ORIGINAL ARTICLE

Investigating antecedents of social innovation in public sector using a service ecosystem lens

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Abstract

The purpose of the study was to empirically investigate the concept of social innovation in the public sector, viewed through an ecosystem lens. A conceptual model of social innovation was developed and empirically examined using primary data collected from the public sector in the United Arab Emirates (UAE). The findings showed that Organizational and Technological factors acted as key innovation enablers in the ecosystem. These two enablers supported interactions between the institution and (a) its citizens, and (b) its partners, leading to social innovation. Several implications for public sector institutions are discussed, and illustrative descriptions of three interactive online applications in the UAE are described. Since citizens worldwide are willing to play a central role in value co-creation, the findings shed light on how to facilitate and encourage this citizen interaction with public institutions.

Keywords Social innovation · Ecosystem · Public service · Service dominant logic · Interactions, innovation enablers · Value co-creation

1 Introduction

The public sector has recently been facing budgetary constraints and increased expectations from citizens (Micheli et al. 2012; Sangiorgi 2015). This has placed the onus on the sector to innovate and deliver more for less by improving both the efficiency and effectiveness of public services (Cropley and Cropley 2017; Kohli and Mulgan 2010; Tuurnas 2015). In this regard, there is a growing recognition that a government, acting in isolation, will be unable to generate the appropriate novel solutions required to address pressing issues they are currently confronted with (Crosby et al. 2017).

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In the public sector, innovation involves designing new services that satisfy public needs by defining new collaborative roles for the stakeholders in the system of public service provision (Hartley 2005; Meričkova et al. 2015; Mulgan and Albury 2003). Sørensen and Torfing (2011) stated that public innovation takes place through collaboration among different stakeholders. As end-users of services provided by public institutions, citizens constitute a key stakeholder for the institutions. Consequently, it was proposed that citizen involvement and direct participation, in reducing the innovation to practice, played a key role in terms of the success of the innovation process (Borins 2001; Fuglsang 2008; Von Hippel 2007).

From this point of view, co-creation itself becomes a public service innovation or, in other words, a *social innovation*, and it provides economic benefits as well as legal and democratic values to the delivery of public services (Meričkova et al. 2015). Social innovation has been described as the establishment of sustainable partnerships that aim to address societal needs by creating novel frameworks, policies and procedures among the related stakeholders, including end-users, through an open process of innovation (Fuglsang 2008; Hartley 2005; Meričkova et al. 2015; Osborne and Brown 2011; Sørensen and Torfing 2011; Voorberg et al. 2014).

In the public sector, social innovation motivates citizens to play an active role in the innovation process (European Commission 2011, p. 30), thereby enhancing public values such as effectiveness, efficiency, and legitimacy (Meričkova et al. 2015; Voorberg et al. 2014). Therefore, the related concepts of social innovation and co-creation have emerged as a solution to the social challenges and budget austerity governments are facing within a new reform strategy for the public sector, (Voorberg et al. 2014).

In this regard, scholars have urged governments to embrace a new paradigm of innovation based on co-creation to deliver enhanced public value (Fuglsang 2008; Lee et al. 2012; Nambisan 2008; Osborne et al. 2013), a stand supported by OECD (2011) that considered co-creation as an effective approach in developing and delivering public services globally. Hartley (2005, p 27) similarly proposed a collaborative arrangement to "create, share, transfer, adapt and embed good practice."

Despite the significant potential co-creation offers in meeting citizen expectations while reducing the cost of service delivery it, nonetheless, presents public sector institutions with both organizational and cultural challenges (Tuurnas 2015). The present work focuses on the impact of three key issues affecting social innovation and value co-creation:

- The adoption of service logic in conceptualizing innovation rather than a manufacturing paradigm (Osborne and Brown 2011).
- Organizational factors, comprising of support and leadership of senior management, and employee empowerment through institutional policies supporting creativity and innovation (Demircioglu 2018; Loewenberger et al. 2014; Parahoo et al. 2017),
- Technology enabled operations (Mulgan and Albury 2003) that leverage interactions facilitated by web 2.0 technologies (Micheli et al. 2012).

A recent paradigm for value co-creation that emanates from new service logic is particularly relevant to the context of the preset study as it incorporates the above three factors. Service logic is based on a(n) value and/or experience-centric focus

(Prahalad and Ramaswamy 2004), thereby requiring a new perspective of service innovations (Ordanini and Parasuraman 2011). Following their seminal article, Vargo and Lusch (2004) are credited to have organized the service literature into a service perspective on value creation and marketing that they termed service-dominant logic (Grönroos 2011). The service-dominant logic perspective conceptualizes service as a process involving the integration of resources and competences among various actors (service provider, partners, and customers) so that value is co-created through the positive evaluation of an experience at a particular time, or during a specific exchange encounter (Vargo and Lusch 2004).

In a subsequent development in operationalizing the new service logic, it was proposed that service innovation and value co-creation occurred within a service ecosystem (Akaka and Vargo 2014; Lusch and Nambisan 2015), which incorporated conducive organizational and technological factors (Lusch and Nambisan 2015; Mulgan and Albury 2003; Osborne and Brown 2011; Voorberg et al. 2014). The service perspective literature was further enriched by scholars from the Nordic School who discussed the roles, interactions and contributions of the different actors in the ecosystem in influencing the customers' perceptions of value-in-use (Grönroos and Voima 2013; Heinonen and Strandvik 2015). Osborne et al. (2013) stated that the legitimacy and relevance of New Public Management (NPM) framework was questionable as it was founded on private sector experience related to goods-based logic that assigned a passive role to the consumer. The authors instead advocated a new theoretical framework and insight based on service logic that they termed 'public service dominant logic'.

While there is now a vibrant growing body of recent literature focusing on how service logic and service ecosystem support innovation in the business sector (Akaka and Vargo 2014; Grönroos and Voima 2013; Heinonen and Strandvik 2015; Lusch and Nambisan 2015; Ordanini and Parasuraman 2011), the situation stands in a stark contrast in the public sector. In their systematic review of the literature spanning the period 1987–2013, Voorberg et al. (2014) noted that most studies on social innovation tended to focus on (single) case studies, while more quantitative study designs were required to determine the weights of influential factors. Although social innovation is described as an emerging trend (Ferreira et al. 2017), few preceding studies have used the service ecosystem lens to model the antecedents of social innovation. Consequently, to contribute to addressing this gap in knowledge, the objective of the present study was to model social innovation in the public sector viewed through an ecosystem lens (discussed in next section).

2 Theoretical background

2.1 Innovation ecosystem

The concept of innovation ecosystem derives from system theory. A system has been defined as an 'organized, purposeful structure that consists of interrelated and interdependent elements', which continuously influence each other to achieve the objective of the system (Business Dictionary, online). The ecosystem plays a central role in service innovation, and it has been defined as: "a relatively self-contained, self-adjusting

system of mostly loosely coupled social and economic (resource integrating) actors connected by shared institutional logics and mutual value creation through service exchange" (Vargo and Lusch 2011).

It was proposed that the knowledge-intensive and customized services commonly available today relied increasingly on customers contributing to the service delivery, and/or providing information through organizational or technological channels (Maglio and Spohrer 2008). Consequently, within the ecosystem, service institutions influenced value co-creation by providing guidelines as to what was considered to be a valuable resource in a particular place and time, and how such resources might be accessed, adapted and integrated in a specific context (Akaka and Vargo 2014). The authors added that the ecosystem perspective highlighted the key roles of interactions; the social context within which innovation and value co-creation occurred, and finally the integration of resources for innovation.

Similarly, in the public sector, it was argued that an ecosystem approach which accounted for the inter-organizational reality of the public service logic would support 'genuinely sustainable models of public services delivery' (Osborne et al. 2013). Similarly, Meričková et al. (2015) discussed the need to consider the environment within which innovation takes place, highlighting the critical role of the political and administrative context, the legal environment, state governance and civil service tradition, and availability of resources. This supports the adoption of an ecosystem approach to investigate social innovation.

2.2 Social innovation and public value co-creation

The concept of value creation tends to be vaguely defined in service literature (Grönroos and Voima 2013). However, recently some consensus has emerged around a customer experience focus that views value as a co-creation process and the outcome of interactions between customer and service provider, referred to as value-in-use (Grönroos and Voima 2013; Heinonen and Strandvik 2015; Lusch and Nambisan 2015). Value creation by the customer, or co-creation interactively with the service provider, was thus proposed as "an ongoing process that emphasizes the customer's experiences, logic, and ability to extract value out of products and other resources used" (Grönroos and Voima 2013, p 135). It is important to highlight that co-creation refers to the active involvement of customers at various stages of the production process (Prahalad and Ramaswamy 2004; Vargo and Lusch 2004), referring to an active role of customers as opposed to merely being passive participants in the innovation process (Voorberg et al. 2014).

In the New Public Governance paradigm, the concept of co-creation formed an integral part of the inter-organizational collaborative processes among the beneficiaries and the involved institutions (Osborne et al. 2013; Tuurnas 2015). Similarly, Osborne et al. (2013) argued for a citizen-centric approach, whereby public service institutions acted as facilitators for value co-creation by citizens, within the citizens' own life experiences. As discussed above, some scholars have argued that the collaborative process, whereby citizens and service providers interact to mutually create the service in a novel way, leads to co-creation itself constituting an integral part of social innovation (Meričková et al. 2015). It is useful at this stage to shed light on what precisely constitutes an innovation.

Innovation represents an offering not previously available to a firm's customers (e.g. a new service or delivery process), that requires modifications in the sets of competences applied by service providers and/or customers (Menor and Roth 2007). Similarly, it has been defined as the 'rebundling of diverse resources that are beneficial (i.e. value experiencing) to some actors in a given context' (Lusch and Nambisan 2015). In the public sector, Mulgan and Albury (2003, p.3) described innovation as:

> "...new ideas that work. To be more precise: successful innovation is the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes, efficiency, effectiveness or quality"

Social innovation thus involves collaboration or networking among various actors (citizens, public institution and its partners) to leverage available resources with the objective of efficiently producing a novel offering that adds value to the citizen experience. Osborne and Brown (2011) reviewed the public sector innovation literature, and *inter-alia*, they determined the following success factors for social innovation:

- The nature of insights and breakthroughs leading to innovation suggest that an institution should not rely on internal sources alone, but should also interact with a network of actors in the external environment;
- While an innovation may be the result of an individual employee's efforts, an organizational culture conducive to innovation is critical for innovation to become sustainable;
- Innovation managers need to adopt service logic thinking which emphasizes the roles of the service recipients and other actors in co-producing a service.

2.3 Development of hypotheses

2.3.1 Interactions among actors for innovation and value co-creation

As discussed above, social innovation is largely influenced by an interaction process, both externally and internally, involving actors and citizens (Osborne et al. 2013; Tuurnas 2015).

An interaction constitutes a mutual or reciprocal action whereby two or more actors are in contact with each other, or have a mutual effect on each other (Grönroos 2011). Citizens may interact with a public institution through a variety of communication media from the traditional face-to-face, to telephone, electronic platforms, and electronic channels such as email (asynchronous) and live chats (synchronous or real-time). These interactions enable an exchange of information, knowledge, and competencies between the actors that support innovation and value co-creation. In this regard, it was proposed that the impetus for interactions, between the public service provider and the citizens in the ecosystem, was the need to integrate and leverage resources in order to co-create unique experiences for the service beneficiaries (Osborne et al. 2013).

In public service-dominant logic, co-creation plays a critical role with the experiences and knowledge of the service user being at the core of effective pubic service design and delivery (Osborne et al. 2013). In this regard, the state is now adopting an

open government paradigm to facilitate inputs of its citizens during the co-creation process. This paradigm, termed 'Citizensourcing' is the equivalent of crowdsourcing in industry, and it uses modern approaches to leverage the willingness of citizens to inform, monitor, and participate in public value creation (Schmidthuber and Hilgers 2018). Based on their systematic literature review, Voorberg et al. (2014) identified three different types of citizen involvement in co-creation, namely: citizens as co-implementers (in the majority of cases); followed by citizens as co-designers, and citizens as initiators.

Grönroos and Voima (2013) operationalized the process of value creation and co-creation in service logic. They elaborated on the respective roles of the customer and the service provider for successful interactions, as well as the scope, locus, and nature of value co-creation. They proposed a three spheres model (provider, joint, and customer) for value creation that described the process by which the service provider and customers interacted. In the customer sphere, the customer remained the value creator with the service provider acting as value facilitator. However, when the customer invited the provider into the process (in joint sphere), the latter could act as a co-creator of value with the customer. In summary, the interactions potentially resulted in either the customer creating value independently (customer sphere), or co-creating value along with provider (joint sphere). In the present study, we are focusing more on the joint sphere as Voorberg et al. (2014) determined that this is the most common occurrence in practice.

Other key actors in the ecosystem are partners of the public institutions which are typically other government departments, and also sometimes private sector firms (when there are mutual benefits to a partnership, as illustrated with an example from healthcare later). It was proposed that enhanced actor interactions for innovation and value co-creation depended on real partnerships between the service provider, its partners, and the service users (Ordanini and Parasuraman 2011; Tuurnas 2015). In this regard, public institutions establish strategic alliances with partners, a framework that facilitates interactions between the institutions, thereby enabling them to access resources, ideas, insights, or best practices, leading to enhanced capabilities for social innovation and value co-creation.

From the above discussion, the first two hypotheses for this study may be proposed as:

- H1: Interactions between the public institution and the citizens in the ecosystem have a positive effect on social innovation.
- H2: Interactions between the public institution and its partners in the ecosystem have a positive effect on social innovation.

2.3.2 Enablers for interactions

Two key enablers of actor interactions for social innovation emerge from literature: *Technological* and *Organizational factors*. Various scholars have discussed the critical role of technology in supporting the actors to engage in dynamic interactions for knowledge sharing and process integration among various actors within and across service systems (Akaka and Vargo 2014; Maglio and Spohrer 2008; Osborne et al. 2013). In practice, the growth in internet and connectivity has led governments to

develop various electronic platforms such as websites and mobile apps to enable citizens to conveniently access and interact with public services.

In addition to technology, mechanisms to facilitate knowledge integration play a critical role in service logic, which considers knowledge renewal a major source of innovation (Ordanini and Parasuraman 2011). Voorberg et al. (2014) reviewed the literature and identified four influential organizational factors that influenced co-creation processes with citizens:

1. Compatibility of public institutions in relation to co-creation in terms of supportive structures and procedures;
2. Open attitude of employees and politicians towards citizen participation;
3. Absence of a risk-averse, conservative administrative culture; and
4. Presence of clear incentives for co-creation.

Similarly, it was argued that the support of senior management, presence of a shared vision, and employee empowerment, contributed to the reduction of institutional obstacles to creativity and innovation (Demircioglu 2018; Loewenberger et al. 2014). In addition, public institutions interact with other similar institutions creating some type of one-stop shop, thereby offering convenience and service excellence to citizens. As an illustration, in the UAE, through strategic partnership between Dubai's Ambulance Services and hospitals and supporting electronic protocols, paramedics in the ambulance vehicles are able to transmit a patient's records electronically to the receiving hospital. This enables doctors at the hospital to promptly embark on the required treatment once the patient reaches the hospital premises.

Based on the discussion above, two further hypotheses may be proposed as:

- H3: Technological factors support interactions among (a) the public institution and citizens (b) the public institution and its partners.
- H4: Organizational factors support interactions among (a) the public institution and citizens (b) the public institution and its partners.

The preceding discussion and relationships between constructs may be graphically summarized in the study's conceptual model (see Fig. 1).
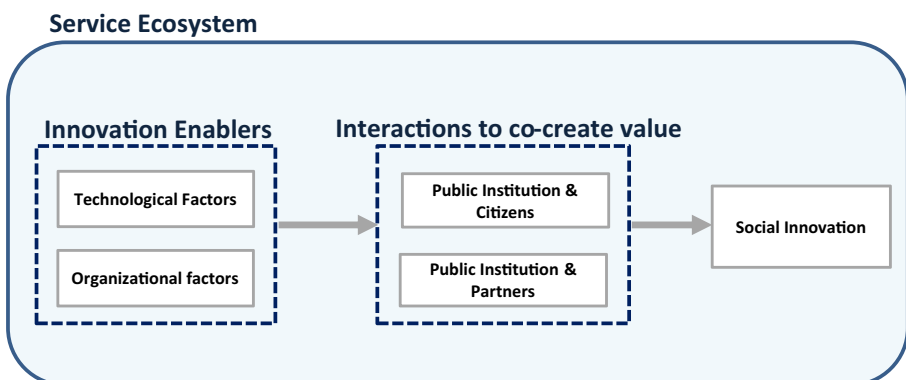

Fig. 1 Conceptual model of service ecosystem for Innovation and its antecedents

3 Research method

3.1 Research setting

The United Arab Emirates (UAE) provided an ideal empirical context for the study as the country has emerged as a major economic development hub over the past three decades. UAE Vision 2021 actively established the current strategic focus "to transform its economy into a model where growth is driven by knowledge and innovation" (https://www.vision2021.ae/en/our-vision). UAE has adopted a well laid out and multi-faceted strategy charting its path towards higher national innovativeness (Parahoo et al. 2017). These strategies/initiatives may be defined at three levels of analysis.

At the national level, the UAE launched a National Innovation Strategy on October 2014 with the objective of guiding the UAE to be among the most innovative nations in the world within 7 years. This strategy is supported by complementary initiatives such as:

- Innovation Week and Awards;
- Training in Innovation: short courses for employees; and a compulsory undergraduate course introduced in all public universities from August 2016;
- Dubai 10X that motivates public institutions in the Emirate of Dubai to achieve service excellence by focusing on radical innovations;
- Mohammed Bin Rashid Centre for Government Innovation, an institution that aims to enrich the culture of innovation within the public sector;
- Dubai SME, a public institution that provides a wide range of support initiatives for entrepreneurs as well as incubation facilities;
- Annual World Government Summit held in Dubai, that brings together prominent thought leaders and pioneers to engage in inspirational, future-focused dialogues that aim to shape the future of governments and improve the lives of citizens worldwide. The sixth summit was held in February 2019.

At the organizational level, many public institutions have aligned with the national vison and developed internal mechanisms to promote institutional innovation. Prominent examples would include the Innovation lab at Road and Traffic Authority, the employees' ideas portal at Dubai Electricity and Water Authority, and the technology-enabled interactions between Dubai Corporation for Ambulance Services and its partners.

At the micro level, individual innovators may use the support services and incubation facilities of various support intuitions such as Dubai SME, and seek mentoring and funding support from the Khalifa Fund for Enterprise Development, or Mohammed Bin Rashid Innovation Fund. As users, the individuals may also submit suggestions to improve public services through *Smartmajlis* (described later). Consequently, UAE public institutions are primed to focus on social innovation, making them a good research setting to test the study hypotheses.

3.2 Research design

The present study comprised of 2 sequential phases:

- *Qualitative phase*: This initial phase incorporated an intensive review of relevant literature complemented with in-depth interviews with seven key informants (six senior managers in the public sector, and a professor of Innovation). The interviews used an open-ended interview guide focused on exploring the innovation environment and related policy framework in UAE public sector, the identification of key actors and their respective roles in the innovation ecosystem, and the process of innovation and value co-creation. They were digitally recorded for ease of transcription. The authors independently analysed the resulting data to ensure reliability and to minimize researcher bias, they subsequently met to collate findings and to develop the conceptual model. For conciseness, the outcome of this phase is summarized in Fig. 1. This phase also supported the identification of appropriate measures reflecting the study constructs, which were primarily sourced from validated scales used in previous studies and adapted to the context of present study (see Table 1 for details of final questionnaire items).

3.3 Quantitative phase

The draft questionnaire (item description at Table 1) was piloted to establish its suitability for the present study. Each item was rated on a 5-point Likert scale, anchored at both ends and with no labels for intermediate scale points. Back translation (Brislin 1970) was used to develop an Arabic version of the questionnaire. Respondents were offered the option of using either the English or the Arabic language version of the questionnaire, as per their personal preferences.

Next, a purposive sampling frame was drawn. In order to avoid a bias in selection of participants, the support of two senior and experienced managers from the public sector was sought. With their support, it was possible to draw a list of 29 public sector institutions/departments representing the diverse spectrum of public services in UAE. The list was validated with the support of a third expert, an HR Director in a public institution. At each public institution, one of the authors approached an identified contact person to present the scope of the academic study and to seek his/her collaboration. The contact person was asked to electronically circulate a cover letter including a link to an online questionnaire, and assuring anonymity of responses, randomly to ten managers in the public institution. A regular follow up was maintained with the contact persons to support the data collection process. A total of 290 public sector employees were thus approached and 203 valid responses were obtained, representing a response rate of 70%.

Using LISREL software, confirmatory factor analysis (CFA) was undertaken for establishing reliabilities and validities of the five different study scales, while structural equation modelling (SEM) was used to test the study's hypotheses, as discussed in the next section.

Table 1 Description of questionnaire items for study constructs (column 1), their standardized path loadings and significance (*t*-values) derived from CFA analysis (column 2), and source of items from literature (column 3)

Item description	Standardized loading (*t*-value)	Source of item
Social innovation		
In comparison with other public service providers, our institution has introduced more innovative services	0.86 (15.19)	Wang and Ahmed (2004)
We develop products or services that better meet the needs of our citizens than any other service currently available	0.86 (15.14)	Uzkurt et al. (2013)
In comparison with other public service providers, our institution is faster in bringing new services into the market	0.84 (14.53)	Wang and Ahmed (2004)
In comparison with other public service providers, our institution has a higher success rate in new services launch	0.82 (14.15)	Wang and Ahmed (2004)
Our institution is able to change/modify our current service approaches to meet special requirements of our citizens	0.83 (14.41)	Grawe et al. (2009)
Public institution & citizens interactions		
We co-define value with our citizens	0.76 (12.31)	Dobni (2008)
We interact with our citizens beyond the standards of market research to co-create value	0.82 (14.09)	Ordanini and Parasuraman (2011)
Staff are treated as equals amongst peers, and this motivates their collaboration in value co-creation	0.81 (13.45)	Dobni (2008)
There is trust and mutual respect between management and staff and this motivates staff collaboration in value co-creation	0.78 (12.89)	Dobni (2008)
Public institution & partners interaction		
We interact with institutional partners beyond the standards of market research	0.79 (13.05)	Ordanini and Parasuraman (2011)
The perceived intensity of institutional -partner interaction is high	0.85 (14.40)	Ordanini and Parasuraman (2011)
The frequency of meetings with our institutional partners is high	0.81 (13.38)	Ordanini and Parasuraman (2011)
The number of institutional partners with whom we interact is high	0.74 (11.85)	Ordanini and Parasuraman (2011)
Organizational support factors		
Top management gives special emphasis to innovation	0.82 (14.03)	Grawe et al. (2009)
We have an effective environment for collaboration within and between departments as well as with key actors (staff, citizens, and partners)	0.79 (13.23)	Dobni (2008)
We are prepared to commit new resources or redirect current resources to support ventures that result from our innovation pathway	0.83 (14.34)	Dobni (2008)
Staff have the freedom to develop the appropriate responses in efforts to create value for our citizens	0.82 (13.88)	Dobni, (2008)
We encourage key actors to think and behave in original and novel ways	0.86 (14.96)	Wang and Ahmed (2004)

Table 1 (continued)

Item description	Standardized loading (*t*-value)	Source of item
Technological support factors		
The institution has up-to-date online databases that provide staff with resources to support their innovation efforts	0.80 (13.56)	Adapted from Sanz-Valle et al. (2011)
Staff have access to smart online systems/processes to develop the appropriate responses in efforts to create value for our citizens	0.80 (13.51)	Adapted from Sanz-Valle et al. (2011)
Our institution makes effective use of information technology to share information and to facilitate collaborations among key actors (staff, citizens, and partners)	0.80 (13.54)	Adapted from Sanz-Valle et al. (2011)
The physical facilities at the institution create a conducive and flexible work environment that promotes creativity and innovative thinking	0.78 (13.13)	Drafted based on feedback during qualitative interviews
The institution has appropriate physical facilities to support innovation activities (e.g. office layout, interior design, brainstorming rooms, etc.)	0.81 (13.90)	Drafted based on feedback during qualitative interviews

4 Results

4.1 Establishing scale uni-dimensionality, reliability and validity

A CFA was effected on the five study constructs and their associated measurement models. An assessment of the model showed a good fit to the data as per recommended thresholds (Hair et al. 2010; Hooper et al. 2008) with normed chi-squared (607.51/220) =2.76; SRMR = 0.048; IFI = 0.98), thereby establishing uni-dimensionality of each of the five study scales. The composite reliabilities (CR) determined for each of the five scales were all well above 0.80 (see CR column, Table 2), indicating excellent reliabilities (Hair et al. 2010).

Face validity was satisfied as the scale items were sourced from validated scales from literature and fine-tuned to the context of the study (see last column of Table 1).

Table 2 Summary statistics for scale items reflecting composite reliability (CR) of study constructs, AVE values in bold on diagonal, and confidence intervals for correlations between constructs below diagonal

SN	Item description	#Items	CR	1	2	3	4	5
1	Social Innovation	5	0.92	**0.71**				
2	Institution & Citizens interactions	4	0.84	0.81–0.93	**0.57**			
3	Institution & Partners interactions	4	0.88	0.69–0.85	0.69–0.85	**0.64**		
4	Organizational support factors	5	0.91	0.76–0.88	0.71–0.87	0.66–0.82	**0.68**	
5	Technological support factors	5	0.89	0.91–0.99	0.80–0.92	0.57–0.77	0.78–0.90	**0.64**

Moreover, the items all had high loadings on their respective constructs (see column 2, Table 1), which combined with the average variance extracted (AVE) being well above threshold of 0.50 (see diagonal items on Table 2) helped to establish convergent validities (Hair et al. 2010).

To assess discriminant validity, the method of Anderson and Gerbing (1988) was used. The 95% confidence interval (±two standard errors) around the correlation estimate (φij) between pairs of study constructs was estimated to confirm that each one did not contain unity (1.0). The correlation and standard errors were sourced from the *phi* (φ) matrix in CFA, and the analysis showed that none of the confidence intervals contained unity (see items below diagonal in Table 2), thereby establishing discriminant validity.

The five study scales, therefore, demonstrated uni-dimensionality, reliability and different types of validity, and could be used to test the study hypotheses as discussed next.

4.2 Testing study hypotheses

The study hypotheses were empirically tested using SEM in LISREL. An examination of the output file showed that while the model fit was acceptable, one path in the model representing hypothesis H4a, that is from Organizational factors to Public Institution and Citizens interactions, was not significant at $p < 0.05$ level (gamma = 0.14; $t = 1.55$). Consequently, the non-significant path was released and the model parameters were estimated again.

As expected, all paths in both the measurement and structural models were now significant. The model fit was adequate (Hair et al. 2010; Hooper et al. 2008) with: normed chi-squared = 690.97/224 = 3.08; IFI = 0.97; SRMR = 0.055. The following conclusions could, therefore, be drawn about the hypotheses: Hypotheses H1; H2; H3a; H3b; and H4b were confirmed while H4a was rejected. Interestingly, despite its parsimony the model explained 84% of the variance in social innovation. Figure 2 summarizes the outcome of the empirical scrutiny of the conceptual model. For convenience and ease of reference, the related statistics are provided in Table 3.

5 Discussion

The public sector environment is rapidly changing with the public and other stakeholders playing a key role in service innovation and value co-creation (Hartley 2005;
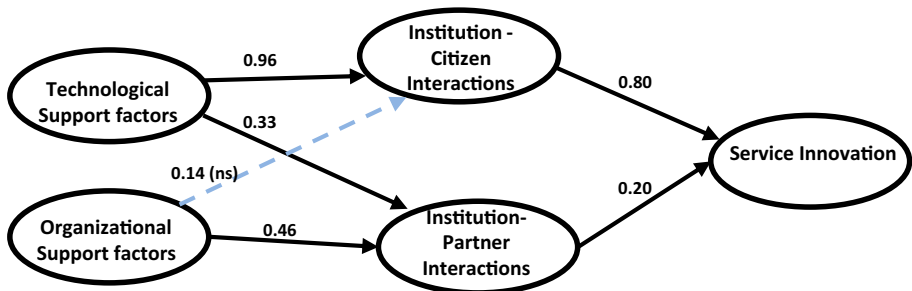

Fig. 2 Structural model showing standardized coefficients, all paths are significant at $p < 0.01$ except for dotted path which is non-significant (ns)

Table 3 Conclusion on hypotheses (Hyp), standardized loadings, and related t-values

Hyp	Path	Loading	t-value	Conclusion
H1	Institution/Citizens interactions-Social Innovation	0.80	9.83*	Supported
H2	Institution/Partners interactions- Social Innovation	0.20	3.34*	Supported
H3a	Technology factors- Institution/Citizens interactions	0.96	11.72*	Supported
H3b	Technology factors-Institution/Partners interactions	0.33	2.48*	Supported
H4a	Organizational factors - Institution /Citizens interactions	0.14	1.55#	Rejected
H4b	Organizational factors- Institution/ Partners interactions	0.46	3.46*	Supported

*-$p < 0.01$; #-$p > 0.05$, Not significant

Meričkova et al. 2015). Consequently, there is a need for analyzing operational procedures involved in co-creating public value (Hartley et al. 2017). In this regard, the present study modeled social innovation by investigating its antecedents in the public sector using a service ecosystem lens.

The study specifically determined that Organizational and Technological factors acted as key innovation enablers, and supported the public institution to engage in effective interactions with (a) its citizens and (b) its partners, thereby leading to social innovation and value co-creation (See Fig. 2).

The findings of Voorberg et al. (2014) as affecting co-creation processes with citizens (discussed at section 2.3.2) provide support for Organizational and Technological factors as enablers. The most popular factor identified by Voorberg et al. (2014) was the extent the public institutions supported citizen participation. People are living in an increasingly technology-enabled environment. Therefore, it may be argued that in the current connected era, technological factors enabled by smart devices, social networks, technological infrastructure, and apps, have become complementary to organizational factors. Further support for the importance of a conducive organizational environment characterized by organizational and technological factors has been provided by various scholars (Akaka and Vargo 2014; Lusch and Nambisan 2015; Ordanini and Parasuraman 2011).

In the ecosystem, it was determined that interactions among actors played a key role in social innovation. Theoretical support for their pertinence on social innovation is provided by social exchange theory (Thibaut and Kelley 1959). This theory proposes that actors involved in a dyadic relationship recognize that exerting efforts and going beyond the call of duty to engage with others achieved reciprocation in kind, thus creating mutual benefits for both parties. The innovation ecosystem creates a conducive organizational climate supporting such inter-personal dynamics, leading to innovation, as described next.

As discussed above, citizen involvement in co-creation has been classified into three types, namely citizens as: co-implementers; co-designers; and initiators (Voorberg et al. 2014). To illustrate how social innovation may smoothly occur in the presence of the right ecosystem, one typical occurrence of each citizen role enacted in the UAE is briefly described.

- *Co-implementer role*: In line with Dubai government's framework of service excellence, Dubai Municipality has encouraged citizens to separate different types

of wastes. It has, to this effect, installed separate garbage disposal bins in various communities, schools and university campuses. This enables recycling to reduce the amount of waste being sent to the landfill sites in the country.

- *Co-designer role*: A group of women in UAE collaborated with DCAS to co-design *Mama Ambulance Service,* a comprehensive pregnancy emergency service that is fully staffed by women. This service was granted an International Ambulance Best Practice Award in 2015.
- *Initiator role*: During the fasting month of Ramadhan, community groups in Dubai initiated a project of food sharing by installing refrigerators in selected public areas. Citizens could stock them with food, so that manual labors would conveniently be able to break their fast. Dubai Municipality supported the initiative by installing its own refrigerators with juices, dates and dairy products in public parks as part of its Ramadan Walk initiative.

As part of empirical investigation, using data collected from 203 public sector employees in the UAE, the study tested six hypotheses. Five hypotheses were confirmed (see Fig. 2 and Table 3), thereby providing support to the conceptual model. It was thus determined that technological factors had a standardized path loading of 0.96 ($p < 0.01$) on public institution & citizens interactions, and 0.33 ($p < 0.01$) on Institution & Partners interactions, while organizational factors had a similar effect of 0.46 ($p < 0.01$) on Institution & Partners interactions. Surprisingly, hypothesis H4a was rejected, implying that organizational factors did not exert a significant effect on Institution/Citizens interactions (loading = 0.14, $p > 0.05$). This unexpected finding is discussed at the end of this section.

This important role of technological factors was not surprising given that many public institutions in UAE have developed mobile apps to enable citizens to conveniently interact with them. This strategy is supported by the high internet penetration in UAE, combined with the various policy initiatives discussed above that support technology-enabled social innovation in the UAE.

As a practical illustration, the Road and Traffic Authority in Dubai has developed a mobile app called *Wojhati* that acts as an interactive journey planner. The user of public transport services (bus, metro, tram, ferry, and taxi) may launch *Wojhati* from his/her smart phone to access the timings of the various public transport services. The traveler may then interact with the app to efficiently design a convenient trip from A to B based on the constraints imposed by his/her physical location in the city, and his/her preferred departure or arrival time. The traveler can also check the balance on his/her *Nol* smart travel card (used to pay for public transport), and if required, even recharge the card using the smart phone. If required, the traveler can also call RTA customer service center and interact with a member of staff for additional service information. In another instance, Dubai Electricity and Water Authority (DEWA) allows the general public to interact with the public institution using multiple technology-enabled platforms (online, mobile, email, and phone), for different purposes (setting up or closing an account, online payment, or improvement suggestions). DEWA has developed a virtual assistant based on artificial intelligence, called *Rammas*, that guides customers in co-creating value by answering their enquiries instantly. *Rammas* is available on multiple platforms, iOS, Android, DEWA's website and Facebook page, Amazon's Alexa and Google Assistant.

These two examples clearly illustrate the key role that technology plays in enabling interactions in the ecosystem for social innovation and value co-creation, and supports the high effect of such interactions (0.80, $p < 0.01$, see Fig. 2) on innovation. With the emergence of a new connected era characterized by Artificial Intelligence, the Internet of Things, and Augmented & Virtual reality, it is likely that the importance of technological factors will be further enhanced in the future.

In addition to technology, the importance of organizational factors in enabling interactions between the institution and its partners is evident from the direct effect (loading = 0.46, $p < 0.01$) it exerts, and hence it cannot be underestimated. A conducive organizational environment for social innovation involves factors such as: an institutional openness to welcome ideas both from employees (internal) and external stakeholders (citizens, partners), a positive attitude towards citizen participation, absence of a risk aversive culture, and supportive policies for interactions (Voorberg et al. 2014).

As an illustration, inspired by Dubai 10X vision (described above), Dubai Corporation for Ambulance Services (DCAS) has developed strategic partnerships to collaborate and network with key stakeholders, in its value chain, leading to service excellence for its patients. For example, through its strategic partnership with 25 hospitals in Dubai, DCAS is able to transmit the patient's history as well as in-transit diagnosis results electronically from the ambulance to the receiving hospital. This collaborative innovation ensures that the doctors and hospital employees are in high state of readiness to receive the patient and immediately embark on treatment, thereby saving precious minutes.

A further practical instance of a judicious combination of technological and organizational factors in enabling interactions with partners to innovatively support value co-creation may be illustrated by a new service, called *Esefni* recently implemented by DCAS. Esefni is an Arabic word that may be translated as 'rescue me', and the initiative involves health professionals from the community who offer their time to contribute as volunteers to DCAS operations. Essentially, the initiative uses an app to connect the screened and selected volunteer healthcare professionals to patients requiring emergency assistance in their neighborhood. This enables fast response emergency care to the patients with the response time being below 3 minutes in 90% of response cases. To date, over 200 healthcare professionals are enrolled in the database, while their proximity to the emergency site ensures shorter average response time than the regular ambulance service. This initiative has clear efficiency and effectiveness benefits for DCAS and its patients.

The example of *Esefni* demonstrates that in the presence of the right organizational culture, the institution may partner with individuals from the community. This may be further illustrated by the following practical illustration. Within open government initiatives to support innovation, the government of Dubai encourages the general public to contribute innovative ideas and insights, within the paradigm of 'Citizensourcing' (Schmidthuber and Hilgers 2018). The general public may thus contribute to improve public services through a government portal called *Smartmajlis*. Through these interactive mechanisms, the public institutions have access to the community that acts as a source of ideas for innovation and service improvement.

It is now time to return to the unexpected finding from the study: the non-significant effect of organizational factors on interactions between the institution and its citizens. This is more surprising given the presence of technological environment and

supporting institutional and national policies. Further investigation is required to identity the precise causes of this situation. Some insights to a potential explanation may be provided particularly by two of the factors identified by Voorberg et al. (2014), namely the absence among public employees of an open attitude towards citizen participation, and the presence of a risk-averse administrative culture in an institution. At this stage, it may be postulated that some public sector employees may, to some extent, have kept their traditional habits and may not have adapted yet to the new paradigm of interacting with citizens to co-create value. This interaction is being undertaken largely through automated services (e.g. *Wojhati, Rammas, Esefni* as discussed above), so that the effect of technological factors on such interactions is consequential and significant. The implication for management is to carefully scrutinize the motivational framework enabling interactions among employees and citizens, and it may thus need to consider to further incentivize such interactions.

6 Conclusion

The study modeled social innovation in the public sector as viewed through the service ecosystem lens. It contributed to the emerging innovation literature on public service logic by identifying the antecedents to social innovation using an ecosystem lens. Using a review of the extant literature, in-depth interviews, and a questionnaire survey to collect data, the study findings identified Organizational and Technological factors as key innovation enablers. These enablers supported interactions between the institution and its citizens, and the institution and its partners leading to innovation (see Fig. 2). The study identified the key role of technological factors in supporting the actor interactions, with technology exerting the highest effect on institution-citizen interactions. Similarly, this type of interactions had the highest effect on social innovation. Interestingly, despite its parsimony, the model explained 84% of the variance in social innovation.

However, one unexpected finding of the study was that organizational factors did not have a significant effect on interactions between the institution and its citizens. While further investigation is required to identity the causes of this situation, it was tentatively proposed that that public sector employees might, to some extent, be entrenched in their traditional administrative and risk-averse habits and might not yet have adapted to the new paradigm of collaborating with citizens to co-create value. It was, therefore, proposed that management may further incentivize such collaborations.

Several illustrations of how UAE public institutions used technology platforms and apps to enable automated interactive services were highlighted (e.g. *Wojhati, Rammas, Esefni)*. The study hence provided insights on how public sector institutions in the UAE have engaged decisively on the path of social innovation.

In a context of globalization, the expectations and behaviour of citizens in various countries worldwide has now become more homogeneous. Similarly, it might be extrapolated that expectation of citizens from public services worldwide would have become increasingly convergent. Therefore, while extension of findings to other contexts should be undertaken with customary caution, the findings would nonetheless be relevant to public institutions in other countries, particularly those that operate within technology-enabled environments.

Although the literature review and qualitative phase of the study supported the influence of technological and organizational factors as key enablers, in a dynamic environment characterized by public funding constraints, changing expectations of citizens, and the development of technology-enabled services using artificial intelligence (AI), other enablers might emerge. In further research, it would be relevant to investigate if other enabling factors, relating for example to customer experience in using such services, may be identified. The changing environment would also impact the way social innovation is currently conceptualized, particularly with public institutions and citizens potentially leveraging technology breakthroughs in AI in their collaborative roles as co-implementers, and co-designers of service innovation and co-creation. There is a need to investigate the evolution of social innovation in this light, as well.

Further, the study may be replicated in other countries to validate the study model and confirm the effects of enablers and interactions among actors on innovation. It would be particularly relevant to use qualitative techniques to investigate the reasons for the non-significant path from organizational factors to interactions between the institution & its citizens. The findings would have implications on assessing the paradigm of public sector governance in place- Is it aligned to the expectations of citizens?. Finally, it would be interesting to use qualitative techniques to assess the extent to which public employees in different sectors (e.g. Education, Healthcare, Environment, Local Government, etc.) have adapted to the new paradigm of treating citizens as partners in co-creating value.

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