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Résumé – Cet article vise à comprendre le rôle des réseaux dans le développement de services municipaux intelligents en s'appuyant sur le potentiel interprétatif du concept de Réseau d'Innovation Public-Privé dans les Services (ServPPINs). Un cadre conceptuel est proposé afin de comprendre le rôle, la structure et la nature des "smartServPPINs", et les facteurs qui influencent leur performance en matière d'innovations technologiques et non technologiques destinées au développement intelligent des villes.

Mots-clés – Réseau, innovation de service, ville intelligente, réseaux d'innovation public-privé dans les services

Marasco (Alessandra), Errichiello (Luisa), « The role of networking in the development of new city services. A framework for exploring smart public-private service innovation networks »

Abstract – This paper aims at understanding the role of networking for the development of smart city services by leveraging the interpretive potential of Public-Private Innovation Networks in Services (ServPPINs). We address the role, structure and nature of 'smartServPPINs', and the drivers influencing their performance in realizing technological and non-technological innovations for cities' smart development. An explorative analysis of two European case studies of 'smartServPPINs' is conducted.

Keywords – Networking, service innovation, smart city, Public-Private Innovation Networks in Services (ServPPINs)

THE ROLE OF NETWORKING IN THE DEVELOPMENT OF NEW CITY SERVICES

A framework for exploring smart public-private service innovation networks

Alessandra Marasco
and Luisa Errichiello[1]
Institute for Research on Innovation
and Services for Development
(IRISS)

INTRODUCTION

Recent years witnessed an increasing interest in cities' strategies and efforts to become smart in response to the societal challenges of sustainable socio-economic and urban development, global competitiveness and improved quality of life. Smart city initiatives involve innovative approaches to develop advanced services in various areas of the city life that are relevant to the needs of users and the urban environment (Nam and Pardo, 2011a, Paskaleva, 2011). In this direction, several studies point to the importance of partnerships and networks involving private firms, non-market organisations and citizens for the development of smart city innovations (*a.o.* Komninos, 2006, Schaffers *et al.*, 2011a, 2012b, European Parliament, 2014). However, theoretically grounded efforts to understand these complex

1 National Research Council of Italy (CNR); Via Guglielmo Sanfelice, 8 – 80134 – Naples, Italy; a.marasco@iriss.cnr.it, l.errichiello@iriss.cnr.it

collaborative arrangements at the crossroad of urban, social and service innovation are still limited.

This paper aims at providing a contribution in this direction by leveraging the interpretive potential of the service innovation perspective, namely the concept of Public-Private Innovation Networks in Services (ServPPINs). Recent literature on innovation in services emphasizes the role of these flexible inter-organisational structures between public, private and third-sector organisations for the development of new or improved services, also within the context of public services (Djellal *et al.*, 2013, Gallouj *et al.*, 2013a, Weber *et al.*, 2014). We argue that ServPPINs can provide a useful lens to advance the understanding of innovation within the complex landscape of smart cities, by properly addressing the complexity of interactions between public and non-profit stakeholders, private firms and users/citizens communities for the development of innovative solutions in response to urban and social needs. Based on research on innovation in smart cities and on ServPPINs, a conceptual framework is proposed for exploring the nature and role of what we labelled "smartServPPINs" in realizing opportunities for technological as well as non-technological innovations in the smart city context and the factors influencing their operation and performance. Specifically, the framework identifies a set of nested components for understanding the drivers, structure, dynamics and outcomes of smart-ServPPINs. Then, an exploratory case study analysis of two successful public-private service innovation networks in two different European smart cities is conducted on the basis of the conceptual framework with the aim of confront our framework with field insights so as to validate its potential for exploring the characteristics and role of ServPPINs in the implementation of smart city innovation projects and disentangling the complexity of these collaborative arrangements.

The paper is structured as follows. The next section examines the literature on innovation in the smart city context, highlighting the importance of networking among a variety of stakeholders for developing new and improved city services. Moreover, the main issues and gaps are considered in relation to the analysis of collaborative arrangements for smart city innovation. Section 3 introduces the service innovation perspective, notably the ServPPIN concept, as a useful lens to advance the understanding of the complex nature and functioning of public-private

innovation networks in smart cities. Against this background, Section 4 presents a conceptual framework for exploring smartServPPINs, which identifies the key components to be investigated for understanding the role of innovation networks to realize new smart city services and the factors influencing their effective functioning. In Section 5 two European case studies of smart innovation networks are analysed as an initial step of the research in order to validate and illustrate the value of the proposed framework. Finally, in the last Section some conclusions and directions for future research are provided.

I. NETWORKING AND INNOVATION IN THE SMART CITY

In recent years, the concept of "smart city" has attracted an increasing attention as many cities worldwide have started to develop strategies and initiatives to manage in a more effective way the complexity of urban living and development within the social, economic and environmental domains. Notwithstanding the multiple uses of the term and the lack of a shared definition, a smart city is quintessentially enabled by innovative approaches in urban areas that are based on the symbiotic connection of people, businesses, institutions, technologies, infrastructures and spaces (Nam and Pardo, 2011b, European Parliament, 2014). Indeed, many studies in this area point to the importance of embracing an open perspective to city innovation, emphasizing a wide range of collaborative models and approaches (e.g. districts, clusters, public-private-people partnerships, living labs, open data, e-governance), which link local government, research institutions, universities, companies, third-sector organizations and citizens into an innovation ecosystem for developing more inclusive, higher quality and efficient services (Schaffers *et al.*, 2011a, Paskaleva, 2011, Komninos *et al.*, 2013, Zygiaris, 2013). Also the current European Commission programs FP7-ICT and CIP ICT-PSP stimulate experimentation into smart cities as open and user-driven innovation ecosystems for designing and piloting innovative solutions based on the collaboration between citizens, firms

and local governments (Schaffers *et al.*, 2012). In this respect, Schaffers *et al.* (2011a) distinguish two different layers of collaboration in smart city innovation ecosystems. The first concerns collaboration within the innovation process between research, development, validation and utilisation, with the innovation projects carried out within smart cities being the typical arenas to explore these interactions. The latter concerns collaboration at the territorial level, significantly driven by urban and regional development policies aiming at strengthening the "urban value creation system". At this level, the creation of effective conditions for innovation is affected by a number of factors, including physical and immaterial infrastructures, entrepreneurial climate, demand for services and policy interventions aimed at stimulating the enhancement of innovation capabilities and the creation of sustainable partnerships among the main stakeholders from business, research, policy and citizen groups. Clearly, both levels of collaboration and their interaction are important to foster the development pathway towards a smarter city.

However, available studies seem to focus either on collaborative approaches at the second level, stressing the key role of public-private partnerships (PPP) in urban planning and infrastructure development (e.g. Bevilacqua *et al.*, 2012, Bakici *et al.*, 2013, Ng *et al.*, 2013), or on interactive and user-driven models of innovation, with a particular emphasis on the potential of living labs for co-creating new city services (e.g. Pallot *et al.*, 2011, Paskaleva 2011, Schaffers *et al.*, 2011b). Moreover, available studies on networked innovation within smart cities are mostly technology-oriented, focusing on its outcomes in terms of new technologies and e-service applications. While technological innovation is a necessary condition to make a city smart, the development and adoption of up-to-date technologies per se do not guarantee the success of smart cities initiatives. Indeed, as Nam and Pardo (2011a, p. 190) underline, the challenge of smart city innovation is not primarily on technology, but on service transformation and improvement, since "the ultimate goal of a smart city is to enhance the overall quality of city services". This calls for a more comprehensive view of innovation, including also the non-technological human, organizational and political changes associated with the innovative fulfilment of city's service demands (Nam and Pardo, 2011a). Such a broader view is in line with the concept of social

innovation, which is increasingly emphasized within current smart city programs and initiatives (e.g. URBACT II, Periphèria, Human Smart City movement). A core concept to social innovation for smarter cities is the co-production of socially innovative solutions to urban problems with a strong involvement of citizens and non-governmental associations and the diffusion of innovative models of cooperation and social relationships to improve service quality (Ramsden, 2012). By this brief review, it appears that research on networking for innovation in the smart city context would benefit from additional efforts to better take into account the interplay between the different layers of collaboration, the complex nature and role of collaborative arrangements involved in innovation processes and the non-technological, social nature of smart city innovation.

II. THE ROLE OF PUBLIC-PRIVATE INNOVATION NETWORKS FOR THE DEVELOPMENT OF SMART CITY SERVICES

Recent literature on innovation in services has focused on the role of interactive structures and processes in relation to a general open innovation perspective covering a range of cooperative models (Gallouj and Djellal, 2010). These include Public-Private Innovation Networks in Services (ServPPINs), which involve collaborative partnerships between public, private and third-sector actors for developing, producing and delivering new and/or improved services. ServPPINs are flexible collaborative structures that support the exploitation of complementarities and synergies among different organisations, the integration and sharing of dispersed knowledge, technology, competences and potential risks in uncertain innovation processes. These inter-organizational arrangements are a specific type of innovation networks, being characterised by three fundamental features (Gallouj *et al.*, 2013a): firstly, the interaction between public and non-market actors and private actors occupies a central role; secondly, service providers act as the main actors in the networks; and, finally, they build upon a broad conceptualization of innovation, including

also non-technological forms (i.e. organizational, process, cognitive, conceptual, network-based). Moreover, they are "naturally" characterized by customer/user interactivity and involvement in innovation processes, given the endogenous role of customers in service co-production. The relational configuration of ServPPINs can widely vary depending on the actors involved, their role and the degree of formality of relationships among them. Further, it is subject to change during the networks' lifecycle, which can be described in terms of the three main phases of initiation, emergence and wider implementation or uptake (Green *et al.*, 2013, Weber *et al.*, 2014).

Empirical research on the structure and operation of these networks in transport, health, tourism, knowledge-intensive services highlights that their success is determined by four main interrelated sources (Rubalcaba *et al.*, 2011): a) the role of both internal and external drivers, including trust, pro-innovation culture, leadership, a right strategy between bottom-up or top-bottom approaches, financial and political support, technological opportunities and policies concerning innovation, public procurement, employment and skills, sectoral development; b) the integration within wider systemic and social networks; c) the ability to overcome barriers in areas such as the rigidity of public administrations, the existence of different interests and incentive systems, free riding, asymmetric information and networking competences, appropriability; d) the reduction of evolutionary inefficiencies, concerning the risk of not being efficient enough to adapt to the changing phases of networks' lifecycle.

Recent studies have emphasised ServPPINs as a viable means for approaching, from a network-based perspective, a field of innovation that is still largely underexploited, namely innovation in public services (Djellal *et al.*, 2013, Weber *et al.*, 2014). Indeed, research in this area pays a growing attention to innovation models for the public sector, given the increasing complexity underlying the goal of public value creation for service users, citizens and society as a whole in an era of economic and financial crisis where traditional mechanisms of public provision such as the State and the Market are no more adequate. In particular, it is highlighted that innovative solutions to modern challenges can be effectively developed, promoted and maintained through multi-actor collaborative structures that enable public, private, third-sector and

civil society actors to interact in a complementary and synergistic way in joint innovation processes (Weber *et al.*, 2014). In this viewpoint, ServPPINs have been suggested as a viable alternative for realising innovations to existing models, such as outsourcing of public service provision and contractual PPPs. Moreover, it has been shown that these structures represent a suitable organisational mode for social innovation, facilitating the collective creation process necessary for the development of new solutions to societal needs (Djellal and Gallouj, 2011, Rubalcaba *et al.*, 2013).

For their features, ServPPINs can thus be a valuable concept to explore innovation networks in smart cities and advance the understanding of key factors influencing their effective operation and role in realising innovations for cities' smart development. Indeed, these new inter-organizational arrangements describe the way in which multiple public, private, third-sector and civic actors interact to produce not only technological innovations but also social innovations. Thus, they allow to address public-private collaboration for innovation through a more holistic view, by taking into account the complexity of networked innovation processes in the context under examination in terms of actors' heterogeneity, relationships' dynamism and variety of innovation outcomes.

III. A FRAMEWORK FOR EXPLORING PUBLIC-PRIVATE SERVICE INNOVATION NETWORKS IN SMART CITIES

Drawing on studies in the fields of collaborative innovation in smart cities, ServPPINs and previous research (Errichiello and Marasco, 2014), a conceptual framework is proposed for disentangling the complexity of smartServPPINs and understanding their role in realizing opportunities for service innovations. The framework (Figure 1) identifies a set of nested components including: 1) the structural features, processes and dynamics of the network; 2) the innovation outcomes produced at various levels; 3) the broader smart city innovation context; 4) the networking regime related to a given smartServPPIN.

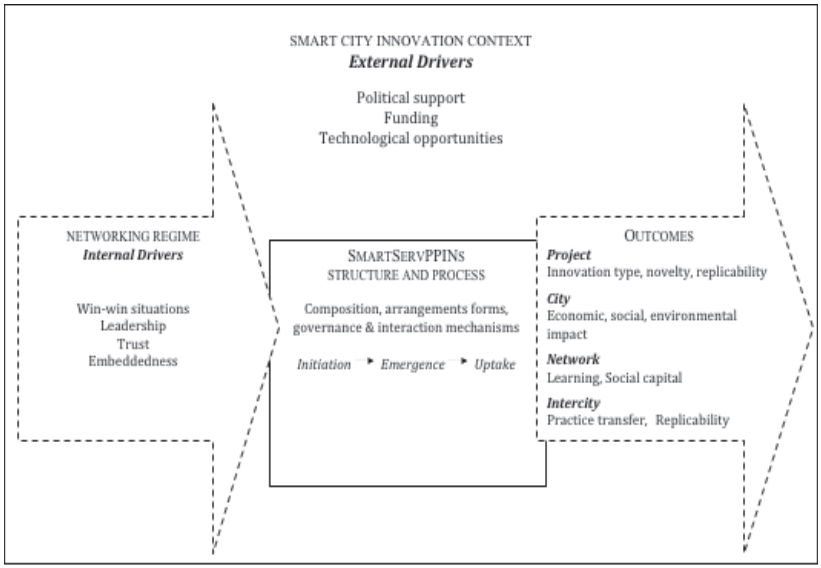

FIG. 1 – The conceptual framework.

The first component concerns the *structure and process* of smartServP-PINs, which can be described in terms of actors' roles, their competencies and contribution to the different stages/activities of the innovation process, the forms of arrangements, the governance and interaction mechanisms. These arrangements can vary widely, for example, depending on the number and type of actors involved, which can be from the public administration, the policy-making area, the research system, the private business sectors, the third-sector, the civil society. It is to be noted that often smartServPPINs have an open "geographical" character that goes beyond the boundaries of the city, because they include actors from other cities and regions that are gathered together by the same transnational project and funding. For example, this is the case of the transnational innovation networks that participate to the several European smart city projects aimed at transferring and testing innovative solutions in each of the partner cities (e.g. Genius Open – URBACT; CitySDK – ICT PSP; Open Cities – ICT PSP). Moreover, their initiation can be based on a top-down approach, driven by public action, as well as by bottom-up initiative, based on the voluntary engagement of other actors. Further,

these arrangements can be characterized by a "caretaker" mode, in which one actor plays the role of conductor, hub actor or system integrator, or by a "distributed" nature, in which responsibilities are more diffused among the actors (Gallouj *et al.*, 2013a). Overall, the structure and process of smartServPPINs need to be considered in a dynamic way, in order to take into account the evolution of the network over time. This can be described as a life-cycle (Green *et al.*, 2013, Weber *et al.*, 2014), distinguishing between the three main phases of initiation, emergence and up-take: the first one is characterised by the development of a shared vision among partners of needs, benefits, contributions as well as of the basic operating mechanisms; the second phase involves the full operationalization of the network along with the finalisation of agreements, the establishment of more sophisticated and practical structures and processes, agreed roles, lines of communication, milestones, leadership, and decision-making; in the third phase, the goals of the network have been achieved in the case of successful network formation and the network could be terminated or continued in a further project where opportunities exist. Throughout these phases, smartServPPINs are likely to change and evolve along most of their dimensions, including composition, roles of actors, governance/communication mechanisms, networking regime, external and internal enablers.

The second component of the framework reflects the short-term and long-term *outcomes* of smartServPPINs, which can be conceptualized through a multi-dimensional and multi-level categorization. Specifically, we can identify innovation outcomes at four interrelated levels: 1) the innovative solution realized through the project; 2) the network; 3) the city; 4) the intercity level. As to the first level, the type of innovation (technological, non-technological), its degree of novelty and replicability are the most significant elements to consider. Developing new technological solutions, such as electronic management systems, digital platforms and e-service applications is a key objective for many smart city initiatives. However, the development of new technological applications in smart city projects is often the enabling condition for other (central) innovation outputs: *service innovations* in different smartness fields, i.e. the development of new or improved services for city users, such as new energy-efficient services (smart environment), e-car sharing and e-bike services (smart mobility); *social innovations*, i.e. the behavioural

change of citizens (e.g. the reduction of their energy consumption) or the community involvement in public decision-making; *network-based innovations*, when the main goal of the project is the establishment of a new collaborative arrangement between private and public organizations. The replicability of the innovative solution is linked to the possibility of increasing the size of the related project by involving more stakeholders (also from different cities), funding and services (scaling of the project), or extending the geographical area of application/adoption of the solution within the same city or, more ambitiously, in other smart cities European Parliament (2014). At the network level, the main innovation outcomes can be primarily measured in terms of acquisition of new skills and competences by participants in the innovation network (learning) and increased social capital, especially in the form of accrued mutual trust. Acquiring new knowledge is key for both private and public organizations, since it increases their innovation capability and foster knowledge transfer across different innovation projects (i.e. a specific partner would operate as a knowledge gatekeeper from one project to another). In a similar way, if trust building is a matched goal of project-based collaboration, this will reveal a crucial intangible asset for starting new innovation projects with the trusted partners. At the city level, the overall goal of any smart city strategy would always be to realize significant economic (e.g. new job opportunities, new businesses), social (e.g. better health, timesaving, democratic governance) and environmental (e.g. energy saving and lower Co2 emissions) outcomes through a portfolio of relevant initiatives and innovation projects. Finally, at the intercity level, the main outcomes derive from the possibility of benefiting from the practice transfer and learning from new and different environments. This can yield, among others, opportunities for a better assessment of the suitability of innovations for different circumstances and for improving their replicability and dissemination.

The third dimension relates to the *smart city innovation context*, which creates opportunities and constraints for networked innovation influencing the general features and properties within which specific smartServP-PINs initiate, develop and operate over time. As pointed out by recent research on ServPPINs (Rubalcaba *et al*., 2011, Weber *et al*., 2014) and innovation in smart cities (Schaffers *et al*., 2011a), this broader context mainly reflects the institutional framework that operates at the city level

and that shapes processes of innovations (Nelson and Nelson, 2002, Schartinger, 2013, Labarthe *et al.*, 2013). The role of "institutions", generally defined as social rules, norms, conventions, habits and values that structure social interactions (e.g. North, 1990, Hodgson, 1998), within the smart city innovation context is considered at different levels (Williamson, 2000, Hollingsworth, 2000), notably: cultural and social norms that shape the business climate, the entrepreneurial spirit and the degree of diffusion of a pro-innovation culture at the urban level; the institutional environment constituted by formal rules (i.e. laws, regulations, policy interventions and government investments) that can shape and foster infrastructural/technological development, employment and skills, entrepreneurship, innovation and collaboration opportunities; the institutions of governance (Williamson, 2000), i.e. specific conditions that influence the strategic decision of actors to form an innovation network rather than choosing hierarchies or entering markets. These conditions, indeed, influence the structure and process of the smartServPPIN in many respects, e.g. in terms of mode of network inducement (top-down or bottom-up) and the specific nature of the network (supply chain or strategic alliance) (Schartinger, 2013) or in relation to end-users' involvement in the innovation process (Labarthe *et al.*, 2013). Next to the institutional setting, the smart city innovation context also includes the smart-oriented strategy that characterizes urban environments in terms of level of commitment showed by cities to act along one or more smartness areas (i.e. smart economy, smart mobility, smart environment, smart living, smart governance, smart people). This dimension, indeed, directly affects the overall "endowments" of a smart city (Giffinger and Pichler-Milanovic, 2007) and reflects different degree of integration, coordination and interaction capabilities of local stakeholders (and the public actors in particular) in managing smart initiatives and projects (Achaerandio *et al.*, 2012). According to the framework, the smart city innovation context also includes inter-city factors that serve to place a city within a broader arena where other cities are actively engaged in implementing smart development programmes. The smart city innovation context influences the evolution and performance of smartServPPINs from their outset and over time, providing the key external drivers for the initiation of a given project and the related collaborative network, but also creating the conditions for its development along a specific

innovation trajectory and its effective operation, thus influencing the dynamics of the collaborative network in all the three phases of initiation, emergence and up-take (Green *et al.*, 2013). In this respect, empirical research on ServPPINs has identified a number of key driving forces for all the temporal stages of these innovation networks that, according to our framework, emerge from the broader smart city innovation context. These include (Gallouj *et al.*, 2013a, Weber *et al.*, 2014): technological and market opportunities, customer demands, environmental concerns, concrete actions from public or semi-public institutions in the form of programmes, political support, semi-public coordination, financial incentives and funding opportunities for specific projects. Many of these conditions preserve their relevance also in the context of smart city innovation, so that (for example): the "public mission", i.e. the intention to improve the quality and efficiency of city services, can be viewed as a key driver for the ServPPIN's initiation in all those cities actively involved in the implementation of a smart development plan; a sufficient allocation of financial resources for new smart city service development can be crucial for the emergence of the innovation network; finally, the establishment of a convincing business model can guarantee the uptake of the project as well as its replication on a wider scale. As for inter-city factors, we assume that the level of rivalry among cities aspiring to become "valuable practices" of smart city development is particular relevant. Indeed, this factor can directly influence cities' capability and effort to access financial or knowledge resources that are allocated to specific smart initiatives and projects through competitive schemes.

The final component of the framework, namely the *networking regime*, includes the set of relational conditions that can foster or hamper networked collaboration at the project-level. This can be connected to the overall atmosphere of the relationships[2] (among network members) *à la* Håkansson

2 The concept of "atmosphere" is part of the Interaction Model developed by the Industrial Marketing and Purchasing (IMP) Group to understand the interaction process in dyadic relationships and their embeddedness in industrial networks. In this model, the interaction occurs within an atmosphere arising from the closeness, dependency, expectations and cooperation of the parties, and is further part of a larger environmental system. In his seminal work on the Interaction Model, Håkansson (1982, p. 29) notes that the variables related to the atmosphere "are not measured in a direct way in this study. Instead, the atmosphere is considered as a group of intervening variables, defined by various combinations of environmental, company specific, and interaction process

(1982), which arises from the overall state of closeness or distance, power-dependence, conflict or cooperation and mutual expectations of the parties involved in a specific smartServPPIN. On the one hand, this component is embedded in (and thus is conditioned by) the broader smart city innovation context, which influences the openness of firms' towards collaboration and their innovation capabilities on the other hand, it includes a number of internal conditions that influence the dynamics and performance of the innovation network with variable intensity and often in combination. The networking regime provides key drivers for the initiation of a smartServP-PIN that can be considered *sine qua non* conditions for collaboration, but remain essential throughout the innovation process. These include (Bryson and Crosby, 2006, Emerson *et al*., 2011, Gallouj *et al*., 2013a, Weber *et al*., 2014): leadership, commensurability and non-rivalry of needs and interests, complementarity of competences. As for mutual trust, although it is widely recognized as a precondition for initiating collaboration at the inter-organizational level, innovation networks can also start with low degree of mutual trust. Indeed, what is crucial for successful collaboration is the capability of trust building along the innovation development process (Ring and Van de Ven, 1994, Vange and Huxham, 2003). Similarly, prior relationships or integration in existing social networks at both local and extra-local level (*structural embeddedness*)–though not always required for the initiation of a smart city project–can facilitate the formation and maintenance of collaborative innovation networks since it is often through them that actors can judge the trustworthiness of other potential partners (Ring and Van de Ven, 1994, Bryson and Crosby, 2006), increase their attitude towards risk-taking and a pro-innovation orientation. However, the influence of the collaborative regime on the smartServPPINs' dynamics and performance is not unidirectional. Indeed, over time, the network itself affects the emergent features of the collaborative innovation regime, since it contributes, for example, to accruing the capability of the parts to exploit complementary skills, to maintaining commitment towards a common goal, to reducing unbalance between firms (e.g. large firm dominating), to conciliating different culture, interests and competences (e.g. among public and private actors).

characteristics. The atmosphere is a product of the relationship, and it also mediates the influence of the groups of variables".

IV. AN EXPLORATIVE ANALYSIS OF TWO EUROPEAN SMARTSERVPPINS

As an initial step of the research, an exploratory empirical analysis has been conducted based on two European case studies in order to confront our framework with field insights in order to validate its analytical potential for exploring the characteristics and role of ServPPINs in the implementation of smart city innovation projects. Specifically, the in-depth case study analysis is aimed at showing how the complexity of these organizational arrangements can be disentangled by focusing on the set of nested components of the conceptual framework: 1) the structural features of these innovation networks and their dynamics; 2) the innovation outcomes produced at various levels; 3) the broader smart city innovation context, which creates the general environment within which specific ServPPINs unfold over time and provides external drivers for their formation and up-take; 4) the networking regime, which creates the set of internal drivers for public-private collaborative innovation at project level.

METHOD

The analysis is based on two case studies conducted by the authors within a broader research project that considers a number of European smart cities and focuses on several innovation projects within each of them. We selected two case studies in which the phenomenon of interest is "transparently observable" (Pettigrew, 1988, cited in Eisenhardt, 1989). The selection of the cases was carried out at two different levels: the smart city level and the project level to which a specific service innovation network is associated. As to the first level, two cities being strongly committed and engaged in a *smarticization* process have been identified among a list of European best practices, which was compiled on the basis of available rankings, indexes and awards (including the Ranking of European Medium-Sized Cities; the Between Smart City Index; the IDC Smart City Index; the IESE Cities in Motion Index; the World Smart City Awards). The fact that the two cities have both a formal "smart strategy" plan and that

innovation projects are part of a broader public mission towards the smart development of the city allows us for comparison. However, the two cities present differences in terms of focus, number and degree of integration of initiatives and projects carried out under the smart city "umbrella". This aspect allows us to examine the influence of the specific smart city innovation context on the development and operation of the two smartServPPINs under examination. With regard to the second level, this study adopted the selection criteria developed within the European FP7 Project ServPPIN–The Contribution of Public and Private Services to European Growth and Welfare, and the Role of Public-Private Innovation Networks (Gallouj et *al*., 2013a): (1) the cases have a concrete innovation aiming at the improvement in service characteristics; (2) there is a constellation of public-private organizations that is central to the realization of the innovation in focus. Consistently with these criteria, we selected two cases: the Climate Street (*Klimaatstraat*) project in Amsterdam (The Netherlands) and the Love City Index project in Siracusa (Italy).

Climate Street (CS) represents a flagship innovation project among the official pilots of the Amsterdam Smart City Program and its primary goal was the reduction of Co2 emissions and energy consumption in a popular shopping street (the *Utrechtsestraat*) in order to improve its sustainability and its attractiveness for city visitors. The project was conceived as a small scale city demonstration and a testing pilot for a portfolio of sustainable innovations and advanced energy saving technologies (e.g. sensor monitoring systems for efficient energy management, smart solutions for public spaces, sustainable waste logistics innovations). The pilot was launched in 2009 by the Amsterdam Smart City (ASC), which is a public-private partnership set up to stimulate and advance local innovation projects aimed at testing and developing smart technology solutions focused on energy transition and open connectivity. Initiated in 2009 by the Amsterdam Economic Board (a not-profit public organization), the City of Amsterdam and two private companies, ASC has grown over two years to include more than 70 partners among businesses, authorities, research institutions and the citizens and carry on more than 20 pilots. Among these formal projects, CS has been established as an international best practice of smart initiatives oriented at maximum energy efficiency and minimum environmental impact in

the city and it is widely considered as a blueprint for other European cities (Amsterdam Smart City, 2011).

The *Love City Index Siracusa* (LCIS) project was developed after that in 2012 the city of Siracusa was been selected as the only Italian one for "Smarter Cities Challenge", IBM's global competitive grants program that funded the deployment of IBM's top experts to cities' worldwide to help them address critical challenges and become smarter. During three weeks in June 2012, a team of six IBM experts worked in the city to deliver recommendations on the key challenges identified by the municipality, after analysing all relevant data and reports and meeting several representatives of local stakeholders (public actors, private firms, non-profit organisations, associations, citizens). Based on IBM team's findings, six fundamental "pillar" recommendations were developed together with various projects that lay out how each recommendation could be achieved. In particular, one of them was directed to improve the tourist infrastructure and services, concentrating on understanding tourism needs and behaviours (IBM, 2012). In line with this goal, in September 2013 the LCIS project started with the purpose of developing a new mobile application, which was meant to be not only a digital guide for city visitors, but also a tool to engage them in the preservation of Siracusa's outstanding cultural heritage, which is part of the UNESCO World Heritage List. Through the three functionalities of the app (*Know-Feel-Act*), the user can get information about the selected point of interest (e.g. history, visiting hours, contact references, best next places around); communicate and share his/her feelings ("love") in front of the visited place; and, give his/her own opinions, suggestions and comments as an "expert evaluator" to preserve Siracusa and its heritage. The "buzz" and suggestions generated through the app are evaluated through social analytics tools in order to detect the Love Index of the city and give the public decision makers valuable information on the actions to be taken to preserve the sense of love people feel and improve the local tourist/cultural services. The first release of the Love City Index app (LCISiracusa) included more than 60 points of interest in three different categories (Products, Landscapes, Buildings and Places).

Data about these cases was collected through a series of semi-structured interviews with key actors, i.e. projects' leads and members of organisations involved in the projects. The interviews were conducted

in the period May-July 2014 and based on a semi-structured interview protocol aimed at gathering information on: the role of different actors in the network; the relationships among them; the governance and information sharing mechanisms; the drivers and barriers to collaboration in the smartServPPINs, the short-term and long-term outcomes. Moreover, we put together the interviews' results with documentary evidence (reports, press articles, projects material, websites) in order to obtain a triangulation of information and thereby to enhance the reliability of the data collection process (Yin, 2003).

RESULTS AND DISCUSSION

In this section the selected smartServPPINs are analyzed and compared on the basis of the proposed framework. Accordingly, the results are discussed with reference to its different components (Figure 1).

The structure and process of the two smartServPPINs

The two cases differ significantly in terms of composition, modes of inducement, governance structures and dynamics. In more detail, the network associated to the CS project was quite broad and diversified, including 19 partners from both the public and private sectors. Private companies were mostly technology providers operating in different sectors (e.g. utilities and infrastructures, telecommunications, logistics) and included local providers and techno startups next to international players, such as Vodafone and Philips. However, the smartServPPIN was initiated by a small core team of partners, namely: Amsterdam Smart City; Van Gansewinkel, a local waste collecting private company; Club of 30, a project organization specialized in the implementation of sustainable operational process solutions that was formally given a project management function by ASC; the young Ultrechtsestraat Business Association, involving all the 120 entrepreneurs of the street and represented by the so-called "shopping street manager". The formation of the innovation network was driven, through a bottom-up approach, by the decisive action of Van Gansewinkel that proposed the idea for the project to ASC, the shopping street manager and the association of local entrepreneurs. Involving the end-users (the entrepreneurs) in the innovation network as formal partners was the main goal of the

initiators, since a number of technological innovations (including smart grids, energy scanners and smart meters) needed to be tested through real-life, daily use at the entrepreneurs' workplace, i.e. bars, restaurants and local shops in the street. At the same time, their involvement was necessary to achieve the long-term goal of the CS project, namely the change of end users' behavior and patterns of energy consumption. Beside the local entrepreneurs, the choice of the cooperation was predetermined (*path dependent*) only for Van Gansewinkel that previously collaborated with the municipality of Amsterdam and for Club of 30, which was directed by the prior commercial director of Van Gansenwinkel when the project was formally launched. For the vast majority of private companies that joined the project as development partners, the forms of partner selection corresponded rather to the supply chain type of the network (Schartinger, 2013) Specifically, the contributions of most partners did depend much upon their specific resources, i.e. finance, market knowledge as well as technology-based services to showcase in the street. Other network partners, such as utilities and infrastructure providers were selected by call for tenders based on their technical know-how and resources. As for entrepreneurs, only a small group of 40 inspired and motivated entrepreneurs was initially involved in the pilot and was formally given the role of "frontrunners" for individually testing new technologies and working together in the co-development of the CS concept.

In the LCIS case, the project was associated to an innovation-oriented PPP, which can be considered a specific case of ServPPIN (Gallouj *et al.*, 2013b). The partnership was composed of the Siracusa municipality and the IBM Foundation Italy, a non-profit organization instituted by IBM for promoting technological innovation projects on the themes of culture, education, labor and social problems and providing financial and operational support to organizations and institutions working in these fields. This partnership was created in continuity with Siracusa participation to IBM's Smarter Cities Challenge by the joint initiative of the municipality and the IBM Foundation. Therefore, its initiation was essentially driven by public action (top-down approach) and based on a previous, positive relationship between the partners. The partnership operation was characterized by a distributed nature of responsibilities that well reflected actors' competences. Specifically, IBM Foundation

Italy funded the project and involved the IBM Human Centric Solution Center for the R&D supervision and the technical development of the app's architecture. The municipality coordinated the project jointly with IBM Foundation Italy and participated to the development phase for delivering the app's contents. In the project's final stage, the municipality involved the local Impact Hub[3] for collaborating with the partners (IBM Foundation Italy and IBM Human Centric Solution Center) in the presentation and promotion of the app. Impact Hub Siracusa was created in 2010 by a public-private initiative (a.o. Siracusa municipality, Catania University, Association of Cooperative Companies) within the European project Euro-South Hub. Since then, the Hub participated to several projects, contributing with its network of relationships and experiences in facilitating collaboration.

As described, in both cases the core network was formed by PPPs based on previous relationships that developed with the aim of leveraging the complementarities of competences and the possible synergies among the partners. Moreover, they were commonly characterized by the key role of multinational technological players (IBM, Philips, Vodafone) in the development of innovative solutions. This is not surprising in consideration of the smart nature of these networks and the related technological and market opportunities for these big firms. In the CS case, for example, it is difficult to assume that these technology providers would have joined the project without a strong belief in the high potential offered by ICT-based solutions to improve energy efficiency and reduce Co2 emissions. To them, the pilot offered the opportunity to significantly reduce the risks and the financial effort required for the experimentation and testing stages of the innovation process before their release into the market and large-scale production. Another common feature across the cases is the relative stability in the networks' composition and actors' roles along all the life cycle of the projects though they have different durations–two years for CS and three months for LCIS, respectively. This is particularly relevant

3 Impact Hub is a shared work and event space for a global community of entrepreneurs, activists, artists, and professionals using the power of business to drive positive social and environmental change. The first Impact Hub was founded in London in 2005 and has evolved into a rapidly expanding global network of over 7,000 professional members in 60 cities worldwide.

in the CS case, where the network stability significantly mattered to drive the ServPPIN forward and to ensure its success in achieving the expected goals. Such a structural strength of the network is likely to be connected also to the well-structured approach adopted by the core team in the pre-initial phase of the project, which relied on the mapping of all the relevant stakeholders, the rigorous assessment of the potential environmental impact of the project and, finally, a dedicated effort to communicate to different stakeholders the relevance of the project's goals. Indeed, all these actions positively contributed to their partnering and collective commitment to the project, ass highlighted by the project leader: "Different groups have different targets… You have to make sure that everyone is aware that you can reach your own target only with cooperation with each other… it takes a lot of time and effort to keep everyone committed, especially the entrepreneurs". Moreover, it is arguable that another relevant feature of CS smartServPPIN that positively influenced its stability and performance was the adoption of a formal governance structure based on the creation of a dedicated entity–a steering committee representing all the partners– that centrally coordinated key decisions and activities. By contrast, the governance of the LCIS case was characterized by a shared but informal structure, with the two partners working jointly without an *ad hoc* administrative entity. This difference in the structure can be due also to the diverse scope of the two smartServPPINs, with the former posing greater governance challenges for the high number and variety of members.

The outcomes of the smartServPPINs

The new solutions produced by the examined ServPPINs can be considered successful innovations, notwithstanding the short duration of the projects and the fact that they have been completed quite recently. It is acknowledged that measuring success of smart city initiatives is challenging task that is made complex by a number of factors including: the relative immaturity stage of most projects (i.e. they are mainly in the pilot testing phase); the difficulty of reliably assessing the direct contributions of these projects to wider city objectives and isolate their effects from those produced by other

projects and initiatives; the potential lack of concrete performance measures; and, the fact that success can mean different things to different stakeholders. Therefore, projects' success is often defined essentially in relation to the most visible elements (the objectives, inputs, processes and intended outcomes) and their overall impacts are strongest when they can be scaled, replicated or otherwise extended to other locations (European Parliament, 2014). Also in the examined cases, projects' achievements can be evaluated by taking into account the stated objectives and in light of the scaling potential of the outputs. With regard to CS, according to an *ad hoc* research carried on by the partner Club of 30, the pilot project has resulted in a structural reduction of CO2 emissions in the city of about 200 tons/year with an efficiency improvement in energy use of more than 40 %. In more detail, the experimentation has produced about 9 % of energy savings for each business activity involved in the project, while the implementation of smart technologies in the public spaces has led to 36 % energy savings. Moreover, the success of the project is proved by the subsequent development of the smart device "Quby", an energy management system awarded with the "Smart Grid Innovation Awards 2011" and implemented by 30 entrepreneurs in the Climate Street. Indeed, through the testing phase and end users' involvement, the Quby Owner (Home Automation Europe) further developed the device and scaled up its product abroad. Moreover, one of the big energy companies in the Netherlands (Eneco) currently offers the Quby device free to its customers. As for LCIS, the LCISiracusa App received in 2014 the Smart City Award at the most important Italian event dedicated to ICT solutions (Smau). Siracusa municipality is actually engaged in the up grading of the app in order to extend the service to 1000 points of interest all over the surrounding territory. However, it is to be noted that in both cases the development of new technological applications was the enabling condition for other outcomes. Specifically, CS can be considered as a complex "architectural innovation" (Gallouj and Weinstein, 1997), where the change effort of a multi-agent interacting system was oriented at the co-production of different forms of technology-mediated and non-technological service innovations. The first types of innovations are closely connected to new technology products, solutions or devices (e.g. the Quby energy

display) and offer new or improved services to city users (e.g. energy consumption information services, logistics services, LED-based lightening services). Non-technological innovations are social in nature, since the project also aimed at producing a change in the awareness and patterns of energy consumption of end users' (e.g. entrepreneurs and citizens). Also in the LCIS case, the technological output (the LCISiracusa App) can be associated to a social innovation being aimed at stimulating a behavioural change of users (awareness and responsibility towards the protection of the city and its cultural heritage) and their involvement in public decision-making. Indeed, describing the innovation concept, an IBM Manager stressed its social and participatory value: "For the first time we addressed an important aspect that concerns what we call the 'rate of love' towards our artistic and cultural heritage. The way we feel in front of a work of art can now be measured and used by those who have the responsibility to make decisions for its protection and enhancement. This is very important, since smart cities are made of emotions beyond the technological aspects that support their development". At the same time, this app is also the vehicle for an innovation of practices within the public institution for decision-making processes related to cultural and tourism development, since these can be based on bottom-up information reflecting real users' needs. The social nature of innovations in both projects is also reflected at the broader city level, where they pursued to respectively produce an environmental (CS project) and cultural impact (LCISiracusa), which in both cases is ultimately aimed at fostering cities' sustainable development. At the network level, the main innovation outcomes consist of learning opportunities created by collective work and knowledge transfer practices among the partners. In the CS network, these mainly concern the adoption of the Living Lab methodology since it relied on a real-life laboratory with end users acting as "testers" of specific technologies or their combinations through their daily use at the workplace. For the other case, significant learning opportunities were reported with regard to the structured approach brought by IBM for communications management. As highlighted by Giuseppe Di Guardo, head of Siracusa municipality Europe Office (Ufficio Programmi Complessi e Politiche Comunitarie): "This partnership allowed us to learn much about such a valuable

approach to managing interactions". Moreover, the collaboration with IBM was perceived by the public actor as an opportunity for pushing an internal change process that was felt necessary for boosting urban innovation. It is worth noting that other long-term outcomes of the LCIS project are likely to emerge yet and therefore to be assessed only after some more years from its conclusion (in the year 2013). Indeed, while the outcomes that are direclty related to the innovative solution realized through the project are quite evident in the short term (i.e. the development of new services for city visitors), other outcomes at the network, city and intercity level related to learning and change processes require a longer term to be appreciated.

The smart cities' innovation context

In the achievement of the above outcomes, a number of external and internal drivers appear to have been influential for the initiation, development and operation of the examined networks. With regard to those stemming from the broader smart city innovation context, the two cases present some common factors, namely the high importance of the public mission, i.e. the intention to improve the quality and efficiency of city services, accompanied by concrete actions from institutions in the form of: innovation supporting initiatives; funding opportunities; institutional/political support to the network. Indeed, in the CS case increased environmental concerns produced strong pressure on public agents to improve the efficiency of city services and reduce the levels of pollution and Co2 emissions through the development and adoption of energy-saving technologies by city users. In this respect, although the initial impulse to the project was given by a private waste collecting company, the decision of ASC to formally launch the project relied on the convincing nature of the proposed concept and the high energy-efficiency potential of the envisaged technologies. ASC's central role as initiator, coordinator and promoter shows the key function of the public actor for signaling the importance of the project and accelerating the network formation. Since the public-private partnership has acted from the beginning without any "personal and financial interests" to bring interested parties together and foster collaboration, it has built a solid public

trustworthiness, thus providing an important impulse to network building. Public support was also given in the form of funding, with financial resources provided by both the non-profit public organization Amsterdam Economic Board, co-founder of ASC, and the Amsterdam Centrum District Administration. According to Ger Baron, cluster manager of ASC, Amsterdam is one of the few example of urban innovation that has showed to be sustainable through the balanced mix of private and public actors: "The Public administration support is essential: produces 'trust', open data, long-term commitment, policies and leadership".

In a similar way, the LCIS project was itself the concrete result of the strong municipality's commitment and effort to smart urban innovation and to the definition of a holistic plan for balancing the competing economic imperatives of tourism and industry with its environment, transport, culture and the preservation of its great heritage. This commitment was reflected in the support to the project's activation, development and promotion from the local public authority. At the same time, an important driver for the PPP's set up was the support provided by IBM Foundation Italy, which financed the project, contributed to its coordination and made available highly specialized human resources, technological know-how and service solutions. Another significant external driver shared by the two cases was the orientation of institutional actors towards an inclusive approach to urban innovation, balancing top-down and bottom-up initiatives. The CS project perfectly reflects the approach deliberately adopted at higher level by ASC to stimulate collaboration and innovation through the development of smart city projects (Zygiaris, 2013). As reported by Ger Baron (2013), "ASC does not just believe in a top-down approach; there is a strong belief at ASC that bottom-up ideas can contribute greatly to our city, especially when it comes to the development of new products and services". According to the cluster manager, an inclusive bottom-up approach enables end users (i.e. the Amsterdam's citizens) to collaborate in the development and experimentation of products and services that are mainly directed at them and at the same time it is the most effective strategy for increasing citizens' awareness to deal with the environmental and sustainability challenges of the cities. The municipality of Siracusa has also put into practice a number of inclusive initiatives to foster the collaboration

among local stakeholders and the direct participation of the community in the implementation of the urban development plan. In this respect, it organized several technical tables involving a high variety of local stakeholders to discuss key decisions and actions for planning the city's future and pursued social empowerment. This, in particular, was considered by project's partners and the public actor in particular as a pillar for city's development and branding. This result is in line with previous evidence on smart cities, highlighting the importance of an inclusive and participative bottom-up approach for the success of smart strategies (Achaerandio *et al.*, 2012, Komninos *et al.*, 2013, European Parliament, 2014).

The networking regime of the two smartServPPINs

With regard to internal drivers (i.e. stemming from the networking regime), the comparative analysis shows some common key factors in the two smartServPPINs. First, the adoption of a joint public-private leadership, which in the CS case was exerted by ASC (in terms of strategic leadership) and Club of 30 (in terms of operative leadership) and in the LCIS one was played by the Siracusa municipality and IBM Foundation Italy. In this regard, it is important to highlight that in both cases the collective nature of the leadership had its roots in previous collaboration and personal relations among the involved parties. In the LCIS case, in particular, the positive regime between the partners also derived by the fact that the project was conceived in close continuity with past collaboration (i.e. Siracusa's participation to IBM's Smarter Cities Challenge). Moreover, inter-organizational relationships were characterized by a balance in actors' influence and power in the network and win-win situations were guaranteed from the outset, when it was clear that collaborative innovation was beneficial for all the partners and the network dynamics was not influenced by opportunistic behavior and interests' conflicts. In the case of CS, the presence of key innovative individuals provided a further important internal driver for the success of the innovation network. In this respect, the action taken by the shopping street manager was particularly crucial. Indeed, he served as local visionary pioneer and innovation champion for the project and together with ASC and the project manager "had to work to connect

and translate the Climate street concept to entrepreneurs" convincing them to join the pilot. Actually, this was not an easy process since "*most entrepreneurs did not have the time to think about the environment*" (Sauer, 2012). His role, however, was essential not only in the initial stage of the network formation, but throughout the development process when it was necessary to ensure their involvement: "the processes must be explained to the entrepreneur in a clear manner. It is important for the entrepreneur to be able to understand clearly what the benefits are for the business… the shopping street manager is the main point of contact and hereby can communicate with one voice to the entrepreneurs about all the developments in the street" (Amsterdam Smart City, 2011). Indeed, the champion role of the street manager proved to be vital for the set-up of an effective communication system, which was direct, transparent, based on face-to-face information exchange, to promote their strong commitment to the project's sustainability goals. Finally, the choice to initially involve in the pilot only a small number of more motivated and innovative entrepreneurs revealed itself as an important success factor (European Parliament, 2014), since through their convinced action they served as "ambassadors" of the project, promoting its benefits to other entrepreneurs in the street and locally producing positive spillovers.

In sum, the two smartServPPINs share a number of common factors that are likely to contribute to their success, against a different maturity stage of cities' *smarticization* and complexity of the innovative solution realized by the selected innovation projects. Figure 2 provides an overview of the main common and different factors emerged from the comparative analysis. This, in particular, shows the applicability of the framework in different arenas, networking conditions and various level of complexity of innovation processes and outcomes.

CONCLUSIONS AND FURTHER RESEARCH

The analysis presented in this article represents an exploratory and initial phase of a broader research project aimed at advancing knowledge and practice on the increasingly relevant issue of innovation

within the smart city context. Specifically, it provides a contribution to the understanding the role of networking for the development of smart city services by leveraging the interpretive potential of the service innovation perspective, namely the concept of ServPPINs, drawing on the research stream disclosed by Gallouj and colleagues in recent years. These public-private innovation networks in services enrich the traditional concepts of innovation networks and PPPs and are a new means of approaching, from a network-based perspective, a field of innovation that is still largely underexplored, namely innovation in public services (Gallouj *et al.*, 2013a). Thus, it is believed that ServPPINs can provide a useful lens to advance the understanding of networked innovation within the complex and fast-changing landscape of smart cities, by better addressing the complexity of interactions between public, private, third-sector organizations and users/citizens communities in the development of innovative city services.

Based on this concept, the paper proposes a conceptual framework for exploring the role of ServPPINs in realizing opportunities for technological as well as non-technological innovations in the smart city context and the factors influencing their effective operation. In order to validate and illustrate our framework, an exploratory analysis has been subsequently conducted based on two European case studies of smart projects and the service innovation networks associated to them. The case study analysis supports the interpretive capability of the ServPPIN concept in the context of smart city innovation, thus providing a conceptual contribution to this emerging field. It is shown how the proposed framework can contribute to disentangling the complexity of these inter-organizational arrangements through its components and how this can apply in different arenas, conditions of networking and various level of complexity of innovation processes and outcomes. Moreover, the exploratory analysis provides first insights into the characteristics of smart innovation networks, their set up and governance, and the relative importance of different drivers for the successful development of innovations for the smart transformation of cities.

<table>
<tr><th rowspan="2">Framework components</th><th colspan="2">Examined projects and associated smartServPPINs</th></tr>
<tr><td>Amsterdam Climate Street concept (The Netherlands – 2009)</td><td>Love City Index Siracusa App (Italy – 2013)</td></tr>
<tr><td rowspan="2">Structure and process</td><td>– Broad and diversified network
– Small team of private-public initiators
– Bottom-up mode of inducement
– Member selection based on existing personal relationships and technical know-how/resources
– Formal governance structure</td><td>– Innovation-oriented PPP
– Top-down mode of inducement
– Partnership based on previous cooperation and existing relationships
– Informal governance structure</td></tr>
<tr><td colspan="2">Common features:
– Key role of big multinational technological players
– Network stability (composition and roles)</td></tr>
<tr><td rowspan="2">Outcomes</td><td>– Architectural innovation (technology-based system of service solutions)
– Social innovation: environmental awareness and energy consumption behaviour
– Learning at network level through the Living lab methodology
– Environmental impact at city level</td><td>– Social innovation: awareness and responsibility for cultural heritage protection; innovation of decision-making practices through users' engagement and feedback integration
– Learning at network level through the sharing of communication management practices
– Tourism and cultural heritage development at city level</td></tr>
<tr><td colspan="2">Common features:
– Technological innovation</td></tr>
<tr><td rowspan="2">Smart City Innovation context</td><td>Advanced stage of smarticization</td><td>Moderate stage of smarticization</td></tr>
<tr><td colspan="2">Common drivers:
– Public mission
– Funding opportunities
– Technological opportunities
– Institutional/political support
– Balance of top-down and bottom-up approaches</td></tr>
</table>

Networking Regime	– Presence of an innovation champion – Frontrunners as project ambassadors	– Project born in continuity with previous collaboration
	Common drivers: *Joint public-private leadership rooted in previous collaboration/personal relationships* *Influence and power balance* *Win-win situations*	

Fig. 2 – Summary of the comparative case analysis.

In particular, the comparison between two quite different cases allowed us to identify some common key factors for smartServPPINs success, notwithstanding their inherent differences with regard to the smart city innovation context and the level of complexity of the innovative solutions realized within the two projects. In particular, the comparative analysis supports existing evidence on ServPPINs, confirming the relevance of some external and internal drivers for their initiation and successful development (Rubalcaba *et al.*, 2011; Gallouj *et al.*, 2013a, Weber *et al.*, 2014), including financial and political support, technological opportunities, a balance between bottom-up or top-bottom approaches, non-rivalry of needs and interests, complementarity of competences. Moreover, the case study analysis allowed to identify new drivers that seem particularly relevant for the examined context of smart cities, namely the value of collaborating with multinational technological players, since it provides significant opportunities for innovation and learning, and the importance of the public mission, meant as a strong institutional intention to improve the quality and efficiency of city services through leveraging collaborative innovation and citizens' active involvement in innovation processes. Further, the empirical analysis adds to the role of leadership as a relevant internal driver of smartServPPINs'success, showing that the collective nature of the public-private leadership has existing organizational and personal relationships between the involved parties as a key antecedent and that how this aspect contributed to shaping a positive networking regime. These common factors should be taken into account for the effective

set up, management and diffusion of networked innovation models for the smart transformation of cities. From an operational point of view, this implies the need to develop an understanding of the role and the functioning of smartServPPINs and, based on this, to create/ensure the proper conditions that are functional to the activation and maintenance of both the external and internal key drivers of collaborative innovation, coherently with the specific smart city situation. In this direction, public actors have a key role and responsibility, since they are in the position to exert concrete actions at different levels to influence the effectiveness of innovation networks in the smart city context.

On the basis of the proposed framework and the first insights provided by the case study analysis, a number of research issues can be put forth as relevant for both theory and practice and thus for future investigation. A first potential research direction to be undertaken for improving the proposed framework and advance existing knowledge on this topic is represented by a deeper analysis of innovation network dynamics. Although this issue does not constitute the analytical focus of this paper, it clearly plays a key role for explaining the success as well as the potential barriers of smartServPPINs formation and maintenance in developing smart city innovations. Accordingly, the future steps of this research should be devoted to examine the temporal evolution or life cycle of the relationships among network members so as to shed light on how network dynamics influences the performance of smartServPPINs. In this respect, deeper insights into the evolution of these service innovation networks could be provided by relying on longitudinal approaches that explicitly take into account the temporal dimension of inter-organizational relationships. In addressing this goal, a potential direction of research development could be exploring the influence of the broader smart innovation context on the network dynamics of smartServPPINs. Indeed, although this relationship was not the focus of the paper, the smart city innovation context, especially in terms of institutional factors, have been definitely relevant for the analyzed cases to evolve and gain momentum and thus it is worth of further investigation. Another promising area of research concerns the "networking regime" component in our framework. Indeed, as we have already highlighted, relational conditions do not simply influence the initiation of collaborative innovation networks,

but are, in turn, shaped and modified over time by the interactions among their various members. The examined cases show that successful innovation networks are those in which partners go beyond short-term transactional benefits and incorporate relational factors such as commitment and trust. This evidence, which is in line with the relationship marketing perspective (Håkansson, 1982, Morgan and Hunt, 1994), suggests the opportunity to further investigate the dynamics of formation and maintenance of these factors along the innovation process as well as their linkages with the performance outcomes of smartServPPINs.

The "scope" of these innovation networks represents a structural dimension that requires further analysis in relation to both to the drivers and barriers of inter-organizational collaboration as well as to the short-term and long-term outcomes of smartServPPINs. The exploratory analysis presented in this article shows that these arrangements can vary widely, from quite broad networks (as in the CS project) to dyadic innovation-oriented PPP (as in the LCIS case). The number and type of actors involved in the innovation network are likely to significantly affect the formation, governance and performance of smartServPPINs. The same can be said with regard to their more or less transnational nature beyond the boundaries of the city. Since a "one size fits all" approach to managing these innovation networks is clearly ineffective, a better understanding of the linkages between the varying scope and nature of smartServPPINs and the conditions/requirements that influence their operation, dynamics and performance could offer useful insights for the firms involved to effectively creating and managing public-private service innovation networks.

Another potential area for future research is related to the innovation outcomes produced by smartServPPINs at the network level. In this regard, additional research efforts should be made to understand how the participation of a variety of stakeholders in innovation projects influence knowledge transfer processes and how the acquired knowledge turns into long-term benefits for the members, both private and public ones, influencing their relational competencies and innovation capabilities. From both the examined cases it emerges that learning opportunities are created by collective work and knowledge transfer among the partners. Accordingly, to what extent these learning opportunities are actually

recognized and leveraged by participant actors represents a crucial issue that deserves further investigation.

Finally, the conceptual framework assumes that innovation outcomes produced by smartServPPINs have the potential to impact on the smart city innovation context, thus influencing the developmental path of a city toward higher level of smartness. However, in our case studies, we limited the analysis to one project in each city: this narrow focus clearly impedes us to fully comprehend the effects produced by the innovation outcomes on the *smarticization* process of the city. Accordingly, future research should consider more innovation projects (and the associated smartServPPINs) within the same city in order to understand how their development and interactions would jointly transform the smart city innovation context, seeding better conditions for future smart city initiatives as well contributing to the potential development of the city as a system of innovation.

Further research will be thus oriented to overcome the limits of the present study and pursue an in-depth exploration of the above issues, by extending the number of cases to further validate and strengthen the applicability of the proposed framework. In this regard, it could be useful to perform cross-case analysis of different smartServPPINs within the same city as well as of similar networks in terms of goals and innovation types in different cities. Notwithstanding its limits, this article sheds initial light on a crucial issue that can generate important implications for both theory and practice, given the increased importance of innovation processes and networking for facing the emergent urban and societal challenges. As to the first, it has been showed how the service innovation perspective adopted in this article, namely the concept of ServPPIN, is particularly relevant for advancing actual knowledge on innovation processes and specifically the role of networking for innovation at the city level. With regard to the latter, a better understanding of the role and functioning of smartServPPINs is a necessary step for implementing a successful smart city strategy that relies on effective collaboration among different stakeholders and on citizens' involvement in the development of new and improved city services.

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