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Leading smart city projects: Government dynamic capabilities and public value creation

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ABSTRACT

This research studied the effect of different combinations of government capabilities (innovation capability mix) on public value in smart city-framed innovation projects. The study drew on the public value theory, the collaborative public innovation approach and the dynamic capabilities theory to devise a conceptual framework that links government capabilities and public value. Insights from smart cities and literature on public innovation were also used to identify a range of intra-organizational and external collaboration capabilities of governments that should lead to valuable public sector innovation. These capabilities were combined inductively through factor analysis, which was applied to a sample of 143 innovation projects in Spanish municipalities, leading to four forms of innovation capability mix. A factor analysis regression was then estimated. Overall, the study found that 'citizen-oriented management' (i.e., outstanding innovation-oriented internal management coupled with strong collaboration with citizens) and 'provider focus' (i.e., outstanding collaboration with providers) seem to have a positive influence on three dimensions of public value (i.e., efficiency, effectiveness and societal challenges). By contrast, 'citizen and expert focus' (i.e., outstanding collaboration with experts and citizens) and 'peer focus' (i.e., outstanding collaboration with other governments) do not contribute to any of the three dimensions of public value. While project type was studied, it was found that its isolated effect was limited, although analyzing it provided some interesting findings.

1. Introduction

Cities need to transform themselves to respond to complex threats and challenges (e.g., increasing demands of energy, traffic jams, pollution, crime, poverty) and take advantage of environmental opportunities (e.g., fast progress of ICTs and other technologies, more educated population) (Estevez et al., 2016). An increasing number of cities all over the world are embracing the smart city label as an overarching perspective for articulating their transformation.

Nevertheless, there is no consensus as to what a smart city is and what needs to be done in order to make a city smart (Hollands, 2008; Meijer and Rodriguez Bolívar, 2016; Mora et al., 2019a). Smart city views may be broadly divided into those that focus on technology and those that adopt a human-centric, people-driven, holistic perspective (Mora et al., 2019a). Under the technological perspective, technology providers (e.g., IBM) play the role of protagonist. In the holistic perspective, digital technologies are adopted to meet local development needs, be they of a social, economic or environmental nature. The approach for transforming cities consider the unique characteristics of each city and is grounded in participatory governance and open innovation.

For the purposes and context of this research, we adopted the holistic perspective of Chourabi et al. (2012), who see a smart city as a city that strives to become smarter in the sense of making itself more efficient, livable, equitable and sustainable. A 'smart city' is therefore understood as an aspiration/ambition (Nam and Pardo, 2011) or 'desirable direction for urban development' (De Jong et al. 2015, p. 34), instead of its current stage of maturity. Nam and Pardo (2011) argued that when a smart city is viewed in terms of intentions/ambition, the label smart city represents urban innovation. Urban innovation refers not just new ideas but new practices (Nam and Pardo, 2011), which are expected to lead to public value creation (Meijer, 2015; Neumann et al., 2019;

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Panagiotopoulos et al., 2019).

We build on Nam and Pardo (2011) and further contributions, which see smart cities as urban innovation, to frame this research (e.g., Camboim et al., 2019; Caragliu and Del Bo, 2019; Lee et al., 2014; Manville et al., 2014; Appio et al., 2019). Specifically, we considered that the smart city ambition is shaped by a set of specific, financially viable, achievable collaborative innovation projects/initiatives, which are ideally guided for an overarching vision, strategy and plan. An innovation project is defined in this research as an intentional effort to develop new solutions that improve public value (van Winden and van den Buuse, 2017; De Vries, Bekkers, and Tummers, 2016). These solutions disrupt existing practices and ways of thinking in a particular domain, although they may have been previously implemented in other contexts (Sørensen and Torfing, 2011).

Under this perspective, in which urban innovation is shaped through innovation projects that pursue public value creation, the government of the city becomes the main actor in the process of creating public value but not the only one (Meijer et al., 2016). The role of the (open) city government as the most active organization (Mora et al., 2019b) and leader/orchestrator of the process of innovation in cities is frequently viewed as essential in smart city research (see e.g., Giffinger et al., 2007; Meijer and Rodriguez Bolivar, 2016; Janssen and Helbig, 2018; Ojo et al., 2015; Soe and Drechsler, 2018; Esposito et al., 2021). Governments are the explorers commissioned by society to search for public value (Moore, 1995), the ones that can introduce the legislative changes necessary for some initiatives to advance, and manage public funds, which are crucial to finance many smart city-framed innovation projects in Europe and Spain (e.g., Europe's Horizon 2020 program, the European Regional Development Fund, and the Spanish Plan for Smart Cities) (Achaerandio et al., 2012; Van Winden and Van den Buuse, 2017).

Therefore, city governments are usually viewed as orchestrators of the processes of collaborative innovation necessary to develop and implement many smart city initiatives. However, collaborative innovation may be complex for city governments to orchestrate, and government leaders may lack the necessary capabilities and fail in many ways (Nam and Pardo, 2011; Ruhlandt, 2018). For instance, governments may be short of visionary thinking and breakthrough ideas, choose the wrong partners (Crosby et al., 2017), mistakenly orchestrate the relationships between them (Smith, 2004), be misguided by self-interested participants (Cabral et al., 2019), lack of vision and leadership (Nam and Pardo, 2011), and have insufficient absorptive capacity to understand the complex content and implications of the issue at hand (Neumann et al., 2019). Several authors question the public value generated to date by smart city initiatives and link this failure with governance weaknesses (Kummitha, 2018; Komninos et al., 2021). This is problematic as cities could be investing in innovation projects without capturing the expected benefits (Ruhlandt, 2018).

While the capabilities of local governments to orchestrate collaborative innovation projects are usually considered salient to explaining public value (Bryson et al., 2017; Cabral et al., 2019; Janowski et al., 2018; Pang et al., 2014), our systematic knowledge about which specific governmental capabilities lead to the public value of smart city-framed innovation projects remains limited (Neumann et al., 2019; Panagiotopoulos et al., 2019; Pittaway and Montazemi, 2020; Trivellato et al., 2019). We have taken a step forward towards covering this gap by responding to the next research question: Which government capabilities generate public value in smart city-framed innovation projects?

For this purpose, we devised a conceptual model in which a combination of first-order government capabilities shapes more complex (second-order) innovation capability mixes, which affect public value. We tested the model with a sample of 143 local government representatives who participated in smart-city framed innovation projects in Spain.

We adopted a three stage, deductive-inductive methodological approach. The deductive stage (first stage) was based on a review of previous literature on collaborative public innovation (e.g., Crosby et al., 2017; Hartley et al., 2017; Meijer, 2019), broader public innovation (e.g., Lewis, Ricard and Klijn, 2017), smart cities (e.g., Gil-Garcia et al., 2015; Meijer and Rodriguez Bolivar, 2016; Trivellato et al., 2019), and public value theory (Moore, 1995, 2005). This literature review led us to choose four internal (intra-organizational) and four external collaboration capabilities that have proven to be important in explaining public innovation success.

We also reviewed theories that explain change and innovation at a broader level, which led us to draw on dynamic capabilities theory (DCT), which suggests that the locus of innovation is in the mix of capabilities, instead of individual capabilities (Teece et al., 1997; Teece, 2009). In other words, the dynamic capabilities needed for innovation/change are complex combinations of basic resources and lower-order capabilities (Teece et al., 1997).

DCT has recently attracted attention in smart city literature (Chong et al., 2018; Klievink and Janssen, 2009; Linde et al., 2021; Luna-Reyes et al., 2020; Trivellato et al., 2019). However, previous survey research that considers DCT as a framework for explaining public innovation outcomes is scarce (Piening, 2013). Therefore, we did not have enough theoretical background to hypothesize (deduce) how governments combine the internal and extra-organizational capabilities found in the deductive phase. Consequently, in the second stage we used an inductive approach. Specifically, our empirical data were used to find out how local governments created second-order capabilities by mixing first-order capabilities when conducting specific innovation projects. We then tested what capability mixes led (or not) to public value creation (third stage).

Public value (i.e., the urban innovation outcome) is broadly defined in this research as producing what is good for the public (Moore, 1995, 2005; Alford and O'Flynn, 2009; Meynhardt, 2009; Benington and Moore 2011). Bryson et al. (2014) suggest that public value creation requires what is good for the public to be co-determined (in networks) and pursued, which fits the holistic view of smart cities. The concept of public value is relatively vague and fuzzy, and has been rarely operationalized in concrete terms (see Ju et al., 2019, and Tarrant et al., 2003, as exceptions). We draw on previous research that discusses public value (e.g., Kelly et al., 2002; Twizeyimana and Andersson, 2019) and smart city outcomes (e.g., Gil-Garcia et al., 2021; Mora et al., 2019b) to suggest that, in smart city contexts, public value may be broadly categorized in three dimensions: efficiency-related value (e.g., reducing the cost of street lighting, cost reduction in waste management); effectiveness-related value (i.e., meeting previously unmet needs or improving the quality with which traditional services are provided; e.g., virtual and friendly access to information and public services); and societal challenges-related value (e.g., better protection of cultural heritage, improving social inclusion, higher entrepreneurial opportunities, CO2 emissions reduction).

As innovation projects are of a different nature, we controlled for the effect of project type in our results. While recognizing that project type may be defined by multiple criteria and categorizing projects is problematic, we considered two typologies. Firstly, we adapted the broadly used categorization from Giffinger and colleagues (Giffinger et al., 2007; Giffinger and Gudrun, 2010), referring to the purpose of the project: smart economy, smart mobility, smart environment, smart people, smart living and smart governance. Secondly, building on Mergel et al. (2019), we considered four categories that focus on the technological (or not) content of the innovation: digital relationships, digital services, other new technology-based projects, and projects that do not rely on new technologies.

The study provides a threefold contribution: conceptual, empirical and managerial. From a conceptual perspective, we provide a deeper understanding of both innovation-related capabilities of governments and public value, and their relationships, addressing the related claims of several researchers (e.g., Mergel et al., 2019; Mora et al., 2019b; Neumann et al., 2019; Panagiotopoulos et al., 2019). From an empirical perspective, we provide an empirical text involving a relatively large-n

of participants in real-world smart city-framed innovation projects, and an estimation of the specific effects of the various capability mixes and project types considered. From a practical perspective, this research provides public managers with insights on how to combine internal and collaborative capabilities to create public value through service innovation.

The remainder of the paper is structured as follows. Section 2 discusses the major concepts that form the basis for this research (i.e., smart cities, capabilities and collaborative innovation). Section 3 provides the conceptual framework and justifies the first-order capabilities and project types considered in this research. Section 4 examines the methodological issues. Section 5 describes the results of the empirical testing. Sections 6 and 7 present points for discussion, and conclusions and avenues for further research, respectively.

2. Theoretical background

This section summaries the conceptual background related to smart cities, public value, public value governance, and resource-advantage and dynamic capabilities theories.

2.1. Smart cities

In this research, we adopt a holistic perspective of smart cities. Within this perspective, Caragliu et al., 2011 p.70) consider "a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance." This concept embraces a multidimensional view of smart cities by incorporating the technological, human and collaborative dimensions of smart cities, and stresses that smart cities pursue smart purposes such as sustainable economic growth and a high quality of life. Under this perspective, progress towards smartness is usually understood as involving the six dimensions proposed by Giffinger et al. (2007): economy, mobility, environment, people, living, and governance (Appio et al., 2019).

Our approach is similar to the ones proposed by Manville et al., (2014); Camboim et al., (2019) and Mora et al., (2019b). These authors adopt a holistic perspective, and attach particular salience to innovation projects/initiatives and the role of government and participatory governance.

Manville et al., (2014), studied 20 smart cities in Europe. They viewed smart cities as those seeking to address public issues through smart solutions based on the creation of human capital, social capital (e.g., multi-stakeholder, municipally based partnerships), and a technological infrastructure (particularly, ICT infrastructure). In their view, these solutions are developed and refined through smart city innovation projects or initiatives, which they categorized under the six dimensions proposed by Giffinger et al., (2007). These dimensions were viewed by Manville et al., (2014) as the ends/purposes for which stakeholders participate in a smart city project (e.g., to solve a mobility issue). They viewed the success of a smart city as dependent on the depth and effectiveness of each project, and on the coherence or balance of the portfolio of projects across the city.

Camboim et al., (2019) studied smart city initiatives in Amsterdam, Barcelona, Lisbon, and Vienna. They saw a smart city as an urban innovation ecosystem. They proposed that any city that wants to be smarter needs to develop smart city projects following a comprehensive plan. This plan should contain a broad vision, strategies, policies and goals for the city of the future. They considered it remarkable that the government should not be the unique transformation agent. The government should create an alternative governance model that stimulates community engagement. They also contended that, after that, the city should start initiatives on different scales and with different scopes in order to achieve those goals defined in the strategic plan.

Mora et al., (2019b) analyzed four best practices in Europe (Amsterdam, Barcelona, Helsinki and Vienna) and found that smart city development in these cities had been enabled by the continuous implementation of short and medium-term ICT-related interventions that had gradually transformed the cities into smart environments. They formulated a set of strategic principles that cities should consider in order to become smarter, including: looking beyond technology (holistic approach), moving towards a quadruple-helix collaborative model, combining top-down (government-led) and bottom-up (community--driven) contributions, and building a smart city strategic framework.

2.2. Public value

The main purpose of city governments is to create public value (Moore, 1995; Meynhardt, 2009). Despite the broad and growing attention paid to the public value theory, there is still no clear, shared understanding of what public value is (Bryson et al., 2017; Panagiotopoulos et al., 2019). We build on Moore (1995, 2005) and related works (e.g., Alford and O'Flynn 2009; Meynhardt, 2009; Benington and Moore 2011) to define public value as producing what is good for and positively valued by the public.

In his seminal contribution, Moore (1995) argued that the creation of public value is the central activity of public managers, just as the creation of private value is at the core of a private sector manager's role. His work generated a great deal of research that has extended the idea that creating public value is the core mission of public sector organizations (PSOs). He viewed value as arising through activities (e.g., innovation projects), which are judged on whether they add (create) public value or not.

While Moore's definition of public value is relatively vague, he highlighted specific forms of public value, including efficiency, effectiveness, and other higher-order forms, such as accountability, fairness and justness (Moore, 1995, 2005). Similar forms of public value were considered by Kelly et al., (2002) in their study for the UK Cabinet Office. They described public value as being made up of the value inherent in public services (service quality, efficiency and effectiveness), the higher order aspirations of societies, such as poverty reduction and public health, and trust, legitimacy and confidence in government. In the field of digital governance, Twizeyimana and Andersson (2019) conducted a literature review on public value and suggested that achieving public value should be understood as improving efficiency in government, and improving services to citizens and social values, such as inclusion, democracy, transparency, and participation. Ju et al., (2019) saw public value creation as the efforts made to improve the efficiency or effectiveness of governance or to increase societal fairness and democracy. Meynhardt (2009) used the term public "values" and suggested that they may involve different dimensions such as service quality, integrity, or equal opportunities. Cole and Parston (2006) referred to productivity (efficiency), service quality (effectiveness), outcomes (contribution to societal challenges) and democracy.

In smart city literature, smart city outcomes have been approached in different ways. Meijer and Rodriguez Bolivar (2016) see public value as the outcome of smart city governance, but do not provide a definition of public value. Castelnovo et al., (2016) describe public value in terms of the outcomes (direct short term effects) and long term impacts of the initiatives implemented. Dameri and Benevolo (2016) emphasize a combination of economic and social value creation. Neumann et al., (2019) recognize the fuzziness of the concept of public value and state that it may refer to different dimensions such as service quality, integrity, equal opportunities and citizen involvement.

Many authors refer to the benefits expected by specific smart-city initiatives, without mentioning public value. Komninos et al., (2021) refer to efficiency gains (reduction in costs, time gained) and effectiveness. Gil-Garcia et al., (2021) classify the benefits of information sharing in megacities into three categories: efficiency, effectiveness and service quality. Barba-Sánchez et al., (2019) see entrepreneurial opportunities

as an outcome of smart city development.

Mora et al., (2019b) classified the smart city activities of the four benchmark cities they studied in 11 categories and identified the outcomes pursued. While they did not refer to public value, the outcomes they described may be summarized as pursuing three forms of public value: efficiency (cost savings), effectiveness (service improvement) and societal challenges (sustainability, social inclusion). Efficiency is pursued, for instance, by energy networks-related initiatives that reduce the cost of street lighting, water-related initiatives that improve water resource management, and waste-related initiatives that improve waste management processes. Effectiveness is sought, for instance, by safety and security-related initiatives that ensure safety and security in urban spaces, air-related initiatives that improve air quality, and e-government-related initiatives that increase the convenience and accessibility of public services and information to city users. Response to societal challenges is pursued, for instance, by energy networks-related and mobility/transport-related initiatives that enhance sustainability, cultural heritage-related initiatives that improve the protection of cultural heritage and enhance their cultural value, and social inclusion-related initiatives that support social inclusion. While innovation projects can pay particular attention to one public value dimension, they may have the potential to contribute to various outcomes. For instance, street lighting initiatives may reduce costs (efficiency), improve the pedestrian experience (effectiveness) and contribute to sustainability (societal challenge).

Public value is, therefore, understood in this research as the value created (added) by public governance through service innovation (in our sample mostly ICT-enabled). The literature reviewed above led us to conclude that most conceptualizations related to the public value of service innovation involves efficiency, effectiveness or service quality, and other higher-order and/or long-term values or aspirations.

2.3. Governance of public value: collaborative innovation

This study analyzes smart cities from the perspective of a focal stakeholder: the city government. We use the term 'government' for simplicity. However, it is understood in a broad sense by including its majority-owned subsidiaries and external agencies. Sometimes these agencies are created to deal with the complexities inherent to urban innovation and smart city projects. The government is not viewed as an isolated/hierarchical actor, but as an open or networked innovator that participates in (and may orchestrate) innovation networks to improve processes, services and public policies, and co-create public value.

Moore (1995) focused on governments and public managers. He suggested that public managers need specific organizational capacities and resources to create value. The public value theory sees managers as agents who have discretion, democratic values, and accountability (Moore, 1995, 2000; Moore and Hartley, 2008). However, public managers and their organizations may be short of visionary thinking and breakthrough ideas, and may lack the necessary knowledge of the issue at hand, the costs, risks and benefits of alternative solutions, the drivers and obstacles to innovation, and the way that the latter could be overcome (Crosby et al., 2017).

Therefore, public managers cannot create public value alone and need to adopt collaborative governance approaches (Meijer et al., 2016). Collaborative governance is broadly understood in this research as smart, multi-actor, urban collaboration in networks (Meijer and Rodriguez Bolivar, 2016) addressed to create public value (Meijer et al., 2016). More specifically, we focus on collaborative innovation (Hartley, Sørensen, and Torfing, 2013; Sørensen and Torfing, 2011, 2012; Torfing, 2019), which has been defined as "multi-actor collaboration that […] may foster innovation by bringing together public and private actors with relevant innovation assets" (Sørensen and Torfing, 2012, p. 1). Collaborative innovation involves connecting the resources and perspectives of various knowledge centers of the city into action (Meijer and Rodriguez Bolivar, 2016).

Systemic (Gloor, 2006; Hekkert et al., 2007) and collaborative approaches to innovation (Gieske et al., 2016; Hartley, Sørensen, and Torfing, 2013) suggest that collaborative innovation is a superior form of innovation (Meijer, 2019; Trivellato et al., 2019). Collaborators are able to contribute the various resources, perspectives, and knowledge types that are necessary for developing and implementing innovation initiatives aimed at solving complex societal problems (Sorensen and Torfing, 2011). Under this perspective, smart cities are perceived as collaborative ecosystems that facilitate innovation, by creating links between citizens, government, businesses, and educational institutions/research centers (Su et al., 2018; Appio et al., 2019).

Several authors have discussed the link between collaborative governance and public value. Stoker (2006) linked public value management with forms of network governance. In attempting to define what he labelled an alternative 'public value paradigm', he argued that government activity is interconnected and interdependent and, as such, may require a more collaborative effort in the pursuit of public value. He contended that public managers should be able to manage through networks, be open to learning, and draw in resources from various sources.

Bryson et al., (2014) used the term 'public network governance' to rethink the role of the public manger within the scope of public value creation. In what they labelled a 'new approach to public governance', public managers are viewed as oriented towards creating public value and encouraged to build collaborative arrangements and involve citizens in defining and achieving mutually agreed goals. Crosby et al., (2017) explored how public value creation may be achieved through collaborative innovation. They focused on top managers and their capacity to lead what they call 'distributed processes of collaborative innovation.' Top managers were described as the principal architects or leaders of collaborative and creative processes, but not directors in a command-and-control sense.

Meijer (2015) built on the broad literature that focuses on government barriers to digital government transformation. He suggested that the central idea of this literature is that government barriers can be overcome if key organizational actors are willing to support the innovation process and if the contributions of these actors can be managed properly. Meijer (2015) contended that government managers and citizens are not motivated by the promise of technology but by frames that connect technological opportunities to the production of public value. A case study of a technological system for collaboration between police and citizens in The Netherlands confirmed his literature-driven view. Janssen and Helbig (2018) conducted two case studies and found some evidence of a shift from expertise-based policy-making toward orchestration by policy-makers. They suggested that as orchestrators, policy-makers engage stakeholders, oversee the policy-making process, and assure quality engagement activities.

The contributions from Meijer (2015) and Janssen and Helbig (2018) represent many studies that embrace a collaborative approach to smart cities (see also, Gil-Garcia et al., 2015; Jiang et al., 2019; Meijer, 2018). This perspective emphasizes that social change should come primarily through collaboration between the different stakeholder groups in the local sphere, highlighting the interlinked nature of the innovation dynamic that constitutes a smart city (Capdevila and Zarlenga, 2015; Lara et al., 2016; Meijer and Rodriguez Bolivar, 2016). Meijer and Rodriguez Bolivar (2016) view collaborative innovation as superior in terms of both process legitimacy (citizen participation) and outcomes legitimacy (public value creation).

2.4. Capabilities: resource-advantage theory and dynamic capabilities theory

The view of smart cities as urban innovation leads attention towards the capabilities of governments to devise public value-driven innovation projects and conduct them successfully (Gieske et al., 2016; Meijer, 2019; Trivellato et al., 2019). However, Panagiotopoulos et al., (2019)

suggest that the capabilities required to develop, support and sustain smart city initiatives in government are often overlooked.

Collaborative innovation may be complex for governments to orchestrate (Torugsa and Arundel 2016). Crosby et al., (2017) suggest that government leaders may be near-sighted in the sense that they may not see potential partners inside or outside their organization that can help to build urban transformation. They must also take care that collaborations lead to public value creation rather than the particular business value of self-interested participants, learn how to manage potential conflicts, and encourage partners to contribute to innovation and public value creation (Cabral et al., 2019; Neumann et al., 2019). Smith (2004) argued that managing collaborations puts considerable strain and pressure on public managers through increased emphasis on managing complex relationships and ultimately on defining public value. He then questioned whether governments really have the managerial capability to deal with the issues confronting them. Neumann et al., (2019) conducted a comparative case study in the context of smart city initiatives with four cases in Swiss local governments. They argued that the capabilities necessary to lead smart city initiatives are usually beyond the scope of the knowledge base and absorptive capacity of many municipalities. Consequently, public managers need to strive to put the right mix of capabilities in place to successfully manage and integrate such collaborations to create public value.

The view of capabilities adopted in this research builds on resource-advantage (R-A) theory (Hunt and Morgan, 1996) and DCT (Teece et al., 1997). R-A theory was chosen because it is an evolutionary theory of organizations, in which organizations are continuously involved in innovation and organizational learning to improve their performance (Madhavaram and Hunt 2008). Organizations are viewed as using and extending their resources and capabilities wisely (Hunt and Morgan, 1996). Capabilities are understood as higher-order resources or bundles of basic resources (Madhavaram and Hunt 2008). A capability is made up of socially complex combinations of tangible and intangible basic resources that fit together coherently, and, often, in a synergistic manner (Madhavaram and Hunt 2008). Capabilities are expected to enable organizations to produce efficiently- and/or effectively-valued offerings (Mikalef et al., 2020; Wamba et al., 2017). Public managers' availability per se, for instance, is a basic resource, and cross-functional collaboration is a capability. Cross-functional collaboration requires not only the mere presence of public managers in the PSO (a basic resource), but also motivational, cultural and organizational resources that foster collaboration. R-A theory proposes that capabilities could be categorized according to their level of complexity, with higher-order capabilities being more complex, often synergistic and more difficult to create than lower-order ones (Madhavaram and Hunt 2008). For instance, cross-functional collaboration could be viewed as a relatively low-order capability when compared with the higher-order capability of mastering the combination of cross-functional collaboration and citizen collaboration.

DCT describes the ability of organizations to adapt their resources and capabilities to rapidly changing environments (Eisenhardt and Martin, 2000; Winter, 2003; Pablo et al., 2007; Teece, 2009). Teece et al., 1997 p. 516),) defined dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments." Dynamic capabilities are different from ordinary (operational) capabilities by being concerned with change (Drnevich and Kriauciunas, 2011; Winter 2003). According to Madhavaram and Hunt (2008), a capability is considered dynamic if, in rapidly changing environments, it enables the organization to adapt itself to improve its own circumstances and the circumstances of its customers (citizens in our context) through innovation/change (e.g., new service offerings). As public sector innovation management has been viewed as particularly complex (see e.g., Torugsa and Arundel 2016; Demircioglu and Audretsch 2017), this study focuses on dynamic capabilities.

R-A theory and DCT are consistent in their view of different levels of capabilities. Teece (2009) used the term 'co-specialization' to refer to synergistic combinations of complementary resources that are more valuable in combination than in isolation. He also referred to asset orchestration, which he viewed as involving the managerial search, selection, and configuration of resources and capabilities, leading to a whole that is more valuable than the sum of the parts.

When trying to identify the most salient dynamic capabilities, Teece (2009) focused on an organization's agility to (1) sense and shape opportunities and threats, (2) seize opportunities, and (3) enhance, combine, and, when necessary, reconfigure the organization's intangible and tangible resources to enhance organizational responsiveness (he refers to competitiveness). He highlighted external collaborations and partnerships as a source for organizational learning, the creation of new resources through the integration of external activities and technologies (by means of alliances, for instance) and the transformation of existing resources. We are consistent with this approach by considering a set of external collaboration and internal capabilities that are expected to be combined in the form of capability mixes. A capability mix is understood as a specific combination of capabilities, in which some capabilities are applied at comparatively average or low levels and others at outstanding levels (Edmondson et al., 2019). We focus on capability mixes (second-order capabilities), instead of individual (first-order) capabilities for two reasons. Firstly, this approach is more consistent with the systemic view of resources/capabilities and partners underlying the frameworks of collaborative innovation and governance reviewed in this section (Bryson et al., 2017; Crosby et al., 2017). Secondly, DCT suggests that dynamic capabilities that are required for change are complex, idiosyncratic and path dependent, and are built by purposefully creating, extending, and modifying the resource base and recombining basic recourses and (lower-order) capabilities (Eisenhardt and Martin, 2000; Madhavaram and Hunt 2008; Wamba et al., 2017).

The application of DCT to public innovation and smart cities is scarce. Janowski (2015) and Klievink and Janssen (2009), applied DCT to show that smart city initiatives evolve through increasing levels of complexity that require the creation and combination of recourses, leading to new capabilities. A few studies have applied DCT to the understanding of innovation processes in city governments in Germany (Ridder et al., 2005), Italy (Trivellato et al., 2019; Trivellato et al., 2021) and Mexico (Luna-Reyes et al., 2020). Overall, these studies are consistent with Teece (2009). They focus on how governments use their capabilities to recognize, identify and gather knowledge (i.e., sensing or acquiring knowledge), interpret knowledge in context (i.e., seizing or assimilating knowledge), and use, convert and reconfigure knowledge (i.e., knowledge transformation and exploitation). Luna-Reyes et al., (2020) suggested that while knowledge acquisition and assimilation involve a potential capability, knowledge transformation/exploitation involve a realized capability. This view suggests that dynamic capabilities are not only externally oriented but also involve internal processes and capabilities (e.g., absorptive capacity, teamwork) (Trivellato et al., 2019). While knowledge acquisition is mostly related to external collaboration capabilities, knowledge assimilation and transformation/exploitation are more linked to internal capabilities (Luna-Reyes et al., 2020). The above studies coincide in suggesting that the application of dynamic capabilities is addressed to create public value (Luna-Reyes et al., 2020; Trivellato et al., 2019; Trivellato et al., 2021).

This view is also shared by other authors that focus on public innovation capacity, without focusing on DCT (Gieske et al., 2016; Piening, 2013; Meijer, 2019). Gieske et al., (2016) developed a multi-level model of public innovation capacity that highlights the importance of intra-organizational resources and external networks in public innovation. This capacity, as Gieske et al., (2016) indicate, entails the capacity to connect and facilitate collaboration, the capacity to absorb new knowledge and the capacity to apply knowledge. These different capacities are needed to enable the (continuing) realization of public innovations. Similarly, Meijer (2019) referred to mobilizing,

experimenting and institutionalizing.

Panagiotopoulos et al., (2019) proposed a conceptual framework that links technology, government capabilities, services and public value creation in the context of digital government. They argued that the level of public value creation is driven by the capabilities of public managers involved in the co-creation processes of public value and their organizations. The idea that public value is affected by government capabilities (intra-organizational and external) is also implicit in the broader field of research on public innovation. Lewis et al. (2017) conducted a literature review on public sector innovation, and suggested that the innovation capacity of PSOs depends on: (1) leadership (i.e., the qualities and capabilities of senior individuals within the organization), and other internal innovation drivers (i.e., other internal resources, including structures, processes and contextual factors that help/ hinder innovation); and (2) external networking (i.e., the intensity and quality of communication external to the organization).

3. Conceptual framework

The conceptual framework draws on the literature discussed in Section 2. It recognizes that both intra-organizational and external collaboration capabilities are necessary to create dynamic capabilities. This proposal builds on pioneering contributions on dynamic capabilities by Teece and colleagues (Teece et al., 1997; Teece, 2009) and recent studies that apply this perspective in smart city contexts (Luna-Reyes et al., 2020; Meijer, 2019; Trivellato et al., 2019; Trivellato et al., 2021). The framework also proposes a link between dynamic capabilities and public value creation, which is also consistent with the above smart city-framed contributions. Lastly, the framework recognizes that project type may affect public value (Panagiotopoulos et al., 2019). More specifically, the model proposes that twelve first-order capabilities (four intra-organizational and eight external) are combined to create an inductively determined number of second-order capability mixes. The latter lead to three forms of public value. Also, six purpose-related and four technological content-related project types are also expected to affect public value. This section is addressed to justify the twelve specific first-order capabilities and ten project types chosen (see Fig. 1).

3.1. Government capabilities: first-order explanatory variables

As suggested by previous literature (e.g., Gieske et al., 2016; Luna-Reyes et al., 2020; Meijer, 2019), we made a distinction between external collaboration capabilities and internal capabilities.

3.1.1. External collaboration capabilities

Public innovation literature consistently indicates that one crucial capability of innovators should be the management of external searching of resources (Cinar et al., 2019). Many sources of potentially useful resources (particularly, knowledge) are available to municipalities. Building on the quadruple helix approach (Carayannis and Campbell, 2009), which has been implemented by some leading smart cities (e.g., Amsterdam; see Camboim et al., 2019), our framework considers four groups of stakeholders. Specifically, citizens/local society (which are widely understood as families, businesses, representatives of local associations and non-governmental organizations [NGOs]), providers/suppliers, experts (i.e., consultants, researchers and technicians) and peer governments. Municipalities may differ in their level of capability to collaborate with these stakeholders (which have different, often conflicting, agendas and goals) (Gil-Garcia and Sayogo, 2016; Klievink

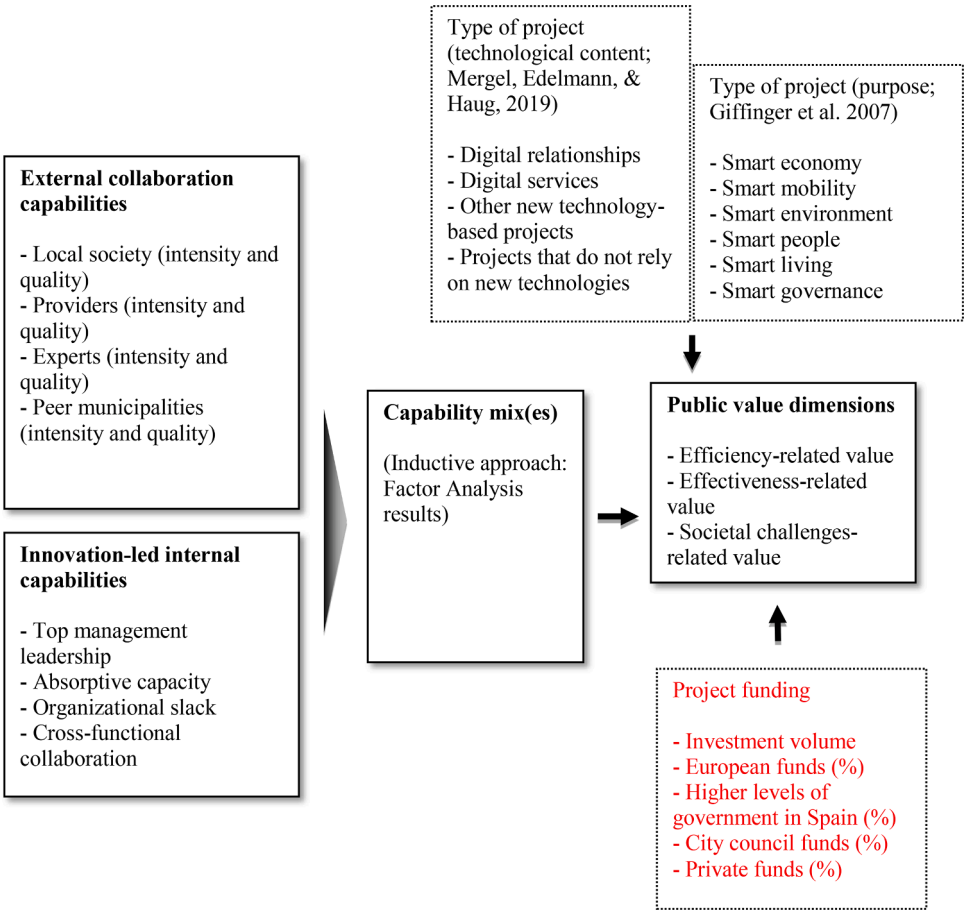

Fig. 1. Proposed framework.

and Janssen, 2009). Among others, Cinar et al., (2019) highlighted the difficulties faced by PSOs when managing relationships with collaborators in collaborative innovation processes, demonstrating that PSOs need to develop external collaboration capabilities (see also Cabral et al., 2019; Neumann et al., 2019; Pittaway and Montazemi, 2020; Westerman et al., 2014). Therefore, this study considers four first-order external collaboration capabilities: citizen/local society, provider, expert (e.g., university, consultants) and peer governments.

3.1.1.1. Citizen/local society. Citizen collaborative capability is the municipality's quality of knowing which local stakeholders/users are capable of contributing useful knowledge and involving the 'right' local stakeholders/users in the innovation process, using them to foster change (Lusch et al., 2007). This capability has two components: intensity and quality. Citizen collaboration intensity refers to the frequency of meetings and time devoted to working with the appropriate citizens. Citizen collaboration quality refers to the fluidity of relationships with citizens and the value of contributions derived from the collaborative process. Both citizen collaboration intensity and quality should be important in creating public value, when properly mixed with other capabilities.

There is a great deal of literature that implicitly or explicitly suggests that collaboration with users (and arguably citizens) leads to knowledge enhancement and innovative solutions (Von Hippel, 2005; Arundel et al., 2015). In the context of smart cities, exemplary contributions include Schuurman et al., (2012), Lee et al., (2014), Chong et al., (2018), Neumann et al., (2019), De Guimarães et al. (2020), Pittaway and Montazemi, 2020, and Johnson et al., (2020). Referring to collaboration with users, Von Hippel (2005) suggested that consumers (and arguably citizens) are increasingly able to innovate for themselves, particularly 'lead-users.' Other authors focus on 'crowd-sourcing' large networks of people for the innovation process by using ICTs (Eiteneyer et al., 2019; Howe 2006; Schuurman et al., 2012). Crowdsourcing and citizen centricity in its different forms are closely associated to the concept of public value. Gil-Garcia et al., (2016) suggest that public value involves knowing what citizens want and use ICTs to understand and fulfill citizens' needs and desires. Lee et al., (2014) saw the city as a technologically-enabled value co-creation platform that facilitates information-sharing and collaboration (e.g., apps that make public data and real-time user-generated information available and can in turn stimulate people's creativity). Chong et al., (2018) stressed the increasing role of citizens in value co-creation by suggesting that as a city moves into digital government, citizen engagement moves from public as participant to co-design and co-production of government functions, utilizing user-generated content or engaging citizens in the co-creation of public services. De Guimarães et al. (2020) studied a sample of 829 inhabitants of a city in Brazil and found that collaboration with citizens contributes to quality of life in the context of smart cities.

All these interrelated views suggest that municipalities need to develop citizen collaborative capabilities. However, the capacity to collaborate with citizens is heterogeneous between municipalities. Specific strategies and practices are needed to get citizens involved, including facilitating access to the required technology, investing in citizens' skills (e-literacy), segmenting citizens and contacting them through different media (Meijer 2015). Despite these difficulties, the intensity and quality of citizen collaboration, when properly mixed with other capabilities, are expected to positively influence public value creation (Chong et al., 2018; Gil-Garcia et al., 2016; Lee et al., 2014; Meijer 2015; De Guimarães et al. 2020).

3.1.1.2. Providers. This research conceptualizes collaboration with other partners (i.e., providers/suppliers, experts, and peer municipalities) in a similar way to that of citizen collaborative innovation (i.e., the quality of knowing and involving the 'right' partners in the innovation process and using them appropriately as mechanisms for change). Collaboration with other partners is also a potential source of knowledge for public service innovation, as value is always co-created (Vargo and Lusch 2016). Lusch et al., (2007) suggest that the capability to involve 'business' partners and use them to foster change (i.e., external collaboration capability) is at the core of effective service innovation processes. The capability to collaborate with other partners also has two components: intensity and quality.

The extant literature stresses suppliers' contribution to the innovation process. The stream of research that emphasizes using public procurement to foster innovation is a relevant example (Edler and Georghiou 2007; Edquist and Zabala-Iturriagagoitia 2012; Uyarra et al., 2014). Edler and Georghiou (2007) suggested that purchasing innovative solutions offers strong potential for improving public services. Edquist and Zabala-Iturriagagoitia (2012) contended that innovation-oriented public procurement contributes to meeting unsatisfied human needs and solving societal problems. Suppliers are very interested in participating in co-creation processes with municipalities to create shareholder value. They usually stimulate different changes in the municipalities that fit their knowledge and skills, intending to improve their relationships with the municipalities (Afuah, 2000). As suppliers compete with each other, they are highly interested in contributing the best of their knowledge to municipalities. Usually, many potential suppliers compete for the same municipal project, meaning that different perspectives (knowledge bases) enter into the innovation process. This may lead to high levels of knowledge enhancement and innovative solutions (Ordanini and Parasuraman 2011). Collaboration with suppliers may also involve significant monetary resources of the municipality and a high perception of risk, which leads to intense contractual relationships, in which in-depth knowledge transfer and knowledge recombination and integration occur.

Despite the above considerations, which support the potential contribution of suppliers to the public value of innovation, Pittaway and Montazemi (2020) studied the collaboration of 11 Canadian local governments with large providers, in the context of digital transformation (they focused on SAP, which is the largest software company in Europe), and found discouraging conclusions. They found that collaboration was complex to manage and that public managers lacked the necessary knowledge and skills to conduct it successfully (i.e., to co-create the necessary knowledge). They explained that providers need to acquire a deep knowledge of the specific characteristics and organizational processes of each municipality, which requires intense and quality-embedded collaboration that is difficult to find in practice. They also suggested that, while it is usual to outsource many IT services, public managers should develop the core competence of choosing the most rewarding innovations and the best plans for implementing these innovations (Pittaway and Montazemi, 2020). However, some evidence exists that collaboration with providers, in the context of smart city initiatives, is related to positive outcomes. For instance, Manville et al., (2014) studied 20 smart cities in Europe and found that smart city initiatives involving the participation of international commercial technology providers benefit from scaling. Therefore, despite the difficulties involved in supplier management, we expect intensity and quality of provider collaboration to contribute to public value creation, when properly managed and mixed with other capabilities.

3.1.1.3. Experts. Experts' contributions to innovation processes have also been emphasized, albeit more recently and to a greater extent. Experts may provide different views and/or specific pieces of knowledge that are necessary for enriching some parts of the project. For instance, Demircioglu and Audretsch (2019) suggested that universities may play a key role in generating innovative activity in public organizations and influencing the nature of innovations, while Etzkowitz, and Zhou (2017) stressed the salience of a triple helix of innovation in which universities, industry and government innovate together. Pittaway and Montazemi (2020) also attributed a role to local universities in the smart

transformation of government. They suggested that municipalities should work with universities to develop a knowledge base specific to the municipal context, and work with academic institutions to design executive education programs specifically for smart governments. However, perspectives of universities and municipalities are not easy to integrate in practice in the form of effective collaborations. Despite these challenges, we expect expert collaboration intensity and quality to contribute to public value creation, when properly managed and mixed with other capabilities.

3.1.1.4. Peer governments. Academics (e.g., Allen et al., 2001) and practitioners (for instance, the United Nations' claims at its summits) have considered inter-municipal networking to be an appropriate response to palliate many municipalities' weaknesses in terms of knowledge (and other resources) when tackling important problems such as climate change and digital transformation. By entering into collaborative arrangements, municipalities may share resources (especially knowledge) and risks and co-create new knowledge. However, these collaborations involve a lot of costs and difficulties (e.g., reluctance to share knowledge for fear of losing a position of privilege without obtaining returns) and are thus heterogeneously managed by the different governments (Pittaway and Montazemi, 2020). Therefore, some conditions that are difficult to find in practice are necessary, such as shared vision, network identity, trust, and extrinsic incentives to collaborate facilitated by higher tiers of government. Despite these difficulties, the intensity and quality of peer government collaboration are expected to contribute to public value creation, when properly managed and mixed with other capabilities.

3.1.2. Innovation-led internal capabilities

Innovation-led internal capabilities are understood as combinations of organizational resources that enable the integration of external knowledge with internal knowledge in the form of service innovation. These capabilities allow public managers to scrutinize external information and understand what pieces of knowledge may be useful in the service innovation process. In this way, they can interpret and articulate the relative importance of the heterogeneous pieces of knowledge that are gathered and devise ways to integrate and exploit this knowledge (Gil-Garcia and Sayogo, 2016; Zahra and Nielsen 2002). Innovation-led internal capabilities are hard to develop and sustain, heterogeneous between municipalities, and have been viewed as interlinked with public value creation (Panagiotopoulos et al., 2019).

This study builds on previous literature on smart cities and broader service and public service innovation to choose four internal capabilities: top management leadership, absorptive capacity, organizational slack for exploration and cross-functional collaboration. These capabilities were chosen after reviewing previous work in the fields of public sector innovation and smart cities (see below) and identifying the most stressed factors.

3.1.2.1. Top management leadership. Top management supportive leadership (referred to hereinafter as top management leadership, for simplicity) is understood as the style of leadership implemented by top managers that provides informational, instrumental and emotional support to high- and middle-level public managers (House, 1981). This style of leadership points to public managers' perception of having the necessary power to make decisions and being confident that top managers share the responsibility for the success or failure of the project with the project team and would support them if something went wrong (Pinto and Prescott 1990). Top managers are usually politicians, although they could be high-level technicians in big municipalities. As integrating external knowledge is a complex time-, effort-, money- and risk-intensive process that requires high managerial involvement (De Luca and Atuahene-Gima 2007), and disconfirmation of managers' old cognitive frameworks (Pittaway and Montazemi, 2020), this study views top management leadership as a prerequisite for successful knowledge co-creation (Eynon and Margetts, 2007; Feldman and Khademian, 2007; Gil-Garcia and Sayogo, 2016). This view is pretty consistent with extant smart city literature and public service innovation research (e.g., Arundel et al., 2015; Borins 2002; Chen et al., 2019; Gil-Garcia and Sayogo, 2016; Lewis, Ricard, and Klijn, 2017; Mergel, 2018; Pärna and Von Tunzelmann 2007). Sørensen and Torfing (2011) highlighted cultural barriers to innovation (e.g., technology reluctance, fear that technology may replace people, older staff and staff in senior positions feeling threatened by large-scale technology-induced work changes, bureaucratic culture), which could be overcome when top management leadership is in place. A broad variety of barriers to innovation may result in a reluctance by top managers to experiment, devote organizational resources, and only make these resources available if new technologies have proven their value beyond doubt (Eynon and Margetts, 2007; Meijer, 2015; Mergel, 2018; Pittaway and Montazemi, 2020). When considered together, the above comments suggest that top management leadership is a crucial resource for public value creation, when properly mixed with other capabilities.

3.1.2.2. Absorptive capacity. Absorptive capacity refers to the knowledge base of the municipality as an organization and, in particular, the municipal managers involved in the innovation project and their consequent capability to properly, and relatively quickly, understand pieces of information and knowledge and identify, interpret and analyze the implications involved and their possible effect on the municipality (Jansen et al., 2005; Zahra and George 2002). Because external knowledge may be disperse, overwhelming, uncertain, sticky, complex and biased in terms of benefitting the interests of informants, this research views absorptive capacity as a key internal capability to discard useless and biased knowledge and focus on and integrate appropriate external knowledge (Klievink and Janssen, 2009; Pittaway and Montazemi 2020). These barriers could be perceived as particularly high when ICTs are involved. For instance, Moon (2002) and Raus et al., (2009) highlighted the relevance of lacking technical (and managerial) knowledge as a barrier to e-government adoption. Similarly, Gil-Garcia and Pardo (2005) referred to the lack of technological skills within project teams and shortages of qualified technical personnel as important barriers to e-government projects (see also, Lee and Kim, 2006). Neumann et al., (2019) found that the inherent complexity of some smart city initiatives was coupled with the insufficient absorptive capacity of governments, which led to poor outcomes. More broadly, Cinar et al., (2019) conducted a literature review on public sector innovation and found that a lack of skills, knowledge and expertise (i.e., absorptive capacity) appears in many studies as a significant barrier to innovation. Thus, absorptive capacity is viewed here as a key organizational capability to explain public value creation, when properly mixed with other capabilities.

3.1.2.3. Organizational slack for exploration. Organizational slack is understood here as uncommitted resource availability (people, time, ICT facilities and money) to support new strategic initiatives such as innovation projects (De Luca and Atuahene-Gima 2007; Salge, 2010). Collaborative processes are complex and resource-intensive, and therefore inaccessible to municipalities with tight resources (Gil-Garcia and Sayogo, 2016; Salge, 2010). De Vries, Bekkers and Tummer (2016) contended that the availability of organizational resources, especially in terms of organizational slack, is the most frequently mentioned antecedent of public innovation performance. Cinar et al., (2019) drew similar conclusions in their literature review. Accordingly, organizational slack is viewed here as a crucial resource with which to face the complexity and uncertainty associated with knowledge searching and integration, leading to public value creation, when included in an appropriate innovation capability mix.

3.1.2.4. Cross-functional collaboration. Cross-functional collaboration refers to the degree of collaboration, the extent of representation and the contribution of relevant functional units to the public service innovation process (Li and Calantone, 1998). The transfer of knowledge among functional units is often costly, ambiguous and uncertain because of the diversity of functional information, backgrounds and experiences (Pittaway and Montazemi, 2020). This complicates analysis and interpretation and reduces the likelihood of novel (re)combinations of municipal knowledge (Galunic and Rodan 1998). Cross-functional collaboration ensures regular interactions that enable the flow, recombination, and integration of knowledge from different functions (Layne and Lee, 2001). Cross-functional collaboration improves the efficiency and effectiveness of knowledge use and allows for quality decision-making regarding knowledge integration (Madhavan and Grover 1998). In the public sector context, Bloch and Bugge (2013), among others (Cinar et al., 2019; De Vries, Bekkers and Tummer, 2016), found that a lack of intra-organizational coordination is a barrier to innovation. Smart city-framed research suggests that ICT-enabled innovation can facilitate cross-functional collaboration which, in turn, could lead to public value. For instance, Cordella and Tempini (2015) suggested that ICTs can help to overcome traditional siloed public sector systems by supporting easier coordination between departments. Camboim et al., (2019) similarly contended that smart city initiatives make it possible to integrate data from multiple sources, which facilitates cross-functional collaboration and optimization of urban environments. Thus, cross-functional collaboration is viewed here as a key organizational capability to explain public value creation, when properly combined with other innovation capabilities.

3.2. Type of project

Project type could affect our results (Chen et al., 2019). For instance, while some projects could particularly affect societal challenges-related values (e.g., bringing together businesses, nongovernmental organizations, universities, and other stakeholders to reach a consensus on how to respond to climate change), others could mostly impact effectiveness-related value (e.g., providing information about waiting times at bus stops and apps). However, it is not easy to control for the type of project, as smart city-framed innovation projects may vary in many dimensions that could affect public value (e.g., ends pursued, technological content, stakeholders involved, level of difficulty when using the service, investment volume and funding, and so on).

Considering the broad range of all possible project-related dimensions that could affect the three forms of public value goes beyond the scope of this research. For simplicity purposes, we focus on two approaches considered in previous smart city literature, which refer to project purposes and content (particularly, technological content).

Firstly, we addressed the main purpose/aim of the project. Smart city projects have been categorized as pursuing one of six well-known dimensions proposed by Giffinger and colleagues (Giffinger et al., 2007; Giffinger and Gudrun, 2010):

(1) Smart economy (competitiveness, innovative spirit, entrepreneurship). Examples in our dataset include the creation of a local public agency aimed at promoting innovation and creativity in the city, and a co-working space for developing new business ideas.
(2) Smart mobility (accessibility, availability of ICT-infrastructure). Examples in our dataset include carsharing, bike lanes, and new access systems for vehicles based on optical character recognition (OCR) cameras.
(3) Smart environment (pollution, sustainable resource management). Examples in our dataset include waste collection with sensors (which measure the filling level) and electronic cards, computer control of municipal light-emitting diode (LED) lighting, and smart irrigation systems that save water and energy.
(4) Smart people (qualification, lifelong learning, participation in public life). Examples in our dataset include a new municipal energy-related school, and specific training programs for poorly qualified people (e.g., female cleaners taught to clean hospital operating rooms).
(5) Smart living (cultural facilities, crime prevention, health conditions, social cohesion). Examples in our dataset include an integrated strategy to promote health and an app that brings the local police service closer to citizens in a bidirectional way.
(6) Smart governance (participation in decision-making, transparency, public and social services). Giffinger and Gudrun (2010) include participation in decision-making in this dimension, and improving public services based on the new paradigm of citizen-centric services and service integration. As both aspects have a very different nature, we consider two separate dimensions of smart governance that are clearly present in our dataset: governance understood as participation in decision-making, and governance understood as public service integration. The latter is not clearly included in the dimensions discussed above.

Examples of governance (participation) include a joint definition (in collaboration with a university and other stakeholders) of the citizen participation process to prepare the municipal budget and the "Youth Dialogue Web Platform", which serves as a means to channel contributions from young people to improving the city's public policies. Examples of governance (public service integration) include centralization of all municipal procedures in a single, efficient and accessible service, a new citizen service center, and incorporation of biometric signatures into citizen services.

While innovation projects try to be synergistic by pursuing several dimensions/purposes, we categorized projects according to their main purpose. To limit subjectivity, two researchers and three public managers categorized the projects separately and a final consensus was reached. Finally, 16 projects were classified as 'smart economy', 16 as 'smart mobility', 28 as 'smart environment', 9 as 'smart people', 15 as 'smart living', 40 as 'smart governance' (service integration) and 14 as 'smart governance' (participation). In five projects, respondents did not give sufficient information to categorize the project.

Secondly, building on Mergel et al., (2019) we considered the following four categories, which focus on the technological content of innovation:

(1) Digital relationships: service innovation aimed at digitizing relationships between public administrations and users. Examples in our database include a youth dialog web platform, an urban lab to access latent community wisdom, a citizen folder allowing access to all records and documents generated through citizen-administration relationships, and participatory public budgets.
(2) Digital services: service innovation aimed at digitizing or automated services offered by the public administration to its users. Examples in our database include safe school routes, selective collection of bio-waste using electronic access, a municipal app (that contains all the local information of interest to citizens and an alert service in direct contact with the local police to increase security), and a virtual assistant.
(3) Using new technology: service innovation based on other initiatives that rely on the use of new technologies. Examples in our database include sharing electric vehicles, new street lighting and electric charging points for vehicles.
(4) Low-tech: initiatives that rely only marginally on new technologies. While we focused on municipalities that had adopted the smart city label, some low-tech projects were reported by respondents. Examples in our database include restorative resolution of school and community conflicts, muralism and ephemeral art, and door-to-door waste collection.

Finally, 27 projects were classified as digital relationships, 71 as digital services, 15 as using new technology, and 25 as low-tech projects.

3.3. Project funding

Previous research has suggested that adequate funding could affect public innovation performance (Sorensen and Torfing, 2012). Accordingly, the amount of funding and its distribution among financial sources (i.e., city council, higher levels of government in Spain, Europe, private) was considered in this research.

4. Methods

The analyses in this study are based on a survey. Respondents are public managers who actively participated in smart city-framed innovation projects in Spanish cities. They provided information on the capabilities of the city government to develop focal projects and the level public value that was generated. The unit of analysis is the city government, and the scale of analysis is the focal project. While we broadly use the term city government, our respondents more specifically represented multidisciplinary work teams that the government had created to deal with the complexity of smart city-framed innovation projects (e.g., head of transparency and the open government group), governmental departments, either traditional or brand new (e.g., head of strategic projects) and majority-owned subsidiaries and external agencies (e.g., head of the innovation and economic development agency).

4.1. Research setting, data collection and questionnaire design

Spain is no newcomer to smart city initiatives. Cities such as Barcelona (Zygiaris, 2013; Capdevila and Zarlenga, 2015), Santander (Schaffers et al., 2011) and Malaga (Scuotto et al., 2016) have led the change, and many cities have followed these pioneering cities (Palomo-Navarro and Navío-Marco, 2018). The IoT Institute named Barcelona one of the top five smart cities in the world and several authors have considered it to be at the forefront of best practices in Europe (Camboim et al., 2019; Mora et al., 2019b). In the last decade, many cities have worked to follow the pioneers, and large cities, such as Madrid, and many medium and small cities, such as Hospitalet, are working within a smart city movement, which is supported by the Spanish national, regional and provincial governments. Spain is, then, an appropriate setting in which to search for a response to our research question. Our contribution is timely, as many municipalities have been engaged in smart-city-framed innovation in Spain in recent years (COIT, 2018).

We tested our conceptual framework by using public managers' perceptions. The inclusion criterion was that municipalities had shown an interest in smart city initiatives. We interpreted the participation of municipalities in smart city-led networks as a manifestation of interest. Firstly, we identified a network of municipalities whose specific purpose was to work collaboratively to achieve the smart city ambition; specifically, the RECI (Spanish Network of Smart Cities). We achieved a formal agreement with the network orchestrator who promoted our study between municipalities. A letter was sent to an email address that was provided by the network orchestrator. A link to an online questionnaire was included in the letter. Follow-up phone calls were conducted (up to three times if a response was not received). The network was composed of 81 municipalities, and we obtained a relatively large number of complete responses (i.e., 53 responses; response rate = 65.4%). We then identified a second network, INNPULSO (an acronym meaning boosting innovation in Spanish), which involves cities that have proven to have a commitment to science and innovation, according to a certificate given by the Spanish Ministry of Science, Innovation and Universities. This network included 72 municipalities. While the orchestrator did not provide us with a specific email address, she promoted our study to members of the network. Follow-up emails and phone calls were conducted by the orchestrator. The process also yielded a relatively large number of useful responses. Specifically, 44 responses (response rate = 61.1%).

We then searched for other evidence of interest in smart cities, such as municipalities submitting innovation projects to the Spanish government's call for smart city grants (e.g., 108 cities participated in the second call in 2015), participating in smart city conferences (e.g., 155 projects were presented in the IV smart city conference, 2018) and describing themselves (on their websites or in press releases) as being interested in developing and implementing smart city initiatives. The terms "smart city", "innovation", "initiative", "project" and "municipality," (in Spanish) were used in Google to search for potential participants in our study. After identifying the municipalities, we sent an email to their public email addresses in which a formal letter was attached to the municipalities' mayors asking them to designate politicians or civil servants to participate in the research project. We stipulated that the respondent must have a high level of knowledge regarding the initiative. Follow-up phone calls were conducted (up to three times if a response was not received). This process yielded 46 complete responses.

A total of 143 completed questionnaires were received. The fieldwork was completed between March and July of 2019. Of the respondents, 57 were women and 86 were men. Their average tenure in the municipality was 13.6 years (standard deviation [S.D.] = 9.5), and their average professional experience was 20.9 years (S.D. = 9.1). Most of the respondents were senior-level civil servants (specifically, 124), with only 19 of them being politicians (mayors or councilors). Most of the municipalities were relatively large (average population = 161,772 inhabitants), with an average GDP per capita of 27,814 euros (vs 25,730 euros in Spain) and an unemployment rate of 12.95% (vs 14.45% in Spain). All of the Autonomous Communities (regions) in Spain (17) were represented in the study. Catalonia (24 innovation projects), the Basque Country (17), Valencia (16), Madrid (11), Andalusia (10) and Castile Leon (8) were the most represented.

To avoid ambiguity, the questionnaire referred to a specific innovation project chosen by the respondent. The first part of the questionnaire stated, 'Please choose a recent (and completed) service innovation project in which you were strongly involved and respond to all of the questions in this questionnaire while thinking about the project you have chosen'. The questionnaire also asked for a brief/open description of the project. Some of the projects described by the respondents were as follows:

Safe school routes. *After a detailed study with the help of a university, the concept of a "safe route" was defined. Sidewalks/pavements, lighting, bridges, shops, etc. were assessed. A survey was carried out with parent representatives and school students to learn about their mobility preferences. Vertical and horizontal signs, changes to urban furniture, three smart pedestrian crossings and 3D crossings were designed. We are going to buy Bluetooth wristbands for students, sensors and software so that parents know when their children arrive at school.*

Participatory aging. *The project ensures the inclusion of the elderly in the use of digital public services through the development of services that are accessible through mobile phones, based on open data from the town council. This project encourages the elderly to access citizen participation, active aging and get involved in their communities.*

Citizen security app. *This is an app that brings the local police service closer to citizens and groups (commerce, vulnerable groups) bidirectionally (local police to citizens and* vice versa*). This is a free public alert service.*

The need to add the amount of funding and its distribution among financial sources to the analysis was suggested by an anonymous reviewer. Consequently, in December 2021, we contacted the participating municipalities again to ask for such data. The process yielded 82 responses. As we had the name and description of each project/initiative, we were able to supplement these data with secondary sources (e.g., municipalities' websites, public calls for proposals, and conferences). This task allowed us to add financial data from 49 initiatives, bringing the total to 131.

We observed that many initiatives were funded by the European Union (i.e., 94 initiatives, 71.7%). European funds were channeled primarily through the National Smart Cities Plan of the Spanish Ministry of Economic Affairs and Digital Transformation and the Sustainable and Integrated Urban Development Strategies (known by its Spanish acronym EDUSI). These programs covered between 50% and 80% of the investments made (mean = 59.65%). However, they were usually only accessible to municipalities with more than 20,000 inhabitants. Our study also included small cities that showed interest in the concept of smart cities and developed novel initiatives, such as virtual assistants for tourists and citizens, urban laboratories, or e-offices. In these cases, funding usually came from the city councils and different public administrations in Spain.

It should be noted that most of the initiatives included in this research are defined at a specific level, usually being a small part of broader strategies (e.g., strategies submitted for funding within the National Smart Cities Plan or EDUSI). Therefore, the amount of funding for these initiatives is relatively small, despite the fact that the largest and the most active cities in Spain in the field of smart cities participated in this research (e.g., Madrid, Barcelona, Valencia, Alicante, Seville, Almería, Murcia, Bilbao, San Sebastián, Vitoria-Gasteiz, Pamplona, La Coruña, Vigo, Huesca, Segovia, Valladolid, Palencia, Ávila, Cáceres, Badajoz, León, Logroño, or Santander). While the investment mean is 1273,827 euros, the standard deviation is large (2837,685 euros).

The participation of the private sector in the funding of the initiatives chosen by the participants was limited (three initiatives). In one initiative (i.e., the development of a Wi-Fi network in a tourism destination) the investment was 100% private. Small private investments (5% of the total) were also reported in two urban labs.

4.2. Measurements

The questionnaire included 59 closed questions (items) that captured the respondents' degree of agreement with predefined statements that referred to the variables involved, and two open questions related to the tenure and role of participants. Likert-type scales between 1 (strongly disagree) and 10 (strongly agree) were used. When possible, the items were adapted from scales that had proven to be valid and reliable to the public sector context. The specific items that were used are reported in Appendix A. All the measurements were devised to capture the content and various nuances of the definitions provided in the previous sections of this paper.

The scales for provider, expert, peer municipalities and citizen collaborative capabilities, in terms of intensity, were adapted from Gruner and Homburg (2000). As Gruner and Homburg (2000) focused on the intensity of interactions, a second scale was added to capture the quality of interactions. Top management leadership was assessed with a three-item scale adapted from Pinto and Prescott (1990). Organizational slack was measured with two items adapted from De Luca and Atuahene-Gima (2007). Two items from Jansen, Van Den Bosch and Volverda (2005) were used to measure absorptive capacity. Cross-functional collaboration was assessed using three items adapted from De Luca and Atuahene-Gima (2007).

We did not find an appropriate scale to measure the three dimensions of public value. While the scales from Tarrant et al., (2003) and Ju et al., (2019) were useful for this study, they do not capture the dimensions of efficiency, effectiveness, and societal challenges we considered. Therefore, we created three new scales inspired by private sector literature, which had to be critically adapted (Hoyer et al., 2010; Kim and Atuahene-Gima, 2010; Pinto and Prescott, 1990). The scales were discussed with three public managers who collaborated with the researchers. Collaboration was aimed at avoiding misunderstandings and gaining contextual relevance. Some items were modified, and others dropped during the process.

5. Model specification and results

5.1. Structural model specification

We used factor analysis regression (FAR), which is a regression analysis technique based on factor analysis (Kosfeld, and Lauridsen, 2008; Sharma, and Chandra, 2019). The analysis was conducted in three stages.

In the first stage, we tested whether the 59 items fit the 12 variables that were defined and operationalized deductively. The expected internal consistency of the items was tested by using the Cronbach alpha. It should be noted that a factor analysis with all items (59) is not appropriate in this research due to the requirement of at least 5 observations per variable, and preferably a 10:1 ratio (Hair et al., 2010).

After confirming the internal consistency of the 12 variables, the nine independent variables (i.e., not public-value related) were used to create second-order orthogonal factors (second stage). The number and content of the second-order factors were not pre-determined but created inductively as a combination of all first–order variables, based on the factor analysis results (Kalu, 2020).

Then, the resulting factors were modelled as explanations of the three public value dimensions in an ordinary least squares (OLS) regression (third stage). This approach was used due to its consistency with the tenets of DCT. As dynamic capabilities are defined as mixes of first order capabilities, we expected that all first-order factors would contribute to the second-order factors but at different levels (e.g., a government focus on citizen collaboration does not mean total absence of effort in maintaining a certain level of collaboration with other stakeholders and managing internal capabilities). Factor analysis is appropriate when we expect that there is a latent trait or unobservable characteristics among the observed variables. It uncovers the constructs underlying the data and identifies latent factors to explain the data (Sharma and Chandra, 2019; Kalu, 2020). It has been largely used in previous research (e.g., Liu et al., 2010). Consequently, our model specification was as follows:

$$(1 \text{ to } 3)\ \textit{Public}\ \text{value dimension}_i = \alpha_1 + \beta_{11}\,(\text{factor1}_i) + \beta_{12}\,(\text{factor2}_i) + \ldots + \varepsilon_{1i}$$

Where, the number of factors and their content was inductively determined by using factor analysis.

5.2. First-stage results

Stata statistical software was used to analyze the data. A Cronbach's alpha of the 12 first-order variables used in this research was computed to prove the internal consistency of the scales (see Table 1). Scores ranged from 0.7356 (good) to 0.9766 (excellent) (Streiner, 2003). Once the internal consistency had been tested, a summated scale was created for the 12 variables. The means and SDs of the variables indicated that municipal managers perceived that, for the reported projects, their municipalities had mostly developed collaborative capabilities with providers and experts and, to a lesser extent, with citizens and peer governments, which fit the dominant technological view of ICT-enabled innovation projects of public managers. Interestingly, peer governments' collaborative capabilities were found to have a relatively large SD (3.315 for intensity and 3.487 for quality), as did experts' collaborative capabilities (3.240 for intensity and 3.165 for quality), indicating that there were diverse patterns of inter-governmental collaboration and expert collaboration depending on the municipality and/or project. Overall, innovation-led internal capabilities were perceived as being more developed than collaborative ones. Among the former, top management leadership and absorptive capacity were perceived as being more developed than cross-functional collaboration, and organizational slack was viewed as the weakest internal capability, which is consistent with the economic restrictions stemming from the financial crisis. Overall, the projects were viewed more as leading to long-term

Table 1
Descriptive statistics and internal consistency of first-order variables.

First-order variable	# Obs.	Mean	S.D.	Cronbach's alpha	# of Items
Top management leadership	143	7.409	1.914	.8682	4
Organizational slack	143	5.825	2.443	.7356	2
Absorptive capacity	143	7.409	2.064	.9606	2
Cross-functional collaboration	143	6.743	2.470	.9261	3
Citizen intensity	143	5.267	2.933	.9385	5
Citizen quality	143	5.294	2.974	.9586	6
Government intensity	143	4.037	3.315	.9155	3
Governments quality	143	4.642	3.487	.9766	6
Provider intensity	143	7.087	2.688	.9563	2
Provider quality	143	7.030	2.514	.9592	5
Expert intensity	143	6.412	3.240	.9514	3
Expert quality	143	6.965	3.135	.9847	6
Efficiency-related value	143	7.006	2.632	.9011	2
Effectiveness-related value	143	7.665	1.658	.8797	7
Societal challenges-related value	143	8.025	1.893	.8561	3

Notes: Obs. = observations; S.D. = Standard deviation.

challenges (8.025) and effectiveness (7.665) than efficiency (7.006).

The correlations matrix is shown in Table 2. Most correlations are moderate or low. The presence of many moderate or low correlations, with a correlation as small as -0.0116, indicates that the possible impact of common method bias is not a concern in this research (Lindell and Whitney 2001). As an exception, the correlations between collaboration intensity and quality with each type of partner tend to be high, which could be interpreted in the sense that when public managers collaborate intensively with a partner, it is because they understand that contributions are high quality.

5.3. Findings of the second stage: factor analysis results

Tables 3 and 4 summarize the factor analysis results. Table 3 shows that a four-factor solution fits the data well (method: principal factors; rotation: orthogonal varimax; retained factors = 4). The LR test (independent vs. saturated) was significant (chi2(66) = 978.07; Prob>chi2 = 0.000). The third column in Table 3, 'proportion', indicates the relative weight of each factor in the total variance, with the first factor explaining 28.7% of the total variance; the second factor 24.7%, the third factor 23.7% and the fourth factor 18.7%. As reported in the fourth column, 'cumulative', the four factors account for 95.9% of the total variance.

Table 4 shows rotated factor loadings (pattern matrix) and unique variances. Loadings above 0.30 are in bold, as they are considered to meet the minimum level for interpretation of structure (Hair et al., 2010, p. 117). First–order variables for expert collaboration intensity (0.7741)

Table 3
Factor analysis (Method: principal factors; rotation: orthogonal varimax (Kaiser off); retained factors = 4).

Factors	Variance	Difference	Proportion	Cumulative
Citizen and expert focus (Factor 1)	2.195	.303	.287	.287
Citizen-oriented management (Factor 2)	1.892	.077	.247	.534
Peer (Factor 3)	1.815	.381	.237	.771
Provider focus (Factor 3)	1.433		.187	.959
LR test: independent vs. saturated: chi2(66) = 978.07 Prob>chi2 = 0.000				

Notes: Variance = Eigenvalue; Proportion indicates the relative weight of each factor in the total variance; Cumulative shows the amount of variance explained by n+(n–1) factors; Difference reports the difference between one Eigenvalue and the next.

and quality (0.7847), and citizen collaboration intensity (0.6666) and quality (0.6549) load strongly on second–order factor 1. Consequently, this factor was labelled "citizen and expert focus". The first–order internal variables for top management leadership (0.6938), organizational slack (0.5703), absorptive capacity (0.664) and cross-functional collaboration (0.5587) load strongly on the second–order factor 2, with the loadings for citizen collaboration intensity (0.3911) and quality (0.399) also being strong. Factor 2 was then labelled "citizen-oriented management". The first–order variables for peer governments' collaboration intensity (0.8955) and quality (0.8875) load strongly on the second–order factor 3. Factor 3 was then labelled "peer focus". Finally, the first–order internal factors for providers' collaboration intensity (0.8359) and quality (0.8238) load strongly on the second–order factor 4. Factor 4 was then labelled "provider focus".

5.4. Structural model results and post hoc analyses

Tables 5.1, 5.2, and 5.3 summarize the OLS estimation results for efficiency-, effectiveness- and societal challenges-related value, respectively. We checked for normality by using the Shapiro–Francia test (Shapiro and Francia, 1972), which indicated that many first-order variables were non-normal. Consequently, second-order factors also appeared as non-normal. Therefore, we used the robust regression method to conduct the structural analysis.

The effects of the type of project are presented in models (1) and (2). Model (1) shows that the technological content of the project by itself is not significant enough to explain efficiency- and effectiveness-related value; it only has a significant but small enough effect to explain societal challenges-related value. Specifically, digital relations (β = -1251; p = .017) and digital service (β = -0.911; p = .041) contribute less to societal challenges than low-tech projects. It is probably due to the fact that low-tech projects in our database are particularly aimed at meeting societal challenges in the medium/long term, such as promoting entrepreneurship or bringing stakeholders together to co-define strategies to

Table 2
Correlation matrix.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Top management leadership [1]	1											
Organizational slack [2]	.4050*	1										
Absorptive capacity [3]	.5653*	.4277*	1									
Cross-functional collaboration [4]	.4873*	.3343*	.4246*	1								
Citizen intensity [5]	.2232*	.2559*	.2206*	.2359*	1							
Citizen quality [6]	.2130*	.2125*	.1996*	.2845*	.8538*	1						
Government intensity [7]	-0.0631	.2334*	-0.1051	.0560	.1969*	.1239	1					
Government quality [8]	.0125	.2603*	-0.0116	.1214	.1833*	.1737*	.8675*	1				
Provider intensity [9]	.0568	.0817	.1077	.0108	.1424	.0174	.1139	.0415	1			
Provider quality [10]	.1833*	.0020	.0845	.1454	.1420	.1283	.1055	.0598	.7496*	1		
Expert intensity [11]	.0559	.0849	.0976	.1705*	.3478*	.2757*	.3468*	.3235*	.1487	.1631	1	
Expert quality [12]	.1284	.0830	.1455	.2425*	.3290*	.3186*	.2815*	.3305*	.0362	.1536	.8747*	1

Notes: *Significant at the 95% confidence level (one-tailed test).

Table 4
Matrix of rotate components rotated factor loadings (pattern matrix) and unique variances.

Variable	Factor 1 (Citizen and expert focus)	Factor 2 (Citizen-oriented Management)	Factor 3 (Peer Focus)	Factor 4 (Provider /double-helix focus)	Uniqueness
Top management leadership	.0656	**.6938**	-0.032	.1086	.5015
Organizational slack	.0351	**.5703**	.2557	.0079	.6081
Absorptive capacity	.0865	**.664**	-0.0566	.0864	.5409
Cross-functional collaboration	.1838	**.5587**	.069	.0526	.6465
Citizen intensity	**.6666**	**.3911**	.036	.0436	.3996
Citizen quality	**.6549**	**.399**	-0.0106	-0.0375	.4104
Government intensity	.1465	-0.0288	**.8955**	.0664	.1713
Government quality	.1574	.0662	**.8875**	-0.0039	.1832
Provider intensity	.0311	.0316	.0474	**.8359**	.2971
Provider quality	.1147	.0784	.0274	**.8238**	.3013
Expert intensity	**.7741**	-0.0884	.2874	.1441	.2896
Expert quality	.7847	-0.0148	.2532	.072	.3147

Notes: bold figures represent abs(loading)>0.3; uniqueness is the variance that is 'unique' to the variable and not shared with other variables. It is equal to 1–communality (variance that is shared with other variables).

Table 5.1
Efficiency-related value (structural model results; robust regressions).

Model	(1) coef.	*P>t*	(2) coef.	*P>t*	(3) coef.	*P>t*	(4) coef.	*P>t*	(5) coef.	*P>t*	(6) coef.	*P>t*	(7) coef.	*P>t*
R-sq.	.019	.452	0.126	.006	0.016	0.671	.2402	.000	.2555	.000	.3239	.000	.2668	.000
Citizen and expert focus							-0.276	.153	-0.131	.703	-0.091	.763	-0.299	.135
Citizen-oriented management							**1.002**	**.001**	**1.037**	**.001**	**0.923**	**.003**	**1.041**	**.001**
Peer focus							.332	.111	.432	.057	0.430	.057	.274	.194
Provider focus							**.970**	**.000**	**.897**	**.004**	**0.852**	**.002**	**1.059**	**.001**
Digital relations	-0.217	.769							-0.159	.800				
Digital service	.661	.295							0.328	.594				
New technologies	.354	.681							.301	.701				
Low-tech	*													
Smart economy			-0.491	.958							.511	.579		
Smart people			-0.559	.073							-0.692	.485		
Smart governance (service)			**1.68**	**.035**							**1.465**	**.043**		
Smart governance (participation)	*													
Smart mobility			.232	.803							.694	.403		
Smart environment			**2.10**	**.012**							**1.647**	**.039**		
Smart living			1.70	.073							**1.873**	**.026**		
Investment volume (logarithm)					.048	.700							.110	.327
European funding (%)					1.638	.532							1.220	.623
Funding from HLG in Spain (%)					.050	.987							.447	.875
City council funding (%)					1.110	.641							1.383	.544
Citizen and expert focus (Squared)									.186	.331	.262	.136		
Peer (Squared)									-0.105	.675	-0.269	.288		
constant	6.64	.000	5.89	.000	5.164	.007	7.00	.000	6.97	.000	5.91	.000	4.386	.020

Notes: bold figures indicate that variables are significant at the 95% confidence level (one-tailed test); * Low-tech is the omitted dimension, so "constant" is the mean for low-tech; HLG = Higher Levels of Government.

face wicked problems.

Model (2) shows that the project purpose only contributes to efficiency. Specifically, smart governance (services) (β = 1.68; p = .035) and smart environment (β = 2.10; p = .012) contribute more to efficiency than the other project types. It is probably due to the fact that smart governance (services) refers to ICT-enabled, citizen-centric public service integration, and smart environment involves ICT-enabled, more efficient provision of individual traditional services (e.g., waste collection with sensors and electronic cards, computer control of lighting, and smart irrigation systems).

Model (3) shows the effect of investment volume and its distribution among three sources of funding (i.e., Europe, city council, and higher levels of government in Spain) on the three forms of public value. For these purposes, the investment volume was logarithmically transformed. Private funds were not considered because we had only three cases. The regressions and most of the coefficients were not significant. However, city council funding (as a percentage of the total) contributed negatively to effectiveness (β = -1.521; p = .043) and societal challenges (β = -1.197; p = .045).

Model (4) shows the effect of the four forms government capabilities. Government capabilities clearly have greater influence than project type on public value in its three forms. Interestingly, two second-order factors ('citizen-oriented management' and 'provider focus') have a significant effect on the three forms of value, with the effect of the remaining two ('citizen and expert focus' and 'peer focus') not being significant. Specifically, 'citizen-oriented management' (β = 1.002, p = .001) and 'provider focus' (β = 0.970, p = .000) have a significant and positive effect on efficiency. 'Citizen-oriented management' (β = 0.632, p = .000) and 'provider focus' (β = 0.501, p = .030) have a significant and positive effect on effectiveness. Finally, the same variables (β = 0.479 and β = 0.526, respectively) contribute to the value related to societal challenges. Efficiency (R–sq. = 24.02%) is better explained than effectiveness (R–sq. = 18.94%) and societal challenges (R–sq. = 11.58%).

The joint effect of government capability mixes, project type, and project funding appears in models (5), (6), and (7). As shown in model (5), the project type (in terms of content) marginally improves the explanatory value of government capability mixes. Only the smart governance (service) projects (mostly related to service integration) are

Table 5.2
Effectiveness-related value (structural model results; robust regressions).

Model	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*
R-sq.	.011	.668	.056	.261	.020	.2113	.1894	.000	.2510	.000	.243	.000	.1970	.000
Citizen and expert focus							-0.071	.655	-0.365	.196	-0.215	.391	-0.062	.708
Citizen-oriented management							**.632**	**.000**	**.618**	**.000**	**.616**	**.001**	**.614**	**.002**
Peer focus							-0.077	.601	-0.183	.218	-0.079	.584	-0.090	.530
Provider focus							**.501**	**.030**	**.608**	**.010**	**.520**	**.017**	.508	.059
Digital relations	-0.290	.533							-0.288	.642				
Digital service	-0.473	.234							-0.850	.414				
New technologies	-0.196	.717							-0.323	.377				
Low-tech	*													
Smart economy			-0.582	.337							-0.220	.702		
Smart people			-0.647	.361							-0.873	.164		
Smart governance (service)			-0.109	.831							-0.241	.581		
Smart governance (participation)	*													
Smart mobility			-0.047	.938							.056	.897		
Smart environment			.505	.352							.050	.901		
Smart living			.546	.376							.359	.475		
Investment volume (logarithm)					-0.045	.510							.001	.977
European funding (%)					-1.112	.143							-1.212	.156
Funding from HLG in Spain (%)					-1.368	.336							-0.857	.491
City council funding (%)					**-1.521**	**.043**							-1.290	.126
Citizen and expert focus (Squared)									-0.216	.185	-0.185	.248		
Peer (Squared)									-0.150	.278	-0.224	.145		
constant	8.00	.000	7.66	.000	9.585	.000	7.66	.000	8.51	.000	8.12	.000	8.878	.000

Notes: bold figures indicate that variables are significant at the 95% confidence level (one-tailed test); * Low-tech and smart governance are the omitted dimensions. HLG = Higher Levels of Government.

Table 5.3
Societal-challenges related value (structural model results; robust regressions).

Model	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*	coef.	*P>t*
R-sq.	0.057	0.047	0.081	.081	.041	.168	.1158	.002	.1863	.000	.1778	.000	.1525	.006
Citizen and expert focus							.056	.772	-0.239	.453	-0.003	.991	-0.000	.999
Citizen-oriented management							**.479**	**.024**	**.453**	**.029**	.395	.088	**.471**	**.033**
Peer focus							-0.069	.694	-0.134	.427	-0.097	.565	-0.106	.557
Provider focus							**.526**	**.029**	**.596**	**.018**	**0.552**	**.017**	**.557**	**.038**
Digital relations	**-1251**	**.017**							-1.267	.460				
Digital service	**-0.911**	**.041**							**-1.274**	**.006**				
New Technologies	-0.138	.818							.301	.492				
Low-tech	*													
Smart economy			-0.377	.580							-0.191	.769		
Smart people			-0.523	.511							-0.826	.373		
Smart governance (service)			-0.157	.786							-0.352	.440		
Smart governance (participation)	*													
Smart mobility			.538	.430							.535	.268		
Smart environment			1.09	.074							.681	.093		
Smart living			0.120	.862							-0.241	.659		
Investment volume (logarithm)					-0.009	.890							.030	.684
European funding (%)					-0.099	.849							-0.083	.892
Funding from HLG in Spain (%)					-2.201	.149							-1.446	.300
City council funding (%)					**-1.197**	**.045**							-0.832	.194
Citizen and expert focus (Squared)									-0.148	.407	-0.062	.736		
Peer (Squared)									.050	.782	-0.038	.821		
constant	8.76	0.000	7.85	.000	8.93	.000	8.02	.000	9.05	.000	8.12	.000	8.185	.000

Notes: bold figures indicate that variables are significant at the 95% confidence level (one-tailed test); * Low-tech and smart governance are the omitted dimensions. HLG = Higher Levels of Government.

viewed as contributing less to long term societal challenges than the other project types (see Table 5.3). Model (6) shows that the inclusion of the project type (in terms of purpose) improves the explanatory power of capability mixes to understand efficiency (R-sq. = 32.39%; see Table 5.1). In particular, smart governance (service) projects ($\beta = 1.465$; $p = .043$), smart environment ($\beta = 1.647$; $p = .039$), and smart living projects ($\beta = 1.873$; $p = .026$) contribute significantly more to efficiency than the other project types (purpose). However, project type (purpose) does not contribute to explaining effectiveness- and societal challenges-related value (see Tables 5.2 and 5.3). Model (7) shows that the negative contribution of city council funding (%) to effectiveness and societal challenges does not remain when capability mixes are considered.

As the 'citizen and expert focus' and 'peer focus' factors were shown to have no significant linear effects on the three dimensions of value, the extended models (models 5 and 6) were also tested for possible curvilinear (quadratic) effects. However, these effects were not confirmed by our data.

6. Discussion

Orchestrating collaborative innovation involves costs, risks, complexity and uncertainty (Demircioglu and Audretsch 2017; Torugsa and Arundel 2016). Consequently, collaborative public innovation may be unproductive in terms of public value (Bannister and Connolly,

2014), and insights that guide public innovation management of municipal managers' knowledge-searching efforts are necessary (Neumann et al., 2019). However, we are far from having a systematic knowledge of what mix(es) of internal and/or external collaboration capabilities of governments lead to public value creation (Panagiotopoulos et al., 2019), which is our research question. To address this gap, we studied the effect of different innovation capability mixes on public value, in smart city-related innovation projects. Project type was also considered.

The study identified core internal and external collaboration capabilities, and inductively combined them through a factor analysis applied to a sample of 143 service innovation projects in Spanish municipalities, which showed some evidence of pursuing the smart city ambition.

Overall, the study found that while some innovation capability mixes lead to public value, other combinations are unproductive. We used a real-world inductive approach to identify four innovation capability mixes that were used by our respondents (public managers) to manage the projects they reported. These second-order factors were labelled as follows:

(1) "citizen and expert focus" (i.e., outstanding collaboration intensity and quality with experts and citizens);
(2) "citizen-oriented management" (i.e., outstanding innovation-oriented internal management coupled with intense and high-quality collaboration with citizens);
(3) "peer focus" (i.e., outstanding collaboration intensity and quality with peer governments); and
(4) "provider focus" (i.e., outstanding collaboration intensity and quality with providers).

6.1. Citizen and expert focus

The "citizen and expert focus" approach did not contribute to value in any of its three dimensions (efficiency, effectiveness, and societal challenges). This means that when outstanding collaboration with experts and citizens is not coupled with the implementation of other capabilities at an outstanding level (e.g., innovation-led internal capabilities), it is unproductive. In our view, it should not be interpreted in the sense that governments should not collaborate with citizens and experts, but in the sense that this collaboration should be focused and balanced with other capabilities. It is possible that the municipalities/projects with high scores in this factor have incurred high costs and risks from involving themselves in an unfocused and excessively broad search for knowledge, which has led to overwhelming, saturation, a great deal of conflicting ideas that do not fit the current availability of resources of municipalities, and inconclusive results. As these municipalities have not applied outstanding internal capabilities, it is also likely that new and apparently promising ideas have not been sufficiently scrutinized, debated and assessed by municipal managers, which could have led to inappropriate implementation explained by a possible pro-innovation bias, as suggested by Damanpour and Aravind (2012).

Our findings seem to support the view of some authors that indicate that collaboration with a relatively large range of diverse stakeholders may exceed the current capabilities of city governments and lead to unproductive results. Torfing et al., (2020), suggested that while stakeholder diversity seems ideal for generating innovative public value outcomes, there is a catch, since diversity may clash with the need for constructing common ground that allows participating actors to agree on a joint and innovative solution. Neumann et al., (2019) suggested that cooperation partners may have interests of their own and the governments' goal to create public value through IT-enabled innovation may not necessarily be coherent with them. This potential for a conflict of interest in such collaborative innovation can make it difficult to achieve common ground. Choi and Chandler (2020) referred to a "knowledge vacuum." They understood "knowledge vacuum" as an organizational condition in which excessive exploration and organizational inertia and resistance interact to create a vicious cycle of low performance. In such a context, governments frequently tend to adopt complex and heterogeneous innovations which do not fit the capabilities of middle-level public managers and employees, and lead to frustration and resistance to change. For instance, if top management leadership is not in place, workers may feel frustration about insufficient training or low participation in the decision-making processes or be negative about the supposed improvements to the new systems. Some studies on digital innovation have reported low performance levels (e.g., Anthopoulos et al., 2016; Criado et al., 2013; Pittaway and Montazemi, 2020). Low performance has not usually been explained in terms of lack of exploration, but in terms of unfocused exploration and poor management of innovation. Using cross-sectional data from a national survey of government managers in the United States, Gil-Garcia and Sayogo (2016) found that performance (in terms of information sharing) was not predicted, due to the diversity of participating organizations and the participation of external consultants. However, some internal capabilities (including formally assigned project managers and availability of financial resources) contributed to performance. In short, it seems that the promises of collaborative innovation are leading some governments to focus on listening to all local voices in an unfocused and overwhelming effort that probably exceed their current capabilities. It may also be that the current capabilities of citizens and local experts to generate public value-driven innovation that goes beyond their own and divergent interests are limited.

6.2. Citizen-oriented management

"Citizen-oriented management" contributes to the three dimensions of public value. This means that governments can be confident in creating public value through service innovations if they combine outstanding internal management of innovation and relatively intense and high-quality collaboration with citizens. This occurs despite not showing outstanding collaboration capabilities (only average levels) with suppliers, other governments and experts. This may be understood in the sense that when a government puts outstanding innovation-oriented internal capabilities and intense and high-quality collaboration processes in place to find out more about the needs of its citizens, other external knowledge-seeking efforts (e.g., suppliers, experts) may be much more focused and productive. An important nuance here is that collaboration with citizens is not at the highest level as in the 'citizen and expert focus' case. Here collaboration with citizens seems to be at a relatively strong level but focused, manageable, and coupled with outstanding internal capabilities.

The consistent contribution of this combination of capabilities to the three dimensions of value supports the view of Pittaway and Montazemi (2020), among others (e.g., Manville et al., 2014), who argued that digitization should not be viewed as only providing lower-costs or efficiency (i.e., the wrong view of some public managers), but also higher service quality or effectiveness, and improvements in terms of societal challenges. Similarly, Gil-Garcia et al., (2016), suggested that citizen centricity (i.e., knowing what citizens want and responding to it) is a key dimension characterizing smartness in government. Our findings are consistent with previous public innovation research that attaches particular salience to context (Hartley 2005; Moore 2005; Hjelmar, 2019). However, our study also adds that collaboration with citizens needs to be combined with strong internal management capabilities, as suggested by others (Bertot et al., 2016; Janowski et al., 2018).

Allen et al., (2020) state that, in the context of contemporary development of digital technology and smart city initiatives, it remains inconclusive whether citizen-government collaboration improves public value (in the form of service quality). They tested the relationship between e-participation and service performance and found that e-participation has a stronger relative influence on complex problems

than using simple routine services. In the context of smart city-framed service innovation, we found that the effect of citizen participation is only productive when interlinked with the internal capabilities of governments. Focusing too much on citizen collaboration while crowding out internal management efforts seems to be unproductive.

6.3. Peer focus

The third combination of capabilities, "peer focus", does not contribute to any of the three dimensions of public value. It seems that outstanding levels of collaboration intensity and quality with peer governments (with the remaining capabilities being at average levels) are insufficient to create public value. While collaboration with peer governments is valuable and many governments participate in inter-governmental networks, relying on this capability alone seems to be unproductive. Manville et al., (2014) suggested replication (i.e., repeating initiatives in other local spaces) as an appropriate strategy to extend smart city implementation. However, smart solutions cannot simply be copied but need to be assessed on their value for different contexts and translated to fit other conditions (Meijer et al., 2016). This means that collaboration with citizens and internal capabilities of adaptation and recombination are also necessary.

It seems that city governments sometimes confuse participation in networks with organizational mimicry (Mergel, 2018), or mimetic isomorphism (Eom, 2012), that underlies the smart cities movement in many countries (i.e., some slower municipalities tend to mimic the existing behavior of municipalities that were able to jump onto the bandwagon earlier). This approach does not seem to be based on strong managerial criteria (vision, strategy, purpose, means-ends adequacy and idiosyncratic needs), but to respond to other considerations such as searching for legitimacy or opportunism. As municipalities under this approach are not outstanding in terms of crucial capabilities such as absorptive capacity, provider collaboration or citizen collaboration, they may choose erroneous alternatives or adapt them poorly. Our research seems to confirm previous findings that suggest that inter-governmental collaborations result in high costs and difficulties (Pittaway and Montazemi, 2020), and the management capabilities to conduct them are difficult to find in practice.

6.4. Provider focus

The "provider focus" approach contributes to the three forms of value. It seems that in smart-city contexts, outstanding levels of collaboration intensity and quality with providers seem to be an important distinctive capability. It could be related to the size and salience of some of the usual suppliers in smart city contexts, involving companies such as SAP, Microsoft, large telecommunications operators and CISCO, which are leaders in their sectors worldwide. It seems that municipalities that are able to transfer the tacit knowledge of their specific needs to providers properly, and properly understand the range of opportunities that innovation opens up to them are also able to create public value. This finding confirms the salience that many researchers have attached to public procurement as a form of innovation (Edler and Georghiou 2007; Edquist and Zabala-Iturriagagoitia 2012), particularly in digital innovation contexts (Manville et al., 2014; Pittaway and Montazemi, 2020).

6.5. Product type

We used two product type approaches, addressing project purposes and technological content, respectively. Overall, we found that:

(1) project type is less explanatory in terms of the three forms of public value than government capability mixes, and
(2) the heterogeneity of projects in terms of their content and purposes leads to heterogeneous effects on the three forms of value.

The purpose-related project typology was explanatory in terms of efficiency. In particular, smart governance projects related to ICT-enabled citizen-oriented service integration, smart environment projects and smart living projects contributed more to efficiency than smart mobility and smart governance (participation) projects (model 2, Table 5.1). However, the purpose-related project typology was not explanatory in terms of effectiveness and societal-challenges. This result is in line with some previous literature that suggests that public managers (wrongly) associate smart city-framed innovation with efficiency, while neglecting its influence on other outcomes (Pittaway and Montazemi, 2020). Interestingly, when government capability mixes and project type were jointly considered to explain efficiency-related value, this finding proved to be robust (model 5, Table 5.1). Furthermore, the effect of "peer focus" changed to become marginally significant in explaining efficiency ($\beta = 0.430$, $p = .057$). It seems that "peer focus" could have some influence on efficiency for some project types based on using ICTs to integrate services or improving traditional services, such as waste management.

By contrast, content-related project typology was only found to be useful in explaining societal-related changes. Digital service projects contributed less to societal challenges than low-tech projects. This is probably due to the fact that low-tech projects in our dataset involve culture-related projects and collaborative projects for defining agreed responses to wicked problems, which could be viewed by our informants as particularly affecting (long-term) societal-challenges.

6.6. Funding

The non-significance of the investment volume on public value could be considered counterintuitive, as a greater funding could lead to more opportunities for creating public value. However, this is not so clear when considering value perceptions in relation to heterogeneous initiatives. In our database, zero-cost and near-zero-cost initiatives (e.g., an internally developed citizen app) coexist with high-investment infrastructure-related initiatives (e.g., energy-transition investments). However, the latter type of initiative does not necessarily lead to higher value perceptions than the former. Overall, while some infrastructure-related initiatives require high investment, social, low-investment initiatives (e.g., encouraging entrepreneurship in urban labs) could be perceived as similarly valuable.

The negative contribution of city council funding to effectiveness and societal challenges could indicate that initiatives funded by Europe and higher levels of government in Spain could be more robust by passing various filters prior to approval. However, this contribution is small and disappear when capability mixes are considered.

7. Conclusions, limitations and further research

The study provides a threefold contribution: conceptual, empirical and managerial. It also has limitations and provides avenues for further research.

7.1. Conceptual contribution

From a conceptual perspective, this study provides a deeper understanding of both the innovation-related dynamic capabilities of governments and public value, and their relationships. Twelve first-order capabilities, four second-order capability mixes, and three forms of public value were discussed by combining insights from various research streams. The view and operationalization of capability mixes as combinations of first-order capabilities is novel and consistent with DCT, which suggests that dynamic capabilities that are required for change are complex. By considering project type, this study provides new insights for improving our understanding of how diverse project types may affect different forms of public value; it makes the heterogeneity underlying both concepts apparent (i.e., project type and public value) and

the need for nuanced understanding and interpretation.

7.2. Empirical contribution

This study provides empirical evidence that, in the context of smart city-framed innovation, the contribution of collaborative innovation to public value creation is explained by the innovation capability mixes deployed by governments. 'Citizen-oriented management' and 'provider focus' seem to have a positive influence on three dimensions of public value. It should be noted that citizen-oriented management does not mean that the greater the citizen collaboration the greater the public value. Too much effort on collaborating with citizens/civil society is unproductive when not accompanied with outstanding internal management efforts (i.e., citizen and expert focus). The important role of provider collaboration in smart city initiatives is also noteworthy. The contribution of project type to public value seems to be relatively scarce and varies according to the form of public value.

7.3. Practical contribution

From a practical perspective, this research provides public managers with insights on how to combine internal and external collaboration capabilities to create different forms of public value through service innovation. This is important, as orchestrating collaborative innovation involves costs, risks, complexity and uncertainty, and public managers have scarce resources that cannot be wasted as they belong to people and wasting them may strongly affect people's well-being. This study suggests that public managers cannot rely on the supposed "inherent" positive characteristics of innovation projects to create public value; management is important and requires a complex combination of capabilities that do not occur spontaneously, but are heterogeneous and possibly generated through a path dependent process (Janowski, 2015). It seems that, at their current level of capabilities, city governments that pursue public value should focus on non-complex innovation projects that simultaneously meet their current internal capabilities and fit citizen needs. They could also rely on tested solutions provided by experienced commercial providers. In the context of smart city-framed service innovation, we found that the effect of citizen participation is only productive when focused and interlinked with the internal capabilities of governments. Focusing too much on citizen collaboration while crowding out internal management efforts seems to be unproductive. As suggested by Meijer and Rodriguez Bolivar (2016, p. 399) too much emphasis on collaboration "may result in more attention to issues of collaboration than actually making things work."

7.4. Limitations and further research

This study shares the usual limitations of cross-sectional studies conducted in a specific context. Firstly, although our data are static, the development of smart cities is an ongoing phenomenon. We hypothesized that capability mixes affect public value created by smart city-framed projects. However, each smart city-framed project could have an effect on capabilities (e.g., some ICT-enabled smart city projects facilitate internal and external collaboration), which suggest a circular process that cannot be properly captured by our cross-sectional methodological approach. Further research could include a longitudinal assessment of the different variables involved.

Secondly, factors unique to our context may limit the applicability of the results to other settings. We addressed municipalities in Spain and asked municipal managers to choose a recent, completed innovation project (successful or not) in which they had participated intensely. We focused on specific real-world projects to avoid ambiguity. It is probable that municipal managers favored innovation projects in which town councils played a leading role, meaning that projects led by the private sector are less represented. Also, most of the projects we studied have a technological focus, which could affect our results. Thus, the technological content of the projects could explain the salience of the 'provider focus' capability. Further studies conducted in other settings may shed light on the generalizability of our results.

Thirdly, when considering project type, we characterized each project into a single box with the help of three municipal managers. However, we recognize that real-world projects usually have mixed content and purposes, which makes it difficult to characterize them. Despite important conceptual contributions in this area, more research on project types is necessary.

Lastly, this study is based on the perceptions of public managers, which could affect results. For instance, our respondents seem to associate the citizen-oriented, ICT-enabled integration of public services with efficiency. However, it could also affect effectiveness and societal challenges, although this seems to be less clearly perceived by public managers. In addition, public managers reported the public value of projects. They are knowledgeable about the projects and receive inputs from different stakeholders, and can therefore provide a balanced assessment of public value. However, according to public value theory, public value should be assessed by citizens. Further studies could consider the opinion of other local stakeholders, particularly citizens. This study involved several municipalities and projects, which made it unfeasible to consider the opinions of citizens. In any case, public value is extremely fuzzy and different groups of citizens could have different, even contrary, opinions, which is difficult to manage in only one study.

While these limitations indicate that more research is necessary, this study improves our knowledge on which government capability mixes and project types lead (or do not lead) to different forms of public value.

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CRediT authorship contribution statement

Jose M. Barrutia: Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Carmen Echebarria:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Itziar Aguado-Moralejo:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Vanessa Apaolaza-Ibáñez:** . **Patrick Hartmann:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Writing – original draft, Writing – review & editing.

Appendix A. Items used in the questionnaire

Public value

Please indicate the extent to which you agree with the following statements referring to the new service you have chosen (1 = strongly disagree, 10 = strongly agree):

Efficiency-related value (Kim and Atuahene-Gima, 2010)

The new service helps to improve cost efficiency

With the new service, we are more efficient than similar municipalities

Effectiveness-related value (Kim and Atuahene-Gima, 2010)

The new service improves the service quality the municipality provides

With the new service, we provide higher service quality than similar municipalities

The new service provides a response to previously unsolved

problems

The service quality provided with the new service is in line with our expectations

The new service fits the needs of local society better than the ones provided by similar municipalities

The new service satisfies local society

The level of use of the new service fits our expectations

Societal challenges-related value

This service helps us to meet economic, social and environmental goals that go beyond efficiency and service quality

This service helps us to progress towards meeting crucial social and environmental challenges

This service helps our city to progress

Collaborative Capabilities

Provider collaboration competence (intensity) (Gruner and Homburg 2000)

Please indicate the extent to which you agree with the following statements referring to your collaboration with providers while working on the new service you have chosen (1 = strongly disagree, 10 = strongly agree):

We spent a lot of time linking our work to that of providers.

The frequency of meetings with providers was high.

Provider collaboration competence (quality)

Our interaction with providers was fluid.

The providers' contributions to the new service were valuable.

The providers' contributions outperformed our expectations.

The providers contributed highly relevant knowledge.

We felt very close to our providers.

Expert collaboration competence (intensity) (Gruner and Homburg 2000)

Please indicate the extent to which you agree with the following statements referring to your collaboration with experts while working on the new service you have chosen (1 = strongly disagree, 10 = strongly agree):

We spent a lot of time linking our work to that of experts.

The frequency of meetings with experts was high.

We involved several experts.

Expert collaboration competence (quality)

Our interaction with experts was fluid.

The experts' contributions to the new service were valuable.

The experts' contributions outperformed our expectations.

The experts contributed highly relevant knowledge.

We felt very close to the experts who participated.

We get on very well with them

Other governments' collaboration competence (intensity) (Gruner and Homburg 2000)

Please indicate the extent to which you agree with the following statements referring to your collaboration with other governments while working on the new service you have chosen (1 = strongly disagree, 10 = strongly agree):

We spent a lot of time linking our work to that of other municipalities.

The frequency of meetings with other municipalities was high.

We involved several municipalities.

Other governments' collaboration competence (quality)

Our interaction with other municipalities was fluid.

The peer municipalities' contributions to the new service were valuable.

The peer municipalities' contributions outperformed our expectations.

The peer municipalities contributed highly relevant knowledge.

We felt very close to the representatives of the peer municipalities.

We got on well with them.

Civil society collaboration competence (intensity) (Gruner and Homburg 2000)

Please indicate the extent to which you agree with the following statements referring to your collaboration with local civil society while working on the new service you have chosen (1 = strongly disagree, 10 = strongly agree):

We spent a lot of time linking our work to that of local society representatives.

The frequency of meetings with local society representatives was high.

We involved a high number of groups, including local collectives, NGOs and businesses.

We involved a high number of people from local society.

Civil society collaboration competence (quality)

The participants were representatives of the users of the new service.

Our interaction with civil society was fluid.

Civil society's contributions to the new service were valuable.

Civil society's contributions outperformed our expectations.

Civil society representatives contributed highly relevant knowledge.

We were very close to our local society while devising and developing the new service.

We got on well with the local society representatives.

Internal capabilities

Please indicate the extent of your agreement about how well the following statements describe what happened in your municipality during the process of the ideation, development and implementation of the new service you have chosen (1 = strongly disagree, 10 = strongly agree):

Organizational slack (De Luca and Atuahene Gima 2007)

We had uncommitted resources that could be used to fund strategic initiatives at short notice.

We had no problems obtaining resources at short notice to support new strategic initiatives.

Top management leadership (Pinto and Prescott 1990)

We were confident that the top managers would provide additional resources if needed.

The top managers shared the responsibility for the success or failure of the project with the project team.

We were confident that the top managers would support us if something went wrong.

The top managers gave us the necessary power to make decisions regarding the project.

Absorptive capacity (Jansen et al., 2005)

This municipality had knowledgeable people who were able to understand the pieces of information and knowledge we accessed properly and relatively quickly.

This municipality had highly qualified people who were able to identify, interpret and analyze the changes involved and their possible effects on the municipality.

Cross-functional collaboration (De Luca and Atuahene-Gima 2007)

Different municipality departments cooperated fully in generating, screening and developing the ideas for the new service from the very beginning.

Different municipality departments cooperated fully in establishing goals and priorities for the new service.

Different municipality departments were adequately represented on the project teams who worked on the new service.

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