

**Published article:** <https://doi.org/10.1080/03003930.2022.2078807>

## **Assessing the effect of organisational factors and ICT expenditures on e-maturity: empirical results in Italian municipalities**

The article quantitatively investigates the e-maturity of municipalities, which is defined as the extent to which a public organisation is using Information and Communication Technologies (ICT) for managing and delivering public services. We first question the existing e-maturity models, and then propose a new method for assessing e-maturity based on the usage of digital services. For this purpose, we perform a Latent Class Analysis on data coming from 2,219 Italian municipalities. Subsequently, we introduce organisational factors and ICT expenditures to further characterise the created classes, in order to highlight the determinants underlying the level of e-maturity registered by municipalities. As a result, we underline the importance of key organisational characteristics, which partially explain e-maturity. Furthermore, we observe that municipalities with null or extremely low e-maturity tend to spend less in ICT. Instead, no difference is found when comparing municipalities with medium and high e-maturity. Hence, high adoption of digital services does not depend on the amount of money spent in ICT, while, probably, on the priorities and strategic choices set by municipalities. This result paves the way for further studies in the field.

**Keywords:** e-government; e-maturity; local government; municipalities; ICT expenditures; organisational factors.

### **Introduction**

During the last decades, the advent of Information and Communication Technologies (ICT) revolutionised the way through which public organisations perform their daily operations and interact with citizens and firms (Bertot et al. 2010; Yildiz 2007).

ICT address organisational transformation in the public sector (Tangi et al. 2020; Nograšek and Vintar 2014; Tangi, Janssen, et al. 2021) as well as a deep renovation in the way public organisations approach public service delivery (Tangi, Benedetti, et al. 2021; Scholta et al. 2019). This transformation is still ongoing and

public organisation are looking for the best way of introducing ICT in order to pursue cost-effectiveness, transparency, citizen engagement and participation (Budding, Faber, and Gradus 2018; Nam 2019).

The implementation of e-government initiatives requires to be continuously assessed and benchmarked in public organisations (Andersen et al. 2011). Therefore, scholars developed tailored mechanisms for its evaluation (Lee 2010). The concept of e-maturity (Layne and Lee 2001; Andersen and Henriksen 2006) particularly addresses this purpose.

Scholars often define e-maturity as the extent to which a public organisation is using ICT for managing and delivering public services (Layne and Lee 2001). Originally, the concept of e-maturity was strictly related to the provision of a wide range of digital services by exploiting the potential coming from ICT introduction. The first paper referring to e-maturity defines the full maturity as the achievement of the so-called 'one-stop-shop', i.e. a single contact point where citizens can access to all governmental services (Layne and Lee 2001). Nowadays, with the increasing penetration of ICT in governments, e-maturity needs a refocus, thus moving from assessing the mere existence of digital services (or the one-stop-shop) to investigating how to offer high-quality digital services that can be effectively used by citizens and firms. In other words, e-maturity should no longer be reduced to the achievement of a mere online presence. Rather, it requires taking into account the effective usage of digital services (Tangi, Benedetti, et al. 2021).

The concept of e-maturity was often embedded with – or even hidden in – the identification of e-maturity models, i.e. a series of subsequent steps to evaluate the maturity levels of a public organisation (see for example Andersen and Henriksen 2006; Scholta et al. 2019). As for the concept of e-maturity, also the existing e-maturity

models were recently criticised, claiming the need for further research in the field (Andersen et al. 2020). In particular, e-maturity models are often not explanatory and do not link e-maturity with explanatory variables. Moreover, often e-maturity models assume a linear way towards a final stage, while the digitisation process is often not linear and the final stage is not the same for each public organisation (Andersen et al. 2020; Tangi, Soncin, et al. 2021).

When assessing the factors influencing e-maturity, scholars mainly look at environmental (like the number of inhabitants or the population age) and socio-economic (like the income per capita) ones (Budding, Faber, and Gradus 2018). If, on the one hand, it has been demonstrated that these factors are extremely relevant (Budding, Faber, and Gradus 2018; Manoharan 2013), on the other hand, they cannot fully explain e-maturity. In fact, organisational choices can significantly alter e-maturity (Tangi et al. 2020; Nasi, Frosini, and Cristofoli 2011). One of the most relevant among these choices is budget allocation, i.e. the expenditures in ICT. However, to our knowledge, no paper quantitatively addressed its impact on e-maturity.

This study aims at filling these gaps, answering to the following research questions: how can e-maturity be assessed in local governments? Which organizational factors influence e-maturity? Is e-maturity related to the amount of money spent in ICT?

To answer these questions, we rely on a dataset of 2,219 Italian municipalities with more than 5,000 inhabitants, which represents 92% of the population and 28% of all Italian municipalities. As a methodological approach, we define e-maturity profiles through Latent Class Analysis (LCA) and investigate their characteristics and determinants through multinomial logistic regression with respect to structural and organisational aspects, and Tuckey pairwise comparison test concerning ICT expenditures level.

The paper is organised as follows. Section 2 addresses existing literature in the field. Section 3 describes the adopted methodology and the available data used during the quantitative analysis. Section 4 presents the results that are further discussed in Section 5. Moreover, Section 6 stresses the implications for practice, while Section 7 highlights the directions for future research. Finally, Section 8 sums up the main outcomes and conclusions of the article.

### **Literature review**

Two main areas of the exiting literature influenced our study: (i) the concept of e-maturity, (ii) the e-maturity determinants, among which the organisational factors, and ICT expenditures.

#### ***The concept of e-maturity***

Concerning e-government implementation, scholars have questioned the need to find a proper assessment method that could reflect its success. In this perspective, the existing literature (e.g. Valdés et al. 2011) agrees on identifying Andersen and Henriksen's (2006) model of Public sector Process Rebuilding (PPR), based on the model previously developed by Layne & Lee (2001), as the referring framework. PPR frames e-maturity in four stepwise subsequent stages, namely cultivation, extension, maturity, and revolution. This model mirrors all the main characteristics and limitations of the existing e-maturity models in public settings.

First, the large majority of the models are developed into a series of linear and subsequential steps (Coursey and Norris 2008), whose precise and quantitative definition is, however, very difficult to assess in practise through the design of indicators (Dias 2020). Second, they are mostly based on theoretical reflections, since the last stages of most of these models are rather aspirational (DeBrí and Bannister

2015), as they propose possible future outlooks whose assessment is difficult to empirically observe.

Only a fraction of existing studies has been designed for quantitatively assessing e-maturity (Andersen et al. 2020; Budding, Faber, and Gradus 2018). Interesting examples in this sense are West (2004) and Das et al. (2017), who both relied on the screening of governmental websites for assessing e-maturity. Moon (2002) and Budding et al. (2018), instead, used survey data for the assessment.

Moreover, most of the models assess e-maturity looking exclusively at the presence and the quality (usability, accessibility, etc.) of the digital service. This administration-centred perspective is restrictive for two reasons. First, even if the digital service is available and it is matching high-quality standards, the use of traditional channels often remains high (Faulkner, Jorgensen, and Koufariotis 2019; Tangi, Benedetti, et al. 2021). Hence, digital services are only added to existing channels, leading exclusively to additional costs for the organisation (Anthopoulos et al. 2016). Second, within the same organisation, services differ in terms of complexity, users' need, and actors involved (Tangi, Soncin, et al. 2021), and the evaluation of e-maturity from an administration-centred perspective tends to over-simplify the complexity of the digitisation process.

This paper aims at overcoming these limitations by:

- i. Offering a new perspective for defining e-maturity, which moves from the mere online presence of a digital service to its effective usage;
- ii. Identifying how to properly assess e-maturity from a quantitative viewpoint.

### ***Organisational determinants of e-maturity***

Existing literature identifies different determinants of e-maturity, which are often

referred to as the “organizational capacity” of public administrations (Ahn 2011). These determinants typically include socio-economic variables, budgetary capacity, technical expertise, and willingness to cooperate.

First, many studies investigate the impact of socio-economic variables (Nasi, Frosini, and Cristofoli 2011; Manoharan 2013; Moon 2002; Budding, Faber, and Gradus 2018). On the one hand, population size was found to be a major factor that encourages municipalities in developing their digital service provision as a consequence of a higher demand for public services (Ahn 2011). On the other hand, e-maturity is also associated with economic wealth, generally measured as GDP per capita (Das, Singh, and Joseph 2017; Ifinedo 2011).

Second, the implementation of e-government initiatives requires a strong effort in terms of specific ICT investments needed (Dahiya and Mathew 2018), which define a consistent stake of governmental budget capacity. In e-government literature, these ICT expenditures are typically associated with the creation of an adequate infrastructure (Dawes 2008), which includes expenses that refer to physical requirements like hardware, software, licensing, and integration efforts, as well as the associated operative costs. More generally, the ICT budget is composed of CAPEX and OPEX cost categories, whose accountability and monitoring are crucial to define cost performances while pursuing e-maturity (Khisro, 2020).

Nonetheless, to our knowledge, few studies have addressed the specific relationship between ICT expenditures and e-maturity. Only Budding et al. (2018) limited the analysis to the cost of services, while Nasi, Frosini, and Cristofoli (2011) qualitatively explored the impact of the percentage of financial allocation on ICT investments.

This paper assumes that ICT expenditures are expected to bring benefits to the organisation (Dahiya and Mathew 2018), both in terms of available ICT assets (including hardware and software) and in terms of value in use, which is linked to the organisation's capability of extracting benefits from the use of new ICT assets (Ojha and Pandey 2017).

Third, what is missing in the body of literature is the impact of the organisational factors, which are commonly referred to as "internal capacity" (Ingrams et al. 2018). To our knowledge, few studies have quantitatively assessed the relationship between these organisational factors and e-maturity. Nasi, Frosini, and Cristofoli (2011) used the stake of ICT personnel in the administration as e-maturity predictors. However, they based their statement on simple descriptive statistics, without a robust quantitative analysis.

The importance of looking at organisational factors is also confirmed by the recent hype around the term 'digital transformation' (Tangi et al. 2020; Curtis 2019; Mergel, Edelmann, and Haug 2019). The term was introduced in the academic literature for emphasising the organisational and cultural change coupled to a digitisation process. Tangi et al. (2020), for instance, demonstrate that ICT is nowadays significantly related to a change in the existing processes and employees' duties and tasks.

In this context, some studies focus on the need of relying on a dedicated actor (e.g., the Chief Information Officer) (Ingrams et al. 2018) or a group of people able not only to understand the importance of ICT adoption (Feeney et al. 2020), but also to foster cultural acceptance, leading to proper organisational changes (Burn and Robins 2003; Savoldelli, Codagnone, and Misuraca 2014; Tangi, Janssen, et al. 2021).

Further research also investigates the presence of dedicated ICT personnel, recognising the presence (or the change) of the staff units as a potential trigger towards

a better service provision (Homburg, Dijkshoorn, and Thaens 2014). Nonetheless, the existence of more specialised personnel is generally connected with the dimension of the municipality, given more financial availability for e-government development (Ruano de la Fuente 2014).

Fourth, other studies, instead, focus on the need to collaborate with other municipalities, intended as an organisational choice whose impact is associated with a wide spectrum of benefits (Allers and de Greef 2018; Bel and Gradus 2017; Baba and Asami 2020). Collaboration creates opportunities to ensure better service delivery (Gil-Garcia, Chengalur-Smith, and Duchessi 2007; Ferro and Sorrentino 2010). The collaboration aspect is the only one that, to our knowledge, has been quantitatively tested so far. In fact, e-government scholars acknowledge that collaboration forms have a significant impact on e-maturity (Kim et al. 2008; Budding, Faber, and Gradus 2018; Tangi and Soncin 2021).

Therefore, this study aims at filling this gap in the e-maturity literature by providing quantitative evidence of the underlying relationship between e-maturity and the organisational factors adopted by the governments at a municipal level.

## **Methodology**

### ***Data used for the analysis***

The database used for this study has been developed through a survey delivered in 2019 by the Italian Auditing Institution (“Corte Dei Conti”) to all local public organisations in Italy. The respondents officially submitted their responses by self-declaring the required information, which is publicly available. For our study, we considered: (i) “e-maturity level” section, which discloses the level of penetration of supplied online services, (ii) “organisational factors” section, which is associated with ICT



implementation, and (iii) ICT expenditures per capita declared from 2016 to 2018.

We limited our analysis to the municipalities with more than 5,000 inhabitants as extremely small municipalities do not have a well-defined organisational structure due to an extremely limited number of employees. Hence, we extrapolated the survey data on 2,219 Italian municipalities. The sample represents 92% of the total number of Italian municipalities with more than 5,000 inhabitants.

### *E-maturity*

The survey assessed the penetration of digital services considering a sample of 22 services delivered by municipalities. The original database just asked a ‘yes’ or ‘no’ question on the presence of the digital channel for delivering a specific service. If the answer was ‘no’, the database did not distinguish between the municipalities that were not in charge of providing the service and the ones that provided it but not through the digital channel. Hence, we had to exclude those services for which the delivery was not a duty of the municipalities (for instance, the pass for limited traffic area, which exists only for extremely big municipalities). We thus focused on a sub-sample that represents the 14 services that are delivered by all Italian municipalities: (1) issuance of the registry certificate, (2) notification of the change of residence, (3) provision of electoral card, (4) request of the disability placard, (5) issue of the building authorisation, (6) contraventions payment, (7) garbage fee payment, (8) land occupation fee payment, (9) properties fee payment, (10) issue of ID card, (11) kindergarten enrolment and payment, (12) school canteen enrolment and payment, (13) school transport enrolment and payment, and (14) permission for production activities. The sub-sample includes both Government to Business (G2B) services (5 and 14) and Government to Citizen (G2C) services (the remaining services within the sample).

For each service, municipalities declared whether they were delivering it through digital channels and, the percentage of requests that were completely handled online out of the total number of requests received in one year. Hereinafter this value is labelled as “penetration”.

However, raw data exhibited significant differences in the measure of penetration of the considered services, whose distribution and descriptive statistics were extremely variable, due to their intrinsic nature (for instance, the complexity of their supply or the characteristics of their users). Consequently, for each service, we rescaled the data from 1 to 5 through a dedicated substitution. This choice was made for mitigating heterogeneity among services, hence enabling the creation of an aggregate indicator of penetration that considers the registered performance of a municipality compared to the sample. The substitution was done according to the criteria reported in Table 1.

[Table 1 near here]

Table 2 shows the descriptive statistics of the sample according to the aforementioned criteria.

[Table 2 near here]

### *Organisational factors*

For the organisational factors, we looked at the presence of key figures for leading the digitisation process: a Digital Transformation Officer (DTO) and a Data Protection

Officer (DPO). Despite in Italy the identification of those figures is mandatory by law, many municipalities are still not compliant with their nominee.

Second, we included the presence of collaboration agreements – in all their possible forms – among municipalities or upper-tier organisations defined by Italian laws.

Third, we calculated the percentage of ICT personnel with respect to the total number of employees within the organisation.

### *ICT expenditures*

The third set of data deals with the ICT expenditures per capita. The value used for the analysis is the average expenditure self-declared for the years 2016, 2017 and 2018.

More specifically, these data address the ICT budget of the analysed municipalities. We considered the annual average of the three years under analysis to reduce possible distortions given by specific investments registered in only one year. Then, we further calculated the expenditures per capita for each municipality, in order to enable comparability when interpreting results.

Table 3 resumes all the variables selected as e-maturity determinants, highlighting their expected impact on e-maturity and the related existing literature.

[Table 3 near here]

### *Statistical models*

In order to derive the maturity profiles, we performed a Latent Class Analysis (LCA), a mixture modelling technique that posits the existence of underlying, unobserved, and mutually exclusive subgroups, known as latent classes, based on the available multiple

manifest variables (Lazarsfeld and Henry 1968; McCutcheon 1987; Collins and Lanza 2010).

We have excluded from the analysis those 261 municipalities that had no active online service and, therefore, reported 0% on each of the 14 services under analysis. Such category is labelled as “*No Digitals*”, whose class and significance could not be considered as latent, given that they declared they are not adopting at all digital services. Hence, we keep the “No Digitals” as a class of the sample, but these observations will not be included in the LCA, in order to avoid a bias in the calculation of the other latent classes, whose characteristics are still unknown.

Therefore, the latent classes are defined starting from the penetration scores calculated on the 14 services listed in Table 2, which define the level of e-maturity of the municipalities in our case. Therefore, the LCA is performed on the polytomous data (ranging from 1 to 5) of the services issued by municipalities, using poLCA package on R (Linzer and Lewis 2011).

There are a variety of studies that investigate the issue of deciding the number of classes (Nylund, Asparouhov, and Muthén 2007). These studies rely on different evaluative indicators, like Log Likelihood, Akaike’s Information Criterion (Akaike 1987) and Bayesian Information Criterion (BIC, developed by Schwarz (1978)). According to BIC, the procedure consists of adding classes stepwise to the model testing its goodness of fit. Indeed, when the BIC indicates a minimum value at the K-class model, that K number of classes should be retained.

Posterior to the identification of the latent classes, we further characterise the maturity clusters by using a multinomial logistic regression (Lanza, Tan, and Bray 2013). Here, each profile is regressed against demographic and organisational covariates in order to provide an insightful characterisation of the latent groups

(Neumann et al. 2011). In multinomial logistic regression, the largest class is used as the reference group, according to which odds ratios are provided to estimate the likelihood that a certain characteristic recurs in relation to the reference group.

In addition, we further added the ICT expenditures data we have previously extrapolated and used them as the reference variable for a final analysis based on the Tuckey pairwise comparison test, in order to investigate the underlying relationships among ICT expenditures and maturity profiles and provide further quantitative evidence.

## **Results**

### ***Latent Class Analysis***

Table 4 shows the results from fit statistics. The five-class model is depicted as the best model for the analysis, corresponding to the minimum BIC.

[Table 4 near here]

For each of the five identified classes (to be added to the No Digitals), Figure 1 plots the patterns in terms of digitisation (on the vertical axis) related to the services under analysis (on the horizontal axis). This allows to visually define the characteristics of the clusters.

[Figure 1 near here]

First, we identify the “*Digital Champions*”, the municipalities that outperformed in terms of e-maturity in mostly all the considered services. Champions represent 213 out of 2,219 (10%) Italian municipalities that have pervasively adopted the online channel as a means to supply government services.

Second, the “*Believers*” subgroup identifies a further class that consists of those municipalities that have a medium digitisation level on all the considered services. This class has 239 (around 11%) observations and represents those that have started adopting e-government services but are not still consolidated. Nonetheless, they have an embedded potential given the wide range of services adopted and the current level of performance.

Third, it is possible to detect the “*Moderates*” cluster, represented by 200 (9%) municipalities that have a consistently high number of available services with relatively low penetration scores.

The fourth class identified by LCA is labelled as “*Selectives*”. It includes 407 (18%) municipalities that supply only a few services, mostly related to school-related services, in which they outperform with respect to the remaining average.

Lastly, we observe the “*Beginners*” subgroup, which includes 899 (40%) municipalities that mostly adopt only those digital services that have been made compulsory by the Italian government, like the permissions for production activities, while the other items are rarely or not sufficiently adopted. These municipalities are therefore characterised by a missing integration of the digital channels as a means to supply services.

### ***Post-hoc analysis***

Once having defined the classes, we further investigated a set of contextual and organisational covariates in order to provide a useful characterisation of the latent

groups. Hence, we performed a multinomial logistic regression in which the largest class (Beginners) is used as the reference group.

Table 5 presents the results of the analysis, where each of the different models represents the cluster against which the reference group (Beginners) is compared with. In this way, it is possible to detect those variables that have a higher incidence in characterising the different clusters and highlight the main differences among groups.

[Table 5 near here]

The analysis associated with the multinomial logistic regression allows extrapolating the following considerations.

First, we observe that bigger municipalities (from 150.000 inhabitants) are more likely associated with more mature profiles (Champions, Believers, and Selectives). Nonetheless, a consistent portion of Champions is also located in the range of 20.000–60.000 inhabitants, highlighting how virtuous examples can be found also in smaller municipalities.

Second, we consider the organisational covariates. The results show that: (i) No Digitals tend not to appoint the DPO with respect to the other groups, and (ii) most of the municipalities have a DTO nominated in the same proportion.

Moreover, we consider the ratio between the personnel dedicated to ICT and the overall amount of personnel in the organisation with respect to the population range. (iii) Significant differences in the composition of the personnel, with respect to specific ICT roles, can be detected in Moderates and in Selectives, which both exhibit a high take of ICT personnel in their organisations.

In addition, (iv) Selectives not only are more likely to provide themselves with key organisational figures, but also have an active inter-municipal agreement to run the supply of digital services.

### *Tukey pairwise comparison test on ICT Expenditures*

The Tukey pairwise comparison test exhibits significant differences, indicated by the adjusted p-values, among class means with respect to the ICT expenditures per capita, as disclosed in Table 6.

[Table 6 near here]

First, the results suggest No Digitals class exhibits a difference in ICT expenditures when compared to Champions, Selectives, and Moderates, meaning that those municipalities who have discharged the opportunity to leverage on the digital channel tend to be more cost-efficient than most of the others.

Second, Selectives exhibit significantly higher expenditures compared to Beginners.

Lastly, no further statistical differences are reported by the analysis. This means that e-maturity performances are just partially explained by the level of ICT expenditures.

### **Discussion**

The study adds interesting insights on e-maturity from two different perspectives. On the one hand, it discusses the validity of the current e-maturity models, adding new perspectives to look through the digitisation process in municipalities. On the other



hand, it sheds light on the organisational factors that determine e-maturity and on the relation between e-maturity and ICT expenditures. Moreover, a major contribution is also given by the circumstance that, to our knowledge, the factors included in the study were never quantitatively tested before on a significant sample of medium and big municipalities like the one we have examined.

Concerning e-maturity, our study proposes a new way of defining and assessing it. In fact, we conducted the analysis looking at the percentage of usage (that we named penetration), instead of limiting its assessment to the presence or absence of a digital communication channel. This approach differs from the one proposed by Budding, Faber, and Gradus (2018), who consider the possibility of making use of an electronic ID as the maximum achievable maturity score.

Our approach starts from a different assumption: the e-maturity of a local government do not depend either on the number of delivered services or on the quality of those services. On the opposite, a local government can be considered ‘e-mature’ when a high percentage of users are accessing the portfolio of its services through a digital channel.

Our choice of looking at penetration was made according to previous literature. In fact, several studies demonstrate that the digital channel might remain just a new channel, added on the traditional ones, with additional costs (Anthopoulos et al. 2016; Tangi, Benedetti, et al. 2021). Hence looking at the mere online presence might not be sufficient to assess e-maturity. Our results confirm these insights, highlighting how, among municipalities, different patterns can be detected, and the presence of a digital channel does not automatically bring to its usage by citizens and firms.

In this context, we also added another element. The ‘satisfactory’ percentage for considering a local government ‘*e-mature*’ depends on the characteristics of the service

and the digital skills of its users. This approach is built on and confirms previous qualitative literature that looked at the complexity and ambiguity of a service, as well as at the digital skills and attitude of the users (see for instance Ebbers, Jansen, and van Deursen 2016; Tangi, Benedetti, et al. 2021).

To our knowledge, the assessment of e-maturity through penetration is a novelty in the field that not only considers the capability of local governments to supply and deliver digital service, but also captures the extent to which citizens adopt the digital channel as the preferred one, hence limiting the physical presence at public counters. The need of looking at the penetration of the digital channel is even more urgent nowadays that, due to Covid-19, digital interaction is preferred not only for cost reduction but also for security and health reasons.

Moreover, results demonstrate how the linear evolution trend and the administration-centred perspective, often proposed by existing e-maturity models (Andersen et al. 2020) are not generally observed, highlighting a limitation of the existing e-maturity models. Indeed, in our study, the Selectives cluster contrasts previous literature. Those municipalities digitised only a sub-sample of services: the non-educational school services and the two G2B services used for the analysis. A similar pattern can be detected for the Beginners cluster, which digitised mainly G2B services. Municipalities can adopt different strategies and make different trajectories towards digitisation but also can limit the digitisation to a sub-sample of services (as we have taken a snapshot in a time where we do not know if the digitisation process is ongoing, or rather municipalities consider their actual level as an end-state).

Hence, we observe municipalities who have preferred to focus on a sub-sample of services and fostered penetration while on the opposite other municipalities have

tried offering a larger portfolio of digital services, with lower results in terms of penetration.

Moreover, results confirm the need to distinguish between G2B and G2C services when looking at e-maturity (Yildiz 2007; Tangi, Soncin, et al. 2021). Municipalities with medium or low e-maturity tend to digitise only G2B services. Probably companies push municipalities for offering digital services, as they are more mature in the usage of digital channels. Looking at the G2C services, results support a step forward in the existing literature. They highlight how the distinction between G2B and G2C is not enough detailed, and, among the G2C services, differences must be considered. In fact, non-educational school services are directed to a narrower and younger target of users. Hence, they are the preferred services for digitisation. This quantitative evidence confirms an intuition of a previous qualitative study (Tangi, Benedetti, et al. 2021).

The obligation or the spontaneous trend of making some digital services mandatory (Tangi, Benedetti, et al. 2021; Madsen and Kræmmergaard 2015; Madsen, Lindgren, and Melin, *in press*) can support the explanation of the high percentage of users who adopt the digital channel in G2B and non-educational school services. On the one hand, in Italy there is a path traced by the national government in making G2B service available exclusively through a digital channel. On the other hand, we observe a spontaneous trend among municipalities in making the digital channels mandatory for non-educational school services at least for users with no specific needs (Tangi, Benedetti, et al. 2021).

Moreover, the analysis offers novel insights on the relation between e-maturity, the size of a public organisation, and, most notably, organisational factors and ICT expenditures.

Looking at the size of the organisation, results confirm that bigger municipalities are on average more digitised (Budding, Faber, and Gradus 2018; Manoharan 2013).

Moving to the organisational factors, our analysis partially confirms previous literature on the importance of key organisational factors for being digital mature (Nasi, Frosini, and Cristofoli 2011). Only some of the indicators are statistically significant and exclusively for a subset of the identified e-maturity clusters. This result complements previous literature on e-maturity determinants (Nasi, Frosini, and Cristofoli 2011; Budding, Faber, and Gradus 2018; Nam 2019; Manoharan 2013; Tangi, Soncin, et al. 2021), filling a gap in the existing body of literature (Tangi, Soncin, et al. 2021).

Moreover, our results stress how different maturity profiles can be characterised by different organisational characteristics. Municipalities at the earlier stages of maturity do not exhibit a structured adoption of key figures, in particular DPO. Also, the number of ICT employees seems to have a significant relation with e-maturity. More mature municipalities (Moderates and Selectives) have a higher number of ICT employees. The same difference is not detected for the Champions, which probably can benefit from a more efficient management of digital systems. Looking at collaboration, no clear patterns have emerged, probably due to the absence of small municipalities, which are more willing to cooperate.

Finally, the last and novel result is the relation between e-maturity and ICT expenditures. In a previous study, Budding, Faber, and Gradus (2018) investigated the correlation between e-maturity and cost items. These items refer to the specific costs of services from the citizen's side, e.g. tax stamps, while we focused on the overall policies adopted by municipalities with respect to ICT investments, in order to detect the commitment of local governments in the field.

Our findings show a significant difference between No Digitals and the other clusters of e-maturity (except the pair No Digitals – Beginners). The same difference is not detected among the other clusters. Hence, starting a digitisation process requires a minimum investment, probably due to the needed infrastructure. Once achieved, the next steps in e-maturity do not go together with higher ICT expenditures. This is a novel result, which highlights the partial importance of the ICT expenditures.

After the first steps (No Digitals and Beginners), higher expenditures do not automatically correspond to higher e-maturity in terms of usage of the digital service by citizens. Hence, we can hypothesise that, for municipalities that already offer digital services and aim at increasing the percentage of usage of the digital channel, *how* they spend money is more important than *how much* money they spend.

### **Implications for practice**

Results show a large heterogeneity in e-maturity among municipalities.

Even when considering medium and large municipalities, there is a significant part of them that does not deliver any digital service. As demonstrated by a previous study (Tangi, Soncin, et al. 2021), this percentage is even higher if considering all municipalities. Hence policymakers should reflect on how supporting those municipalities for giving to citizens and firms the same rights and opportunities in accessing public services.

Among the municipalities that offer digital services different digitisation profiles have been traced. Municipalities exhibit different strategies that result in a different opportunity for citizens and firms in accessing the service through digital channels. The common trait is the higher percentage in the offering and usage of G2B services. If the need is to move towards full maturity, policymakers should incentivise the digitisation of G2C services and their usage by citizens. Moreover, on average, the percentage of

citizens who use the digital channel is still limited, often below 50% and in some cases below 20%. Hence, policymakers should focus not only on the presence or absence of a digital channel, but rather on identifying proper behavioural and channel management interventions (Tangi, Benedetti, et al. 2021) for fostering the usage of the digital channels, when available.

These results become particularly relevant in light of the ongoing Covid-19 pandemic. Accessing digital services is becoming not only a preferable solution for seeking efficiency but also a preferable (if not unique) solution for health reasons. Hence, the shift towards digital channels is becoming a duty for public organisations and a non-postponable intervention.

Looking at the organisational determinants and the ICT expenditures, results show that the biggest barrier is the initial trigger, i.e. moving from being no digital to the offer of the digital channel(s). This shift requires higher expenditures and a larger number of employees. Once made this step, organisational variables become less important: *how* to spend money becomes more important than *how much* money; *how* employees are managed becomes more important than *how many* ICT employees a public organisation has. This evidence offers a fresh policy implication. On the one hand, investments should be done for triggering the digitisation process. On the other hand, in order to support and foster the usage of digital channels, strategic choices (Pieterse 2010) together with political and managerial willingness (Tangi, Janssen, et al. 2021) become extremely important.

### **Limitations and further research**

The study has some limitations. Regarding the data used for the analysis, we first must underline that all the information coming from municipalities is the result of a self-declaration, although the data collection has been performed by an institutional body. In

this perspective, the values declared by municipalities, in particular penetration values, should be further validated and monitored in the future, despite the complexity of collecting these types of information on such a large scale and spectrum of observations.

Moreover, we must remark that the data used in the study are related to the Italian context, whose performances in terms of national digitisation are currently behind all the other major European countries (European Commission 2020). Hence the replicability of the results in other nations can be different and deserve further research.

In this perspective, our analysis excludes the smallest municipalities (characterised by a population below 5,000 inhabitants) due to the investigation of organisational factors, hard to detect in extremely small municipalities. Nonetheless, further research should be dedicated to them, in order to specifically investigate the distinctive features and leverages (e.g. the presence of collaboration forms and support from upper-tier administrations) that play an important role in guiding these municipalities into digital transformation and implementation of digital services.

The analysis of the organisational determinants leaves open questions and room for future research. All the determinants analysed by scholars over the years seem to be just partially explaining e-maturity. Several qualitative studies highlight that e-maturity is also the result of a series of factors, like the presence of a leader (Tangi, Janssen, et al. 2021; Ashaye and Irani 2019), a group of people who properly manage organisational change (Svahn, Mathiassen, and Lindgren 2017) or the collaboration with third parties (Ashaye and Irani 2019; Janssen and Klievink 2009). All these and other intangible factors can hardly be comprehended through quantitative analyses.

## **Conclusion**

The study aims at looking at e-maturity, highlighting the existence of patterns of digitisation choices by municipalities. This result questions the linear path traced by previous literature and offers a fresh perspective to be looking at while assessing e-maturity. Also, the empirical robust validation from a large database that covers almost all the population of Italian municipalities is one of the main results of the analysis.

Moreover, we focus on organisational factors and ICT expenditures, elements that are rarely taken into consideration in the existing body of literature. We highlight how these elements only partially explain e-maturity, adding important evidence but also leaving a gap for further research.



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