▪ Journal of Competitiveness

Local Institutions, Digital Revolution and Competitivity: Tracing Digital Transformation in EU Capital Cities

Andrés Gómez, Fernando García-Monleón, Oliver Carrero, José M. Mas

Abstract

This research explores the impact of digitalization on local governments in EU capital cities. The study employs the Institution Digital Development Index (IDDI) as a primary analytical tool to measure the level of digitalization . The relationship between digitalization and various indices, such as Competitiveness and Smart Cities, will be examined to understand the implications of digitalization on local governance. The analysis will also investigate the correlation between digitalization and the quality of communication content on institutional web pages. The research findings offer essential insights into the effectiveness of digitalization strategies in enhancing institutional competitiveness and public engagement in the context of the EU .

Keywords: *IDDI, Digitalization, Institutions, Competitivity, Local Governments*

JEL Classification: H83; O33; R58; L86; M15

Article history: Received: April 2024; Accepted: March 2025; Published: March 2025

1 INTRODUCTION

The European Commission has embarked on a strategic initiative, "The Digitalization Decade 2020-2030," to bolster the EU's digital independence (European Commission, 2021). This program is based on four critical domains: digital abilities, digital infrastructures, digitalization of public services, and digitalization of businesses. Public institutions are anticipated to be pivotal in leveraging digitalization to augment efficiency and services while fostering civic involvement and democratic participation. (Abdullaev et al., 2019, Ndou et al., 2023).

The digital transformation process has become an obligation not only for citizens and businesses but also for the institutions that represent them (Shen et al., 2021; Salih et al., 2024). The Academy fully accepts that today, we live in a Digital Society. In this society, all members must be able to develop their tasks and responsibilities through the new models, mechanisms, and tools developed in recent years under the umbrella of the development of the new Digital Society (Castells, 2010).

In this environment, under the objective of achieving full European digital sovereignty, set out in the Digital Compass Strategy: The Digital Decade 2020-2030 (European Commission, 2021), we will analyze the digital transformation process of the local governments of the 27 capital cities of the EU member states, taking into consideration the measurement model established in the Digital Development Index of Institutions (IDDI) (Ponzoa et al., 2023a).

As a result, Digital transformation has emerged as a central force driving changes not only in the public sector but also in the private sector on a global scale (Ponzoa et al. et al., 2023; Chirvase & Zamfir, 2024)). With the advent of technologies such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT), institutions must adapt swiftly to maintain their competitive edge and efficiency. This shift towards a more digitalized operational framework is not just reshaping traditional industries but also redefining the role of local institutions and governments (Gomez et al., 2024; Florida et al., 2008)). The urgency to evolve is fuelled by the growing demands for transparency, efficiency, and citizen-centric service delivery, particularly in European capitals, where institutional performance is directly linked to urban competitiveness (Avila et al., 2023).

Researching about digital transformation is especially pressing for public institutions (Salih et al., 2024; Mas & Gómez, 2021). These organizations must navigate the complexities of integrating new technologies into their administrative, operational, and service delivery frameworks. This study explores how local governments in European capital cities respond to this challenge by employing the Institutions Digital Development Index (IDDI) (Ponzoa et al., 2023). Understanding the extent and impact of digital transformation within these institutions is crucial for assessing how effectively they are transitioning towards more innovative, more competitive cities that can meet the needs of their citizens while maintaining global relevance (Merger et al., 2019).

The objective of this research, which seeks to assess digital transformation across European capital cities using the IDDI, is critical for several reasons. Firstly, it provides a quantifiable measure of how effectively institutions are adopting digital technologies. Secondly, by correlating these findings with urban competitiveness and smart city initiatives, this study offers valuable insights into the success factors that enable cities to thrive in the digital age (Pérez-Morote et al., 2020; Gasco-Hernandez et al., 2022). Understanding this relationship between digitalization and competitiveness will offer a framework for policymakers to implement strategies that ensure sustainable growth and development in the context of global technological shifts.

While existing literature has extensively explored the impacts of digital transformation in private-sector businesses (Lythreatis et al., 2023; Slavkovic et al., 2023; Datti et al., 2023), fewer studies have addressed how this phenomenon is shaping the public sector, particularly at the local government level. By focusing on institutions within European capitals, this study aims to fill this gap and contribute to understanding how digitalization can enhance the efficiency and competitiveness of public entities. As previous research suggests, digital transformation is a key driver of institutional success, and investigating its implementation is crucial for developing competitive, smart cities.

In summary, the research project about digital transformation through the IDDI is essential and timely. Understanding how local governments can leverage technological advancements to foster urban competitiveness is crucial. By contextualizing this objective within the broader framework of smart city initiatives and the evolving digital landscape, this study aims to provide actionable insights for policymakers and public administrators who seek to position their cities as leaders in the global digital economy.

Given the broader global context of digital transformation, the process for local governments in European capital cities is a crucial area of study. Historical trends in the EU, such as the eGovernment Action Plan and the Digital Single Market Strategy (European Commission,

2016), have laid the groundwork for today's initiatives, such as the Digital Decade 2020-2030. These efforts are part of a larger agenda to harmonize digital policies across member states and foster technological innovation at the local government level. The role of local institutions in this transformation is particularly significant because they serve as the immediate interface between citizens and government services (Kuhlmann & Heuberger, 2023; Gasco-Hernandez et al., 2022).

In this context, this study aims to assess the digital transformation of local governments across European capitals using the Institutions Digital Development Index (IDDI). The study evaluates how digitalization impacts these institutions' efficiency, transparency, and overall competitiveness (Pittaway & Montazemi, 2020). This approach is informed by previous research, such as the works of Ponzoa et al. (2023) and Gómez et al. (2024), highlighting the importance of digital transformation in improving institutional competitiveness and smart city development.

Given the rapid advancements in technologies like artificial intelligence, blockchain, and IoT, institutions must adapt quickly to maintain their competitiveness (Pérez-Morote et al., 2020; Gasco-Hernandez et al., 2022). This study seeks to fill the gap in the existing literature by focusing on local governments, which play a critical role in implementing digital policies at the grassroots level.

The primary research objective is to evaluate the current state of digital transformation in the local governments of EU capitals. This evaluation is essential for understanding the key factors influencing the success of digital transformation initiatives. Specifically, this study seeks to explore how digital transformation impacts the efficiency and transparency of local government operations and its correlation with broader indices such as competitiveness and smart city performance. By addressing these aspects, the research aims to provide valuable insights for policymakers working to enhance digital governance.

Thus, the key research questions driving this investigation are:

1. What is the current level of digital transformation in the local governments of the 27 EU capitals?
2. What are the critical success factors for digital transformation in local governments?
3. How has digital transformation affected the efficiency and transparency of local governments?

These research questions are grounded in the theoretical framework that posits digital transformation as a crucial element of public sector modernization. Prior studies (Ndou et al., 2023; Salih et al., 2024) have identified digitalization as a key driver of institutional success, particularly in enhancing public engagement and operational transparency. The research questions build upon this foundation by examining the specific context of local governments in European capitals, where digitalization is critical for maintaining competitiveness in a rapidly evolving technological landscape. In summary, this study aims to comprehensively analyze digital transformation across EU capitals by addressing the research questions in a theoretically justified and contextually grounded manner.

The representative nature of EU capital cities justifies the selection of these cities for this study because they reflect broader regional policies and initiatives. These capitals are often at the forefront of implementing digital policies and serve as models for other cities within their

respective countries (Datti et al., 2023). By focusing on these urban centres, the study aims to understand the unique challenges and opportunities these prominent cities face in their digital transformation journeys. The findings from these capitals can provide insights that may be extrapolated to other cities with similar characteristics, though some results may be context-specific.

Historically, the digitalization of Europe has been influenced by various political, economic, and social changes. The adoption of digital technologies in local governments has evolved significantly, driven by initiatives such as the EU's eGovernment Action Plan (European Commission, 2016) or the broader Digital Single Market strategy (Pérez-Morote et al., 2020). These efforts aim to harmonize digital policies across member states and enhance the digital capabilities of public institutions. The current trends in digital transformation reflect a culmination of decades of policy development and technological advancements, addressing challenges such as the digital divide, cybersecurity, and data privacy (Mergel et al., 2019; Avila et al., 2023; Salih et al., 2024).

This study aims to fill several gaps in the academic literature. Firstly, there needs to be more research on the comparative analysis of digital transformation at the local government level across different EU capitals. Secondly, while much of the existing literature focuses on digital transformation in private sectors or national-level institutions, this study emphasizes the role of local governments, which are crucial for grassroots implementation of digital policies. The implications for public policy and administrative practice include providing evidence-based recommendations for enhancing digital governance, improving public services, and fostering greater civic engagement through digital means.

Local institutions are crucial in driving digital transformation and fostering competitiveness, particularly in urban settings. This belief is well-supported by existing literature, highlighting the importance of local governments as the primary interface between citizens and governmental services. According to Gasco-Hernandez et al. (2022), local administrations are instrumental in successfully implementing digital transformation initiatives, mainly when supported by strong organizational capacity and leadership. Similarly, Pittaway Montazemi (2020) argue that effective leadership within local governments is essential for guiding digital transformation, ensuring that institutions can manage integrating new technologies.

Moreover, Kuhlmann and Heuberger (2023) emphasize that while digitalization initiatives can significantly improve operational efficiency and citizen engagement, they often face constraints such as limited resources and digital literacy within local administrations. Despite these challenges, the central role of local governments in enacting digital policies remains undeniable, as they are responsible for implementing digital strategies at the grassroots level and ensuring that public services are accessible to all citizens.

These findings align with our research objectives, which aim to assess the impact of digital transformation in local governments across European capitals. The focus on local institutions is supported not only by the literature but also by However, it is also a critical aspect of our study, given the pivotal role these institutions play in enhancing urban competitiveness and smart city development.

Many authors state that the 21st Century is the Century of Cities, and in these urban centres where the real competition occurs (Florida, 2002; Montes et al., 2021). The responsibility of promoting the competitiveness of their respective economies and attracting talent falls directly

on the cities and their governing bodies. They need to develop policies that promote the generation, growth, and attraction of talented individuals, which is one of the fundamental pillars of global competitiveness (Boyne et al., 2005; Huggins, 2003).

Digital technologies offer public institutions an excellent opportunity to improve transparency and accessibility in their operations (Ponzoa et al., 2023b; Avila et al., 2023), enabling citizens to participate actively in decision-making through online platforms and digital tools to provide feedback, express their concerns, and contribute to policy making (Dunleavy et al., 2006). Moreover, digitalization can help bridge the digital divide and ensure all citizens have equal access to information and services, regardless of location or socioeconomic background (Calza-Perez et al., 2024; Lythreatis et al., 2022; Ndou et al., 2023).

2 THEORETICAL BACKGROUND

The rapid evolution of digital technologies such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT) has revolutionized the public and private sectors. This global digitalization, driven by advancements in information technologies, is reshaping operational frameworks and redefining institutional roles worldwide. As institutions grapple with adapting swiftly to these changes, local governments face unprecedented demands for transparency, efficiency, and citizen-centric service delivery (Ponzoa et al., 2023; Gómez et al., 2024).

The urgency to evolve towards digital governance frameworks stems from global trends in e-government and smart city initiatives, which aim to enhance institutional performance and urban competitiveness. International efforts, such as the EU's eGovernment Action Plan and the Digital Decade 2020-2030 initiative, have set the stage for a widespread digital revolution. This revolution is crucial for fostering administrative efficiency, bridging the digital divide, and enabling inclusive access to public services (European Commission, 2021; Pérez-Morote et al., 2020).

The study is grounded in the dynamic capabilities theory, which posits that institutions must develop ongoing strategic renewal processes to successfully navigate the complexities of digital transformation. Warner and Wäger (2019) highlight that institutions, particularly local governments, must continuously adapt their capabilities to meet evolving technological demands and citizen expectations. Furthermore, empirical studies by Kuhlmann and Heuberger (2023) reveal that local governments, while often constrained by limited financial resources, play a pivotal role in driving digital transformation at the grassroots level.

2.1 Distinguishing Between Digitization and Digital Transformation:

It is essential to clarify the distinction between digitization and digital transformation, as they are related but distinct concepts. Digitization refers to converting information from a physical format into a digital one. This typically involves scanning documents or transferring analogue records into digital systems (Verhoef et al., 2021). Digitalization converts existing resources into a digital format without fundamentally altering the underlying processes.

On the other hand, digital transformation involves a more comprehensive, strategic process. It refers to integrating digital technologies into all areas of an organization, leading to fundamental changes in how institutions operate and deliver value to stakeholders (Mergel et al., 2019). Digital transformation not only includes digitization but also involves rethinking business

models, processes, and user interactions, focusing on enhancing efficiency, transparency, and competitiveness (Torres&Muñoz,2019; Ponzoa et al., 2023).

For local governments, digitalization might include implementing e-government platforms and converting paper-based procedures into digital formats. However, digital transformation holds a promising future, involving a broader strategy that integrates emerging technologies such as AI, blockchain, and IoT. This transformation can fundamentally change how public services are delivered and how governments engage with citizens, ushering in a new era of efficiency and citizen-centric governance (Gómez et al., 2024).

By clarifying this distinction, this study ensures a more precise understanding of the processes being analyzed, where digitization serves as a foundational step. However, digital transformation represents the broader strategic evolution of institutions.

2.2 Digitalization

Notably, contemporary society is progressively moving towards complete digitalization, as highlighted by the recent studies of Kalimullina et al. (2021) and Verhoef et al. (2021a). This transformation has significant implications for various fields, including education, business, and social interactions (Bezrukova et al., 2022; Calza-Perez et al, 2024; Dufva & Dufva, 2019). Academia has documented new behaviours associated with the technological revolution and the emergence of the 'network society' (Messner, 2013; Vargo & Lusch, 2016).

Technology advancements have reduced the cost of economic and social transactions for administrations, businesses, and individuals (Delacroix et al., 2020). This development has modernized services, making them more affordable, efficient, and convenient (Mas & Gómez, 2021a). However, digitalization has also introduced new needs for many people who previously did not require them (Verhoef et al., 2021).

Multiple researchers, such as Antonucci et al., have extensively studied the concept of digital transformation, highlighting various aspects and implications, including adopting new technologies, integrating digital platforms, and developing digital capabilities. (2021), Banalieva & Dhanaraj (2019), Hautala-Kankaanpää (2022), Kraus et al. (2019), Siachou et al. (2021a), and Smola (2017). Aaronson (2018) argues that digitalization has revolutionized operations, creating new opportunities and challenges for organizations.

Institutions must prioritize their digital transformation efforts to remain relevant and competitive. (Gómez et al., 2021; Mas & Gómez, 2021; Gómez et al., 2024), an argument reinforced in 2021 by the European Commission Digitalization Decade Strategy (2021). However, many institutions lag behind, leading to significant consequences; institutions that resist digital transformation risk becoming outdated and losing their competitive edge (Abdullaev et al., 2019b; Pramanik et al., 2019; Vargo & Lusch, 2016). The slow progress in digitalization contributes to the digital divide, disproportionately affecting groups lacking access to digital services and resources (Lythreatis et al., 2022; Georgescu et al., 2022). Given the relevance of this process, a quantitative approach to its achievement degree must be made so that institutions gain insight, into its current situation and evolution, and it is in this context that the IDDI is proposed.

2.3 Competitiveness and its Link to Digital Transformation

Competitiveness is a critical concept in understanding the success of both businesses and public institutions in today's rapidly evolving digital landscape. The term "competitiveness" refers to the ability of an entity—whether a city, region, or institution—to sustain and improve its position in the marketplace by enhancing productivity, innovation, and efficiency (Porter, 1990). In the context of local governments and digital transformation, competitiveness is particularly relevant as it directly impacts a city's ability to attract investment, foster innovation, and improve the quality of life for its citizens (Mas & Gómez, 2021).

The relationship between digital transformation and competitiveness is well-documented in Literature. According to Mergel et al. (2019), digital transformation can enhance institutional competitiveness by improving operational efficiency, transparency, and responsiveness to citizen needs. Similarly, Gasco-Hernandez et al. (2022) emphasize that institutions that effectively integrate digital technologies are better positioned to compete in the global economy, as they can streamline services and optimize resources.

Furthermore, Porter (1990) and subsequent scholars argue that competitiveness is a private-sector concern and highly relevant to public institutions, particularly in urban development and governance. Cities that invest in digital transformation become more attractive for businesses and residents, contributing to economic growth and improved public services (Ponzoa et al., 2023). Therefore, this study links digital transformation to competitiveness to evaluate how local governments in EU capital cities use digital tools to enhance their competitiveness and drive urban success.

Focusing on competitiveness, this research aligns with the broader discourse on how local institutions can leverage digital transformation to maintain a competitive edge in governance and public service delivery. This is crucial for understanding the strategic priorities of local governments as they navigate the complexities of the digital era.

2.4 Digital Transformation and Local Institutions

Recent analysis of more significant digital transformation in local administrations has highlighted various approaches, impacts, and constraints. Pittaway and Montazemi (2020) emphasize the importance of leadership know-how in guiding digital transformation within local governments. Their study illustrates that effective leadership involves a comprehensive understanding of digital tools, strategic vision, and the ability to manage change. Successful digital transformation also requires fostering a culture that supports innovation and continuous improvement within the organization (Pittaway & Montazemi, 2020).

Kuhlmann and Heuberger (2023) explore the practical aspects of implementing digital transformation in local governments in Germany revealing that while digital initiatives can significantly enhance operational efficiency and citizen engagement, they are often constrained by factors such as limited financial resources, resistance to change, and inadequate digital skills among staff. These constraints necessitate tailored strategies that address local contexts and build capacities incrementally (Kuhlmann & Heuberger, 2023). Demidov and Lukashov (2021) further discuss selected approaches to digital transformation in public administration, highlighting the need for clear policy frameworks and cross-sector collaboration to overcome these challenges (Demidov & Lukashov, 2021).

The dynamic capabilities framework proposed by Warner and Wäger (2019) underscores the ongoing strategic renewal process required for digital transformation. They argue that local governments must develop dynamic capabilities to continuously adapt to technological changes and evolving public needs (Warner & Wäger, 2019). Additionally, the historical perspective provided by Nixon and Koutrakou (2006) on e-government in Europe sheds light on the long-standing efforts and gradual progress in digitalizing public services, demonstrating that sustained commitment and iterative improvements are essential to successful digital transformation (Nixon & Koutrakou, 2006). Pérez-Morote, et al. (2020) highlight the importance of trust and addressing the digital divide to enhance the adoption and effective use of e-government services across European countries (Pérez-Morote et al., 2020).

These insights collectively suggest that while digital transformation in local governments presents significant opportunities for enhancing public administration, it also requires strategic leadership, adequate resources, and a supportive policy environment to navigate the complexities and constraints inherent in such initiatives. Given this context, providing an overall and cross-country view and measure of the impact of individual and local achievements towards an optimized digitalization process results relevant to assess the current situation and the best potential lines of action.

The role of local institutions in digital transformation is not solely determined by policy and resources. However, it is also significantly influenced by the cultural context of the country in which they operate. Cultural attitudes toward technology, innovation, and change play a vital role in either facilitating or hindering the adoption of new technologies (Hofstede, 2001). These cultural factors affect how institutions perceive the risks and benefits associated with digital transformation and, in turn, shape the strategies they implement to adopt digital technologies.
For example, in cultures characterized by high levels of uncertainty avoidance (Hofstede, 2001), there may be resistance to adopting disruptive technologies like artificial intelligence or blockchain, as these technologies are perceived as risky or threatening to existing structures. Conversely, cultures with lower levels of uncertainty avoidance or those with a high level of individualism may be more open to experimentation and technological change, thus facilitating a faster and more successful digital transformation (Straub, 1994).

Research has shown that European countries vary significantly in their cultural attitudes toward technology, influencing how local governments and institutions implement digital policies (Koca, 2023). As stated by Auzina-Emsina (2023), countries like Sweden and Denmark, which have a high degree of trust in institutions and a positive attitude towards technology, have advanced digital transformation efforts more swiftly than countries with more traditional or risk-averse cultures. This variance in cultural perception is an essential factor when evaluating the effectiveness of digital transformation initiatives across different EU capitals (Koca, 2023). Therefore, the cultural context is an essential aspect of this study, as it provides insight into the varying levels of digital readiness and the distinct approaches to digital transformation taken by local governments. By considering the influence of culture, we gain a more comprehensive understanding of the factors that facilitate or hinder technological development in different institutional settings.

Moreover, in this transformative journey, citizens and institutions play a crucial role as the actors to which all change is subordinated. This is based on the infrastructures and capacity of local councils to communicate these processes, as well as the digital skills acquired by citizens due to the actions mentioned above or their respective councils' actions (Slavković et al., 2023).

2.5 Government Support for Business Digitization

Government support plays a crucial role in the success of business digitization efforts, particularly within the context of local economies and competitiveness. In recent years, governments at both national and local levels have implemented various initiatives to encourage businesses to adopt digital technologies. These efforts enhance businesses' productivity, efficiency, and innovation potential, contributing to broader economic growth and competitiveness (European Commission, 2021).

One significant example is the European Union's Digital Innovation Hubs, which provide small and medium-sized enterprises (SMEs) with access to expertise and technologies needed to achive the digital transformation. These hubs offer guidance on adopting new digital tools and processes, helping businesses leverage emerging technologies such as artificial intelligence, cloud computing, and big data to modernize their operations (Pérez-Morote et al., 2020).

In addition to direct financial support, such as grants and subsidies, governments have also implemented regulatory frameworks that incentivize digitalization. Policies that encourage investment in digital infrastructure, support research and development, and create favourable conditions for technology adoption are crucial in facilitating business digital transformation (Gasco-Hernandez et al., 2022).

Furthermore, local governments play an essential role in creating a supportive ecosystem for businesses by offering digital platforms, e-governance solutions, and public-private partnerships that help streamline administrative processes and enhance business-government interactions (Zimmerman, 2020; Aparisi-Torrijo et al., 2024). For instance, digital platforms for licensing, permitting, and tax filing significantly reduce administrative burdens, enabling businesses to focus on growth and innovation (Kuhlmann & Heuberger, 2023).

Government support for business digitization is thus a vital component of fostering competitiveness, particularly in local economies where businesses are critical drivers of economic activity and employment. This section of the research highlights the importance of such support in ensuring that businesses, particularly SMEs, can fully participate in and benefit from the ongoing digital revolution.

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

The world is seeing the rise of new ways of sharing information, analyzing data, and communicating, which are crucial in driving economic growth and social progress through global digital transformation (Hinings et al., 2018; Pramanik et al., 2019). However, institutions that lack a digital presence and have limited experience may struggle to keep up with the rapidly evolving demands of digital advancements (Gómez et al., 2021). As a result, they find it challenging to offer sensible solutions to these novel situations, making them vulnerable to competition from organizations that have successfully embraced digitalization (Mas & Gómez, 2021b).

Extensive scientific studies have highlighted the significance of a robust online presence for organizations. This can tremendously impact an organization's image, attract top-notch talent, and encourage innovation (Antonucci et al., 2021). In today's digital era, the quality of an organization's website plays a vital role in measuring its success in adopting digital

transformation (Saura et al., 2017). Digital transformation involves incorporating technology across all aspects of an organization, which leads to reorganizing its operations and enhancing its capabilities. A well-executed website can manifest an organization's dedication to keeping pace with the latest digital trends and is a pivotal component of its comprehensive digital transformation process (Siachou et al., 2021).

Based on all the ideas and concepts previously addressed, the present research intends to address if the IDDI could be considered a reliable indicator of the digitalization level and quality content of the city hall sites to assess the digital transformation level of local entities and based on that assumption measure if the IDDI could be used to analyze to what extent, the digital transformation stage may impact the life quality for people and companies in the cities analyzed, therefore the following three hypotheses are presented for its validation:

Based on the ideas and concepts previously addressed, this research aims to determine whether the IDDI can be considered a reliable measure of the digitalization level and content quality of city hall websites. The goal is to assess the digital transformation level of local entities. Additionally, it seeks to evaluate whether the IDDI can be used to analyze the extent to which the digital transformation stage impacts the quality of life for individuals and businesses in the analyzed cities. To achieve this, the following three hypotheses are proposed for validation:

H_1: The IDDI Model is an effective tool for measuring digitalization and competitiveness in European local institutions. This hypothesis posits that the IDDI Model captures the nuanced aspects of digitalization, reflecting the extent to which European local institutions have integrated digital technologies into their operations and services.

H_2: There is a statistically significant correlation between the IDDI, the Competitiveness Index, and the Smart Cities Index. This hypothesis suggests that higher levels of digitalization, as indicated by the IDDI, are associated with increased regional competitiveness and enhanced performance in smart city initiatives, indicating a synergistic relationship between digital development, competitive capabilities, and smart city functionalities.

H_3: The IDDI positively correlates with the professionalism and strategic quality of communication content on institutions' web pages. This hypothesis proposes that institutions with higher IDDI scores demonstrate more sophisticated and strategically aligned web communication, reflecting their advanced digitalization and the effective use of digital platforms for communication purposes.

A high-quality website is essential for providing a seamless user experience and efficient access to information and services for multiple stakeholders. Critical components of an excellent website include easy navigation, responsive design, and fast loading times, all of which contribute to a positive digital impression. Additionally, Coreynen et al. (2017) suggest that a well-maintained website can promote transparency and accountability, critical elements in today's digital age. In summary, the quality of an organisation's website plays a vital role in its level of digitalization. By prioritizing the pursuit of website excellence, institutions have the opportunity to not only boost their online presence but also strengthen their dedication to fully leveraging the capabilities of technology.

However, to properly develop this process, we must have methodologies to measure and compare the results of the transformation process or the development of our digital presence (Verhoef et al., 2021). We thoroughly analyzed various methods for setting a model for metrics

and analytics in the digital world (Verhoef et al., 2021). Finally, we decided to use the IDDI model created by Ponzoa et al. (2023). This model is precious because it is specifically designed to measure the digital presence of institutions from two main dimensions, content and structure on the one hand and citizens' use of the site on the other, and has been recognized and published in a highly respected scientific publication (Ponzoa et al., 2023; Gómez et al., 2024). Our study goes beyond relying solely on analytical methods. We utilized the IDDI model, which offers a comprehensive methodology for evaluating an institution's digital presence and activity. This approach aligns with well-established metrics and analytical models commonly used to assess the digital presence of both businesses and individuals.

This research is based on a dataset obtained from the websites of city halls across all 27 member states of the European Union. The dataset comprises a cross-sectional sample that covers two years, from 2022 to 2023, representing the latest available updates. This data is crucial for conducting an in-depth analysis of various aspects related to the functioning of city halls across the EU member states. The dataset provides a comprehensive overview of policies, regulations, and practices being implemented at the local government level, making it a valuable resource for researchers and policymakers.

Before the web-metric analysis, we considered making a first descriptive-qualitative approach, contextualizing and prospective intention, on the main contents disseminated on the websites analyzed, checking any direct or indirect allusion to any of the indicators promulgated in LORDI. As part of the framework "Digital Decade for Regions and Cities" and as a result of the collaborative effort of ESPON (European Observation Network for Territorial Development and Cohesion), the European Commission and the Committee of the Regions to develop a methodology and a framework of indicators to help policymakers, businesses and citizens to measure their digital performance and implementation, LORDI (Local and Regional Digital Indicators) is born. In addition, to gauge the digital maturity of these sites, the EU has LORDIMAS (Local and Regional Digital Maturity Assessment System), which is based on 29 digital and regional indicators (Living-in.EU. n.d). It is a series of KPIs focused on stimulating regional contribution and cooperation, the need for common technical standards, where citizenship is the core axis on which all the promotion of digital innovation should revolve. Priority is given to sustainability and improving citizens' quality of life in rural and urban areas (Furtado, 2022).

In this sense, attention has been paid to the tone of the communication strategies of the websites of the different city councils of these cities. Likewise, this observation work aims to elucidate whether they address content such as awareness of using social networks, whether guide publications are carried out, and whether networking events, tutorials, or digital services are advertised. After reviewing the websites of the 27 member city councils, it has been found that, while the tone of communication is very similar in all of them, the most significant differences can be observed in the digital themes highlighted by each city. Thus, the main lines, from a formal point of view, revolve around clarity and precision in the presentation of information. This communicative approach seeks to establish a specific commitment to citizen service, where arguments are shared between informative and educational. As for the language used, it is accessible, without vulgarisms, with sectorial nuances, and always has a formal orientation, which seeks to value the professionalism that is presupposed of an official institution.

Among the results, in terms of accessibility and online services, Amsterdam, Stockholm, and Helsinki stand out for their optimal navigability and a wide range of online services. These cities offer content ranging from administrative procedures to detailed information on transport

and education, with intuitive platforms which stand out for their navigability. On the other hand, Athens has a very limited offer. In terms of ICT and Smart Cities, Amsterdam and Stockholm provide online services and include detailed information on Smart City projects and sustainable development, using ICT to improve aspects such as traffic management and energy efficiency. In this regard, the Dutch capital informs its population about the "Amsterdam Smart City" initiative through its website, where it reports on a series of projects, including smart lighting systems, sustainable mobility solutions, and renewable energy platforms. The city also provides updates regarding the application of cutting-edge technology to control and minimize traffic congestion. Finally, the city's website provides information on energy-saving initiatives and subsidies for residents and businesses. Stockholm shares sustainable development projects with its citizens, such as creating eco-friendly urban areas and promoting green buildings. In addition, the Swedish capital provides data on its policies to expand infrastructure for bicycles and electric vehicles and promote public transport as an environmentally friendly alternative. In line with its commitment to sustainability, the city also provides information on its waste management and energy production from non-fossil waste to generate heat and power on its city council website. In addition, both cities have integrated mobile applications and interactive tools on their websites. This implementation improves the user experience by providing fast and convenient access to municipal services, real-time transport information, and incident reporting systems.

Other cities such as Berlin and Madrid, while offering a solid commitment to accessibility and online services, need to improve their communication regarding interactivity and personalization of the user experience. Together with Lisbon and Warsaw, they offer information on cultural events, administrative procedures, and health services. However, in none of these four capitals have information on ICT projects and Smart Cities been observed.
It is also worth highlighting the commitment to transparency and democratization of information, of which Helsinki and Berlin are the most important representatives. Their websites feature platforms allowing citizens to access various municipal data, fostering innovation and collaboration in developing joint urban solutions. The information policies of Madrid and Lisbon also stand out in the field of awareness-raising and education. Portuguese and Spaniards are also interested in topics such as recycling, responsible water use, and the impact of all these measures on sustainability.

Finally, we present a league table of European cities whose websites show signs of increased digitalization. The ranking is established based on the degree of intensity with which three observable criteria are addressed on these websites: Accessibility and online services, Information on ICT/Smart Cities, interaction, and personalization. Other aspects were also assessed, such as the ease of access to online services and the clarity of the information provided. As a result, with the technical help of the Web Scraping tool (Scrapee), a ranking of European capitals has been established. In this line, without forgetting that the purpose of this table is prospective, the level of quality, high, medium, and low, is evaluated with 2, 1, and 0, respectively, for the items mentioned above.

Table 1: Comparative ranking of European cities in digital transformation and municipal online services. Source: own research

	City	Accessibility and Online Services	Information on ICT/Smart Cities	Interactivity and Personalization
1	Amsterdam	2	2	2
2	Stockholm	2	2	2
3	Helsinki	2	2	2

4	Tallinn	2	2	1
5	Berlin	2	1	1
6	Dublin	2	1	1
7	Luxembourg	2	1	1
8	Warsaw	2	1	1
9	Madrid	2	1	1
10	Copenhagen	2	1	1
11	Vienna	2	1	1
12	Lisbon	2	0	1
13	Paris	2	1	0
14	Prague	1	1	0
15	Riga	1	0	0
16	Budapest	1	0	0
17	Roma	1	0	0
18	Vilnius	1	0	0
19	Zagreb	1	0	0
20	Bratislava	1	0	0
21	Ljubljana	1	0	0
22	Brussels	1	0	0
23	Sofia	1	0	0
24	Nicosia	1	0	0
25	Valletta	0	0	0
26	Athens	0	0	0
27	Bucharest	0	0	0

For the quantitative analysis, to prepare the IDDI index for this investigation, its structure has been divided into two main components or sub-indexes, Usage Index and Site Digitalization Index. To prepare the Usage Index, data from web navigation patterns were extracted to assess the usage of the city hall site. The tool used to extract the information was Semrush (n.d.), and the data are referred to 2022 and 2023, its arithmetic average specifically; we relied on the powerful big data tool, Semrush, to achieve our research goals. This tool provides easy access and allows for the extraction of information in CSV format. According to Ponzoa et al. (2023), our familiarity with Semrush made it the ideal choice for our research. After a preliminary URL analysis, twenty-seven URLs were selected. The variables analyzed were visits, unique visitors, page viewed per visit, visit duration, and bounce rate. To avoid the bias generated by the size of the city that may favour more extensive urban areas, the data were pondered by the number of inhabitants. This last figure was obtained from Eurostat (2024). A usage index was elaborated with the quoted variables to provide a global overview. The tool used to prepare the index was Excel.

$$\frac{Total\ visits * visit\ duration}{city\ residents} * (\%\ of\ unique\ visitors * pages\ viewed * bounce\ rate)$$

Figure 1: Usage Index

Data from the web structure were extracted to assess the city hall site's digitalization level or digitalization depth to prepare the Site Digitalization index. The data are referred to the same time-lapse and were extracted with Semrush. The variables analyzed were Backlinks, Domains, Ips, Follow links, Nofollow links, Text links, Image links, and Keywords, to ensure Internet users are guided to specific websites, there must be alignment between the search queries made by users on search engines and the corresponding URLs or links they encounter as search results

(Ribeiro-Navarrete et al., 2021) To avoid the bias generated by the size of the city, which may favour more extensive urban areas, the data were pondered by the number of inhabitants. To provide a global overview, a site digitalization index was elaborated with the quoted variables. The tool used to prepare the index was Excel.

$$\frac{Backlinks + Domains + Ips + Follow\ links + Nofollow\ links + Text\ links + Image\ links + Keywords}{city\ residents}$$

Figure 2: Site Digitalization Index

With the two previously described sub-indexes, a global digitalization index (IDDI) was elaborated to generate a digitalization ranking for all European capitals. The tool used to prepare the index was Excel.

$$IDDI = usage\ index * site\ digitalization\ index$$

Figure 3: IDDI Index

The preliminary research phase was based on the extraction, transformation, and loading (ETL) data sources (Sabtu et al., 2017). The following steps were considered to execute the extraction process accurately. First, the data was converted into a format ready to start the analysis process. However, the data had to be prepared to cross-reference the traffic-semrush Data with the Backlinks data. Second, the Traffic-Semrush data was segmented by months of the years analyzed, and the Backlinks-Semrush data was a single value per museum. Third, for this endeavour, the Traffic-Semrush variables are grouped in the following way: Visits and Unique Visitors are given the sum statistic and transformed into the variables Sum of Visits and Sum of Unique Visitors, respectively. The variables Pages/Visit, Average Duration of Visit, and Bounce Rate are transformed into Average Pages/Visit, Average Duration of Visit, and Average Bounce Rate, respectively.

Once the IDDI was prepared and its values by city obtained, it was transformed into a raking structure so that it could be compared with the Content Accessibility Index (CAI) and the SEMrush Authority Index (SAI) to assess potential common behavioural traits that may provide further insight into the causality underlying the structural model defined.

The IMD Smart City Index (2023) edition assesses residents' perceptions of two pillars. The Structures pillar refers to the existing infrastructure of the cities, and the Technology pillar describes the technological provisions and services available to the inhabitants. Each pillar is evaluated over five key areas: health and safety, mobility, activities, opportunities, and governance. The index ranks 118 cities worldwide by analyzing the perceptions of 120 residents from each city. The final score for each city considers the perceptions from the last three years, with the weight of 3:2:1 for 2023:2021:2020, respectively. The index was incorporated into the investigation to assess how the digitalization process of the public bodies affected the residents' perception of the city.

The European Regional Competitiveness Index (RCI) is a composite indicator that provides a synthetic image of territorial competitiveness, built on 68 underlying indicators, of which 48 are at the regional level; the 68 indicators are grouped into 11 different pillars and three sub-indices (Basic sub-index, Efficiency subindex, Innovation subindex) gradually moving from enabling factors of competitiveness to cutting edge ones, EU regions are divided into three development stages, based on GDP per head, more weight is assigned to fundamental factors of competitiveness in less developed regions and to cutting-edge factors in more-developed regions. This index represents the ability of a region to offer an attractive environment for companies and citizens to live and work. It covers each region of the 27 Member States of the

European Union. The index was incorporated into the investigation to assess how the digitalization process of public bodies may contribute to a more economically attractive environment for individuals and companies European Commission (2023).

The Human Development Index (HDI) "*is a summary measure of average achievement in key dimensions of human development: a long and healthy life, knowledge, and decent living standards. The HDI is the geometric mean of normalized indices for each of the three dimensions*". This index was incorporated into the investigation to assess how the digitalization level of the leading public bodies of the capital of Europe may impact the quality of life of its inhabitants understood in the multiple dimensions embodied by the index, Health based on life expectancy calculated at the time of birth in each country, and normalized so that this component is equal to 0 when life expectancy is 20 and equal to 1 when life expectancy is 85, Education, measured on two levels: the mean years of schooling for residents of a country, and the expected years of schooling that a child has at the average age for starting school. These are each separately normalized so that both 15 mean years of schooling and 18 years of expected schooling equal 1, and a simple mean of the two is calculated. The economic metric chosen to represent the standard of living is GNI per capita based on purchasing power parity (PPP), a common metric used to reflect average income. The standard of living is normalized to equal 1 when the GNI per capita is $75,000 and equal to 0 when the GNI per capita is $100 (United Nations, 2024).

Data from the digitalization index by content and accessibility described in Table 1 (own elaboration) were incorporated into the investigation to assess to what extent the site content quality may impact the IDDI ranking. The data, which initially contemplated three aspects: Accessibility and Online Services, Information about ICT/Smart Cities, and Interactivity and Personalization, were condensed into an overall valuation (the CAI) to allow its cross-examination with the IDDI.

Finally, the Authority index, elaborated by Semrush, is defined as a composite metric used to measure the overall quality and SEO performance of a domain or website page. It is based on a series of metrics that demonstrate trust and authority. This index is the result of calculations using AI and machine learning to measure the authority of a domain based on three aspects: Link power: quality and quantity of backlinks, Organic traffic: estimated monthly average of traffic from organic search; spam factors, indicators of spam vs. spam link profile a natural profile. This index was incorporated into the research to assess to what extent the IDDI may predict the site digitalization quality (Soloaga, 2023)

Table 2: Data for IDDI Ranking, RCI, SmartCity, HDI indexes Semrush Authority Index (SAI) and Content and Accessibility Index (CAI). Source: own research

CAPITAL	IDDI(R)	RCI	SMART	HDI	SAI	CAI
Helsinki	1	133,4	8	0,96	59	6
Vilnius	2	114,3	65	0,913	41	1
Berlin	3	121,5	33	0,959	77	4
Paris	4	142	46	0,949	74	3
Vienna	5	118,9	28	0,942	72	4
Amsterdam	6	140,6	15	0,962	67	6
Tallinn	7	106	32	0,932	52	5
Brussels	8	136,3	35	0,953	46	1
Riga	9	88,6	83	0,929	44	1

Copenhagen	10	137,7	4	0,967	53	4
Stockholm	11	138,9	10	0,972	59	6
Madrid	12	118,6	37	0,94	71	4
Lisbon	13	110	99	0,9	45	3
Zagreb	14	90	106	0,916	48	1
Prague	15	114,3	14	0,96	53	2
Bratislava	16	113,6	62	0,944	40	1
Sofia	17	85,4	111	0,856	44	1
Luxembourg	18	125,1	45	0,93	47	4
Dublin	19	121,7	63	0,95	53	4
Rome	20	91,4	122	0,917	65	1
Warsaw	21	118,8	44	0,926	65	4
Ljubljana	22	109,6	47	0,953	42	1
Nicosia	23	86,6	117	0,896	33	1
Athens	24	92,3	113	0,909	42	0
Budapest	25	105,5	87	0,922	45	1
Bucharest	26	93,7	106	0,926	41	0
Valletta	27	90	NA	NA	10	0

This table provides an overall view of all the indexes used in this investigation. As a first step, descriptive statistics were applied to assess, in the first place, if the argument that the site CAI may impact the IDDI can be validated. For this purpose, the Pearson correlation coefficient was applied (Bolboacă et al., 2011). The tool used was Excel. The same methodology and tools were applied to assess to what extent the IDDI could be used to measure the digitalization quality of the site hall sites by comparing it with the SAI.

The Pearson correlation coefficient was applied to the variables IDDI, HDI, SmartCity Index, and RCI to detect correlations and assess the adequate methodology for constructing a structural model that could identify the functional relation between these variables (P. Liu et al., 2024).
In the second step, a structural model was constructed based on the methodology of 2SLS (Two Stage Least Squares). The tool used was the software Gretl (n.d.). This methodology has been used since correlations between the variables were detected in the previous step using the Pearson correlation coefficient, suggesting potential causal relations among the variables that may lead to multicollinearity issues if not considered (Zhao et al., 2024). The RCI index, measuring the environment for individuals and companies, was defined as the dependent variable, and the SmartCity index, the HDI, and the Digitalization Index (IDDI) were used as independent variables.

Since the model has two levels, the SmartCity Index will act as the dependent variable, along with the HDI and the IDDI. At the second level, the RCI and the independent SmartCity Index will act as the dependent variable.

The outcome of the described methodology shall be a structural model capable of forecasting the competitive development of the cities studied based on the independent variables defined.

4 RESULTS AND DISCUSSION

In the first phase , the relationship between the different variables has been addressed as a simple predictor of the interaction between the phenomena studied and as an indicator of the path to follow to create a predictive model and the best methodology to address it.
The Pearson correlation coefficient offered the results described below.

Table 3. Correlations of the variables based on the Pearson correlation coefficient. Source: own research

INDICES	CORRELATIONS
SMARTCITY&HDI	-0,827
SMARTCITY&RCI	-0,841
SMARTCITY&IDDI	0,582
RCI&HDI	0,761
RCI&IDDI	-0,596
HDI&IDDI	-0,393
IDDI&AUTHORITY	-0,575
IDDI&CAI	-0,576

The initial descriptive figures present foreseeable results since the Smart City Index contemplates a balanced focus on economic and technological aspects of smart cities on the one hand, and "humane dimensions" of smart cities (quality of life, environment, and inclusiveness) on the other, and the Human Development Index is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and having a decent standard of living. Both indexes present familiar places related to life quality and the economic subtract backing it. The RCI measures the ability of a region to offer an attractive environment for firms and residents to live and work. Again, the RCI presents common places with the previous ones, related to life quality and the economic subtract backing it. On the other hand, the IDDI focuses on a different domain—digitalization. Nonetheless, correlations can be observed, with the economic foundation being the most predictable common factor.

There are clear correlations between the variables, the lowest being between the HDI&IDDI. This figure is foreseeable since both indexes address different fields of analysis and follow a different data structure, the HDI being an index that goes from 0 to 1 and the IDDI a ranking from 1 to 27. Due to the data structure, the correlations described are negative between the SmartCity Index, the HDI, and RCI and between the RCI and the IDDI. The SmartCity Index assigns a lower figure to the best-positioned cities; the same applies to the IDD. The RCI index gives a higher value to the best-positioned cities, and the same applies to the HDI. Based on this correlation path between the variables, the following structural equations have been constructed:

$$\textit{SmartCity INDEX} = 980{,}640 - 1009{,}98\textit{HDI} + 1{,}59725\textit{IDDI}\ (R2 = 0{,}769)\ (\textit{Level 1})$$

Table 4. Statistical information from the software Gretl for level 1. Source: own research

	Coefficient	Typical deviation	T statistic	P value
Constant	980.640	151.946	6.454	1.38e-06 ***
HDI	−1009.98	159.242	−6.342	1.80e-06 ***
IDDI	1.59725	0.548903	2.910	0.0079 ***

This structural model predicts the citizens' perception of the infrastructure and technological pillar with 76,9% accuracy based on the HDI and digitalization index IDDI, both variables relevant to the model. This suggests that actions conducted by the city halls concerning its digitalization process may contribute to improving the citizens' perception of the quality of life in the city.
The second level of the structural model is defined by two variables: the SmarCity Index and the RCI, the city competitiveness Index.

RCI = 137.405 - 0.403226 SmartCity Index (R2 = 0,724) (Level 2)

Table 5. Statistical information from the software Gretl for level 2. Source: own research

	Coefficient	Typical deviation	T statistic	P value
Constant	137.405	3.54934	38.71	3.82e-023 ***
SmartCity Index	−0.403226	0.0508227	−7.934	3.65e-08 ***

This model suggests that as a city is regarded by its citizens as more talented, it also becomes more competitive, offering a better environment for individuals and companies. The forecasting capacity of the model reaches a level of 72,4% accuracy.

Together, both levels can predict a city's competitiveness for its residents, whether individuals or companies, based on the three independent variables described: HDI, IDDI, and SmartCity Index. The model constructed in this research establishes the path for enhanced city competitiveness, in which public bodies, specifically city halls, have a relevant role.

The correlation between the IDDI and the SAI described in Table 3 is -0,575. The correlation is negative because of the data structure. The IDDI gives a lower position in the ranking to the best position site. In contrast, the SAI gives the highest score to the best digitalized site. A correlation of 58% between the two indexes is relevant but not strong enough to hold that the IDDI is an optimal indicator of the site's digitalization quality.

The correlation between the IDDI and the CAI elaborated for this investigation and described in Table 3 is -0,576. The correlation is negative because of the data structure. The IDDI gives a lower ranking to the best position site, whereas the CAI gives the highest score to the best site. A correlation of 58% between the two indexes is relevant but not strong enough to hold that the IDDI is an optimal indicator of the quality CAI of the site . Nonetheless, its accuracy should be improved to be considered an entirely accurate indicator.

The structural model defined presents foreseeable results given the common places between the variables used and described initially.

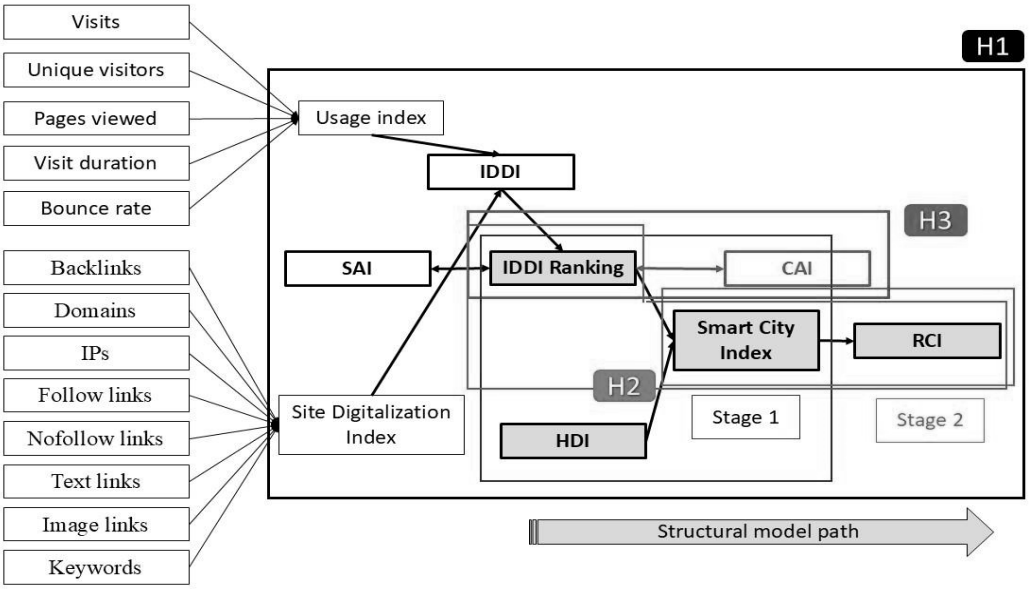

Figure 4: Research Outcomes

The findings of this study provide valuable insights into the digital transformation of local governments in EU capital cities. In evaluating the hypotheses, we found that:

Regarding hypothesis 1: The IDDI Model is an effective tool for measuring digitalization and competitiveness in European local institutions. The predictive model based on the IDDI, the HDI, and the SCI presents a predictive capacity of 72,4% over the RCI index. Therefore, it can be suggested that the IDDI constitutes a quality tool to predict the digitalization stage of European Local Institutions and its effect on its competitiveness supporting the acceptance of H1. This hypothesis was supported, particularly in the cases of countries like Sweden and Denmark, where a high degree of trust in institutions and favourable attitudes toward digital innovation contributed to rapid digital transformation. These findings align with Koca (2023), who found that Sweden's strong digital skills and institutional support significantly accelerated its digital economy. Similarly, Auzina-Emsina (2023) highlights Denmark's success in integrating digital technologies across various sectors, underscoring the importance of cultural context in facilitating transformation.

Regarding hypothesis 2: A statistically significant correlation exists between the IDDI, the Competitiveness Index, and the Smart Cities Index. The IDDI index presents relevant correlations with other widely accepted indicators, such as de RCI or the SAI, backing H2 and contributing to back H1 as well. An improvement in the accuracy of the index is expected for future research papers in our research. Our data revealed that cities with comprehensive digital policies experienced improved operational efficiency and public service delivery. These findings align with the work of Gasco-Hernandez et al. (2022), who emphasized that digital transformation strategies enhance the transparency and efficiency of local governments by streamlining administrative processes and increasing citizen engagement.

Regarding hypothesis 3: The IDDI positively correlates with the professionalism and strategic quality of communication content on institutions' web pages. The IDDI presents a behavioural correlation of 57,6% with the CAI; hence H3 can be accepted, intending to improve the accuracy of the index in the future. While digital transformation positively impacts competitiveness, some countries with strong cultural resistance or traditional governance

structures, such as those with higher uncertainty avoidance (Hofstede, 2001), experienced slower progress. This aligns with Straub (1994), who noted that cultural barriers can impede the adoption of digital technologies even in economically advanced regions.

Compared to the broader literature, our findings are consistent with other studies that emphasize the significant role of cultural factors and institutional support in shaping the success of digital transformation initiatives. Furthermore, the results prove that countries with forward-thinking, technology-friendly policies tend to outperform others in both digital adoption and competitiveness.

5 CONCLUSIONS

This study's findings present compelling evidence supporting the initial hypotheses. Firstly, the Institutions Digital Development Index (IDDI) has demonstrated its efficacy as a robust metric for assessing European local institutions' digitalization levels and competitiveness, thereby corroborating the assumptions underlying Hypothesis 1. Secondly, statistically significant correlations were established between the IDDI, Competitiveness Index, and Smart Cities Index, validating Hypothesis 2. This finding underscores the intricate interplay between digital transformation and urban competitiveness. Lastly, the positive correlation between the IDDI and the quality of institutional communication on web platforms confirms Hypothesis 3, emphasizing the strategic importance of digital tools in enhancing public engagement and transparency.

These results affirm that digital transformation is a critical driver for augmenting institutional effectiveness, competitiveness, and public engagement in European Union capitals. The study highlights the pivotal role of digitalization in modern governance and provides a quantifiable framework through the IDDI for future research and policy formulation.

5.1 Recommendations for Future Research and Policy

Several key recommendations emerge to advance digital transformation effectively within the European Union (EU). Firstly, it is essential to promote collaboration among EU member states. Countries can align their digital policies and practices by pooling resources, sharing best practices, and launching joint projects. This collective approach will streamline efforts across various governance systems, improving efficiency and integration.

Secondly, policymakers should develop flexible, context-specific digital strategies that reflect the unique needs of each local community. This requires carefully assessing local socio-economic factors, current infrastructure, and residents' specific digital demands to ensure that initiatives are applicable and effective.

Thirdly, emphasis must be placed on enhancing digital skills and literacy. Investment in educational programs equipping citizens and government employees with vital digital competencies is critical. This enables individuals to navigate an increasingly digital world and strengthens the digital capabilities of public institutions.

Addressing the digital divide is another crucial area for action. Ensuring equitable access to digital tools and resources, particularly for underrepresented and underserved communities, promotes inclusivity and ensures that the benefits of digital transformation reach everyone.

For future research, more in-depth investigation is needed to uncover the factors influencing digital transformation in various urban settings. Developing inclusive models that capture various digitalization elements—such as technology advancements and adaptive strategies—will help create a more comprehensive understanding of these processes. Incorporating user-related aspects into frameworks like the Integrated Digitalization and Development Index (IDDI) is particularly important. By examining elements such as internet access and levels of digital literacy, researchers can better understand the social implications of public sector digitalization.

Local institutions can fully leverage digitalization by acting on these recommendations, boosting urban competitiveness and improving governance. This proactive stance is vital for sustaining competitiveness in today's rapidly evolving digital landscape.

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Contact Information

Prof. Andrés Gómez, PhD.
Esic University-Esic, Business &Marketing School.
Social Sciences
Business Organization
Spain
Email: andres.gomez@esic.university
https://orcid.org/0000-0002-2852-1970

Prof. Fernando García-Monleón, PhD.
Esic University-Esic Business &Marketing School.
Social Sciences
Economy and Finances
Spain
Email: fernando.garciamonleon@esic.university
https://orcid.org/0000-0003-2993-6745

Prof. Oliver Carrero, PhD.
Esic University-Esic Business &Marketing School.
Social Sciences
Communication
Spain
Email: oliver.carrero@esic.university
https://orcid.org/0000-0001-9380-1445

Prof. José M. Mas, PhD.
Universidad Complutense
Economics and Business Sciences
Marketing
Spain
Email: josemas@ucm.es
https://orcid.org/0000-0003-2931-1235