

Innovative platforms for more compliant Smart Cities: a case study

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Abstract. The quality of public services provided to citizens through information and communication technologies has emerged as one of the key points of public administration reform. In Italy, many legislative measures have triggered a virtuous circle of eGovernment that has achieved limited results in adopting new technologies by citizens and businesses [1]. This paper sets out to explore whether the design of an IT platform operating in a smart city context may increase the quality of services provided to citizens. Based on a case study methodology, the research examines the process of revitalization and smartification of a city, seen from the stakeholders' perspective such as Government, Citizens and Tourists [2]. The paper is original in its examination of the Tely platform enabled by data obtained from the technology developer. It turned out that the platform has the potential to increase the quality of services provided to citizens and promote social integration in an area with a significant migratory population. However, the limitations of a single case study in a specific research context, such as a small town, are acknowledged and further research is needed to fully understand the implications of smart city initiatives and their effective implementation in different contexts.

1 Introduction

Smart city is a new idea of urbanization in which the community smartly manages resources. It aims at promoting a sustainable and energy-self-sufficient economy [3]. Therefore, a smart city, therefore, results from an articulated growth process involving economic activities, environmental resources and interpersonal relationships [4]. This is based on a value co-creation approach, which makes citizens an active part of the environment they live in (European Commission Smart Cities 2020). This is a primary topic of interest to the scientific community and urban planners. Several studies have been conducted, including the work of Sancino and Hudson [5], who compared different Smart Cities initiatives in Europe, North and South America and Australia. Their work strives to consider the e-government leadership and the implementation of tools based on the use of technology. Another contribution was made by Alaliyat et al. [6] in which he analyzes the municipality of Ålesund in Norway and faces the issue of profitability. Kuo & Li [7] address the issue of urban resilience in the context of Taipei City. Our work brings together different aspects of the Smart City with the aim of not limiting it to one aspect, such as e-government or viability, but to multiple elements and factors that are equally impactful. We might add that sustainability is a crucial concern of our times, and it is particularly important in healthcare, as people are set in healthcare systems on which their health and the sustainable use of resources depend.

Due to the complexity of these systems, both in terms of governance and pathways from decisions to behavior, there is no single theory. Still, solutions have to be co-created with the

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actors operating within the systems [8]. Moreover, Smart city is an urban environment that is able to interact with residents actively, commuters and tourists to improve their daily quality of life and facilitate their access to the services they usually use [9]. Therefore, the research question asked is the following:

R.Q. *May the design of an IT platform operating in a smart city context increase the quality of services provided to citizens and promote social integration?*

To answer this question, we conducted a case study on a platform developed by an Italian company and implemented in full compliance with the guidelines of the AGID (Agenzia per l'Italia Digitale), a strategic model of digital growth, to determine whether the main objectives of effectiveness, efficiency, cost-effectiveness, transparency, and democracy are effectively pursued in the provision of public services and administrative procedures.

This text is set as it follows: after the introduction, a literature review, highlighting the state of the art, is offered, followed by the research methodology and the case study findings, as well as the discussion and conclusions.

2 Literature review

With the rapid growth of emerging technologies and services, the smart city has been widely studied with the development of modern societies. There are various applications and strategic visions in different areas of the smart city, such as smart urban planning or smart mobility, to design smart services [10]. The concept and role of smart cities as a new innovative paradigm for urban planning and management have been the subject of particular attention by scholars in recent years [11] [12]. According to [13], a smart city can be defined as a place where traditional networks and services provided to citizens and businesses are improved through technological innovation, Smart Cities promote environmental and social well-being [14]. Furthermore, Khatoun and Zeadaly [15] state that a smart city can be seen as an ultra-modern urban area meeting the needs of businesses, institutions and, above all, citizens. In fact, according to Visvizi and Lytras [11], it is possible to generate new value and provide better services to citizens within smart cities due to the advances offered by new ICT technologies. To be functional, a smart city needs an information infrastructure enabled by technologies such as Big Data, IoT and cloud computing generating values for citizens through advanced sensors, measurement and analysis tools, machine learning and artificial intelligence-based solutions [16]. In literature, efforts to classify smart cities have focused either on the goals a smart city plan seeks to achieve (e.g., green city, innovation city) or the means (e.g., infrastructural, financial and managerial inputs used to implement the smart city), or a combination of both ones. As an example of the first goal, Sikora-Fernandez [17] compared smart cities based on emphasized objectives (labelled 'dimensions') and constructed indices for each of them: transport and mobility; environment; people; life; governance; and economy. Another example of a goal-focused categorization scheme is the one of Lopes and Oliveira [18] who classified smart cities according to fields of action, which they divided into four elements: governance; energy; environment and buildings; mobility; and quality. Other scholars have proposed analytical schemes involving both goals and means, Khan and Han [19] state that the characteristics of a smart city include attributes and infrastructure. Examples of attributes are sustainability, quality of life, urbanization and intelligence. Furthermore, regarding infrastructure, we should consider institutional, physical, social and economic endowments. Another example of categorization schemes including both goals and means is the one of Desdemoustier, Crutzen and Giffinger [20], who use three dimensions (technological, human and institutional) to construct their

categorization framework. To develop a typology of smart city innovation, Nilssen [21] proposes a conceptual map of four dimensions: technological, human and institutional, organisational, collaborative and experimental. In other works, the focus is on how local resources can be harnessed to achieve municipal goals. Dameri [22] analyzed cities along four levels: territory, infrastructure, people and government. Subsequently, Dameri et al. [23] used the technique of qualitative data analysis (QDA) instead. For example, qualitative data analysis (QDA) was useful in Italian and Chinese smart cities to analyze how global and local factors influenced smart city projects at each level. Global factors included urbanization as a problem common to all cities, such as pollution and traffic congestion. Perboli, et al. [24] proposed a complex taxonomy of smart city projects comprising three axes: description, business model and purpose. The description axis includes the objectives (the goals of the smart city project, such as water or the environment), tools (the techniques used to implement the project) and management methods. The problem is that these theoretical frameworks are not sufficiently in line with developments in the field. Several studies systematically collect and process data from smart city plans [23], but only as a means of validating a conceptual scheme developed for smart cities. Few studies consult reality, where smart city plans are actually developed and implemented as a mean to conceptualize a bottom-up categorization scheme. In the following Table 1 a brief summary has been outlined.

Tab. 1. Summary Literature (Authors' elaboration)

Year	Authors	Key concept	Main characteristics
2019	Ismagilova et al. [25]	Topic	smart mobility, smart environment, smart living, etc.
2018	Sikora-Fernandez	Dimensions	transport and mobility; environment, people; living; governance; economy
2017	Lopes and Oliveira	Intervention field	governance; energy, environment and buildings, mobility, and quality of life. attributes: sustainability, quality of life, urbanization, and smartness pillars: institutional, physical, social and economic endowments
2018	Desdemoustier et al.	Dimensions	technological, human and institutional
2018	Nilssen	Dimensions	technological, organizational, collaborative, and experimental
2018	Dameri et al.	Layers	land, infrastructures, people and government
2014	Perboli et al.	Business model	description: objectives, tools, project initiator, stakeholders' business model: management (public, private or mixed sector), infrastructure financing (public or private), and financial resources (public or private) purpose: client (public, private or mixed sector), product (specific or general) and geographical target (urban, national or international)

From the studies analyzed above, it appears that an approach was chosen by considering two views:

- Functional view, concerning service delivery, i.e., the usefulness of the service for citizen. This approach often considers sociological or psychological analyses;
- Systems view, dealing with ICT services allowing the smart city planning itself [26].

Basically, from a functional point of view, it becomes strategic to involve the citizen who is no longer a mere user of services but, together with government agencies, businesses and entrepreneurial and productive realities in the area, is able to manage the city and contribute to the creation of a digital value system [27]. Realizing what has been described so far is possible by following the principle of Service-Dominant Logic [28] and the service science theory. As argued earlier, services offered within the city can be improved and optimized by exploiting the information shared by citizens to create a more sustainable, greener and more competitive city that offers a higher quality of life. This means a configuration of people, technologies, organizations and shared information that may create and deliver value to suppliers, users and other stakeholders through services [29]. Consistent with the principles of SDL [30,31], and Service Science [32] the focus of Smart City Service Science (SCSS) is on the co-creation of value achieved through the collaboration and participation of all smart city actors. For example, by supposing that citizens anonymously share some of their personal data with the city (e.g., their agenda); organizations collect this data to optimize their services (e.g., by organizing events according to citizens' schedules); the city may offer personalized services based on the events planned by the organizations and the citizens' needs; as a result, in a data driven world, citizens will receive a better service, precisely because of the data they have shared. As pointed out in this example, the co-creation of value in the SCSS leads to a virtuous circle: as SCSS actors share more data, better services may be offered to the community and better decisions can be made at the government level. Data sharing is realized through two main elements:

1. An infrastructure enabling the collection of data from the different actors and making it available to the different operational centers in the city (e.g., water control center; transport command and control room, etc.) and to the highest decision-making level (e.g., city government);
2. A shared data model enabling the integration of all information produced in the city.

Normatively, service systems engage in knowledge-based interactions to co-create value, meaning that advances in service innovation are only possible when a service system has information about the capabilities and the needs of its clients, its competitors, and itself. Service science aims to categorize and explain the many types of service systems that exist as well as how service systems interact and evolve to co-create value. Not all interactions between service systems co-create value, and service science seeks to understand the reasons for departures from normative behavior[33]Service perspective underlines how market and social dynamics can be explained in terms of interactions among actors that are interrelated to combine assets to satisfy personal needs [34] In this direction, new logic is proposed where it is possible to overcome the traditional transactional view and embrace a wider perspective, better able to explain the logics and dynamics of social and economic evolutions [35]. The above aspects provide a holistic view of the city's various spheres [36]. At the same time, the technical aspect of ICT services becomes central because, with the help of IT tools, it is able to implement both the infrastructure for managing the smart city and the tools needed to interconnect, integrate and analyze data from different sources. This aspect is fundamental to

provide users with complete information and support the decision maker, who is provided with the basis for developing decision support systems to manage critical issues [37]. The case study revealed a system for reducing the gap between citizens and emerging technologies. This was done by training each user to become a smart citizen capable of taking advantage of all the opportunities that smart cities offer. In relation to this, it must be added that the smartest city research has focused on technological infrastructure or policies but has neglected the most important element of the smart city: the citizen. A clear description and assessment of citizens' roles in smart cities might assist us in properly managing technology. In fact, smart cities frequently fail to fulfill their objectives because people (the end users) are not involved in their creation or are unable to use the technology for a plethora of factors [38]. Among other things, they are an excellent factor in assessing the service quality [39,40]. According to Hollands, smart cities must be based on something more than ICT [41] that also aims to invest in human capital by realizing a participative ecosystem enhancing the ICT infrastructure.

3 Methodology

The methodology used here is about the case study. In particular, we analyzed what the Salerno-based company I.T.Svil implemented through the development of the Tely platform. We obtained primary data from the company that allowed us to develop the case study, obtain results, and answer the research question mentioned above. The aim is to achieve a local public administration capable of providing highly innovative services that are consistent with the design guidelines for websites and digital services of the public administration adopted by AGID with determination No. 224 of 2022, which, following the evolution of technology and regulations, has adapted the methodology and tools indicated in the previous guidelines. I.T.Svil, a service company in the Information & Communication Technology field, was founded in 2005 by a team of resources with in-depth knowledge of business processes. I.T.Svil is in the market to meet the needs of companies interested in evolving through innovation, with the contribution of technology to improve their organization, offer and target market. I.T.Svil invests with the customer, creating a partnership relationship, transforming itself from reference supplier to strategic partner. The territorial context, in which the Tely platform was tested, is the Sele Valley and exactly in the city of Bellizzi, which is a municipality with about 15,000 inhabitants and is located in the province of Salerno (District). The case study methodology is appropriate when trying to answer a question about the "how" or "why" of a set of simultaneous events over which the researcher has a little or no control [42]. In this case, an exploratory approach was adopted and the study was based on a single (holistic) case model [43]. Despite some typical weaknesses of this methodological approach, especially concerning the statistical significance and selection bias, case studies have many strengths, such as depth of analysis, high conceptual validity, understanding of context and process, and promoting new hypotheses and research questions [43]. For this reason, Punch [44] describes it as "empirical research in which the data are not in the form of numbers". According to qualitative studies [45-46], "a case study describes routine and problematic moments and meanings in the lives of individuals. It uses a wide range of interconnected methods in the hope of always gaining a better understanding of the subject matter" [45]. Sekaran and Bougie [46] argue that a case study deals with the meanings that people attach to a topic in a natural context. A case study is an in-depth analysis of a small number of units, gathering information 'about a specific object, event or activity', such as a particular business unit or organization'. Stake [47] further stated that the case study has been defined as an intrinsic, instrumental, collective, "robust" and "reliable" method [48].

4 The case study

The case study offers a nudge for a new complementary model in the relationship between public administration and citizens in line with the contents of the AGID guidelines. The public authority, on the one hand, promotes the offer of new services and new ways of using those already provided and, on the other hand, stimulates demand for them through their more effective promotion in the territory. The enhancement of supply aims first and foremost at promoting the territory in all its aspects:

- Hospitality (restaurants, hotels, agritourist structures);
- Mobility (trains, buses, parking);
- History and culture (monuments, traditions, thematic itineraries, cultural events);
- Local productions (agricultural products, handicrafts, typical products);
- Integration (migrants and seasonal workers).

It should be noted that one of the most intriguing features of the country under investigation is the presence of numerous immigrants, mostly from the labor market. In actuality, the Tely platform's primary objectives include:

1. Promoting social integration, in an area so strongly affected by migratory phenomena;
2. Promoting an inclusive society and guaranteeing security conditions in order to improve, the framework conditions that favor development;
3. Improving the quality and equity of social and labor participation through greater integration and accessibility of social protection, care and reconciliation services and training, learning and work systems.

In most cases, despite their condition of hardship and marginality, migrants habitually use smartphones and tablets. Very often such technology represents the only tools through which they are able to communicate with their compatriots, who share their stay in Italy with them, and with family members living in their homeland. In this sense, the use of a platform with a user-friendly design, developed according to AGID directives, is a great cognitive support element for both citizens and migrant hosts and in general for all stakeholders. It often happens that for them even asking for information gets complicated and this is why it is possible and very useful, through the application platform, to provide a series of services, also in different language, that can bring them closer to the territory and make them consider themselves as resource and not a difficulty to be managed. Information and communication technologies are changing the way cities organize decision-making as well as urban growth. Through the implementation of information and communication technologies in municipal services, cities become smarter in the management of resources. Those new types of cities with new technological applications create new business opportunities and a hub for research. The wave of innovation in smart cities brings new interactive layers to cities, simplifying and also removing barriers from previous models. The fundamental pillars that power a Smart City are found in sensors, intelligent transport systems (metro, train, drones), public space with gardens, automatic and efficient lighting, the gas system, water, telecommunications and energy sharing infrastructure. We can, therefore, indicate at least two indispensable features of the Smart Cities concept [49]:

- The widespread use of ICT, as an infrastructure conveying intangible flows of information and knowledge; - the enhancement of social capital, i.e., the increase of skills, creativity and social inclusion of citizens and migrant populations through their involvement.

- Smart places;
- Smart people.

Intelligent places are those where the connection to digital networks is possible and where the physical and digital worlds merge with the goal of facilitating human activities. These places are inhabited by smart people, capable of using the potential offered by new technologies to their advantage, with a high degree of flexibility, and capable of concentrating their own creativity and ability on the production of innovation. Precisely through this methodological approach, the actors involved in the case study highlighted a significant evolution in the use of IT devices, also thanks to the continuous involvement aimed at validating the services offered through the platform under study. Further, Mitchell [50] argues that in order to graft smartness into a city, the following prerequisites must be met:

1. “Saturate the city with silicon” which is a metaphor to say that thanks to the increasing miniaturization of electronic components, it is possible to equip every single artefact in the city, with software capable of making possible the exchange of information between the object itself and those who use it.
2. Next, it is necessary for the set of devices to function as an integrated system in which each element relates to the others, and all together pour their information into digital networks.
3. Finally, data must be retrieved through intelligent tools such as, control units, sensors, energy meters, cameras, smart phones, GPS devices, etc.

As a result, it is clear that the enhancement of the service offer is accompanied by an enhancement of the channels (PC, Smartphone, Tablet...) through which the users of the services (tourists, residents, commuters, seasonal workers, and foreigners) can easily access them, which is also supported by a smart design of the platform under study. From an architectural point of view, the platform is equipped in the cloud at a data center capable of distributing all the services promoted and provided (local transport, parking, municipal services, promotion of the territory, etc.). The platform is set up for access to services through different channels that also allow the mobile use as described in figure 1.

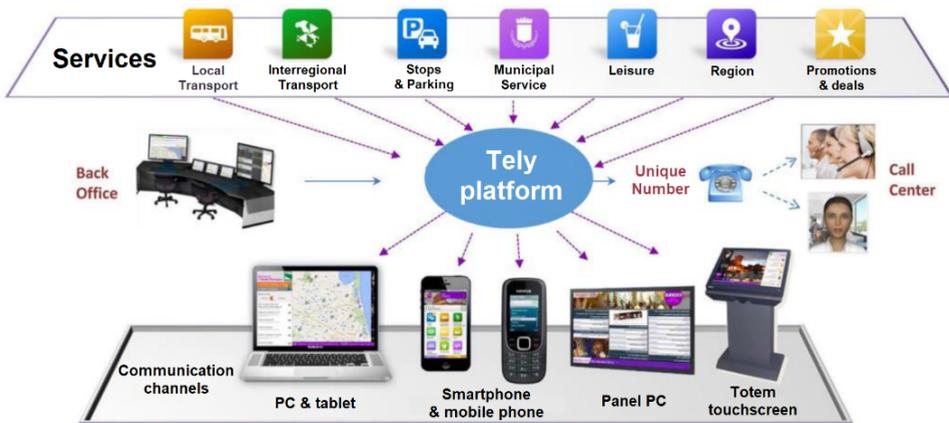


Fig. 1. Channel and service. Source: elaborated from I.T.Svil company

The possibility of providing a range of services through the Tely platform required an extensive integration with existing databases, its implementation was divided into four lines of action and split into two phases: PHASE 1 (Line 1: Territorial promotion portal; Line 2: Parking management and payment) and PHASE 2 (Line 3: Booking and payment services; Line 4: Taxes payment).

- Line 1 Territorial promotion portal. In this line of action, a survey was made of all digital content available for the promotion of the territory, with particular reference to content:
 - Mobility: road and rail public transport lines across the municipal territory. In addition, structured and surface car parks, pedestrian and limited traffic areas.
 - History and culture: a model was presented to enable you to get in the history of the concerned cities organized by historical periods and linking to places, itineraries and relevant events to a given historical period.
 - Places in the city: places of cultural, historical, landscape, commercial and entertainment interest in the city and, limited to the most representative ones, in its surroundings.
 - Events: scheduled events in the city and its surroundings of interest to visitors (e.g., concerts, conferences, organized tours, theatre performances, cultural and sporting events, etc.).
 - Accommodation and catering facilities: accommodation and catering facilities in the area with the possibility of applying search and selection filters according to type (hotel, agritourism, restaurant, self-service, bar, etc. (regional, national, international, etc.).
 - Public utility services: public utility services were presented (e.g., pharmacies, ATMs, banks, taxis, InfoPoint, police stations, etc.). For each service, the periods of activity have been described. There is a navigation function to the service and, where applicable, contact details.
 - Commercial, productive and artisan activities: the commercial, productive and artisan activities present in the test area were presented, with the possibility of filtering data by type of activity and products. For each activity, a card was presented with the products and services offered, and a navigation function to the physical location of the activity was made available.
 - Thematic itineraries: itineraries were presented allowing an “experiential tourism” visit of the area’s typical products and shopping. For each itinerary, the main places to visit, the route, the duration and other aspects related to the visit such as, for example, the points of purchase of typical products along the route were indicated.

Content is uploaded and organized, taking care of all graphic aspects in accordance with the provisions of the AGID guidelines mentioned above. Figure 2 below describes the entire ecosystem of the platform under study.

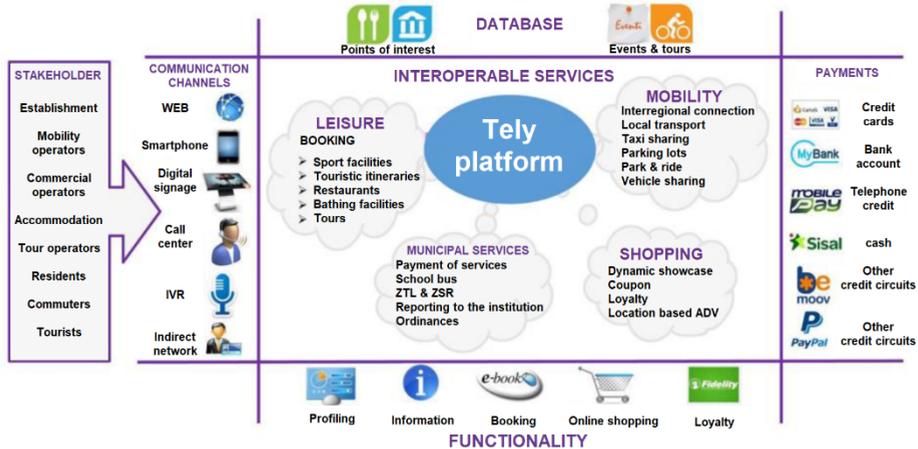


Fig. 2. Tely ecosystems. Source: elaborated from I.T.Svil company

- Line 2 Parking management: an innovative service for locating parking areas and paying for parking was provided. The user, by using the platform, is able to locate the nearest parking spaces on the map and pay through an electronic purse connected to a payment system. The smart parking system is meant to make it simpler for consumers to access services, but it must also take care not to complicate the controllers' task. As a result, the controllers were given a particular App (named Valida and developed by ITSvil – not the focus of this research) that allows them to verify whether the parked cars have paid in real time.
- Line 3 Payment Services: It is possible to pay for services offered by the authority, such as school canteen or entry tickets to the stadium or other events, by using the website and App. The ability to book and pay is tied to the portal's back-office connectivity with the databases of the experimental organization.
- Line 4 Payment of taxes: Another element of great importance was to provide citizens with a platform allowing them to pay through the website and App taxes such as advertising, billposting, occupation of public spaces this with the aim of drastically reducing the need to go to authorities' offices.

The platform under review considers the Italian strategy of the seven-pillar objectives defined by the European Digital Agenda, which are:

- 1) Digital identity and innovative services for citizens: electronic identity card and health card; unified registry office, road archive, digital domicile and PEC. Digital domicile and mandatory PEC for businesses;
- 2) Digital administration: open and accessible data and information, including those of the PA, digital systems for purchasing goods/services, mandatory transmission of documents via Internet;
- 3) Services and innovations to foster digital education: electronic certificates and files in universities, digital school textbooks;
- 4) Measures for digital health: electronic health records, digital medical prescriptions;
- 5) Strong push for broadband and ultra-wideband;

- 6) E-money and e-invoicing;
- 7) Digital justice: electronic chancellery notifications, changes in bankruptcy law to proceed electronically, research and incentives for companies active in new technologies.

E-Gov services not only correspond with the overall computerization and digitalization of public administration, but it is also appropriate to speak of E-Gov when the use of innovative technology clearly contributes to the development of the final services provided to consumers. With its inherent limits, the case study strives to provide reality to these aims.

5 Discussion and non-conclusive considerations

The growth of urbanization and the experience of people's daily life in the city urge scientific and technological research to produce a concrete solution to the new arising problems. Research must be able to improve the relationship of stakeholders with the city and all those services that must make it viable. The use of technology helps to remove obstacles to accessing the services that citizens and tourists use on a daily basis, such as, for example, transport to make it easier to reach places and the various services that support local businesses. Furthermore, the detailed overview of current literature on smart cities recommends to test a new complementary paradigm for the connection between government and citizens. This use-case has emphasized the value of social engagement and inclusiveness in smart cities and the ways in which the Tely platform may support these objectives, particularly for seasonal and migratory workers. The Tely platform case study in the city of Bellizzi is an illustration of how information and communication technology may be utilized to enhance the provision of public services and administrative processes as well as how residents can take an active role in shaping their surroundings. This offers a valuable contribution to the smart city literature by highlighting the need to co-create solutions with the actors operating within the systems and how it is necessary to consider multiple elements and factors that are equally impactful. Overall, the case study suggests that the design of an IT platform operating in a smart city context can increase the quality of services provided to citizens.

5.1 Implications and limitations

This research presents the inherent limitations of a single case study in a specific research context like a small town. Future research might also examine the economic and financial viability of smart city initiatives and how to calculate their return on investment. It will also be crucial to look at the best ways to scale up and replicate smart city programs in other cities and regions while taking the unique cultural, social, and economic context into account. Furthermore, this study stressed the need of having digitally literate individuals who can engage with these systems in addition to having the technology to make usage of e-Gov services possible. Therefore, in order to improve the success of smart city initiatives, future research should also concentrate on how to raise digital literacy and awareness. This includes the analysis of the differences between smart city initiatives in Italy and those in other nations, like the ones in Asia, as well as looking at the effects of territorial restrictions and the function of enabling technologies like cloud platforms and cyber security in the implementation of smart cities. Overall, this case study offers a helpful place to begin future investigation into the execution of smart city programs and the function of social governance in attaining effective results.

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