (11 municipalities x 2 points = 22). We also counted the response values by individual sets and labelled them DPS_sum, DC_sum, and OD_sum. We analysed our data using SPSS 26 software to check for possible correlations in individual responses, response sets, municipality population size, individual set DM and individual indicators.

## 4. Results

Our self-assessment results enabled us to perform a comparative analysis of participating urban municipality DM and investigate the municipality population size as the reason for possible DM differences. Overall DM is the sum of each municipality's scores for each set of questions, as seen in Figure 1. A higher score represents a higher level of DM. Although one would expect larger municipalities to have higher DM levels, as they have more resources at their disposal than smaller municipalities, this is not the case.

**Figure 1:**

Overall DM score as the Sum of DM of each individual set



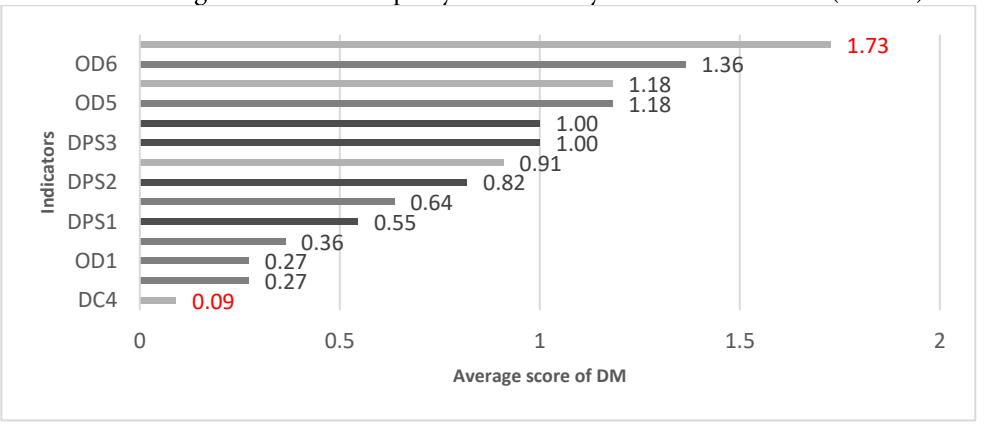

Source: Authors

Figure 1 shows that the highest municipality DM score is 16, and the lowest is 6. The most significant difference in DM score in size is found between the two largest municipalities according to the number of citizens (left side of the scale), where LJ municipality scores 16 and MB 8. Looking at the right side of the scale, where the municipalities with the fewest citizens are located, the results show that the penultimate municipality has the lowest score of all urban municipalities, with 6 points, and the smallest municipality in terms of number of citizens has 10 points. According to these results, we could claim that municipality population size does not influence overall DM.

Comparing the level of DM for each indicator (Figure 2), we used averages because the same number of questions did not represent each section. We find that the maximum possible average score is 2, i.e. all of our 11 municipalities can give a maximum score of 2 for a single question, which equals 22 points divided by the number of municipalities (11). The most significant deviation is evidenced in questions DC2 and DC4, which are both related to Digital Connectivity: "what is the availability of free wireless internet in your municipality's public spaces?" (DC2), and "how advanced is the coverage of smart infrastructure, including public lighting, roads, energy, waste management, and smart buildings in the municipality?" (DC4). It is interesting to note that the average score for DC2 reached 1.73 out of a possible 2, and the average score for DC4 is only 0.09, even though both questions belong to the same set. Regardless of the population size, the municipalities concerned answered these questions similarly.

**Figure 2:**

Average score of municipality DM levels by individual indicator (answer)

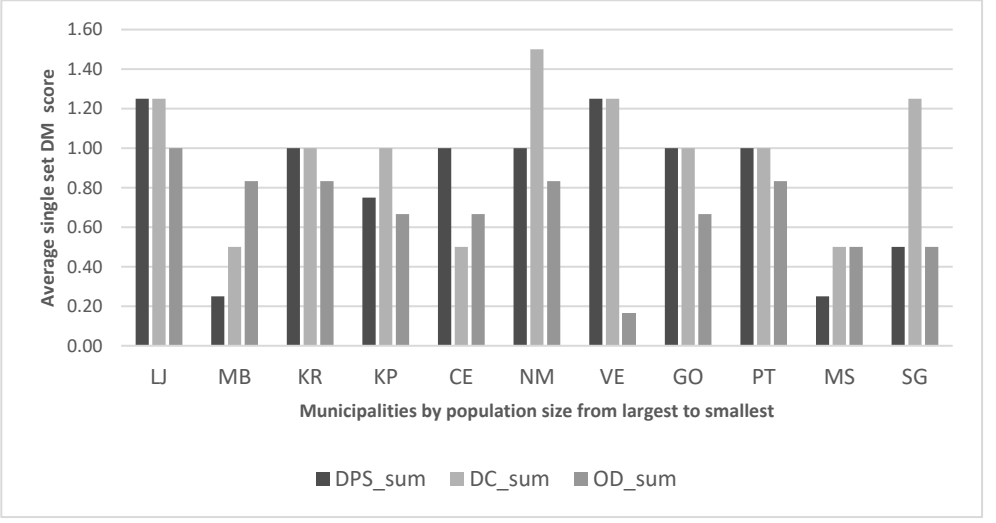



Source: Authors

Looking at the average single set DM scores (Figure 3), we see that the VE municipality in all three sets scores significantly lower on the questions dealing with OD (OD_sum), but its overall DM score is at the average DM level (Figure 4), which might indicate that all the municipalities concerned are trying to implement DT, but are focusing on different aspects.

**Figure 3:**

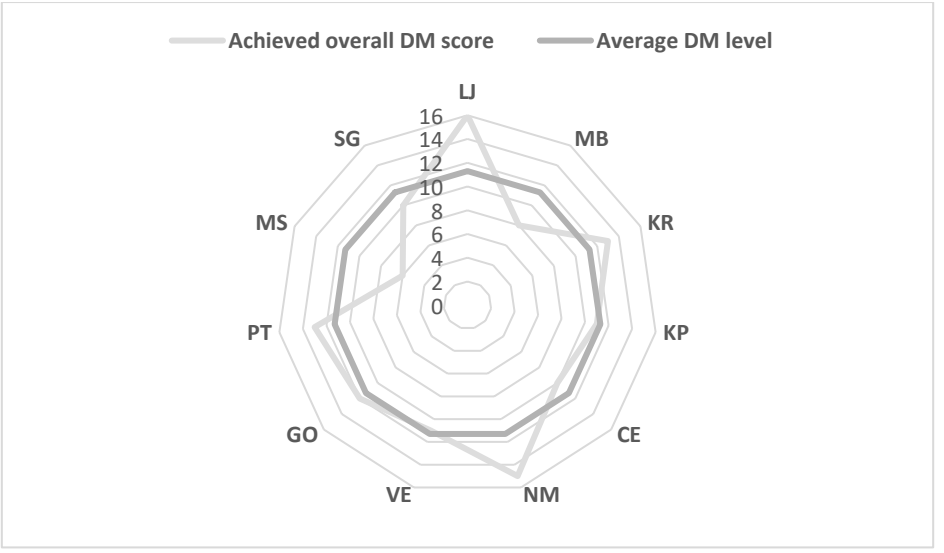
Average single set DM levels for each municipality




Source: Authors

**Figure 4:**

Overall achieved DM levels of each municipality compared to the Average DM Level




Source: Authors

When testing to ascertain whether municipality population size and overall DM level are related, we first checked whether the data were normally distributed or not. Given the small number (N) of urban municipalities concerned, we used the Shapiro-Wilk coefficient of normality to ascertain normality, and its results evidence that urban municipality population size is not normally distributed; the Overall DM Level was distributed normally.

Considering that the population size of the urban municipalities deviates from the normal distribution and the estimates of overall DM are normally distributed, we verified the correlations using the non-parametric Spearman's correlation coefficient.

**Table 4:**

Correlation between urban municipality population size and Overall DM estimate

| | ***N*** | $r_s$ | ***p*** |
|---|---|---|---|
| Overall DM score and Urban municipality population size | 11 | 0.33 | 0.32 |

Source: Authors

Table 4 shows no statistically significant correlation ($p = 0.32$) between municipality population size and the overall DM score. Nevertheless, we wanted to examine whether there were typical statistical correlations between municipality population size, DM indicator set sums (DPS_sum, DC_sum and OD_sum) and individual indicators. Accordingly, we first performed a normality test, which revealed that one of the three sets and all individual responses deviated from the normal distribution, so we verified correlations using the non-parametric Spearman's correlation coefficient.

**Table 5:**

Heatmap of correlations between municipal population size, Overall DM score, DM sets and responses to individual questions (indicators)

| | SIZE | Overall | DPS1 | DPS2 | DPS3 | DPS4 | DPS_sum | DC1 | DC2 | DC3 | DC4 | DC_sum | OD1 | OD2 | OD3 | OD4 | OD5 | OD6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Overall | 0.33 | | | | | | | | | | | | | | | | | |
| DPS1 | -0.46 | 0.41 | | | | | | | | | | | | | | | | |
| DPS2 | 0.22 | 0.60 | 0.34 | | | | | | | | | | | | | | | |
| DPS3 | 0.61* | 0.68* | 0.00 | 0.40 | | | | | | | | | | | | | | |
| DPS4 | 0.33 | 0.43 | -0.30 | 0.56 | 0.35 | | | | | | | | | | | | | |
| DPS_sum | 0,27 | 0.74** | 0.34 | 0.88** | 0.64* | 0.65* | | | | | | | | | | | | |
| DC1 | 0.40 | 0.50 | 0.35 | 0.47 | 0.74** | 0.00 | 0.47 | | | | | | | | | | | |
| DC2 | -0.07 | 0.75** | 0.67* | 0.53 | 0.48 | 0.00 | 0.54 | 0.52 | | | | | | | | | | |
| DC3 | -0.22 | 0.49 | 0.47 | 0.28 | 0.33 | 0.00 | 0.45 | 0.11 | 0.70* | | | | | | | | | |
| DC4 | 0.00 | 0.40 | 0.29 | 0.12 | 0.00 | 0.00 | 0.11 | 0.10 | 0.19 | 0.38 | | | | | | | | |
| DC_sum | -0.07 | 0.66* | 0.57 | 0.41 | 0.49 | 0.00 | 0.55 | 0.42 | 0.81** | 0.93** | 0.52 | | | | | | | |
| OD1 | 0.19 | 0.65* | 0.15 | 0.23 | 0.48 | 0.34 | 0.44 | 0.19 | 0.38 | 0.42 | 0.52 | 0.51 | | | | | | |
| OD2 | 0.05 | 0.57 | 0.55 | 0.23 | 0.00 | 0.00 | 0.20 | 0.19 | 0.37 | 0.08 | 0.45 | 0.23 | 0.04 | | | | | |
| OD3 | 0.78** | 0.33 | -0.31 | 0.14 | 0.44 | 0.31 | 0.13 | 0.42 | -0.04 | -0.32 | 0.24 | -0.09 | 0.46 | 0.08 | | | | |
| OD4 | 0.13 | 0.75** | 0.15 | 0.23 | 0.48 | 0.34 | 0.44 | 0.19 | 0.38 | 0.42 | 0.52 | 0.51 | 0.54 | 0.45 | 0.04 | | | |
| OD5 | -0.32 | -0.52 | -0.25 | -0.81** | -0.33 | -0.46 | -0.71* | -0.38 | -0.42 | -0.40 | -0.49 | -0.54 | -0.45 | -0.14 | -0.39 | -0.14 | | |
| OD6 | 0.72* | -0.12 | -0.83** | -0.07 | 0.44 | 0.31 | -0.06 | 0.24 | -0.39 | -0.42 | -0.24 | -0.34 | -0.04 | -0.46 | 0.57 | -0.04 | 0.03 | |
| OD_sum | 0.66* | 0.65* | -0.12 | 0.03 | 0.59 | 0.25 | 0.22 | 0.36 | 0.13 | -0.10 | 0.26 | 0.08 | 0.44 | 0.50 | 0.59 | 0.67* | 0.00 | 0.34 |

Notes: N = 11. **p < 0.01; *p < 0.05

Source: Authors

Although there is no evidence of a statistically significant relationship between municipality population size and overall DM score, Table 5 evidences there are statistically significant relationships between municipality population size and the responses to question DPS3 ($r_s = 0.61$, $p = 0.05$), the responses to question OD3 ($r_s = 0.78$, $p < 0.01$) and the responses to question OD6 ($r_s = 0.72$, $p = 0.01$). The review also

revealed some characteristic associations between responses to different questions, both within and between different sets, namely between DPS3 and DC1 ($r_s = 0.74$, $p = 0.01$), DPS1 and DC2 ($r_s = 0.67$, $p = 0.02$), DC2 and DC3 ($r_s = 0.70$, $p = 0.02$), DPS1 and OD6 ($r_s = 0.80$, $p < 0.01$), and DPS2 and OD5 ($r_s = 0.80$, $p < 0.01$). The red colour in Table 7 shows positive correlations and the blue colour shows negative correlations. Statistically significant correlations where $p < 0.01$ or $p < 0.05$ are coloured more strongly. The full correlation matrix, including $p$-values, is in the Appendix (Table A1).

In terms of content, the following statistically significant relationships were evidenced between:

- Urban municipality size and answers to the question addressing whether there is a norm for sharing data between city stakeholders or not (OD3).
- Urban municipality size and answers to the question "Do citizens generally trust the municipality when it comes to data privacy, security and ethics?" (OD6).
- The questions: "How many new digitalised services have been launched in the last three years by the municipality?" (DPS3) and "How advanced is the mobile internet coverage in the city?" (DC1).
- The questions: "Is the city providing a significant part of its services digitally?" (DPS1) and "To what extent is free wireless internet in public spaces available?" (DC2).
- The questions: "To what extent is free wireless internet in public spaces available?" (DC2) and "Do citizens expect information, services and interaction to be digitally available 24/7" (DC3).
- The questions: "Does the municipality provide a significant part of its services digitally?" (DPS1) and "Do citizens generally trust the municipality when it comes to data privacy, security and ethics?" (OD6).
- The questions: "Does the city actively support universal access to public e-services, including technical support and communication campaigns?" (DPS2) and "Does the overload of data through different channels make it hard to prioritise key issues and establish an effective dialogue with citizens and businesses?" (OD5).
- The questions: "Does the overload of data through different channels make it hard to prioritise key issues and establish an effective dialogue with citizens and businesses?" (OD5) and the overall score for Digitising Public Services (DPS_sum).

## 5. Discussion

Although the focus of our research on exclusively urban municipalities is conditioned by the ICC project itself, in which Slovenian urban municipalities participate as a

consortium, the sense of such a focus is strongly reinforced by the fact that urban municipalities have become the economic and development centres of Slovenia, influencing with their policies, through the planning and implementation of projects, the overall state of the population as well as the economy and other areas of development in the wider Slovenia, not only in their territory (Katič, 2012). From the perspective that a wide range of activities and operations are located in urban municipalities, it is helpful to include size by population in the study of phenomena such as DT, as a larger municipality can provide more financial, human and technical resources, in particular if it is sufficiently dedicated to the field of digitalisation.

Even though we covered the entire population of Slovenian urban municipalities, this is still relatively small; the results revealed some interesting findings:

- Although 5 out of 11 municipalities score above the overall DM average (average DM score is 11.3) and 4 are relatively close to the average (score 10 to 11), the highest DM score is 16 out of a possible 28, which means that there is still much room for improvement even in the most digitally mature municipalities.
- The lowest average DM score for a single indicator reached only 0.09 out of 2 possible points (indicator DC4), which refers to the extent of smart infrastructure coverage that requires more significant financial, technical and long-term investments.
- Municipality population size does not affect overall DM.
- Municipality population size significantly influences some of the individual DM indicators.
- Low DM levels for individual indicators do not lead to low overall DM levels, and vice versa.

The general findings of the survey regarding individual sets are as follows:

- Digitisation of Public Services (DPS): Even though digital service adoption has increased significantly in recent years and municipalities support universal access to e-services, including urban planning platforms, e-tendering and citizen initiative platforms, municipal governments still provide most services the old-fashioned way, where only information is available online. While municipalities plan to expand their possible e-services, the push in this direction needs to be balanced with increasing citizen and civil servant digital literacy.
- Digital connectivity (DC): Municipalities are quite well connected, mainly through 4G networks, with some piloting 5G and numerous free Wi-Fi networks, not only in libraries and shopping malls but also in other public spaces, especially in city centres. Citizen expectations regarding digital information, services and interaction with municipal governments have been steadily increasing in recent years, with a spike accordant with the current pandemic. The critical challenge

most municipalities face concerns adapting infrastructure and services for the digital age. There are many approaches and pilot projects, but large-scale projects in terms of smart cities still need to be implemented.

- Open data (OD): Some open data is already available, although real-time data such as public transport and public parking data is rare. The challenges municipalities face regarding open data are using open data for policy making and defining the norm for data sharing among the municipalities' various stakeholders. We were happy to discover that citizens generally have confidence in their municipalities when it comes to data privacy and security, which is a valuable foundation to build on.

If we look closer at some of the statistically significant relationships we have evidenced, such as the relationship between DPS1 (availability of digital services) and DC2 (availability of free wireless internet in public spaces), we can conclude that this relationship is logical because free wireless internet service naturally makes more digital services available to citizens, raising the question of the propriety of such questions within the same questionnaire. We can also question the propriety of existing questions when looking at the results for DC2 (the availability of free wireless internet in public spaces) and DC4 (the extent of smart infrastructure coverage, such as public lighting, roads, energy, waste management and smart buildings), where almost all the municipalities concerned responded identically, namely giving a maximum score of 2 points to DC2 and a minimum value of 0 to DC. DC2 refers to only one service, which can be implemented relatively easily, while DC4 implementation requires much more substantial financial, technical and long-term investment.

Accordant with studies confirming the influence of municipality size on DT and DM (Burke & Molitorisová, 2018; Jakob & Krcmar, 2018; Kuhlmann & Heuberger, 2021; Manoharan, 2012; Meijerink, 2016; Zuiderwijk et al., 2018) and defining it as one of the most crucial potential influencing factors in DT implementation, we included municipality population size as a moderator variable in our study. Similar to some of the studies mentioned above, we also found that the size of the municipality's population *per se* does not affect the overall DM score, although there are statistically significant correlations between other individual indicators and the size of the municipality's population, such as the number of employees in the IT department and as well as the level of know-how, the level of development of the municipality's website, the awareness of the importance of digitalisation and its prioritisation, and the municipality's motivational perspectives on opening up and sharing the municipality's data. Therefore, the results of our research confirm that adapting the DM model and DT development to size of the municipality's population is of great benefit.

In addition to interesting findings, we also encountered some limitations during our investigations, namely:

- Although we covered the entire population of urban municipalities in Slovenia, the sample is still relatively small. Therefore, extending the study to other European urban municipalities would be helpful.
- Although municipal officials, in general, did not complete the surveys, but by executives and managers who have data on communication with customers, analysis, reports, etc., and municipalities have fairly established digital channels for communicating with citizens, such as social networks, chatbots, and email, as well as specific applications (e.g. Citizens' Initiatives, Ask the Municipality, Servis 48, Let us Help Shape the City, etc.), and can therefore assess the digital skills of the citizens and their knowledge of the municipality's digital services to some extent, what remains is a subjective assessment of individual survey respondents who are employed by the municipality. It would certainly have been best to collect the answers directly from users (citizens), but this was not envisaged in the ICC project.
- It was not possible to additionally verify or confirm all the responses obtained by the survey with other available municipal data.
- The analysis results may also be affected by the quality of the available data, particularly the limited reliability of the data provided by the municipalities.
- The ICC questionnaire should detail specific areas of digitisation, providing a more authentic picture of each municipality's DM.

Some researchers, such as Dobrolyubova (2021), argue that as a result of the rapid development and use of advanced technologies, including automated data collection and proactive service delivery, the introduction of new approaches, new performance indicators, and new performance evaluation frameworks to measure the quality of public services and thus their DM would be of great benefit.

## 6. Conclusion

Using the DM model as a starting point for comprehensive DT is a sound approach supported by existing literature. It allows organisations to evaluate their performance better concerning what matters to their stakeholders. However, our findings show there is great merit in tailoring the DM model and DT development to municipality size, which should be considered in future research. One size does not fit all. In the case of municipalities, municipal DM is also the basis for the transformation of the smart city and the municipality's inherent own capabilities as a local enabler and provider of public services. At the same time, municipalities must ensure that the e-government concept is not only aimed at providing a large number of services to increase efficiency

and effectiveness, opting for a top-down approach according to the needs of the municipal administration but that decisions are made on the needs of the citizens, a bottom-up approach, as the results of Mikušová Meričková and Jakuš Muthová's (2021) research in Slovakia show that there is a demand from citizens for innovation in local public services. In addition, sharing the results of the DM evaluation between municipalities is very useful as it allows for comparison with others, especially those who are most advanced in terms of DT, and allows those seeking advice to become more aware of best practices, leading to fewer mistakes and better DT outcomes. Therefore, close collaboration between municipalities on DT is suggested, as the results will help a municipality to develop better public policies based on its DM and the experience of other municipalities, their DM and their (proven successful) policies.

Data from individual DM indicators may also better enable municipalities to optimise DT, but more testing of the DM model is required. Our paper makes a significant contribution to the theoretical knowledge on local government DT with its confirmations of the usefulness of the DM model and the importance of including each indicator and their correlation with the size of the municipality's population. The importance of further aligning the DM framework with individual service components (in our case, indicators) was also noted by Špaček et al. (2020) in their pilot study, which focused on a selected area of e-government - the digitisation of central government services for citizens (G2C) in selected Central and Eastern European countries (CEE) - namely the Czech Republic, Hungary and Romania.

Last but not least, the Local Self-Government Act (LSA, 2020) and other municipal ordinances and laws define a wide range of tasks of the municipality and regulate their implementation, which means that the level of investment of the municipality in the development of digitalisation and e-governance is left to the individual municipality itself. Accordingly, the needs of Slovenian municipalities in the area of digitalisation vary, as nicely shown by the survey on the status and needs of digitalisation in Slovenian municipalities (Superina & Stojmenova Duh, 2020). It tried to find out which areas are the most interesting for municipalities in terms of digitalisation and where their priorities lie (e.g. energy, mobility, health, production and care, etc.), but it does not identify the level of digital maturity of municipalities as a starting point for the next steps in the DT process. Therefore, we believe that our research contributes its tessera to the mosaic of understanding DT of urban municipalities.

## References

*AUMS*. (2021). Association of Urban Municipalities of Slovenia. https://www.zmos.si/dokumenti/

Bavec, C., Kovačič, A., Krisper, M., Rajkovič, V., & Vintar, M. (2019). *Slovenija na poti digitalne preobrazbe*. Založba UL FRI.

Becker, J., Knackstedt, R., & Pöppelbuß, J. (2009, May 21). Developing Maturity Models for IT Management. *Business & Information Systems Engineering, 1*(3), 213–222. https://doi.org/10.1007/s12599-009-0044-5

Berghaus, S., & Back, A. (2016, September). Stages in digital business transformation: Results of an empirical maturity study. *Mediterranean Conference of Information Systems*

Burke, C., & Molitorisová, A. (2018). Size Matters: National Identity and the Digital Transformation of Local Government. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3440516

da Rosa, I., & de Almeida, J. (2017). Digital Transformation in the Public Sector. *Advances in Electronic Government, Digital Divide, and Regional Development*, 99–125. https://doi.org/10.4018/978-1-5225-2203-4.ch005

Davenport, T. H., & Westerman, G. (2021, September 17). *Why So Many High-Profile Digital Transformations Fail*. Harvard Business Review. https://hbr.org/2018/03/why-so-many-high-profile-digital-transformations-fail

Dečman, M. (2017, June 30). A Model of Digital Inequality in the Knowledge Society: The Case of Slovenia. *Central European Public Administration Review, 15*(2), 11–39. https://doi.org/10.17573/ipar.2017.2.01

Dobrolyubova, E. (2021, May 12). Measuring Outcomes of Digital Transformation in Public Administration: Literature Review and Possible Steps Forward. *NISPAcee Journal of Public Administration and Policy, 14*(1), 61–86. https://doi.org/10.2478/nispa-2021-0003

Eaves, D., & Lombardo, L. (2021, February). *2020 State of Digital Transformation*. Harvard Kennedy School: Ash Center for Democratic Governance and Innovation. https://ash.harvard.edu/publications/2020-state-digital-transformation

*EMMBA. Establishment of Municipalities and Municipal Boundaries Act*. (1994, January 20). https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/1994-01-2082?sop=1994-01-2082

Ertan, J. (2018). *Digital readiness of Swedish organizations* [Master's]. KTH Royal Institute of Technology.

ESPON. *Policy Brief: The territorial and urban dimensions of the digital transition of public services.* (2018, October 23). https://www.espon.eu/sites/default/files/attachments/ESPON%20Policy%20Brief%20on%20Digital%20Transition.pdf

European Commission. (2016). *Blueprint for cities and regions as launch pads for digital transformation.* https://ec.europa.eu/growth/content/blueprint-cities-and-regions-launch-pads-digital-transformation-0_sl

European Commission. (2018). *The Digital Cities Challenge.* http://www.smarttowns.eu/wp-content/uploads/2017/11/The-Digital-Cities-Challenge.pdf

European Commission. (2020). *Intelligent Cities Challenge and Intelligent City Ecosystems.* https://ec.europa.eu/growth/industry/policy/advanced-technologies/intelligent-city-ecosystems_en

Fath-Allah, A., Cheikhi, L., Al-Qutaish, R., & Idri, A. (2014, March). E-government maturity models: A comparative study. *International Journal of Software Engineering & Applications*, *5*(3), 71–91.

Gill, M., & VanBoskirk, S. (2016). The digital maturity model 4.0. *Benchmarks: digital transformation playbook.* http://forrester.nitro-digital.com/pdf/Forrester-s%20Digital%20Maturity%20Model%204.0.pdf

Gottschalk, P. (2009, January). Maturity levels for interoperability in digital government. *Government Information Quarterly*, *26*(1), 75–81. https://doi.org/10.1016/j.giq.2008.03.003

Hanna, N. (2018, July 16). A role for the state in the digital age. *Journal of Innovation and Entrepreneurship*, *7*(1), 1–16. https://doi.org/10.1186/s13731-018-0086-3

Jakob, M., & Krcmar, H. (2018, July 12). Which barriers hinder a successful digital transformation in small and medium-sized municipalities in a federal system? *Central and Eastern European EDem and EGov Days*, *331*, 141–150. https://doi.org/10.24989/ocg.v331.12

Kane, G. C., Palmer, D., Nguyen Phillips, A., Kiron, D., & Buckley, N. (2017, July 13). *Achieving digital maturity.* MIT Sloan Management Review. https://sloanreview.mit.edu/projects/achieving-digital-maturity/

Katič, A. (2012). Podjetna občinska uprava: Med inovativnostjo in birokracijo. In *Upravljavska sposobnost slovenskih občin: primeri dobrih praks* (pp. 171–189). Friedrich Ebert Stiftung in Fakulteta za družbene vede Zagreb. https://skupnostobcin.si/wp-content/uploads/pulikacije/2059/Knjiga-Upravljalska-sposobnost-slovenskih-obcin.pdf

Kuhlmann, S., & Heuberger, M. (2021, June 25). Digital transformation going local: implementation, impacts and constraints from a German perspective. *Public Money &Amp; Management*, 1–9. https://doi.org/10.1080/09540962.2021.1939584

Lahrmann, G., Marx, F., Mettler, T., Winter, R., & Wortmann, F. (2011). Inductive Design of Maturity Models: Applying the Rasch Algorithm for Design Science Research. *Service-Oriented Perspectives in Design Science Research*, 176–191. https://doi.org/10.1007/978-3-642-20633-7_13

*LSA. Local Self-Government Act.* (1994). http://pisrs.si/Pis.web/pregledNpb?idPredpisa=ZAKO903&idPredpisaChng=ZAKO307

*LSA. Local Self-Government Act.* (2020). http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO307

Maciel, C., Roque, L. G., & Garcia, A. C. (2008). Measuring the e-Participation in Decision-Making Processes through Online Surveys. In *Proceedings of the Tenth International Conference on Enterprise Information Systems* (pp. 426-434). https://doi.org/10.5220/0001720704260434

Manoharan, A. (2012, March 21). A Study of the Determinants of County E-Government in the United States. *The American Review of Public Administration*, *43*(2), 159–178. https://doi.org/10.1177/0275074012437876

Marchand, D. A., & Wade, M. (2014). Digital business transformation: Where is your company on the journey. *Perspectives for Managers*, (187), 1.

McCormack, K., Willems, J., van den Bergh, J., Deschoolmeester, D., Willaert, P., Indihar Štemberger, M., Škrinjar, R., Trkman, P., Bronzo Ladeira, M., Paulo Valadares de Oliveira, M., Bosilj Vuksic, V., & Vlahovic, N. (2009, September 11). A global investigation of key turning points in business process maturity. *Business Process Management Journal*, *15*(5), 792–815. https://doi.org/10.1108/14637150910987946

Meijer, A., & Bekkers, V. (2015, July). A metatheory of e-government: Creating some order in a fragmented research field. *Government Information Quarterly*, *32*(3), 237–245. https://doi.org/10.1016/j.giq.2015.04.006

Meijerink, T. (2016). *Assessing the e-governance maturity level of Dutch municipalities through the analysis of municipal websites: Does municipality size have an effect on website maturity level?* [Master's]. University of Twente.

Mergel, I., Edelmann, N., & Haug, N. (2019, October). Defining digital transformation: Results from expert interviews. *Government Information Quarterly*, *36*(4), 101385. https://doi.org/10.1016/j.giq.2019.06.002

Mettler, T. (2010, October 1). Thinking in Terms of Design Decisions When Developing Maturity Models. *International Journal of Strategic Decision Sciences*, *1*(4), 76–87. https://doi.org/10.4018/jsds.2010100105

Mikušová Meričková, B. & Muthová, N. J. (2021, May 12). Innovative Concept of Providing Local Public Services Based on ICT. *NISPAcee Journal of Public Administration and Policy*, *14*(1), 135–167. https://doi.org/10.2478/nispa-2021-0006

Nemec, J. (2018b, June 1). Public Administration Reforms in Slovakia: Limited Outcomes (Why?). *NISPAcee Journal of Public Administration and Policy*, *11*(1), 115–134. https://doi.org/10.2478/nispa-2018-0005

*OECD: Cities in Europe the new OECD-EC definition.* (2012). https://ec.europa.eu/regional_policy/sources/docgener/focus/2012_01_city.pdf

*OPSI - Open Data Slovenia.* (2020). https://podatki.gov.si/

*Portal GOV-SI | Municipalities in numbers.* (2022). https://www.gov.si/en/topics/municipalities-in-numbers

*Republic of Slovenia | Constitution of the Republic of Slovenia.* (1991). PIS. http://pisrs.si/Pis.web/pregledPredpisa?id=USTA1

Schwab, K. (2016). *The Fourth Industrial Revolution.* World Economic Forum. https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab

Soukopová, J., Nemec, J., Matějová, L., & Struk, M. (2014, December 1). Municipality Size and Local Public Services: Do Economies of Scale Exist? *NISPAcee Journal of Public Administration and Policy*, *7*(2), 151–171. https://doi.org/10.2478/nispa-2014-0007

*Statistical Office of Slovenia | Population by age and sex, municipalities, Slovenia, half-yearly.* (2020). https://pxweb.stat.si/SiStatData/pxweb/en/Data/Data/05C4003S.px/

Superina, A., & Stojmenova Duh, E. (2020). *Raziskava stanja in potreb digitalizacije slovenskih občin, Poročilo.* https://4pdih.com/wp-content/uploads/2021/02/Poroc%CC%8Cilo_o_delavnicah_in_vpras%CC%8Calniku-4PDIH_FE_zaobjavo.pdf

Špaček, D., Csótó, M., & Urs, N. (2020, June 1). Questioning the Real Citizen-Centricity of e-Government Development: Digitalization of G2C Services in Selected CEE Countries. *NISPAcee Journal of Public Administration and Policy*, *13*(1), 213–243. https://doi.org/10.2478/nispa-2020-0009

Thordsen, T., Murawski, M., & Bick, M. (2020b). How to Measure Digitalization? A Critical Evaluation of Digital Maturity Models. In *Responsible Design, Implementation and Use of Information and Communication Technology* (pp. 358–369). Springer International Publishing. https://doi.org/10.1007/978-3-030-44999-5_30

*Tractebel: Free 360° CITY SCAN.* (2020). A tool to guide sustainable urban transformation. https://tractebel-engie.com/en/360-city-scan

*United Nations: UN E-Government Survey 2020.* (2020). https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2020

VanBoskirk, S., Gill, M., Green, D., Berman, A., Swire, J., & Birrell, R. (2017). The digital maturity model 5.0. *Forrester research.* https://foloop.in/uploads/images/stock/The-Digital-Maturity-Model-5.0-1.pdf

Vial, G. (2019, June). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems, 28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Wagire, A. A., Joshi, R., Rathore, A. P. S., & Jain, R. (2020, March 26). Development of maturity model for assessing the implementation of Industry 4.0: learning from theory and practice. *Production Planning & Control, 32*(8), 603–622. https://doi.org/10.1080/09537287.2020.1744763

Zuiderwijk, A., Volten, C., Kroesen, M., & Gill, M. (2018, October 25). Motivation Perspectives on Opening up Municipality Data: Does Municipality Size Matter? *Information, 9*(11), 267. https://doi.org/10.3390/info9110267

## Appendix - Tables

***Table 1. Full correlation matrix between municipal population size, overall DM score, DM sets and responses to individual questions (indicators)***

| | | Size | Overall | DPS1 | DPS2 | DPS3 | DPS4 | DPS_sum | DC1 | DC2 | DC3 | DC4 | DC_sum | OD1 | OD2 | OD3 | OD4 | OD5 | OD6 | OD_sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | $r_s$ | | | | | | | | | | | | | | | | | | | |
| | $p$ | | | | | | | | | | | | | | | | | | | |
| Overall | $r_s$ | 0.334 | | | | | | | | | | | | | | | | | | |
| | $p$ | 0.315 | | | | | | | | | | | | | | | | | | |
| DPS1 | $r_s$ | -0.462 | 0.407 | | | | | | | | | | | | | | | | | |
| | $p$ | 0.153 | 0.214 | | | | | | | | | | | | | | | | | |
| DPS2 | $r_s$ | 0.224 | 0.596 | 0.339 | | | | | | | | | | | | | | | | |
| | $p$ | 0.508 | 0.053 | 0.309 | | | | | | | | | | | | | | | | |
| DPS3 | $r_s$ | .607* | .679* | 0 | 0.395 | | | | | | | | | | | | | | | |
| | $p$ | 0.048 | 0.022 | 1 | 0.229 | | | | | | | | | | | | | | | |
| DPS4 | $r_s$ | 0.334 | 0.432 | -0.303 | 0.559 | 0.354 | | | | | | | | | | | | | | |
| | $p$ | 0.316 | 0.185 | 0.365 | 0.074 | 0.286 | | | | | | | | | | | | | | |
| DPS_sum | $r_s$ | 0.268 | .741** | 0.335 | .876** | .640* | .653* | | | | | | | | | | | | | |
| | $p$ | 0.425 | 0.009 | 0.314 | 0 | 0.034 | 0.029 | | | | | | | | | | | | | |
| DC1 | $r_s$ | 0.4 | 0.503 | 0.346 | 0.469 | .742** | 0 | 0.474 | | | | | | | | | | | | |
| | $p$ | 0.223 | 0.114 | 0.297 | 0.146 | 0.009 | 1 | 0.14 | | | | | | | | | | | | |
| DC2 | $r_s$ | -0.065 | .747** | .671* | 0.53 | 0.479 | 0 | 0.544 | 0.516 | | | | | | | | | | | |
| | $p$ | 0.85 | 0.008 | 0.024 | 0.094 | 0.136 | 1 | 0.083 | 0.104 | | | | | | | | | | | |
| DC3 | $r_s$ | -0.216 | 0.491 | 0.467 | 0.276 | 0.327 | 0 | 0.452 | 0.108 | .696* | | | | | | | | | | |
| | $p$ | 0.524 | 0.125 | 0.147 | 0.411 | 0.326 | 1 | 0.162 | 0.752 | 0.017 | | | | | | | | | | |
| DC4 | $r_s$ | 0 | 0.403 | 0.289 | 0.117 | 0 | 0 | 0.105 | 0.1 | 0.194 | 0.378 | | | | | | | | | |
| | $p$ | 1 | 0.219 | 0.389 | 0.731 | 1 | 1 | 0.758 | 0.77 | 0.568 | 0.252 | | | | | | | | | |
| DC_sum | $r_s$ | -0.066 | .662* | 0.572 | 0.412 | 0.493 | 0 | 0.545 | 0.417 | .808** | .931** | 0.522 | | | | | | | | |
| | $p$ | 0.846 | 0.027 | 0.066 | 0.208 | 0.124 | 1 | 0.083 | 0.201 | 0.003 | 0 | 0.1 | | | | | | | | |
| OD1 | $r_s$ | 0.194 | .650* | 0.149 | 0.227 | 0.479 | 0.339 | 0.442 | 0.194 | 0.375 | 0.418 | 0.516 | 0.505 | | | | | | | |
| | $p$ | 0.568 | 0.03 | 0.662 | 0.502 | 0.136 | 0.309 | 0.173 | 0.568 | 0.256 | 0.201 | 0.104 | 0.113 | | | | | | | |
| OD2 | $r_s$ | 0.052 | 0.57 | 0.553 | 0.225 | 0 | 0 | 0.202 | 0.191 | 0.371 | 0.075 | 0.447 | 0.233 | 0.041 | | | | | | |
| | $p$ | 0.879 | 0.067 | 0.078 | 0.507 | 1 | 1 | 0.552 | 0.573 | 0.262 | 0.826 | 0.168 | 0.49 | 0.904 | | | | | | |
| OD3 | $r_s$ | .777** | 0.331 | -0.311 | 0.14 | 0.443 | 0.313 | 0.126 | 0.418 | -0.039 | -0.322 | 0.239 | -0.094 | 0.463 | 0.076 | | | | | |
| | $p$ | 0.005 | 0.32 | 0.353 | 0.681 | 0.172 | 0.348 | 0.712 | 0.2 | 0.91 | 0.334 | 0.479 | 0.784 | 0.152 | 0.824 | | | | | |
| OD4 | $r_s$ | 0.129 | .747** | 0.149 | 0.227 | 0.479 | 0.339 | 0.442 | 0.194 | 0.375 | 0.418 | 0.516 | 0.505 | 0.542 | 0.453 | 0.039 | | | | |
| | $p$ | 0.705 | 0.008 | 0.662 | 0.502 | 0.136 | 0.309 | 0.173 | 0.568 | 0.256 | 0.201 | 0.104 | 0.113 | 0.085 | 0.162 | 0.91 | | | | |
| OD5 | $r_s$ | -0.319 | -0.521 | -0.249 | -.811** | -0.327 | 0.463 | -.711* | 0.378 | -0.418 | -0.402 | -0.486 | -0.54 | 0.453 | 0.144 | -0.387 | -0.139 | | | |
| | $p$ | 0.339 | 0.1 | 0.46 | 0.002 | 0.326 | 0.152 | 0.014 | 0.252 | 0.201 | 0.22 | 0.13 | 0.086 | 0.162 | 0.673 | 0.24 | 0.683 | | | |
| OD6 | $r_s$ | .717* | -0.12 | -.828** | -0.07 | 0.443 | 0.313 | -0.063 | 0.239 | -0.386 | -0.419 | -0.239 | -0.343 | 0.039 | 0.458 | 0.571 | -0.039 | 0.032 | | |
| | $p$ | 0.013 | 0.724 | 0.002 | 0.838 | 0.172 | 0.348 | 0.854 | 0.479 | 0.241 | 0.199 | 0.479 | 0.302 | 0.91 | 0.157 | 0.066 | 0.91 | 0.925 | | |
| OD_sum | $r_s$ | .664* | .647* | -0.12 | 0.028 | 0.594 | 0.247 | 0.223 | 0.363 | 0.134 | -0.099 | 0.259 | 0.084 | 0.435 | 0.496 | 0.588 | .669* | 0.003 | 0.341 | |
| | $p$ | 0.026 | 0.031 | 0.726 | 0.936 | 0.054 | 0.464 | 0.509 | 0.273 | 0.695 | 0.772 | 0.442 | 0.807 | 0.182 | 0.121 | 0.057 | 0.024 | 0.994 | 0.306 | |