THE ROLE OF INSTITUTIONAL AND OPERATIONAL FACTORS IN THE DIGITALIZATION OF LARGE LOCAL GOVERNMENTS: INSIGHTS FROM ITALY

Marco Bisogno

Department of Business Sciences Management and Innovation Systems

University of Salerno, Italy

Beatriz Cuadrado-Ballesteros

Department of Administration and Business Economy

Multidisciplinary Institute for Enterprise

University of Salamanca, Spain

Flavio Abate

Department of Business Sciences Management and Innovation Systems

University of Salerno, Italy

ABSTRACT

Purpose: This study investigates drivers of local governments' digitalization, focusing on contextual factors that can help explain the level of e-government development. Concretely, it examines financial, socioeconomic, and political factors that represent the local context where e-government initiatives are implemented.

Design/methodology/approach: A composite e-government index was used, adopting a holistic perspective to capture various features of e-government initiatives. The OLS estimator for linear regressions was used for the analysis based on a sample of Italian

municipalities in 2023. The Tobit estimator was additionally implemented to check for the robustness of the results.

Findings: Empirical findings suggest that municipalities with higher indebtedness tend to show lower digitalization levels. Economic and social variables are also relevant factors, while the political orientation of the governing party is not significant. This indirectly documents that e-government initiatives play a strategic role despite the political ideology.

Originality: This study avoids referring to a technological determinism perspective and examines the role of the institutional and operational context, highlighting the need to unveil and explain differences among local governments rather than focusing on similarities.

Keywords: digitalization; e-government; local government; Italy

Article classification: Research paper

1. Introduction

This study aims to investigate the drivers of the development of local governments (LGs) in terms of digitalization, focusing on the Italian context. The motivations for this study rely on the growing importance of digitalization in the public-sector context, which is attracting increasing scholarly interest (Agostino *et al*., 2022).

Previous literature investigating e-government development has frequently considered it as a process consisting of several steps (Ingrams *et al*., 2020). This approach may lead to technological determinism, while the ability of an LG to successfully implement e-government initiatives could be affected by local institutional and operational contexts (Di Giulio and Vecchi, 2019). The implementation of e-government initiatives and their development do not necessarily occur linearly as technological changes cannot occur independently of other factors (Coursey and Norris, 2008; Manoharan and Ingrams, 2018). Previous studies have primarily investigated the effect of digitalization on decision-making, transparency, accountability, and relationships with citizens (Vydra and Klievink, 2019). This research aims to contribute to the academic debate by focusing on contextual factors that can help explain the level of development of LGs in terms of digitalization.

The theoretical framework used for this study relies on innovation and diffusion models (Berry and Berry, 2007), which is consistent with the idea that implementing e-government initiatives implies innovating processes through which an LG provides services to its citizens. Based on a large sample of Italian LGs, empirical results document the positive role of good financial conditions and the economic development of the territory, along with certain characteristics of the population, while political variables are less relevant than expected.

The remainder of the paper is structured as follows: Section 2 reviews previous studies, while Section 3 illustrates the theoretical framework and develops the hypotheses. Section 4 explains the research methodology, and Section 5 presents the results, which are discussed in Section 6, along with concluding remarks.

2. Literature review

Since the early 1990s, governments have been increasingly utilizing the Internet and different online tools to disseminate information and provide services to citizens, implementing strategies to support this transformation (Manoharan, 2013). Conventionally, the starting point of this phenomenon, known as digitalization or e-government, is considered the report 'Reengineering through Information Technology', published in 1993 under the Clinton Administration (Lenk and Traunmuller, 2002). Although the term e-government has been conceptualized in different ways, it generally relies on both the use of information and communication technologies (ICTs) and related organizational changes due to the need to redefine the structure and improve the operations of the government (Epstein, 2022). Scholars argue that this process is facilitating a shift from the traditional bureaucratic paradigm to a new approach where network building and collaboration with other actors are considered particularly relevant (Ho, 2002), as occurs when public-sector innovations are implemented (Criado *et al*., 2023). A more structured and institutional definition (UNDESA, 2001) focuses on the need for developing, sustaining, and providing open and free access to timely, helpful, and relevant information and services for every segment of the population, as well as stimulating close interaction with citizens.

Accordingly, scholars have underlined the intrinsic complexity of e-government initiatives, analyzing related modernization processes (Meijer and Bekkers, 2015) and the

impacts on organizational changes (Castelnovo and Sorrentino, 2018). Other studies (Bisogno *et al*., 2022; Grönlund and Horan, 2005; Guida and Crow, 2009; Patergiannaki and Pollalis, 2024) have investigated if—and to what extent—e-government innovations can enhance external relationships between a public-sector entity and its citizens.

Several studies have documented e-government development, highlighting that it has been slower than expected (Norris and Reddick, 2013). This development has been mainly conceptualized through sequential stages (Garson, 2003; Layne and Lee, 2001; Moon, 2002; Reddick, 2004; Yildiz, 2007). Schlelin (2007) evidenced similarities among models and propounded a further one based on five steps to represent the different levels of governments' web presence. Moving from the approach first proposed by Nolan (1979), the *fil rouge* which links these models is that they are based on an evolutionary process (Andersen and Henriksen, 2006; Layne and Lee, 2001; Lee *et al*., 2011; Reddick, 2004), which leads to considering e-government development through stages as inevitable (Ingrams *et al*., 2020), so to implicitly assuming that the growth stages follow a predefined and linear path to achieving an end state (Janowski, 2015). This may lead to technological determinism.

However, this approach has been criticized, as it has been considered too simplistic and may unveil relevant heterogeneities across different contexts. Esposito *et al*. (2023) suggest that there are no predefined paths to follow while implementing concrete digitalization strategies and policies. Accordingly, technological innovations do not occur in a linearly continuous (Coursey and Norris, 2008; Manoharan and Ingrams, 2018); digitalization should be conceived as an institutional policy (Wollmann, 2004, p. 3) directed at remolding procedures and organizational structures of public administrations, being able to sustain changes if other political, social and organizational factors concur (Kuhlmann and Heuberger, 2023).

A socio-technical perspective should then be adopted to investigate digital transformations (Castelnovo and Sorrentino, 2018). Nevertheless, contradictory results have been recorded. On the one hand, the so-called 'cyber-pessimistic' school of thought has documented challenges and barriers (Manoharan and Ingrams, 2018), as governments must consider regulatory/economic issues and the rights of users while implementing e-government initiatives (Jaeger and Thompson, 2003). On the other hand, scholars have evidenced that e-government can favor citizens' engagement, increase the speed of payments, establish communications with users and improve the quality of services (Andersen *et al*., 2010).

Several studies concentrated on the role of social media, examining their impact on political communication and electoral success (Bode *et al*., 2020; Chadwick and Stromer-Galley, 2016; Epstein, 2018; Towner and Munoz, 2020), or the effect that social media can have on the improvement of functions of government (Epstein *et al*., 2023; Seigler, 2017). Scholars call for further research at a local government level, highlighting the need to distinguish between the adoption and implementation stages (Criado *et al*., 2023; Manoharan and Ingrams, 2018). Kuhlmann and Heuberger (2023) also suggest considering the institutional context and institutional changes, which are expected to play a relevant role.

Building on this last literature stream, this study avoids using a technologically deterministic perspective, aiming to address the complexity of e-government by considering several institutional features in accordance with a socio-technical perspective (Gasco-Hernandez *et al*., 2022). Furthermore, it seeks to capture different but related aspects (such as the implementation of online services, including those allowing e-authentication and e-payments, interactions via social media, municipal apps, free access to open data, public WIFI, Internet of Things, and so on) so to take a holistic perspective.

3. Theoretical Framework and Research Hypotheses

In his recent systematic literature review, Terlizzi (2021) claimed that many studies on digital government have not explicitly utilized a theoretical framework pertaining to policy processes. Accordingly, he argued that future research is highly encouraged to adopt a social science framework. Since implementing strategies and policies regarding the digitalization of LG's processes can be interpreted as a specific form of innovation, this study refers to the innovation and diffusion models framework (Berry and Berry, 2007).

Following Berry and Berry (2007), two forms of explanation regarding the implementation of innovative policies can be used: internal determinants and diffusion models. The first one states that factors explaining innovations are based on the government's economic, political, and social characteristics; the second one emphasizes the role played by emulations of innovations already implemented by other governments. While previous literature referred to internal determinants and diffusion models separately, scholars (Berry and Berry, 2007) suggest utilizing both approaches to explain innovation policies simultaneously. Accordingly, this study borrows from this literature by adapting those models to compare LGs and considering digitalization processes implemented by LGs as particular forms of innovation policies.

Scholars argue that organizations with high levels of 'slack resources' tend to be more innovative than those with fewer resources (Berry, 1994; Rogers, 1983). In a broader sense, classical organizational studies documented that the higher the availability of resources, the higher the ability of an entity to overcome obstacles to innovations (Mohr, 1969). Indeed, García-Sánchez *et al*. (2012) hypothesized that LGs with more available resources could generate other relevant ways to cover e-government development costs. Financial resources are essential because e-government requires complex technical and

administrative infrastructures, so financial position plays a critical role in implementing technological innovations like e-government (Glyptis *et al*., 2020). Rodríguez-Domínguez *et al*. (2011) concluded that governments with a higher financial capacity tend to show greater e-government development. Accordingly, the following hypothesis is stated:

H1: A good financial situation positively affects the development of LGs' e-government initiatives.

Innovation and diffusion models' theorists also highlight that public-sector entities tend to introduce innovations to emulate other entities as they undergo pressures to conform to national or regional rules. This idea could be interpreted in the light of institutional theory (DiMaggio and Powell, 1983), leading to an explanation of the behavior of organizations by considering the different forms of isomorphism. More specifically, according to the literature on innovation and diffusion models, organizations tend to emulate other organizations perceived as successful and legitimate to improve their own legitimacy. However, referring only to external pressures and isomorphisms could be too simplistic (Berry and Berry, 2007). Accordingly, political science scholars suggest considering similarities and differences between governments regarding political ideology (Nicholson-Crotty, 2004), organizational culture and the attitude towards innovation (Nasi *et al*., 2011), the motivations of both politicians and managers (Tan *et al*., 2022), and the role of internal rules and routines (Cinite *et al*., 2009).

From this perspective, another feature that may affect digitalization is the strength of the governing party. Fragmented governments that need the legislative support of other parties and face substantial competition may find it challenging to achieve consensus regarding the reforms to be made (McNeal *et al*., 2003). For instance, passing a new law is easier when a single party controls the government (Boehmke and Witmer, 2004).

Similarly, Brooks (2005) suggested that party fragmentation is inversely related to successful innovation. Accordingly, we hypothesize that:

H2: The higher the strength of the governing party, the higher the development of LGs' e-government initiatives.

Learning processes that are defended by the isomorphism approach are difficult to test, as they require designating a public-sector entity as the pioneer in adopting specific innovations and other entities as followers (Walkers, 1969). Consequently, scholars suggested using testable proxies. For instance, Collier and Messick (1975) identified as pioneers those governments characterized by high economic development. Berry and Lowery (1987) maintain that economic development stimulates increased demand for government services. Furthermore, several studies have documented a positive effect of income per capita on the digitalization level (Budding *et al*., 2018; Manoharan, 2013). So, the third hypothesis proposed here is the following:

H3: The economic development of an LG positively affects the development of its e-government initiatives.

4. Research Methodology

4.1. Sample

Our sample includes 108 Italian municipalities in 2023. This paper focuses on LGs because they have the autonomy to manage expenditure and revenue, and so their decisions can influence their financial health. Previous literature focused on small municipalities, documenting a low digitalization level (Previtali and Bof, 2009). The study concentrates on the largest LGs as they are required to provide many essential public services (e.g., urban waste collection and treatment; cleaning, paving and maintenance of public roads; drinking water supply; social services, etc.). Therefore,

implementing digital innovations is particularly significant, as it can affect the quantity and quality of services provided to citizens.

Considering that LGs have similar autonomy in other countries in managing expenditures and revenue and are required to provide similar services whose quality is also affected by the development of their e-government initiatives, results emerging from the Italian context may prove to be relevant also in other countries, especially those characterized by socioeconomic disparities, as occur in Italy.

4.2. Variables

The level of digitalization is represented by the ICity index elaborated by FPA (https://www.forumpa.it). Since 1990, FPA has been active in the digitalization field, organizing a national event to bring together public administrations, academics, private-sector entities and civil-society organizations. It monitors the digitalization processes of Italian public administrations on a systematic basis, developing reports and indicators to summarize the state of the art. In particular, ICity index consists of 8 different features that are represented by several indicators, summarized in Table 1. The eight scope indicators can be attributed to three fundamental dimensions:

- The *Digital Administration* dimension refers to citizens, firms, and other stakeholders' digital access to LG's website, through which online services are provided, including those related to e-authentication and e-payments.
- The *Open Municipalities* dimension refers to social media interactions, the development of municipal apps, and free access to open data.
- The *Connected Cities* dimension refers to free public WIFI, IoT (*Internet of Things*) devices to collect and share data, and smart-city platforms.

It is worth noting that previous literature has utilized variables similar to indicators belonging to these dimensions to investigate e-government initiatives. For instance,

Epstein (2022) referred to social media, multimedia, and municipalities apps, Feeney and Brown (2017) took into account e-services and civic engagements (among others) as e-government features, Criado *et al*. (2017) investigated the relationship between organizational, institutional, and environmental factors with the successful use of social media in LGs, while Schlelin (2007) referred to different facets of web presence. The eight scope indicators used for our analysis can then be framed in previous literature, but we additionally implement a holistic approach to merge diverse features of such a complex phenomenon. After a standardization process, each of the three components (subindexes) takes values between 0 and 100, from the lowest to the highest level of digitalization. In order to create a global index (*ICity*) we sum the score of each component, so *ICity* takes values between 0 and 300.

<Insert Table 1 about here>

To test the first hypothesis, we need some variables to operationalize the broad concept of "availability of resources" (Berry and Berry, 2007) that García-Sánchez *et al*. (2012) used to analyze the e-government development. This study utilizes three indicators that represent the financial situation of LGs: (i) *Autonomy* refers to financial autonomy that is represented by the ratio of revenue obtained from local taxes and other additional local revenue to total current revenue; (ii) *Current Balance* represents the ability of current revenue to cover current expenses, and it is represented by the ratio of current revenue to current expenses; and (iii) *Indebtedness* is the ratio of total debts to total current revenue. Indicators were calculated by using data that was hand-collected from an open portal (https://www.openbilanci.it), based on official data provided by the Ministry of the Interior.

The second hypothesis is tested through the variables called *Strength*, calculated by dividing the number of councillors who belong to the party (or coalition of parties) that won the last municipal election and the total number of councillors in the LG.

The third hypothesis refers to the economic development level. To represent this feature, this study uses two variables (Barro, 2001): the gross domestic product per capita (*GDP*), in logarithmic terms; and the level of education (with *Education* being expressed through the percentage of the population with high schools leaving qualifications or higher).

The empirical analysis includes several control variables that may also affect the level of digitalization. Concretely, scholars have provided evidence regarding the role of political factors and characteristics of the population (Budding *et al*., 2018; Jacob *et al*., 2019). Accordingly, this study considers: *Population*, which is the number of inhabitants (in logarithmic terms); *Density* that is the number of inhabitants per km2 (in logarithmic terms); *Elderly* refers to the percentage of the total population that is aged over 65, expecting they have poor digital skills. Finally, *Ideology* refers to the political orientation of the city's government (Gallego-Álvarez *et al*., 2010; Rodríguez-Domínguez *et al*., 2011; Tolbert *et al*., 2008), taking the value 0 if it is Centre-left and 1 if it is Centre-right. Data for control variables was hand-collected from several sources based on official data provided by the Ministry of the Interior.

4.3. Model of analysis

Bivariate correlations are analyzed to decide how to include each variable in the model, avoiding multicollinearity problems. Table A1 (see Annex 1) shows the bivariate correlations between explanatory variables to understand if multicollinearity problems—the main drawback that prevents the OLS solution to an economic problem from being adequate (Wooldridge, 2009)—would appear in the regression analysis. The most salient

coefficients between the independent variables suggest a high correlation between *Current_balance* and *Indebtedness* as well as *GDP* and *Education*, so they should not be included simultaneously in the same equation to avoid multicollinearity problems.

Considering these correlations, the following equations are proposed:

$$Digitalization_i = \beta_0 + \beta_1 Autonomy_i + \beta_2 Current\_Balance_i + \beta_3 Strength_i + \beta_4 GDP_i + \beta_5 Ideology_i + \beta_6 Population_i + \beta_7 Elderly_i + \varepsilon_i \quad \textbf{(1)}$$

$$Digitalization_i = \beta_0 + \beta_1 Autonomy_i + \beta_2 Indebtedness_i + \beta_3 Strength_i + \beta_4 GDP_i + \beta_5 Ideology_i + \beta_6 Population_i + \beta_7 Elderly_i + \varepsilon_i \quad \textbf{(2)}$$

$$Digitalization_i = \beta_0 + \beta_1 Autonomy_i + \beta_2 Current\_Balance_i + \beta_3 Strength_i + \beta_4 Education_i + \beta_5 Ideology_i + \beta_6 Population_i + \beta_7 Elderly_i + \varepsilon_i \quad \textbf{(3)}$$

$$Digitalization_i = \beta_0 + \beta_1 Autonomy_i + \beta_2 Indebtedness_i + \beta_3 Strength_i + \beta_4 Education_i + \beta_5 Ideology_i + \beta_6 Population_i + \beta_7 Elderly_i + \varepsilon_i \quad \textbf{(4)}$$

The subindex *i* refers to each Italian municipality included in the sample; *βj* are the *j* parameters to be estimated; *ε* is the error term. *Digitalization* refers to the four indexes that were previously described: *ICity*, *Digital_Administration*, *Open_Municipalities*, and *Connected_Cities*. Then, each model is estimated for each digitalization indicator. The sample includes the year 2023, so all the equations are estimated by using the ordinary least-squares (OLS) estimator for linear regression analysis.

Table A2 in the Annex shows the correlations between dependent variables. These show that the four indexes are highly correlated. However, these large correlations are not an issue for our study; conversely, what they show is that the dimensions that make up the global index (*ICity*) are related to each other, and therefore, they represent the same concept (digitalization), but from different edges or with different prisms. Accordingly, it is essential to use not only the global index (*ICity*) but also the three subindexes (*Digital_administration*, *Open_municipalities*, and *Connected_cities*), which ultimately

measure the same broad concept but consider different specificities of digitalization. In addition, this table shows correlations between dependent and explanatory variables, suggesting the links that we can expect to find in the regression analysis.

5. Results

5.1. Descriptive analysis

Table 2 shows the descriptive statistics of the variables previously described.

<Insert Table 2 about here>

Focusing on *ICity*, the mean value is 168.26. In a range from 0 to 300, it is roughly in the middle, so there is still much to do to improve the digitalization level of Italian cities. The lowest value is shown by the index *Open_Municipalities*, whose mean value is 52.13, while the best score is given by *Digital_Administrations*, with a mean value of 59.73 (both ranging between 0 and 100). Nevertheless, some cities stand over the rest. Figure 1 shows that cities in the centre-north have higher levels of digitalization than cities in the south of Italy.

<Insert Figure 1 about here>

Turning to Table 2, the mean value of *Autonomy* is about 0.57, suggesting that revenue from taxes is around 57% of total current revenue. Furthermore, current revenue is higher than current expenditures since the variable *Current_balance* has mean values higher than 1. Besides, the level of indebtedness is relatively higher than current revenue because the mean value is slightly higher than 1. Regarding the political factors, *Strength* has an average of 0.63, which means that, on average, a mayor is supported by 63% of the total councillors.

Regarding economic development, the mean value of GDP per capita is 21,312.01 euros. Milan has the maximum GDP (31,777.70 euros per capita), while Andria has the

minimum value (12,963.10 euros per capita). The mean value of *Education* suggests that about 55% of the total population has passed secondary education.

Regarding control variables, the mean value of *Ideology* is 0.45, which suggests that about 45% of cities are governed by centre-right parties. The mean value of *Population* is 163,788 inhabitants, who are relatively aged, as the mean value of *Elderly* indicates that 25% of the total population is over 65 years old.

5.2. Empirical analysis

Table 3 shows the empirical results obtained for all previously described equations, using the *ICity* index as the dependent variable. Furthermore, tables 4, 5, and 6 show the results by considering the three subindexes, *Digital_Administrations*, *Open_Municipalities*, and *Connected_Cities*, respectively. The four tables show the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity. When p-value < 0.05, errors are not homoscedastic, so robust standard errors are shown to solve heteroskedasticity problems. In these cases, the test has not been recalculated since it is not possible with robust errors. In addition, the adjusted R-squared has been included, but it is replaced by the traditional R-squared when robust standard errors have been used. Finally, all the tables show the highest Variance Inflation Factor value in each model, complying with the rule of being less than 5 to ensure that there are no multicollinearity problems.

Focusing on Table 3, *Autonomy* is not statistically significant in any equations. However, *Current_balance* and *Indebtedness* variables are statistically relevant in all cases and are negatively related to *ICity*. This means that municipalities with higher current revenues compared to current expenses and higher levels of indebtedness show a lower level of digitalization.

Regarding political fragmentation, *Strength* is not statistically significant in any case, so there is not enough evidence to support our second hypothesis.

Regarding economic development, *GDP* is relevant in all the equations, as is *Education*, showing a positive link with *ICity*. This supports the third hypothesis, suggesting that the higher the level of development and education, the higher the level of digitalization.

Finally, *Population* has positive coefficients, indicating that more populated cities tend to show higher levels of digitalization. *Elderly* is not statistically relevant in most equations. The political ideology is not statistically relevant either, indicating that parties of all ideologies attempt to promote e-government initiatives (Gallego-Álvarez *et al.*, 2010).

<Insert Table 3 about here>

Tables 4, 5 and 6, where the dependent variables are *Digital_administrations*, *Open_municipalities* and *Connected_Cities* respectively, show similar results. However, the *Digital_administrations* index is explained by fewer factors, just *Indebtedness* and *Population*, suggesting that less indebted and most populated municipalities tend to show higher levels of digitalization. *Strength* is statistically significant in explaining *Connected_Cities*, and it has positive coefficients. This suggests that the greater the strength of the governing party, the greater the number of IoT (Internet of Things) devices to collect and share data, smart-city platforms, and free public WIFI, which is according to our second hypothesis.

<Insert Table 4 about here>

<Insert Table 5 about here>

<Insert Table 6 about here>

Bearing in mind that the *ICity* index takes values between 0 and 300, and the other three indicators (*Digital_administrations*, *Open_municipalities*, and *Connected_cities*) take values between 0 and 100, all of them may be considered as censored variables.

Accordingly, the Tobit estimator is used to check for the robustness of our empirical findings. The results are completely similar to those that have emerged from the OLS estimator. Although they are not tabulated here, they are available upon request.

6. Discussion and Conclusion

This study aimed to investigate the level of digitalization of a large sample of Italian LGs. Following Terlizzi's call for using a theoretical framework to investigate e-government issues (Terlizzi, 2021), we referred to innovation and diffusion models (Berry and Berry, 2007), with the basic idea being that e-government initiatives are considered specific forms of innovation (Criado *et al*., 2023). The analysis was based on secondary data, and its availability led us to use an OLS technique, limiting the possibility of using more sophisticated techniques like panel data.

Findings from the analysis show that, in general, the implementation of e-government innovations can be facilitated if an LG has a low level of indebtedness. This result is consistent with e-government literature (García-Sánchez *et al*., 2012; Glyptis *et al*., 2020; Rodríguez-Domínguez *et al*., 2011) and the theoretical framework utilized here (Berry, 1994; Berry and Berry, 2007); indeed, a positive financial condition could be considered a requisite for several public policies implemented at the local level. However, in the case investigated here, important additional features are worth mentioning, and several implications deserve to be considered. First, we refer to strategic innovations towards digitalization and not to public policies in general. This means that the implementation of online services, municipal apps, IoT, and other digital innovations requires adopting a long-term perspective, and long-term investments are needed. This could explain the prevalent focus on the level of indebtedness rather than the current balance. In this respect, it is worth observing that Italian LGs can obtain new loans to finance long-term

investments (as those required by e-government innovations) only if their level of indebtedness is low (namely, it does not exceed certain thresholds periodically indicated by the central government). Therefore, LGs with a high level of indebtedness—as occurs for the vast majority of Italian LGs—cannot improve their level of digitalization because they suffer limitations in contracting new loans devoted to financing innovative digitalization strategies. From a theoretical perspective, this emphasizes the need to consider contextual factors (such as the limitation in obtaining new loans) while investigating e-government innovations at an LG level, supporting our approach of avoiding technological determinism. From a practical perspective, this can also underline the need to support innovations in digitalization processes with adequate planning of resources to be achieved and invested in long-term initiatives. However, we acknowledge that this could be considered a limitation of the study; therefore, future research could utilize additional variables or refer to a concept broader than that of financial condition, referring to financial sustainability.

Regarding political factors, results show that political ideology is not statistically relevant, while the strength of the government is statistically relevant only for the *Connected-cities* index. The main implication emerging from this result is that digitalization innovations implemented at a local level can be considered crucial strategic goals despite the political orientation. Future studies could further investigate the effects of additional variables, to examine the motivations of politicians (Tan *et al*., 2022) or the role of internal rules and routines (Cinite *et al*., 2009).

According to the literature on innovation and diffusion models (Berry and Berry, 2007; Mooney and Lee, 1995), this study has also investigated the effect on digitalization of economic development, considered as a testable proxy of learning processes (Berry and Lowery, 1987). Indeed, previous literature has essentially focused on income per capita

(Budding *et al*., 2018; Manoharan, 2013). This study, in addition to GDP, has also referred to education, documenting the positive effects of both variables. It is also worth noting that Italian northern regions are, on average, more economically developed than southern regions; therefore, our results implicitly support the relevance of geographical proximity in explaining the diffusion of innovations (Berry and Berry, 2007; Mooney and Lee, 1995), as recent studies have documented (Donatella and Bisogno, 2024).

To conclude, several implications emerge from the analysis. First, while the existing literature predominantly concentrates on national agencies (Gasco-Hernandez *et al*., 2022; Kuhlmann and Heuberger, 2022), this study focuses on LGs, contributing to the debate on digital transformation in the public sector context at a local level. Second, it underlines the importance of avoiding adopting a technological determinist perspective while examining the development of e-government initiatives. Third—and accordingly—this study embraces different social and political features that have been proven to be relevant while explaining the development of e-government initiatives so as to take a holistic approach. Such an approach is consistent with suggestions coming from the socio-technical perspective (Castelnovo and Sorrentino, 2018), allowing contextual factors to be taken into account. Concretely, the institutional and operational contexts that characterize the implementation stage of policy processes are considered (Di Giulio and Vecchi, 2019; Terlizzi, 2021) and embedded into an appropriate framework, merging e-government studies with social scientists' approaches.

7. REFERENCES

Agostino, D., Saliterer, I., and Steccolini, I. (2022), "Digitalization, accounting and accountability: A literature review and reflections on future research in public services", *Financial Accountability and Management*, Vol. 38 No. 2, pp. 152-176.

Andersen, K.N., Henriksen, H.Z., Medaglia, R., Danziger, J.N., Sannarnes, M. K., and Enemærke, M. (2010). "Fads and facts of e-government: A review of impacts of e-government (2003–2009)", *International Journal of Public Administration*, Vol. 33 No. 11, pp. 564-579.

Andersen, K., and Henriksen, H.E. (2006), "Government Maturity Models: Extension of the Layne and Lee Model", *Government Information Quarterly*, Vol. 23 No. 2, pp. 236-248.

Barro, R. (2001), "Education and Economic Growth", Helliwell J.F. (Ed.) *The Contribution of Human and Social Capital to Sustained Economic Growth and Well-Being*. OECD (pp. 1-44).

Berry, F.S. (1994), "Innovation in Public Management: The Adoption of State Strategic Planning", *Public Administration Review*, Vol. 54 No. 4, pp. 322–330.

Berry, F.S. and Berry, W.D. (2007), "Innovation and Diffusion Models in Policy Research", Sabatier P.A. (Ed.), *Theories of the Policy Process*, Westview Press, Boulder, Colorado (pp. 223-260).

Berry, W.D., and Lowery, D. (1987), *Understanding United States Government Growth: An Empirical Assessment of the Postwar Era*. New York: Praeger.

Bisogno, M., Cuadrado-Ballesteros, B., and Santis, S. (2022), "Do e-government initiatives and e-participation affect the level of budget transparency?", *International Public Management Journal*, Vol. 25 No. 3, pp. 365-391.

Bode, L., Budak, C., Ladd, J. M., Newport, F., Pasek, J., Singh, L. O., … Traugott, M. W. (2020). *Words that matter: How the news and social media shaped the 2016 presidential campaign.* Washington D.C.: Brookings Institution Press.

Boehmke, F.J. and Witmer, R. (2004), "Disentangling diffusion: The effects of social learning and economic competition on state policy innovation and expansion", *Political Research Quarterly,* Vol. 57 No. 1, pp. 39–51.

Brooks, S.M. (2005), "Interdependent and domestic foundations of policy change: The diffusion of pension privatization around the world", *International Studies Quarterly*, Vol. 49 No. 2, pp. 273–294.

Budding T., Faber B., and Gradus R. (2018), "Assessing electronic service delivery in municipalities: Determinants and financial consequences of e-government implementation", *Local Government Studies,* Vol. 44 No. 5, pp. 697-718.

Castelnovo, W., and Sorrentino, M. (2018), "The Digital Government Imperative: A Context-Aware Perspective". *Public Management Review*, Vol. 20 No. 5, pp.709–725.

Chadwick, A., and Stromer-Galley, J. (2016), "Digital media, power, and democracy in parties and election campaigns: Party decline or party renewal?", *International Journal of Press/Politics,* Vol. 21 No. 3, pp.283–293.

Cinite I., Duxbury L.E., and Higgins C. (2009), "Measurement of perceived organizational readiness for change in the public sector". *British Journal of Management*, Vol. 20 No. 2, pp. 265–277

Collier, D., and Messick, R.E. (1975), "Prerequisites Versus Diffusion: Testing Explanations of Social Security Adoption". *American Political Science Review*, Vol. 69 No. 4, pp. 1299–1315.

Coursey, D., and Norris, D.F. (2008), "Models of e-government: Are they correct? An empirical assessment", *Public Administration Review,* Vol. 68 No. 3, pp. 523–536.

Criado, J. I., Rojas-Martín, F., and Gil-García, J. R. (2017), "Enacting social media success in local public administrations: An empirical analysis of organizational,

institutional, and contextual factors", *International Journal of Public Sector Management*, Vol. 30 No. 1, pp. 31-47.

Criado, J.I., Alcaide-Muñoz, L., and Liarte, I. (2023), "Two decades of public sector innovation: building an analytical framework from a systematic literature review of types, strategies, conditions, and results", *Public Management Review*, pp.1-30, doi: 10.1080/14719037.2023.2254310

Di Giulio M., and Vecchi G. (2019), "Multilevel Policy Implementation and the Where of Learning: The Case of the Information System for School Buildings in Italy", *Policy Sciences*, Vol. 52 No. 1, pp. 119-135.

DiMaggio, P.J., and Powell, W.W. (1983), "The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields", *American Sociological Review*, Vol. 48 No. 2, pp. 147-160.

Donatella, P., and Bisogno, M. (2024), "Determinants of popular financial reporting: Evidence from Swedish municipalities", *Journal of Public Affairs*, Vol. 24 no. 1, pp. 1-12.

Epstein, B. (2018). *The only constant is change: Technology, political communication, and innovation over time*. New York: Oxford University Press.

Epstein, B. (2022). "Two decades of e-government diffusion among local governments in the United States". *Government Information Quarterly*, Vol. 39 No. 2, pp. 1-15.

Epstein, B., Bode, L. and Connolly, J.M. (2023), "Do squeaky wheels get the grease? Understanding when and how municipalities respond to online requests", *New Media and Society*, Vol. 25 No. 11, pp. 3002-3027.

Esposito, G., Terlizzi, A., Guarini, M. and Crutzen, N. (2023), "Interpreting digital governance at the municipal level: Evidence from smart city projects in Belgium",

International Review of Administrative Sciences, pp. 1–17 DOI: 10.1177/00208523231167538

Feeney, M. K., and Brown, A. (2017), "Are small cities online? Content, ranking, and variation of US municipal websites", *Government Information Quarterly*, Vol. 34 No. 1, pp. 62-74.

Gallego-Álvarez, I., Rodríguez-Domínguez, L., and García-Sánchez, I. M. (2010). "Are determining factors of municipal E-government common to a worldwide municipal view? An intra-country comparison", *Government Information Quarterly*, Vol. 27 No. 4, pp. 423-430.

García-Sánchez, I.M., Cuadrado-Ballesteros, B., and Frías-Aceituno, J.V. (2012), "Determinants of e-government development: Some methodological issues", *Journal of Management and Strategy*, Vol. 3 No. 3, pp. 11-20.

Garson, G. D. (2003). *Public information technology: Policy and management issues*. IGI Global.

Gasco-Hernandez, M., Nasi, G., Cucciniello, M., and Hiedemann, A. (2022), "The role of organizational capacity to foster digital transformation in local government", *Urban Governance*, Vol. 2 No. 2, pp. 236-246.

Glyptis, L., Christofi, M., Vrontis, D., Del Giudice, M., Dimitriou, S., and Michael, P. (2020), "E-Government implementation challenges in small countries: The project manager's perspective", *Technological Forecasting and Social Change*, Vol. 152 No. 119880, pp. 1-11.

Grönlund, Å., and Horan, T.A. (2005), "Introducing e-Gov: History, Definitions, and Issues." *Communications of the Association for Information Systems*, Vol. 15 No. 1, pp. 713-729.

Guida, J., and Crow, M. (2009), "E-Government and e-Governance", Unwin, T. (ED.), *ICT4D: Information and Communication Technology for Development*, Cambridge: Cambridge University Press (pp. 283–320).

Ho, A. (2002), "Reinventing local governments and the 'e-government' initiative", *Public Administration Review*, Vol. 62 No. 4, pp. 434-444.

Ingrams, A., Manoharan, A., Schmidthuber, L., and Holzer, M. (2020), "Stages and Determinants of E-Government Development: A Twelve-Year Longitudinal Study of Global Cities", *International Public Management Journal*, Vol. 23 No. 6, pp. 731-769.

Jacob D.W., Fudzee M.F.M., Salamat M.A., et al. (2019), "A review of the generic end-user adoption of e-government services". *International Review of Administrative Sciences*, Vol. 85 No. 4, pp. 799–818.

Jaeger, P.T., and Thompson, K. M. (2003). "E-government around the world: Lessons, challenges, and future directions", *Government Information Quarterly*, Vol. 20 No. 4, pp. 389-394.

Janowski, T. (2015), "Digital government evolution: From transformation to contextualization". *Government Information Quarterly*, Vol. 32 No. 3, pp. 221–236.

Kuhlmann, S., and Heuberger, M. (2023), "Digital transformation going local: implementation, impacts and constraints from a German perspective", *Public Money & Management*, Vol. 43 No. 2, pp. 147-155.

Layne, K., and Lee J. (2001), "Developing fully functional e-government: A four stage model", *Government Information Quarterly*, Vol. 18 No. 2, pp. 122–136.

Lee, C., Chang, K. and Stokes Berry, F. (2011), "Testing the Development and Diffusion of E-government and E-democracy: A Global Perspective." *Public Administration Review,* Vol. 71 No. 3, pp. 444–454.

Lenk, K., and Traunmuller, R. (2002), "Electronic government: Where are we heading?" Lenk, K. and Traunmuller R. (Ed.), *Electronic government first international conference,* EGOV 2002, New York: Springer (pp. 173–199).

Manoharan A. (2013), "A study of the determinants of county e-government in the United States". *American Review of Public Administration,* Vol. 43 No. 2, pp. 159–178.

Manoharan, A.P., and Ingrams, A. (2018), "Conceptualizing E-Government from Local Government Perspectives", *State and Local Government Review,* Vol. 50 No. 1, pp. 56-66.

McNeal, R.S., Tolbert, C.J., Mossberger, K. and Dotterweich, L.J. (2003), "Innovating in digital government in the American states", *Social Science Quarterly,* Vol. 84 No. 1, pp. 52–70.

Meijer, M., and Bekker, V. (2015), "A Metatheory of e-Government: Creating Some Order in a Fragmented Research Field", *Government Information Quarterly*, Vol. 32 No. 3, pp. 237–245.

Mohr, L.B. (1969) "Determinants of innovation in organizations", *American Political Science Review,* Vol. 63 No. 1, pp. 111-126.

Moon, M.J. (2002). "The evolution of e-government among municipalities: rhetoric or reality?", *Public Administration Review,* Vol. 62 No. 4, pp. 424-433.

Mooney, C.Z., and Lee, M.H. (1995), "Legislating Morality in the American States: The Case of Pre-Roe Abortion Regulation Reform", *American Journal of Political Science,* Vol. 39, pp. 599–627.

Nasi G, Frosini F and Cristofoli D. (2011), "Online service provision: Are municipalities really innovative? The case of larger municipalities in Italy". *Public Administration,* Vol. 89 No. 3, pp. 821–839.

Nicholson-Crotty, S. (2004), "The Politics and Administration of Privatization: Contracting Out for Corrections Management in the United States", *Policy Studies Journal*, Vol. 32 No. 1, pp. 41–57.

Nolan, R.L. (1979), "Managing the Crises in Data Processing", *Harvard Business Review,* March-April, pp. 115-126.

Norris D., and Reddick C. (2013). "Local E-Government in the United States: Transformation or Incremental Change?", *Public Administration Review,* Vol. 73 No. 1, pp. 165-175.

Patergiannaki, Z., and Pollalis, Y. A. (2024), "E-government quality from the citizen's perspective: the role of perceived factors, demographic variables and the digital divide", *International Journal of Public Sector Management,* Vol. 37 No 2, pp. 232-254.

Previtali, P., and Bof, F. (2009), "E-government adoption in small Italian municipalities". *International Journal of Public Sector Management*, Vol. 22 No. 4, pp. 338-348.

Reddick, C.G. (2004), "A Two-Stage Model of E-government Growth: Theories and Empirical Evidence for US Cities." *Government Information Quarterly*, Vol. 21 No. 1, pp. 51–64.

Rodríguez-Domínguez, L., García-Sánchez, I.M., and Gallego-Álvarez, I. (2011). "Determining factors of e-government development: A worldwide national approach", *International Public Management Journal*, Vol. 14 No. 2, pp. 218-248.

Rogers, E.M. (1983), *Diffusion of Innovations*. New York: The Free Press.

Schlelin, S. H. (2007), "E-government: An overview*",* Garson, G.D. (Ed.), *Modern public information technology systems: Issues and challenges.* Hershey-New York: IGI Global, (pp. 110-126).

Seigler, D. J. (2017), "Social media responsiveness in the public sector: A study of social media adoption in three functional areas of local government", *International Journal of Organization Theory and Behavior*, Vol. 20 No. 1, pp. 72–99.

Tan, H., Zhao, X., and Zhang, N. (2022), "Technology symbolization: Political mechanism of local e-government adoption and implementation", *International Review of Administrative Sciences*, Vol. 88 No. 2, pp. 511-532.

Terlizzi, A. (2021), "The Digitalization of the Public Sector: A Systematic Literature Review", *Rivista Italiana di Politiche Pubbliche*, Vol. 16 No. 1, pp. 5-38.

Tolbert, C. J., Mossberger, K., and McNeal, R. (2008). "Institutions, policy innovation, and E-Government in the American States", *Public Administration Review*, Vol. 68 No. 3, pp. 549-563.

Towner, T.L., and Munoz, C.L. (2020), "Election countdown: Instagram's role in visualizing the 2020 campaign", Jackson, D., Coombs, D.S., Trevisan, F., Lilleker, D. and Thorsen, E. (Ed.), *U.S. Election Analysis 2020: Media, Voters and the Campaign*. Centre for Comparative Politics and Media Research (available at: https://eprints.bournemouth.ac.uk/34838/1/USElectionAnalysis2020_Jackson-et_al_v1.pdf (accessed: 12 May 2023).

UNDESA (2001), "Benchmarking e-government. A global perspective." United Nations Department of Economic and Social Affairs. Available at: https://publicadministration.un.org/en/Research/UN-e-Government-Surveys [accessed 12 May 2023]

Vydra, S., and Klievink, B. (2019), "Techno-optimism and policy-pessimism in the public sector big data debate", *Government Information Quarterly*, Vol. 36 No. 4, pp. 1-10.

Walker, J.L. (1969), "The Diffusion of Innovations among the American States", *American Political Science Review*, Vol. 63 No. 3, pp. 880–899.

Wooldridge, J. M. (2009). *Introductory Econometrics: Modern Approach* – 5th ed. Ohio, South-Western: Cengage Learning.

Wollmann, H. (2004). "Local government reforms in Great Britain, Sweden, Germany and France: Between multi-function and single-purpose organisations", *Local Government Studies*, Vol. 30 No. 4, pp. 639–665.

Yildiz, M. (2007), "E-government research: Reviewing the literature, limitations, and ways forward", *Government Information Quarterly*, Vol. 24 No. 3, pp. 646-665.

Table 1. ICity index composition				
Index	**Features**	**Indicators**	**Weight**	**No. Variables**
1. Digital Administration	*Online service*	1.1- Main online services 1.2-Services 1.4.1. PNRR	40%	29
	National Platforms	1.3- SPID adoption 1.4- CIE adoption 1.5- Accumulated pagoPA transactions 1.6- PagoPA transactions last year 1.7- App IO thematic areas	40%	29
	Municipal Sites/Portals	1.8- Accessibility and privacy 1.9- Usage support 1.10- Integration tools	20%	21
2. Open Municipalities	*Social PA*	2.1- Dissemination of twitter/X 2.2- Twitter/X productivity 2.3- Twitter update 2.4- Dissemination of YouTube 2.5- YouTube productivity 2.6- YouTube update 2.7- Dissemination of Facebook 2.8- Facebook update 2.9- Social typologies coverage 2.10- Dissemination of Instagram 2.11- Instagram productivity 2.12- Instagram update	40%	24
	Open Data	2.13- Open-data numerosity 2.14- Open-data quality 2.15- Georeferenced open-data	40%	24
	Municipal Apps	2.16- App types 2.17- App communications	20%	8
3. Connected Cities	*Connection Networks*	3.1- Public wi-fi diffusion 3.2- Public wi-fi promotion 3.3- mobile networks 3.4- cabling	54%	15
	Urban Digitalization	3.5- Traffic light network 3.6- Waste collection 3.7- Public lighting 3.8- Info-mobility 3.9- Green management 3.10- Smart-city platforms	46%	21

Source: Authors' elaboration based on ICity Rank Annual Report

Table 2. Descriptive Statistics				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
ICity	168.26	40.17	84.00	255.00
Digital Administrations	59.73	12.53	29.00	87.00
Open Municipalities	52.13	17.61	16.00	87.00
Connected Cities	56.40	16.33	25.00	92.00
Autonomy	0.57	0.12	0.21	0.75
Current_balance	1.20	0.18	1.04	1.75
Indebtedness	1.05	0.66	0.22	2.86
Strength	0.63	0.06	0.47	0.84
GDP	21,312.01	2,772.12	12,963.10	31,777.70
Education	0.55	0.05	0.34	0.65
Ideology	0.45	0.50	0.00	1.00
Population	161,788.3	312,238.4	20,748	2,749,031
Elderly	0.25	0.02	0.19	0.31

Source: Authors' own work

Table 3. Explaining *ICity* index								
	Eq. 1		**Eq. 2**		**Eq. 3**		**Eq. 4**	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Autonomy	-12.1732	21.5512	-7.4769	19.0724	-10.2375	23.5376	-2.2670	20.6390
Current_balance	-36.4392†	20.5316			-70.5423**	20.7116		
Indebtedness			-18.1439***	3.3830			-23.0509***	3.5074
Strength	-7.0458	43.2925	-5.3578	38.4173	25.7083	46.8078	17.4458	41.2875
GDP	101.1664***	23.8189	90.5457***	19.8599				
Education					0.4233	0.5387	0.9478*	0.4632
Ideology	1.6113	5.1316	2.7176	4.5097	-0.0026	5.5949	1.3532	4.8815
Population	28.6286***	3.3121	30.0704***	2.9317	34.3289***	3.2957	34.9377***	2.8977
Elderly	0.5452	1.4208	0.8470	1.2196	1.6224	1.5241	2.1325	1.2738
_cons	-11.2499***	2.3064	-10.7305***	1.7825	-2.1250*	0.8168	-3.2331***	0.6003
Adj. R^2	0.6422		0.7202		0.5741		0.2864	
Het. Test	Prob > chi2 = 0.4021		Prob > chi2 = 0.3670		Prob > chi2 = 0.4283		Prob > chi2 = 0.2154	
Max. VIF value	1.64		1.46		1.36		1.24	

Notes:
(i) †, *, **, and *** represents statistical relevance at 90, 95, 99, and 99.9% of confidence level.
(ii) The dependent variable is *ICity* in all equations.

Source: Authors' own work

Table 4. Explaining *Digital_administration* index								
	Eq. 1		**Eq. 2**		**Eq. 3**		**Eq. 4**	
	Coef.	**Robust Std. Err.**	**Coef.**	**Robust Std. Err.**	**Coef.**	**Robust Std. Err.**	**Coef.**	**Std. Err.**
Autonomy	2.1032	8.5863	2.9908	8.4812	1.8872	8.7319	3.5077	9.5951
Current_balance	-7.6511	11.2937			-16.8036	11.6134		
Indebtedness			-6.8287***	1.5590			-7.4813***	1.6306
Strength	-22.9635	18.6133	-22.7028	19.3876	-12.4358	18.7468	-15.8435	19.1945
GDP	20.0279	12.1817	13.6332	12.1121				
Education					-0.1979	0.2601	-0.0693	0.2154
Ideology	1.5845	2.4123	2.2165	2.2320	1.4203	2.4108	2.0970	2.2694
Population	5.5882***	1.4170	6.3226***	1.3097	6.9843***	1.2846	7.2557***	1.3471
Elderly	0.5047	0.5906	0.4661	0.6034	0.7491	0.6212	0.7351	0.5922
_cons	-1.9422	1.1788	-1.4117	1.1765	-1.1704	36.8485	-22.8673	27.9064
Adj. R^2	0.2490		0.3632		0.2291		0.2207	
Het. Test	Prob > chi2 = 0.0099		Prob > chi2 = 0.0627		Prob > chi2 = 0.0114		Prob > chi2 = 0.1665	
Max. VIF value	1.64		1.46		1.36		1.24	

Notes:
(i) †, *, **, and *** represents statistical relevance at 90, 95, 99, and 99.9% of confidence level.
(ii) The dependent variable is *Digital_administration* in all equations.

Source: Authors' own work

Table 5. Explaining *Open_municipalities* index								
	Eq. 1		**Eq. 2**		**Eq. 3**		**Eq. 4**	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Autonomy	-9.5544	10.7439	-7.6218	10.2839	-8.1095	11.3420	-4.8217	10.7078
Current_balance	-17.9052†	10.2356			-30.3592**	9.9803		
Indebtedness			-5.8815**	1.8241			-8.3420***	1.8197
Strength	-10.6933	21.5826	-10.4603	20.7147	-0.4749	22.5552	-3.1069	21.4206
GDP	44.0912***	11.8744	43.7061***	10.7085				
Education					0.4671†	0.2596	0.6837**	0.2403
Ideology	0.0575	2.5582	0.4289	2.4317	-0.8018	2.6960	-0.3214	2.5326
Population	10.2371***	1.6512	10.5361***	1.5808	12.4530***	1.5881	12.6720***	1.5034
Elderly	-0.4895	0.7083	-0.3023	0.6576	-0.0512	0.7344	0.2378	0.6609
_cons	-4.5719***	1.1498	-4.7860***	0.9611	-0.7194†	0.3936	-1.2248***	0.3114
Adj. R^2	0.5179		0.5572		0.4639		0.5193	
Het. Test	Prob > chi2 = 0.6914		Prob > chi2 = 0.8833		Prob > chi2 = 0.6099		Prob > chi2 = 0.8500	
Max. VIF value	1.64		1.46		1.36		1.24	

Notes:
(i) †, *, **, and *** represents statistical relevance at 90, 95, 99, and 99.9% of confidence level.
(ii) The dependent variable is *Open_municipalities* in all equations.

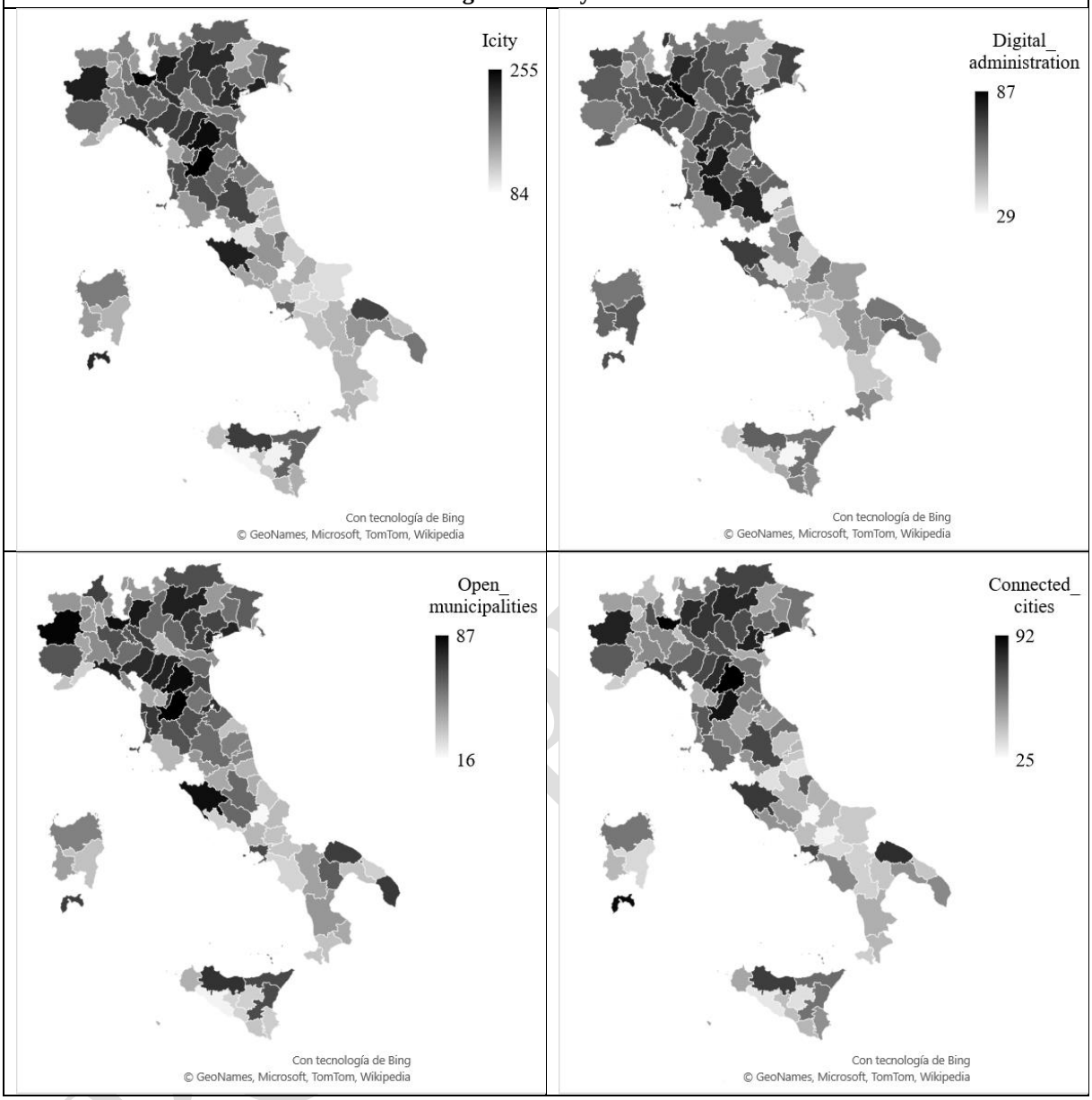
Source: Authors' own work

Table 6. Explaining *Connected_cities* index								
	Eq. 1		**Eq. 2**		**Eq. 3**		**Eq. 4**	
	Coef.	**Robust Std. Err.**	**Coef.**	**Robust Std. Err.**	**Coef.**	**Robust Std. Err.**	**Coef.**	**Robust Std. Err.**
Autonomy	-4.7220	7.8243	-2.8459	6.9476	-4.0152	8.0496	-0.9530	7.2793
Current_balance	-10.8829	7.3335			-23.3795**	7.3157		
Indebtedness			-5.4337***	1.2032			-7.2276***	1.1545
Strength	26.6110†	14.4275	27.8053*	12.8722	38.6190*	15.7233	36.3963*	13.9933
GDP	37.0473***	8.6250	33.2064***	7.7651				
Education					0.1541	0.1962	0.3335†	0.1687
Ideology	-0.0307	1.8188	0.0721	1.6764	-0.6212	1.9473	-0.4225	1.7559
Population	12.8033***	1.8810	13.2117***	1.7635	14.8917***	1.8498	15.0101***	1.7693
Elderly	0.5299	0.5593	0.6832	0.4985	0.9245	0.5939	1.1596*	0.5500
_cons	-4.7358***	0.8397	-4.5328***	0.7317	-1.3938***	0.3080	-1.7796***	0.2672
Adj. R^2	0.7078		0.7455		0.6595		0.7098	
Het. Test	Prob > chi2 = 0.0068		Prob > chi2 = 0.0031		Prob > chi2 = 0.0108		Prob > chi2 = 0.0023	
Max. VIF value	1.64		1.46		1.36		1.24	

Notes:
(i) †, *, **, and *** represents statistical relevance at 90, 95, 99, and 99.9% of confidence level.
(ii) The dependent variable is *Connected_cities* in all equations.

Source: Authors' own work

Figure 1. ICity score



Source: Authors' own work

ANNEX 1. Bivariate correlations

Table A1. Correlations between independent/control variables									
	Autonomy	*Current_ balance*	*Indebtedness*	*Strength*	*GDP*	*Education*	*Ideology*	*Population*	*Elderly*
Autonomy	1								
Current_ balance	0.0019	1							
Indebtedness	0.0454	**0.4730**	1						
Strength	-0.3263	-0.0068	-0.0455	1					
GDP	-0.0653	-0.2902	-0.279	0.2708	1				
Education	-0.1044	-0.0943	-0.0114	0.2359	**0.6940**	1			
Ideology	-0.0758	-0.0101	-0.0147	0.0426	-0.0142	0.0943	1		
Population	0.0842	-0.0694	0.0798	0.1018	0.2946	0.0479	-0.2415	1	
Elderly	-0.1673	-0.1754	-0.1286	0.0571	0.2322	0.1894	0.3225	-0.3373	1

Source: Authors' own work

Table A2. Correlations between dependent and independent/control variables				
	ICity	*Digital_ administrations*	*Open_ municipalities*	*Connected_ cities*
ICity	1			
Digital_administrations	**0.7493**	1		
Open_municipalities	**0.9026**	**0.4924**	1	
Connected_cities	**0.9113**	**0.5445**	**0.7638**	1
Autonomy	-0.0318	0.0444	-0.0593	-0.0478
Current_balance	-0.2491	-0.1529	-0.2505	-0.2201
Indebtedness	-0.3255	**-0.3610**	-0.2486	-0.2505
Strength	0.1946	0.0355	0.1658	0.2736
GDP	**0.6055**	**0.3928**	**0.5618**	**0.5820**
Education	0.2178	0.0556	0.2595	0.2132
Ideology	-0.1143	0.0006	-0.1309	-0.1418
Population	**0.6896**	**0.4016**	**0.6047**	**0.7359**
Elderly	-0.0212	0.0526	-0.0460	-0.0430

Source: Authors' own work