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How Are Medium-Sized Cities Implementing Their Smart City Governance? Experiences from the Emilia-Romagna Region

Barbara Caselli, Gloria Pellicelli, Silvia Rossetti * and Michele Zazzi

Department of Engineering and Architecture, University of Parma, Parco Area delle Scienze 181/a, 43124 Parma, PR, Italy
* Correspondence: silvia.rossetti@unipr.it

Abstract: Within the smart city debate, this paper aims to reflect on whether and how medium-sized Italian cities are organizing their smart transition technically as well as administratively. The smart city concept was developed in the 1990s when major European cities began a smart transition through widespread urban regeneration projects and the introduction of advanced technologies applied not only to the physical city but also to governance, policymaking, and communication, involving multiple sectors of city administrations. In the last decade, medium-sized cities have also started this transition process, although with lower emphasis than metropolitan cities. In most medium-sized Italian cities, this transition, in accordance with national and regional guidelines, has sometimes led to competencies reorganization within local governments. Within this framework, the paper examines the tools with which medium-sized Italian cities' administrations address the smart transformation in their territories, comparing a sample of 10 cities in Emilia-Romagna and considering policymaking, governance structure, past and current projects, and communication transparency. The expected result is therefore a systematic review of experiences to reconstruct a complex picture of the political and administrative choices that have led to the implementation or setting in motion of smart transformation processes to draw some useful lessons.

Keywords: smart city; medium-sized cities; urban policies; urban planning; smart governance; ICT

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1. Introduction

Is it relevant today to talk about smart cities? The development of smart cities, which began in the 1990s, has in the last 20 years become of particular interest to scholars, who have been researching the smartest cities, and drawing up different rankings. In 2011, there were 248 smart cities out of a total of 468 European cities with more than 100,000 inhabitants [1], whereas according to Giffinger's analysis [2], there were 77 cities between 100,000 and 500,000 inhabitants, of which seven were Italian, and 90 cities between 300,000 and 1 million inhabitants, of which seven were Italian. In 2015 in Italy 3.000 out of a total of 8.100 municipalities could be considered smart cities [3].

What is a smart city? As highlighted in the existing academic literature [4], the concept of the smart city remains undefined, as scholars still disagree on a common and shared definition. Furthermore, the literature presents many possible alternative terms for 'Smart' city, such as 'Intelligent', 'Digital', 'Knowledge', or 'Information' city [5–7]. However, the studies on the concept of 'smartness' are numerous in many disciplines, including urban studies.

In most theories, the smart city concept is based on the crucial role that Information and Communication Technology (ICT) plays in urban and territorial transformations and urban growth processes [5–13]. Some other studies emphasise the greater importance of human capital or social and environmental networks as factors for urban development and regeneration to be reinterpreted in a 'smart' perspective [2,14–18]. Many authors

insist above all on the two closely connected dimensions of technology and social capital [6,14,19–21] which need to be integrated. The first dimension considers the use of technology within the urban context, like sensors, that can measure urban phenomena in real time. The second dimension implies the presence in the urban system of a social capital able to ensure the achievement of adequate levels of sustainability and liveability through the appropriate use of resources, primarily energy [19]. According to this vision, technological advancements can meet the increasing demand for sustainability [10,22–24] in the urban growth process, even if sustainable urban development implies multiple values [25]. On the other hand, Papa et al. [20] argue that a key role in coordinating and integrating urban policies aimed at building a smart city in the contemporary city lies with urban planning, due to its holistic approach to urban development. Furthermore, in the analysis conducted by Anthopuolos [26], the urban planning dimensions and smart city architecture have several common points, through which these two notions interact. In particular, the smart city aligns with and contributes to all dimensions of urban planning and supports sustainable local growth through various e-services. On the other hand, the planning dimension can be influenced by smart city stakeholders through participatory politics. A smart city's infrastructures have to conform to planning rules, whereas planning has to uniformly develop smart cities across the regions for coherent development.

From a public policy perspective, specific factors that characterize the development of smart cities are identified by Keshvardoost et al. in four strategic choices: (i) national/local strategies; (ii) for new or for existing cities; (iii) with hard or soft infrastructures; (iv) through sectorial or geographical policies. The main challenges that cities are facing in their smart city policies are related to the urgent need to change the governance model, facing the challenge of becoming more flexible, and of enabling the combination of top-down policies with bottom-up initiatives [27].

In Europe, there are three strategic documents guiding sustainable urban and territorial development: the legislative proposals for EU Cohesion Policy 2014–2020, which promotes integrated urban policies and defines the financial and operational tools necessary for their implementation; the European Digital Agenda (2010) which looks at the urban and regional development in terms of implementation of the territorial digital infrastructures with the aim of exploiting the economic and social potential of ICTs; the Urban Agenda (2011), which provides the recommendations for strengthening the role of cities and turning the 'urban question' into a central issue in European Union development strategies [28]. However, other programmes, such as Horizon 2020 for innovation and research (2014–2020), the European Urban Agenda to deal with different problems in cities (2016), and the SET-Plan for energy efficiency (2008) have also boosted smart initiatives, i.e., projects that are specifically related to a smart city plan or call for proposals.

The European policy framework on the smart city has been defined within the Europe 2020 Strategy [29], adopted in 2010 by the European Commission, to provide a clear plan to deal with the economic crisis by increasing European competitiveness through smart, sustainable, and inclusive growth. It consists of seven 'flagship initiatives' which represent the reference framework for all the projects to be funded.

The European Digital Agenda (DAE), set in 2010, is another initiative of the 2020 strategy, and mostly deals with infrastructures and services that the Network can offer. It is another fundamental pillar on which the nowadays idea of smart city implementation is based [6,28,30].

In urban studies, many critical analyses of smart city projects have been developed from a comparative perspective, especially concerning metropolitan cities [31–34]. They highlight the close relationship between smart cities and territorial competitiveness [31], and how the development of smart cities occurred in response to major environmental challenges to make metropolitan cities future-ready [32]. Furthermore, the research for metropolitan cities focuses on how it is necessary, in addition to a push from the private sector and the participation and support of stakeholders [31], to have external funding from the higher spheres of government. Noori [32] shows how initiatives are necessary to

develop platforms in local policies supported by the administration to enable flagship projects for cities to be able to attract future investments. On the national side [34] the weaknesses, especially in mobility, of Italian metropolitan cities compared to European ones [33] are highlighted, although it is very difficult to compare them due to a lack of data [34]. However, these outcomes specifically refer to metropolitan cities, and it is therefore difficult to transfer them to medium and small cities. On the other hand, the research on metropolitan cities highlights that smart city initiatives are often implemented through stand-alone projects without a strategic plan to systematize them [33].

On the contrary, the focus on medium-sized cities has been far more limited, although some examples are reported in the literature [35–38]. However, due to the heterogeneity of the 'smartness' processes adopted by each country, the EC has also published 'The European ranking of medium-sized cities' [39], which defines variables to classify the municipalities' 'smartness' levels, according to a set of six axes: smart economy, people, mobility, living, governance, and environment.

The goal of the paper is to understand how medium-sized cities in the Emilia-Romagna Region are currently implementing 'Smart City' governance with regard to the territory's smart transition (i.e., required changes to the administrative structure and required initiatives (actions) for a city to qualify as a smart city); figuring out how administration choices can manage the smart city transition, and also though the identification of the ongoing smart city policies and projects.

Moving from the general to the local (Italian) theoretical framework on smart city and smart governance, the paper develops through five sections:

- This section presents the state of the art regarding the concept of Smart Governance, also in the Italian context.
- Section 2 set the criteria, sources, and tools for the research methodology adopted in the paper, and for the selection of a set of case studies.
- Section 3 develops a review and comparative analysis of urban policies implemented by ten—mainly medium-sized—Italian cities of the Emilia-Romagna region. It also compares the smart city strategies promoted by city administrations, assessing the relevance of the proposed actions: specific local actions, or projects with a more widespread impact on the city and surrounding areas.
- Section 4 provides a critical discussion on the review and comparative analysis outcomes, highlighting the emerging similarities and discrepancies among cities, defining critical issues and key drivers towards the definition of a smart city transition in medium-sized cities.
- Finally, Section 5 contains some concluding remarks, highlighting possible lessons learned from the Italian context on smart city transition.

This contribution is also conceived as a preliminary research phase to identify a possible shared vision of the smart city concept in the field of urban and territorial planning.

1.1. Smart City Governance

Indeed, governance has a significant influence on urban planning and management, and many sources argue that the common element to all future cities shall be the participation of the 'smart' community [20,28,30,40–45] with a bottom-up approach supported by the implementation of information exchange systems. Such an approach involves a shift from government to governance. In this vision, public administrations should promote the principle of transparency and people involvement, enabling and facilitating the search for different solutions, in collaboration with other public and private stakeholders [46,47].

Within this debate, new terms have emerged:

- 'e-government', i.e., the digitalised management system of the public administration implemented with the aid of technologies and telematic networks, primarily web applications, to improve the delivery of information and services to city stakeholders;

- 'e-participation', i.e., the process of engaging citizens in policy-making and decision-making through ICT to promote a participatory, inclusive, and deliberative process; and 'e-planning', i.e., the use of technology to integrate spatial planning approaches, public participation, and visualisation techniques [36].

The configuration and the expansion of the urban digital infrastructure, made of connectivity, equipment, applications, and services, can really change the organization of urban physical space, urban government, social involvement, and the functioning of the city itself [21,48].

1.2. The Italian Perspective

Smart city regulations are part of the 'Italian Digital Agenda' program, which contains measures to carry Italian regulations to the requirements of the European Digital Agenda [3]. In recent years in Italy there have been measures dedicated to social innovation in cities, through actions such as the development of a national strategic plan, funding, calls for tenders, smart city programs, and the adoption of the PON Metro 2014–2020 (National Operation Program for Metropolitan cities that includes interventions for the sustainable urban development, according to the Europe 2020 Strategy).

Most of the Italian municipalities evaluate their smart city projects and policies according to the six axes proposed by the EU, but the national online platform which gathers all the projects implemented by Italian cities classifies them into eight 'themes': living, energy, environment, people, planning, economy, mobility, and government. This is called 'Agenda Urbana' and is promoted and realized by the ANCI (National Association of Italian Municipalities), in collaboration with local administrations, the Smart City Observatory (created in 2012 by ANCI, with the aim of developing and sharing research activities and models for starting urban 'smart' transition in Italian cities), and ForumPA (a society of consultation and services of Group Digital 360 to promote the innovation through the meeting among administrations, businesses, and societies) [3].

Anyway, the 'smart' transition of Italian cities cannot exclude the specific features of the national urban system which is made primarily of small and medium-sized cities, with only a few metropolitan ones. On the one hand, Italian metropolitan cities are generally the main actors in the implementation of smart infrastructures, integration policies, and technological innovation because they can take advantage of many resources and can compete at the national and international levels [36,49]. On the other hand, small towns risk being left on the sidelines of the 'smart renewal' process. In between are the medium-sized cities that, despite having fewer resources than metropolitan ones, can still aspire to undertake the transition. Therefore, it seems essential for these cities to identify their own peculiarities, invest in strategic sectors according to European development lines in order to increase their competitiveness, and set up new forms of cooperation, knowledge, and experimentation to promote the 'smart' transition process, also at supra-local level [15,49].

Like European cities, medium-sized cities in Italy also demonstrate a strong interest and active participation in the 'smart city', implementing specific urban strategies and policies, as reported by the National Smart Cities Observatory (2016) [50]. The purpose of this Observatory is to share a vision with Italian municipalities and to set a governance structure for the entire initiative, therefore leading to specific local actions and the choice of the most suitable technological solutions.

Within the current debate on the smart city, this paper aims at reviewing urban policies, experiences, and projects, especially in medium-sized cities, already implemented or ongoing, analysing the provincial capital cities of the Emilia-Romagna Region in Italy.

2. Materials and Methods

2.1. Selection of the Case Studies: Provincial Capital Cities in the Emilia-Romagna Region

Emilia-Romagna is located in the north of Italy and almost crosses the Italian peninsula from east to west, becoming an important hub for transport and connection between

the north and centre of the country. Around 4.5 million people live in the region, which has been usually considered as the union of two different areas: Emilia on the western side and Romagna on the eastern side. The region is administratively divided into eight provinces (Piacenza, Parma, Reggio Emilia, Modena, Ferrara, Ravenna, Forlì-Cesena, Rimini) and the metropolitan city of Bologna, which hosts the regional government headquarters. The provincial capital cities of Piacenza, Parma, Reggio Emilia, Modena, Ferrara, Ravenna, Forlì, Cesena, and Rimini are all representative cases of medium-sized cities in the Italian context, located in a region that presents a good level of dynamism in smart city programs and policies, as will be described below. For this reason, these cities were selected as case studies for the present research, also including the metropolitan city of Bologna to give a complete regional overview.

According to the Italian online platform 'Agenda Urbana', [51], the Emilia-Romagna region has implemented more 'smart' projects than other Italian regions (Figure 1). A total of 208 projects have been developed, especially related to the topics 'Environment' and 'People'. These projects are mainly located in the west of Romagna, as shown in Figure 2.

Aside from the specific local projects, there are some actions and plans in which the entire region is involved. Firstly, the Regional Operative Program (POR-FESR: Operative Program of Regional Development European Fund) [52], which consists of a programming document that defines a strategy for the use of EU resources, allocated to the region by the European Regional Development Fund, to enhance territorial economic growth and attractiveness. A second major program in 2015 provided the Regional Digital Agenda 2015–2019 (ADER) [53], a policy instrument to make cities 100% digital, and to help people improve their quality of life (studying, moving, living) through information technologies. This is the outcome of the MadlER program (Participatory Model for the Local Digital Agenda in Emilia-Romagna) [54] whose aim was to draw up a digital profile of cities between 2012 and 2013. Today, all the provincial capitals of the region have adopted their Digital Agenda, except for the Province of Forlì-Cesena, which is still in the drafting stage.

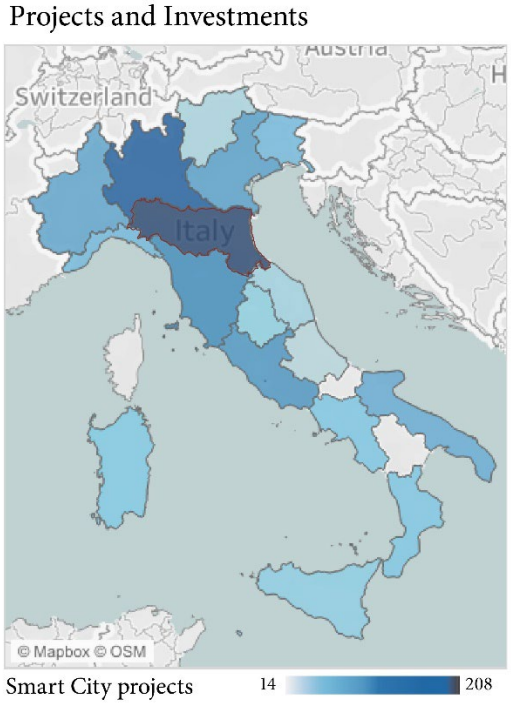

Figure 1. Smart city investments and projects: general situation in Italy. The Emilia-Romagna region, which launched the majority of the projects (208), is highlighted. Source: Agenda Urbana website, consulted in September 2022.

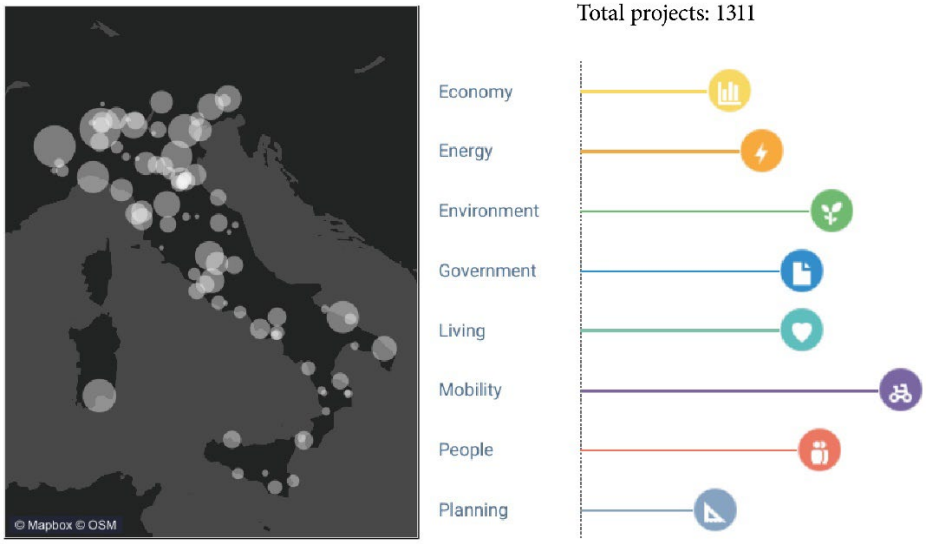

Figure 2. Smart city projects located in Italy. Source: Agenda Urbana website, consulted in September 2022.

Another related regional project, active from 2017 to 2024, is PREPAIR (Po Regions Engaged to Policies of Air) which promotes a strategy to improve the social response to climate change, informing and educating citizens, especially about energy saving at home, in transport and in agricultural activities.

The region has also set up a network of 'open laboratories' in all cities to foster innovation, experimentation, and culture in order to promote the active participation of citizens in order to start cultural projects in a variety of fields.

Finally, the region promoted a call for urban regeneration proposals in 2018, concerning the redevelopment of both architectural emergencies and public open spaces, with a focus on sustainable mobility issues [55]. All the selected cities participated in the call.

Furthermore, all selected cities have subscribed to the Covenant of Mayor [56], starting in 2008, and this initiative has often marked the opening of a 'smart' planning phase. In fact, each city drafted a document, the Sustainable Energy Action Plan (SEAP) within a year of subscribing to the pact, with the goal of reducing greenhouse gas emissions by 20% by 2020 and adopting strategies to address climate change. In recent years, several cities (in particular Bologna, Piacenza, Parma, Modena, Ferrara, Ravenna, and Cesena) have drawn up the Sustainable Energy and Climate Action Plan (SECAP), an update of the SEAP, whose objective is to reduce CO_2 emissions by 40% by 2030.

In 2018, the Digital Agenda Coordination of Emilia-Romagna with the collaboration of ART-ER and Ernst & Young, introduced the smarter index [57] to measure the regional level of 'smartness', and assess which dimension influenced innovation more in each municipality. The analysed dimensions include technology, quality of life, and development of human and economical capital. The results confirm that the ranking is mainly due to the size and geographical location of cities; in fact, the capital cities, where most businesses, services, and infrastructure are concentrated, are in first place followed by the contiguous cities.

2.2. Research Methodology

This research explores the governance structure of cities, attempting to return for each selected city how the political and decision-making process works, what policies and projects are planned to implement the smart transition, and how these initiatives are disseminated and communicated to local communities.

The methodology implemented for the research can be divided into two subsequent steps. The first step consists of a review of the governance and administrative structure

responsible for smart city communication and decision-making. Data, as briefly described in the next paragraph, have been summarised with a comparative methodology in tables that focus primarily on the following two aspects:

1. The administrative structure of the city administration. This level investigates whether there is a specific office that deals with smart city initiatives or whether it is included in offices with a wider range of responsibilities and duties.
2. The local management and governance of smart city projects, verifying whether they are collected in a specific open-access database that citizens can easily consult.

The second step consists of a comparative analysis of the selected cities with regard to the implemented smart city projects, highlighting their objectives and progress.

Data were collected between 2020 and 2022 and both steps of the analysis contributed to outlining the smart profile of each analysed municipality.

The structure of this comparative analysis is inspired by the IO (input–output) methodological approach by Noori et al. [58]. The original method aims to assess smart cities implementation through specific indicators, allowing decision-makers, city planners, and developers to foresee the relevant design variables (i.e., the entities that can change the shape or properties of the model within a specified set of choices [58]), the best possible design choices, and possible improvements to achieve 'smartness'. This model assumes an initial boost using resources and new technologies, which then has an output in terms of applications (projects), meeting specific urban needs.

The revised and simplified method, adopted in this paper (Figure 3), assesses each selected case study:

1. The Input, i.e., the status of the design variables, which relates to the resources needed to implement the smart projects; only the design variables for which data were found in the selected case studies will be considered.
2. The Output: the number of applications (projects) containing design choices/cases relevant to the six smart city axes of the European Union (the original model consisted of slightly different categories: mobility, energy, healthcare, smart government, smart citizens). Only the projects of the last decade which are directly connected to a smart city plan, specifically related to the case study area, and its digital spheres, have been analysed.

Data collection in both phases has been supported by different sources: the national online platform 'Agenda Urbana' which gathers smart city experiences throughout Italy; specific online platforms of the analysed municipalities, which collect past and current projects.

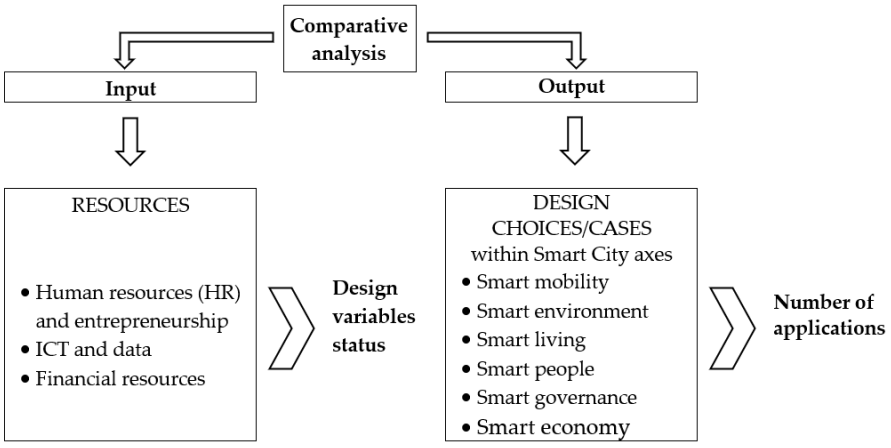

Figure 3. Diagram outlining the method for comparative analysis of smart city projects, inspired by the IO model by Noori et al. (2020) [58].

3. Results: Case Studies' Review and Analysis

3.1. Review of Smart City Urban Policies, Projects, and Governance Structure in the Case Studies

A review of the main 'smart' urban policies implemented by the city governments of the case studies is briefly presented below, together with their governance structure and their current 'smart' projects.

The present paragraph, together with Section 3.2, shows the results that were deduced from the first step of the previously described methodology. They refer to the political and management level of smart city issues within administrations.

3.1.1. Bologna

Bologna is a municipality with a population of nearly 400,000. It is the capital of the homonym metropolitan area, and also the regional capital.

In the structure of the city administration, the task of managing smart city projects is not assigned to a specific department but falls under the duties of the 'Digital Innovation and Data' sector, under the responsibility of the 'General Management'. Among the projects promoted is the 'New technologies, Smart City, Digital Agenda' [59].

The city subscribed to the Covenant of Mayors in 2008, but the project of Bologna Smart City started only in July 2012 when the city government, the University and Aster (a Consortium between the regional government, the University, and other public institutions) signed a memorandum of understanding for the creation of the digital platform 'Bologna Smart City'. The online platform is organised into seven areas:

- cultural heritage;
- Iperbole 2020 Cloud & Crowd (a civic network based on cloud technology and an integrated digital identity to collect the services offered by the public administration, businesses and citizens);
- smart grid;
- sustainable mobility;
- safe and sustainable neighbourhoods;
- healthcare and welfare;
- technical education and training [60].

3.1.2. Piacenza

Piacenza has a population of more than 100,000. The responsibility for the smart city belongs to the 'General Director Staff Operational Unit-Planning and Innovation' office. The city established the 'Piacenza Smart Territory' group in 2013, together with the Province, the Chamber of Commerce and Aster, and joined the Smart City National Observatory. Only in 2019, Piacenza approved a Smart City Plan (for the two-year period 2020–2022) based on two pillars: the administrative organisation and its ability to improve citizen involvement, facilitating the use of online services; quality of life, with optimization of mobility and parking, better control of environmental parameters, and more security and surveillance [61,62].

3.1.3. Parma

Parma has a population of nearly 200,000 and does not have a proper smart city department. The city established the 'Parma Smart City' association with various responsibilities. The association works closely with the city administration to participate in European and national calls for proposals. The protocol for Parma Smart City was presented in May 2019 to plan, develop, and manage the city of the future. The protocol is divided into four strategic goals to be achieved by 2030: (1) smart mobility, (2) carbon neutrality, (3) innovation and digital transition, and (4) creative, cultural, and inclusive city [63].

3.1.4. Reggio Emilia

Reggio Emilia, with a population of about 170,000, does not have a specific smart city department, but the 'Participation Policies Policy Structure' service takes care of citizen participation; it deals with the development of the connection between the city's material and immaterial infrastructures and the community's human, social, and relational capital, in particular through the use and dissemination of new digital technologies; it promotes social and digital innovation projects in the area to improve services and the quality of life of citizens. Information on the 'Reggio Emilia Smart City' protocol of agreement, created in 2017 with the involvement of 36 local organisations, is available in the area concerning networked services of the Municipality's official website. The city first analysed the territory on the basis of six smartness dimensions, specifically: Digital Government, Sustainable Environment, Sustainable Mobility, Competitiveness, Human and Social Capital, and Quality of Life to arrive at the definition of the best actions [64,65].

3.1.5. Modena

Modena has a population of about 185,000 and is probably the most advanced among medium-sized cities in the 'smart' transition. The city administration has an independent smart city department with one alderman and many responsibilities. The department runs a digital platform called 'Modena Smart Community'. The idea of Modena Smart Community was born with the Emilia-Romagna Local Digital Agenda in April 2014. The smart city project was born in 2016, involving all local stakeholders, and integrated with the Digital Constituent of the Emilia-Romagna Region [66,67].

3.1.6. Ferrara

Ferrara, with a population of about 130,000, has recently reorganized its internal governance structure. From 2020, according to the new administrative structure, the new office 'Information systems, digitalization, digital agenda, statistics, smart city' is part of the department 'Development and organization of human and technical resources'. The smart city project started with the signing of the Covenant of Mayors (2008) and then the drafting of the SEAP in 2012. In 2012 Ferrara joined other smaller towns and villages by forming the Intermunicipal Association 'Terre Estensi' to achieve the territorial goals defined by European guidelines, such as reducing carbon dioxide emissions by 20% by 2020 [68,69].

3.1.7. Ravenna

Ravenna, with nearly 160,000 inhabitants, does not have a dedicated smart city department, but representatives of the various smart city projects have formed a working group. A very detailed online platform, called 'Ravenna Smart Community', brings together all the 'smart' initiatives, divided into the six main EU axes. The city has set its transformation process on two pillars: the simplification of administrative processes and the massive introduction of IT in the labour market. The most important project concerns the regeneration of the 'dock', which began at the end of the last century with the renewal of public green areas. A participatory process for the redevelopment of the entire area began in 2011, leading to the 2012 'Plans and Actions' document. In 2012 the Municipality of Ravenna joined the National Smart City Observatory to relate with other Italian cities and develop a smart city profile, as required by European Union guidelines [70].

3.1.8. Forlì

Forlì, with approximately 120,000 inhabitants, is the capital of the Province of Forlì-Cesena. The municipal administration of Forlì has an office that deals with the smart city, called 'Technological Innovation, Planning, Contracts and Tenders Unit', part of the 'Information Technology and Statistics Service'. The office deals, among other services, with Digital Agenda, e-democracy, e-government, and smart city. In 2015 Forlì launched its

own smart city transition project, looking ahead to 2050 to achieve sustainability and urban quality objectives [71].

3.1.9. Cesena

Cesena has less than 100,000 inhabitants. The municipality does not have a proper smart city office, although it started its smart transition in 2014, paying particular attention to the integration of two specific dimensions: smart city and healthy city [50].

3.1.10. Rimini

The city of Rimini has almost 118,000 inhabitants. In the municipal administrative structure, there is neither a dedicated smart city office nor an office dealing with smart city issues. Rimini is interested in the transformation into a smart city, but the projects do not seem to be integrated to build a common vision: an online platform for smart projects is not yet available.

3.2. Comparative Analysis of the Smart City Governance

Table 1 shows the smart city governance system within the studied cities, considering administrative structure and public communication of smart projects through a dedicated platform. The comparison of the city administrative structure reveals a great heterogeneity in the management system; there is no homogeneous, and sometimes unclear, allocation of smart city responsibilities within the organisational structure. As far as communication is concerned, online platforms are not always published or updated.

Table 1. Comparative analysis of municipal administrative bodies and tools dealing with smart city transition and communication in each case study.

City	Office Dealing with Smart City	Smart City Department (Councillorship)	Smart City Online Platform	Description
Bologna	Digital innovation and data	no	yes	Within the 'general management' area there is the 'digital innovation and data' sector, which is responsible for supporting open government and smart city projects.
Piacenza	General Director Staff Operational Unit—Planning and Innovation	no	no	The 'General Director Staff Operational Unit—Planning and Innovation' office deals with smart city issues.
Parma		no	yes	There is not a specific smart city office. However, the city government has different offices which deal with technology, environment, energy.
Reggio Emilia	Policy structure participation policies	no	no	The smart city responsibility is included in the 'Policy structure participation policies' service.
Modena	Smart city, demographic services, and participation	yes	yes	There is a well-defined smart city office with a specific department and councillorship.
Ferrara	Information systems, digitalisation, Digital Agenda, Statistics, and Intelligent City	no	yes	This office is part of the 'Development and organisation of human and technical resources' department.
Ravenna		no	yes	There are two offices that deal with ecological transition and digital transition, but they do not specify their tasks in relation to smart city issues
Forlì	Technological Innovation, Planning, Contracts and Tenders Unit	no	no	Oversight of smart city issues and the municipal digital agenda.
Cesena		no	no	There is not a smart city office
Rimini		no	yes (but not available yet)	There is not a councillorship or office dealing with the smart city themes.

3.3. Comparative Analysis on the Smart City Projects

Even though some cities do not have a specific office or department dealing directly with the smart city, all cities have promoted projects to start their territorial transformation. This section illustrates the results that emerged from the second stage of the methodology used. In particular, it focuses on the practical level of the management of smart city issues, i.e., initiatives in the municipal area [50,59–72].

The table records consist of design variables, taken from the IO model, for which data were found within the official websites of the analysed municipalities. However, not all project variables reported in the IO method were considered because it was not possible to collect information on them. These include 'Transferring (attracting) educated and skilled people' and 'Attracting innovative companies' (in the resource 'HR and Entrepreneurship'), 'Data processing' and 'Data real time analysis' (in the resource 'ICT and data') and 'Foreign investment' (in the resource 'Financial Resources'). It should also be noted that the majority of records are filled in with 'Started' as the limited information does not allow us to date the projects accurately.

Another important difference with the original IO model consists of the compilation of the records. It provided the following entries: A (absent), P (planned), S (started), and C (completed). In Table 2, the labels 'absent' and 'planned' have not been used. The first has been replaced by a graphic symbol indicating the lack of information about certain projects. The second one, on the other hand, was not taken into account because no future projects were identified in the selected time frame. Finally, the label 'started' has not only been used when the project has been started but also when no information on its conclusion has been found.

This first elaboration shows how all cities have already started a transformation process through local funds and almost all of them are also supported by national or European funding sources. Another relevant observation concerns human resources and entrepreneurship since the advancement of social capital knowledge and skills and the pursuit of entrepreneurial dynamism and innovation in the smart city field do not seem to be sufficiently addressed by all the selected municipalities.

Table 2. Smart city development inputs: — (no information), S (started), C (completed). Comparative analysis of case studies: Piacenza (PC), Parma (PR), Reggio Emilia (RE), Modena (MO), Ferrara (FE), Ravenna (RA), Forlì (FO), Cesena (CE), Rimini (RN).

		Cities									
Design Variables	**Resources**	**BO**	**PC**	**PR**	**RE**	**MO**	**FE**	**RA**	**FO**	**CE**	**RN**
Educating and training people	Human resources and entrepreneurship	C	—	C	—	S	C	—	—	C	C
Nurturing the innovation environment		S	S	S	—	S	S	S	S	—	—
Data aggregation	ICT and data	S	S	S	S	S	S	S	S	S	S
Supranational and national investment	Financial resources	S	S	S	S	S	S	S	S	S	S
Local government investment		C	S	S	S	C	C	C	C	S	S
Public–private investment		S	—	—	—	S	—	—	—	—	—

Table 3 shows smart city development outputs, namely the number of projects for each UE smart city axis. The table also lists the main design choices, which include the items found in the original IO model, and some aspects taken from the analysed cities' projects, e.g., energy and water consumption monitoring actions, and implementation of home automation (domotics).

Aside from the site-specific projects, the table also considers the applications which derive from international programs, such as the SEAP (Sustainable Energy Action Plan) to promote the reduction in greenhouse gas emissions, drafted by each city between 2011 and 2014, and the SUMP (Sustainable Urban Mobility Plan), to promote sustainability in the mobility field, drafted by each city between 2017 and 2020.

The national platform 'Agenda Urbana' has been a support to identify the main fields of application of the different projects. In fact, almost all the cities analysed already have an online platform in which they categorize the initiatives based on the six axes defined by the EU; this practice helps the city administrations to include their actions within European addresses and funds.

Table 3. Smart city development outputs. Comparative analysis of case studies: Piacenza (PC), Parma (PR), Reggio Emilia (RE), Modena (MO), Ferrara (FE), Ravenna (RA), Forlì (FO), Cesena (CE), Rimini (RN).

UE Smart City Axes	Design Choices/Cases	BO	PC	PR	RE	MO	FE	RA	FO	CE	RN
Smart Mobility	Smart transportation infrastructures Smart public transportation Smart private transportation	5	3	2	8	4	7	6	2	2	2
Smart Environment	Renewable energy Building energy efficiency and domotics Energy monitoring New technologies for utilities Monitoring of water consumption	4	10	6	3	2	11	6	4	6	1
Smart Living	Structural monitoring Smart health monitoring systems Smart health management and information applications Smart security and safety	1	3	2		1	3	5		1	
Smart People	One-way communication Two-way communication Co-creating and co-designing	2	3	2	6	3	4	7		3	
Smart Governance	Smart administration Smart interaction Smart policies	5	4	3	1	3	3	5		1	1
Smart Economy	Promotion of local market Promotion of local companies Integrated marketing					1	1	2			

As the table shows, each city spends resources and energy focusing on its main urban needs and has its own peculiarities that can be enhanced by smart initiatives. For the metropolitan city of Bologna, most of the projects fall under the smart mobility and smart governance axis. The administrative office dealing with the smart city is 'international relations and projects'.

In the city of Piacenza, Parma, Ferrara, Forlì, and Cesena, the main axis seems to be the smart environment, as many projects focus, respectively, on building energy efficiency, urban resilience (e.g., the 'Ruggedised' project), and energy.

The city of Reggio Emilia included most of the projects within the axes of smart mobility and smart people. For Modena, the main axis is smart mobility, with projects focusing on autonomous-driving vehicles (e.g., the MASA laboratory). The city of Ferrara also gives great importance to smart people, thanks to the city's tourist characterisation (e.g., 'Ferrara waterway' for the redevelopment and promotion of the navigable area, and 'Ferrara tourist card' to provide discounts to tourists for cultural activities). The leading axis for Ravenna is smart people (especially for the promotion of tourism), followed by mobility and environment. One of the city's most important projects is the urban regeneration of the city 'Dock', which transversally addresses the three axes. Finally, the leading axis of the city of Rimini is smart mobility because of its participation in two European projects about info-mobility (analysis of traffic flows, improvement of public transport, availability of real-time traffic information, etc.) and the promotion of sustainable mobility.

A comparison of Tables 1 and 3 shows an interesting recurring element, namely that for many investigated cities, the development axis with the highest number of projects rarely coincides with the competences of the office responsible for the smart city within the city administration. Table 4 lists some of the most important ongoing smart city projects and policies in the analysed cities.

Table 4. Relevant smart projects and policies for each analysed city.

Administration	Name of the Project	Description
Bologna	Metropolitan Strategic Plan 2.0	It started in 2018 with the participation of public and private stakeholders to detect the most important programmes to realise the lines of action.
Piacenza	RoMA 'Resilience Enhancement of a Metropolitan Area'	Funded with more than EUR 10 million from the ministerial call 'Smart cities and Communities and Social innovation', it is an advanced communication and control solution for the defence of critical infrastructures, the urban environment, and the territory.
Parma	Ruggedised	Set up within the framework of Horizon 2020, 'Smart Cities and Communities lighthouse projects' test smart solutions in the fields of energy, transport, and digital technologies. The project focuses on the development of advanced smart cities, with the aim of upgrading cities by accelerating their transition to a low-carbon economy.
Reggio Emilia	Mobility 2.0	Funded by the EU, it aims to test and develop an effective and efficient electro-mobility system based on vehicle and infrastructure intelligence. In particular, it aims to develop an in-vehicle device that can support drivers of electric vehicles in optimally managing their mobility (e.g., by identifying parking spaces and multi-modal options), communicating with electric charging stations and providing data on public transport.
Modena	MASA laboratory	Active since 2017 with public–private partnerships, for experimentations, research, verification, and certification of self-driving vehicles and the connection with urban infrastructures.
Ferrara	Ferrara waterway	It is a regional project, started with a call in 2012, in collaboration with AIPO (Po River over-regional Agency) and the municipality of Ravenna, and consists of different interventions of redevelopment and promotion of the navigable area in order to transform the territory with a cultural, touristic, and economic view.
	Ferrara tourist card	This initiative will allow all visitors to enter all the urban museums, and they will have different benefits in cultural activities.
Ravenna	DARE 'Digital environment for collaborative Alliances to Regenerate urban Ecosystems'	The 'Urban Innovative Action' European call for tenders and refers to the dock city redevelopment: realised in 2019 was a technological platform to manage data about traffic, pollution, and energy consumption of streetlights, buildings, and houses.
Forlì	Smart Land Forlì-Cesena 30.0	It started in 2019 as a project about the implementation of infrastructural strategies over a medium-long period thanks to cooperation, new technologies and best practices.
Cesena	InSmart 'Integrative Smart City Planning'	It is a survey to assess the movement habitats of citizens and the energy characteristics of buildings through a questionnaire. The project involves four other partner cities in Europe. It aims to define an integrated plan of medium- to long-term interventions to promote environmental sustainability that will be included in the Municipal Energy Plan.
Rimini	GIM 'Gestione Info-Mobilità'	Born from the collaboration of Cesena, Piacenza, Ravenna, Reggio Emilia, and Ferrara. It has been established in 2009 to promote effective and efficient governance of 'widespread mobility' and promote its sustainable development through the centralised delivery of multi-channel public-private info-mobility services (traffic low-cost analysis, management of critical events, traffic control and limitation, improvement of local public transport, real-time diffusion of local public transport information, etc.)

4. Discussion

The overview of the main smart city projects makes it clear that all the selected case studies have started to promote 'smart' development within their territories. What is probably still lacking in Italian cities is coordination with the municipal administration. In fact, there is not always an office or organisational unit dedicated to planning the

transition to the smart city, and these are not always consistent with most of the smart city projects implemented.

Despite the heterogeneity of the choices made by single administrations, the analysis revealed a rather common approach to administrative organisation. Generally, the analysed city administrations have assigned the smart city responsibility to the offices dealing with digitalisation and innovation, except for Modena which has set up a specific department (councillorship) having a wide range of responsibilities. Therefore, at a political–administrative level, the smart city issue in Italy does not seem to be perceived as relevant to the field of urban planning and development. The responsibility of smart city projects is usually not attributed specifically to the department dealing with urban planning and management, probably because the foreseen smart city actions are mostly aimed at implementing 'innovation technologies', i.e., ICT and IoT systems, without directly intervening in the physical space.

Concerning project communication, most of the municipalities, even those without a specific organizational unit, have an online platform for the collection and management of smart city interventions and are very active in carrying them out, e.g., the city of Ravenna which set up an autonomous working group and appointed a different representative for each project. Furthermore, the work highlighted that sometimes smart city actions are listed in an online database on a specific web page of the municipality's official website, and in most cases, each project has its own website. However, this aspect can sometimes generate misunderstandings as to whether these projects are part of a broader planning activity or constitute specific and independent actions.

Regarding the scope of the projects, it emerged that all the analysed cities developed smart city projects mainly within the following axes: smart environment, smart mobility, and smart people/living.

The evidence from the comparative analysis shows how municipalities mainly intend the smart city as a digital city, in which technological improvement is fundamental and useful to enhance urban life in all its aspects and sectors. For instance, both the sensors used to regulate public lighting at night and the motion sensors for the traffic light systems are just technological devices but have the wider aim—well-defined and recognisable—of reducing pollution and dealing with issues of the environmental sphere. Likewise, many projects focus on sustainable mobility solutions, others on city management through the installation of technological devices within the public space for improving energy performance and the quality of life. On the other hand, projects under the environment axis, aimed at reducing emissions, managing renewable sources, and monitoring energy consumption, also have a direct impact on the quality of life and especially on long-term sustainability.

Projects implementing online services and the networking of open data to improve social active participation and inclusion were also quite popular. In fact, looking in detail at the design choices, the common feature of many smart city projects seems indeed to be the application of new technologies to improve online services for citizens' daily actions. Digitalisation is still ongoing, and many municipalities are, in fact, spending a lot of energy on computerising the management of citizens' administrative formalities. The study also demonstrates that administrations are more inclined to promote actions for improving services and performances rather than monitoring phenomena and the long-term effects of such initiatives. In this regard, only a few monitoring actions have been counted among smart city projects; also, the 'data processing' design variable turned out to be related in particular to the field of smart mobility and smart environment (e.g., building energy efficiency) and not diffusely applied. Monitoring actions and the construction of expendable quantitative and qualitative data sets on urban needs are still lacking despite being indispensable, in the sphere of urban polices and planning, to construct rigorous knowledge frameworks on which to set decision-making.

As far as the smart urban transition is concerned, very few projects envision a comprehensive urban regeneration process; in fact, most projects assume only punctual and less invasive actions. This is probably due to the limited availability of funding sources. Great

projects that intervene in the transformation of physical urban space are often supported by European funding and involve wider urban areas and several partner cities. Participation in these calls is often a good opportunity to receive economic support and share experiences and good practices in a wider urban network, but in the meantime, it also aggravates the public administration offices, which sometimes lack qualified staff, and furthermore, the success is not guaranteed. Nevertheless, there are some examples in the analysed cities, though implemented in limited urban sectors: the former industrial and derelict site of Reggiane in Reggio Emilia, the 'Modena Ovest' area, and the 'Dock' of Ravenna have all been redeveloped to become new public spaces for social and recreational activities.

It is also interesting to note that all cities participated in at least one European project, in most cases concerning environment and sustainable mobility. This consideration opens further research questions, specifically linked to the possible opportunities for medium-sized cities, which traditionally are not all equally able and equipped to attract external funding for the implementation of smart city projects. This is something that can be investigated not only in the Italian context, but also from a European and International perspective. However, looking at the latest European Smart City ranking available in 2014 (from the European Smart Cities project) [39], there are some examples of medium-sized cities that seem able to attract funds and manage governance processes for the implementation of a smart vision in urban regeneration interventions. This is the case of Eindhoven in the Netherlands, which, with its innovative spirit strengthened by the role of Brainport, has been the site of the Triangulum project: with a total budget of 6.5 million euros, the two neighbourhoods of Strijp-S and Eckart Vaartbroek have been completely transformed into smart and sustainable living environments.

5. Conclusions

The concept of smart transition that emerges from the literature review proposes a digitalized city in which computer networks constantly permeate human life and the physical space, providing more efficient services, real-time data collection, and more dynamic and participative governance, essential to guarantee sustainable development and a better quality of life for citizens. A smart city in this sense is essentially a wired city with a highly interconnected urban system.

Moving from the conceptual to the practical–operational level, different European policies and programs gave new impulses to smart city development in different countries, providing the framework in which regional and interregional initiatives can operate. In this scenario, the European Digital Agenda gave life to Local Digital Agendas and thus to a series of projects promoting the smart transition of European cities.

This paper presented a review and analysis of urban practices and administrative choices that are leading smart transformation processes in representative cases of medium-sized Italian cities, with the aim of better understanding how the 'Smart City' vision is currently being implemented at the political and administrative level, and which are the possible synergies with urban planning. This contribution focused on the case of 10 medium-sized cities in the Emilia-Romagna region, investigating firstly the allocation of the smart city responsibility within the municipal government, secondly the main smart city projects promoted by the public administration, and their progress, design variables, and choices.

What lessons can be learned from studying these cases? What are the main key drivers of smart city transition, especially in medium-sized cities?

Usually, actions promoted by local administrations result in the installation of advanced digital systems but almost never in a pervasive transformation of the physical space. Large urban regeneration projects are, in fact, a rare exception. The installation of technological devices, such as sensors and acoustic devices, located widely throughout a municipal area, can certainly contribute to making a city smarter, providing a great amount of data able to orient urban management, and these information flows can be captured and managed together. The integrating and transformative power of ICT enables the improvement of existing infrastructures and leads to the definition of operations with

some specific objectives [73] which involve, among others, accessibility, security, and energy saving. Anyway, all those initiatives can contribute to the smart city transition only if they are considered as part of a wider and more comprehensive planning activity, a 'smart planning' (a new dimension of urban planning that includes procedural innovation in land-use management and technological innovation in data management) [74] which involves all the different dimensions of the urban sphere [75].

The key driver of a smart planning transition is not only the focus on urban, environmental, and people's needs but also the decision to put people at the basis of the planning process [76–78], especially in the aftermath of the pandemic [79]. Therefore, as highlighted by Townsend [43], the smart century requires qualified and civically engaged social capital, above all possible plans and rules: the smart city must not only put the needs of citizens first but also give people an active role in the processes towards the solutions that smart cities will offer. Within this framework, smart governance should become a wider urban strategy led and supported by citizens trained and educated in the understanding and use of new technologies, funding channels, and creative thinking [80]. Successful municipalities should therefore be able to re-structure themselves, strengthening digital interaction systems between citizens and the administration and providing a well-defined governance structure to become more competitive in generating innovation and attracting funds for the implementation of smart city projects. This attitude implies a strong willingness of the public administrations to start the smart transition and to manage and integrate the different and intertwined social, economic, and technological aspects of the smart initiatives.

The initial results of this research activity can highlight some strategies to be further implemented in future smart city initiatives especially suited for medium-sized cities in Italy:

- Fostering a more effective integration of all smart city projects that should not be disconnected from each other but included in a unique and comprehensive vision.
- Creating specific offices in charge of supporting smart city activities that include different skills and operate with a multidisciplinary approach, as in the case of Modena.
- Publishing and constant updating of interactive online platforms collecting smart city projects, as Ravenna did, to enable all interested parties to be constantly informed.
- Networking among cities, not only to share good practices but also to assess and collaborate in defining new projects. This urban network can be built regionally, nationally, and also internationally. In this direction, the Regional Digital Agenda at the regional level, and the Covenant of Mayors at the European level can be considered best practices.
- Monitoring the smart project's processes and results. Ongoing and completed projects, whether successful or unsuccessful, should be monitored over time to highlight their relevance in the smart transition.

However, we should consider that Italian cities, especially medium-sized ones, have only taken their first steps into the world of 'smartness' since 2010, with the initiatives and programs originating from the Europe 2020 Strategy. Therefore, there are several further research questions and developments that arise from this analysis.

Furthermore, as highlighted in Table 2, monitoring activities of smart projects in the analysed cities are still inadequate, and they could be improved in the forthcoming years, as, for example, cities already working on the SEAP updates are doing. The control of existing projects, also through indicators, could lead to the implementation of a handbook of lessons learned and best practice examples. A centralized system to monitor and record all the projects, referring also to the social-economic sphere, and to direct future investments would be very useful. In Emilia-Romagna, since 2019, there is a regional online platform which has been collecting the projects implemented and controlling the smartness level of each city. This could become a useful starting tool for further deepening the monitoring activity.

Further developments of the present work may include an analysis of the evolution of municipal structures and organizations to pursue the goal of becoming smart cities, e.g.,

providing or expanding their digital platform with data. Furthermore, an upscaling of similar analysis to other European Regions could lead to comparative analysis and considerations.

From the performed study, some critical points can be highlighted, e.g., the lack of information on public platforms, especially regarding the progress of projects that have already begun, but also the lack of information regarding projects that are completed, whether they have been successful, whether they can be considered good practice for the future, and whether they can be repeated in other cities that might see them as a model, or on the contrary, as a warning to be avoided. Further research may also include the mapping of the most recent projects that have just been activated and the creation of a region-wide database that can be updated by all cities. Furthermore, future steps of this research will include direct interviews with the representatives of the administrations involved, if possible, the councillors or heads of offices in charge of developing smart city issues, and surveys with key stakeholders and citizens in order to update collected data and provide a more comprehensive picture of the impacts of the smart city policies on the quality of life and on the environment of the analysed cities. A comparative analysis among cities could also be developed by examining implementation costs and funding of the smart cities initiatives to check, among others, the ability of administrations to attract European funding and to participate in projects of supranational importance. With reference to the costs of the smart initiatives analysed within this paper, it is possible to note that for projects developed within National and European programs and funding, all data are accessible, as well as information on stakeholders and partners who financially contribute to the project. Local actions directly developed at the municipal level may require further research to assess the related costs and partners involved, e.g., by carrying out the above-mentioned interviews, to create a complete framework.

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