

Open innovation in the public sector

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Open innovation in the public sector: A literature review on actors and boundaries

Therese Figenschou^a, Jason Li-Ying^{a,*}, Anne Tanner^b, Marcel Bogers^{c,d}

^a DTU Centre for Technology Entrepreneurship, Technical University of Denmark, Denmark

^b Hillerød Municipality, Denmark

^c Department of Industrial Engineering and Innovation Sciences, Technical University of Eindhoven, the Netherlands

^d Department of Food and Resource Economics, Copenhagen University, Denmark

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ABSTRACT

Open innovation (OI) is increasingly being adopted by city administrations and municipalities. However, the extent to which the public sector applies OI is yet unclear. Furthermore, studies in OI in public organizations has primarily focused on citizen inclusion and the barriers and drivers of attracting and engaging citizens and seldom considered other external actors, such as academia and other public organizations. Consequently, this study reviews the literature on OI in public organizations and applies the concept of organizational boundary to interpret the relationships among OI actors in the public sector. The review identifies that the maturity of OI in public organizations are low between all actors and these organizations differ to a great extent in terms of which aspects of organizational boundary are open. However, grand challenges and social innovation are exceptions demonstrating a high level of maturity. Furthermore, the use of intermediaries has the potential of opening all aspect of boundaries and hence achieving a high level of success. Finally, the framework presented in this review is used to suggest future research.

Evidence for practice

- Public organizations are mostly opening their boundaries to citizens, users and firms, while there is less evidence of opening boundaries to academia and other public organizations.
- Intermediaries and sound public management are important factors for opening the power and identity boundaries between the public organization and external actors.
- Grand challenges and social innovation have the potential to rapidly open power and identity boundaries between actors thanks to their strong social purpose and urgency.

1. Introduction

In response to the pressing challenges posed by climate change, an aging society, obesity, and pandemics, sporadic previous studies have highlighted the need for innovative solutions within the public sector (Bommert, 2010; Chesbrough, 2020; Hilgers and Ihl, 2010). Traditionally, the public sector has pursued innovation through closed mechanisms characterized by limited transparency and minimal engagement

of external stakeholders (Albury, 2005; Bommert, 2010; De Vries et al., 2016; Moore, 2005; Mulgan, 2007). However, a recent surge in literature has emerged, exploring the potential benefits and challenges associated with adopting open innovation (OI) practices in the public sector. By embracing external collaboration and involving civic society, public sector organizations can unlock transparency, inclusivity, and synergy, leading to potential cost and time savings (Bekkers and Tummers, 2018; Kankanhalli et al., 2017; Mu and Wang, 2020).

Despite the growing interest in open innovation, the extent of its application within the public sector remains unclear. Chesbrough and Bogers (2014) define OI as a distributed innovation process facilitated by purposeful knowledge flows across organizational boundaries, utilizing both monetary and non-monetary mechanisms tailored to each organization's business model. This definition implies the need for public organizations to embrace openness. However, the specifics of which *boundaries* of public organizations open and *how* they open remain ambiguous. Besides, OI in public organizations has predominantly focused on citizen inclusion and the barriers and catalysts for engaging and attracting citizens (Mergel, 2018; Pedersen, 2020; Steils et al., 2021). Participation of other external entities such as businesses,

* Corresponding author.

E-mail addresses: tfigen@dtu.dk (T. Figenschou), yinli@dtu.dk (J. Li-Ying), annta@hillerod.dk (A. Tanner), m.l.a.m.bogers@tue.nl (M. Bogers).

other public organizations, and academia has been limited, often restricting the OI process to idea generation only (De Coninck et al., 2021; Mergel, 2018; Steils et al., 2021). These limitations have hindered the progress of public sector OI research. Remarkably, no reviews to date have comprehensively analyzed OI in the public sector concerning the boundaries that open to different actors.

To address this gap, thus, we conduct a systematic literature review and aim at enhancing our knowledge on OI within public sector organizations by addressing the following research questions:

Which aspects of organizational boundaries open among various actors in the context of public sector open innovation?

There are two important elements embedded in the approaches in which we review and synthesize the literature. First, since OI entails cross-organizational interactions at different levels, organizational boundary becomes a fundamental theoretical concept, on which OI research must build. Without the understanding of organizational boundaries, discussion on openness will remain imprecise and superficial. Santos and Eisenhardt (2005) developed the boundary conception as of four aspects, namely, efficiency, competence, identity, and power. Boundary opening in OI, thus, can be investigated through different combinations of the aspects of the boundary concept. This offers an opportunity to use the boundary concept as a lens to review the literature and guide future research. Second, OI is also a process (West and Bogers, 2017). Thus, the literature being reviewed are also displayed and synthesized in a process view, starting from antecedents of OI to the organization of OI, and to the outcomes of OI in public sector organizations.

The insight into the extent of organizational boundary openness in the public sector and the actors they engage with holds both theoretical and practical significance. To advance, a consolidated theoretical foundation and comprehensive analytical framework is developed to unveil the extent of openness in public sector OI. This review contributes to OI theory in two ways. First, through a systematic review, it advances the concept of OI in the public sector by identifying pertinent actors, triggers, strategies, and outcomes, and integrating them into an analytical framework that employs a boundary perspective to analyze the boundaries that open to specific actors. Second, the introduction of an organizational boundary-based process model equips future research to assess public sector OI across varying degrees of openness, shedding light on the organization's maturity stage and the boundaries that should be prioritized for further advancement.

This article proceeds as follows: The first section provides a theoretical groundwork for OI in the public sector, categorised into antecedents, outcomes, and strategies. This is followed by an examination of boundaries and actors, culminating in the introduction of the analytical framework. Subsequently, the methodology for data collection and analysis is detailed. The results are then presented, followed by a comprehensive discussion. Finally, potential directions for future research within this framework are suggested.

2. Theoretical background: Open innovation and organizational boundaries

2.1. Open innovation in the public sector

There are a few recent reviews on open innovation in the public sector that synthesize the literature, but these prior review articles vary to a great extent in term of how they address the extant literature, as they discuss the determinants of OI adoption, barriers, drivers, strategies, its purpose and value creation (De Coninck et al., 2021; De Vries et al., 2016; Mu and Wang, 2022; Pedersen, 2020). For the ease of readership, we reorganize the main topics that were covered by the prior literature review about OI in the public sector into three categories – barriers, drivers and purposes of OI has been categorised as *antecedents*, value creation as *outcomes*, and strategies as *cross-boundary factors*. Below is an overview of the main findings from previous literature

reviews.

2.1.1. Antecedents

Antecedents of public sector OI adoption is well covered in the literature. De Coninck et al. (2021) separate determinants of open innovation adoption in public organizations according to three perspectives; transaction-cost, resource-based and institutional. Resource-based antecedents are divided into tangible outcomes of technological and financial resources, and intangible outcomes of public managers and leaders, professional identity, organizational structure, organizational culture, and strategic alignment. Finally, public sector capabilities of exploring, codifying, transfer innovation needs, manage external innovator's involvement, acting as a meta-governor and agile development methodologies are identified in the literature.

In terms of external pressures to adopt OI in the public sector these are political entities and legislation, pressure from the broader social environment, and sometimes mimetic pressure referring to copying behaviour of comparable organizations (De Coninck et al., 2021).

Pedersen (2020) review the purpose of public sector OI comparing the literature with empirical results, finding that there is general a mismatch between theory and practice. Hence, the purpose identified in theory are innovation of democracy, innovation of public sector organizations, innovation of the relationship between public sector organizations, innovation of the relationship between public sector organizations, citizens and other stakeholders, and innovation in society. Comparing these findings with practice, innovation in society dominates the purpose of public sector OI. Furthermore, innovation of the relationship between public sector organizations is almost non-existing in practice, even though it seems like an obvious opportunity for public sector OI. Pedersen (2020) suggests that it might be under-represented since it can be achieved without necessarily involving citizens and therefore is not covered in the OI literature.

In the context of digital transformation with regard to co-creation, open data and open government, Mu and Wang (2022) analyze how governance strategies and barriers of non-digital OI differ from digital OI and find that relational barriers are more prevalent for non-digital OI while barriers related to capacity and technical challenges are dominant for digital OI.

Finally, reviewing public sector innovation in general, and not open innovation per se, De Vries et al. (2016) identify antecedents at four levels; environment, organizational, innovation and individual. Environmental factors are external pressure, mimetic pressure, and regulatory pressure. Organizational factors are access to resources, skills of management, risk aversion, structures, incentives, and conflicts. Innovation factors are relative advantage, ease of use, trialability and compatibility. Finally, individual factors are innovation acceptance, share perspective and norms, satisfaction with job, demographic aspects, creativity, professionalism, tenure/mobility and empowerment of employees (De Vries et al., 2016).

2.1.2. Cross-boundary factors

Intermediaries, inter-actor trust and standardisation of OI processes across many public organizations are identified as cross-boundary factors in the review of De Coninck et al. (2021). Mu and Wang (2022) support the use of intermediaries, and add that long-term political commitment facilitate cross-boundary relations.

2.1.3. Outcomes

IT investments that enable OI interaction such as open platforms, and non-IT investments such as changes to the organization's business model, structures, processes and capabilities are factors deciding how OI projects create value (Pedersen, 2020). Furthermore, contextual factors that influence the value creation of public sector OI are factors related to the conditions of innovation, the objects of change, and the external innovation assets, where external assets are much more researched than the other two categories. Value creation also depends on the

organization's innovative assets such as the attraction and engagement of citizens or other external stakeholders. Finally, most literature on innovative assets concern contributions from citizens, and other actors are mostly mentioned if there is a smart city project being analyzed (Pedersen, 2020).

Reviewing public sector innovation in general, and not open innovation per se, De Vries et al. (2016) identify outcomes as in the increased and decreased effectiveness, increased efficiency, private partners involved, citizens involved, and increased customer satisfaction. However, in 40% of the papers reviewed there are no outcomes reported. The underreporting on outcomes indicate that many public sector OI projects do not create value, and at best it contributes to increased internal processes.

2.2. Concepts of boundaries

To analyze organizational boundaries, this article applies the four boundary conceptions developed by Santos and Eisenhardt (2005): efficiency, competence, identity, and power. Efficiency refers to legal boundaries, which in the public sector would be legal frameworks strictly regulating relations between public and private organizations. Boundaries of competence are a dynamic view of boundaries, referring to the resources an organization should have in-house, and those they could find outside the organization. This is at the core of OI (Zobel and Hagedoorn, 2020). Boundaries of identity is a holistic approach referring to the “who we are” in the organization. Finally, boundaries of power are the permeable approach, referring to how an organization controls exchanges with external parties. A recent study by Zobel and Hagedoorn (2020) finds that efficiency and competence boundaries are almost always in place when an organization enters OI. However, the further into the process it is and the more OI activities there are, the more power and identity boundaries come into play.

2.3. Actors

Most of the public organizations in this review are local governments or city administrations, while the remaining are public research organizations (see Fig. 1). Apart from the public organizations, actors involved are citizens or end users, academia, firms, policy makers, and NGOs (that is, other public organizations). Most articles study the relationship between local government and citizens: how they interact, and which strategies local government can apply to motivate citizens. Contrary to OI in the private sector, where there is inter-firm collaboration (Bogers et al., 2017), there is very little evidence of inter-government collaboration. We therefore do not know whether governments cooperate in OI efforts. Furthermore, when local governments collaborate with firms it is often characterized as a vendor relationship rather than a co-creative partner relation. Consequently, OI in

the public sector has until now mostly been a study of the relationship between citizens and city government.

There are some exceptions. Secundo et al. (2019) study the actors involved in a health sector ecosystem consisting of patients, family, suppliers, providers, and regulators to identify how learning is transferred among the parties. Moreover, studies that examine living labs involve more actors (Gascó, 2017; Scozzi et al., 2017).

2.4. Boundaries as an analytical framework

Combining the findings above regarding antecedents, cross-boundary factors, outcomes, boundaries, and actors, this review suggests a boundary-based framework enabling the analysis of public sector OI actors in combination with the degree of openness. This is interesting because it provides some insight into what forms of relationships that are established between actors, and thereby may indicate the degree of openness. In accordance with Zobel and Hagedoorn (2020), this paper argues that the relationship intensifies with the opening of power and identity boundaries, and that the most successful cases of OI adoption in the public sector are characterized by the opening of these boundaries. Figure 2 illustrates the mentioning of different boundaries in the reviewed literature.

Furthermore, the framework invites scholars to analyze how the opening of one type of boundary between the public organization and one group of actors may influence the opening or closing of boundaries between the organization and other types of actors. Consequently, it is possible to analyze how boundaries are interrelated.

For example, if citizens open boundaries of competence by participating in a hackathon, this could result in the opening of competence boundaries in firms as well by the external influence in participating in the same public sector event. Research confirms that mimetic pressures lead organizations to open boundaries (De Coninck et al., 2021).

3. Review method

To examine how OI has been studied as a concept in public sector organizations we conduct a systematic and explorative literature review following the methodology of Tranfield et al. (2003). Research on OI in the public sector is a relatively new and fragmented field, which calls for an explorative approach. However, there are some recent literature reviews in adjacent topics that have inspired our methods (De Vries et al., 2016; Mu and Wang 2020).

3.1. Eligibility criteria

The following eligibility criteria to determine the final sample of articles were applied.

Field: In accordance with De Vries et al. (2016) we applied the definition of public sector as “those parts of the economy that are either in state ownership or under contract to the state, plus those parts that are regulated or subsidized in the public interest” (Flynn 2007, 2).

Topic: Each article had to apply the theory of OI to be eligible for this review. A recent review of Mu and Wang (2020) includes papers that apply various related theories, such as co-creation and public-private partnerships, arguing that if these generate outcomes of innovation they could be considered to be OI. However, this review has chosen not to include related theories. We consider it out of scope for this review to argue for how other theories relate to OI. The main objective of this review is to investigate how OI as a theory has been applied to the public sector. Studies therefore had to include both “open innovation*” and “government” or “public*” or “municipalit*” or “cit*” in their title and/or abstract to make it through the first round of screening.

Study design: All articles, empirical and theoretical, applying OI to the public sector were included. Book chapters and conference proceedings were excluded, whereas literature reviews were included.

Year of publication: All years in Web of Science (1900–2022) were

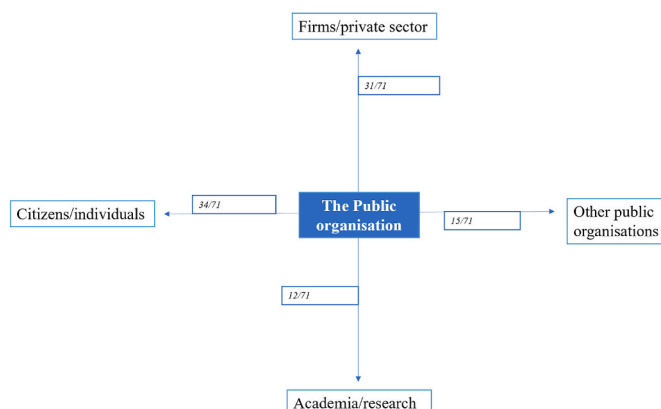


Fig. 1. Number of times each actor is present in an article.

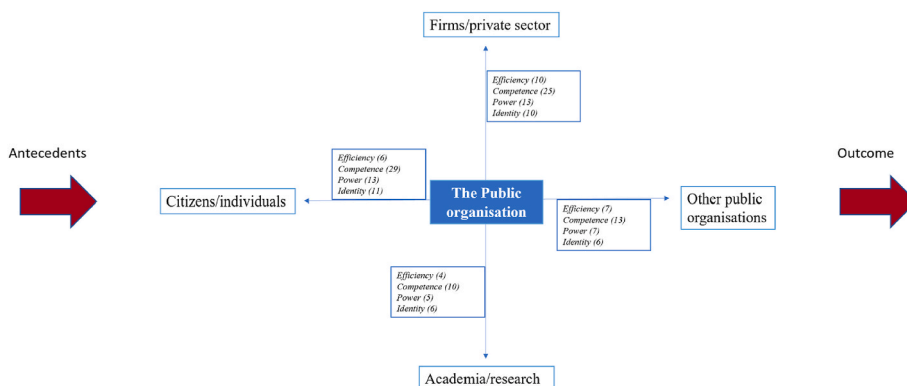


Fig. 2. The boundary framework.

selected.

Language: Only studies written in English were considered, since there were no resources to translate articles in other languages.

Publication status: All published journal articles were included. Due to the small number of published research papers applying OI to the public sector, we did not have the luxury of excluding articles that were not published in a well-established journal. We suggest that this might be relevant for future systematic literature reviews on OI in the public sector.

3.2. Study selection

We screened 648 articles; after applying the eligibility criteria we were left with 148 articles, which we then read in detail. Our selection process is presented in Fig. 3. At the initial screening we applied the eligibility criteria to the title and abstract, and in the following screening we carefully read each paper looking for the application of OI theory to the public sector.

We limited our search to the Web of Science, using the Science Citation Index (SCI) and the Social Science Citation Index (SSCI) database. Furthermore, book chapters and conference proceedings were removed, leaving us with articles and reviews only.

The final sample of 71 articles was analyzed with regard of actors involved and boundaries. Actors were categorised into the following: citizens/individuals, firms/private sector, other public organizations, and academia/research. Boundaries were categorised into the previous mentioned typology of efficiency, competence, power, and identity. Each article was screened for any indication of organizational boundaries by looking for in example outsourcing activities (efficiency), idea generation activities (competence), external actors taking charge of innovative processes (power), and external actors feeling included and part of the public organization (identity). See appendix A for a list of full paper titles per boundary and actor. In 20 out of the 71 articles there were no boundaries identified, and these are therefore not part of the boundary analysis in the result section, however they are included in the reports of antecedents, outcomes, and strategies in the section above.

3.3. Results and analysis

The 71 articles span 38 different journals, with the four journals of *Sustainability Switzerland* (10), *Government Information Quarterly* (9), *R & D Management* (5) and *Public Management Review* (4) being mentioned more than three times. The earliest article found in this review was published in 2009 (see Fig. 4). Between 2009 and 2016 there are very few articles published on this topic (between 1 and 4 each year), however in 2017 there was a peak, with 13 articles. Since then, there has been a steady decline in the number of articles applying OI in public sector.

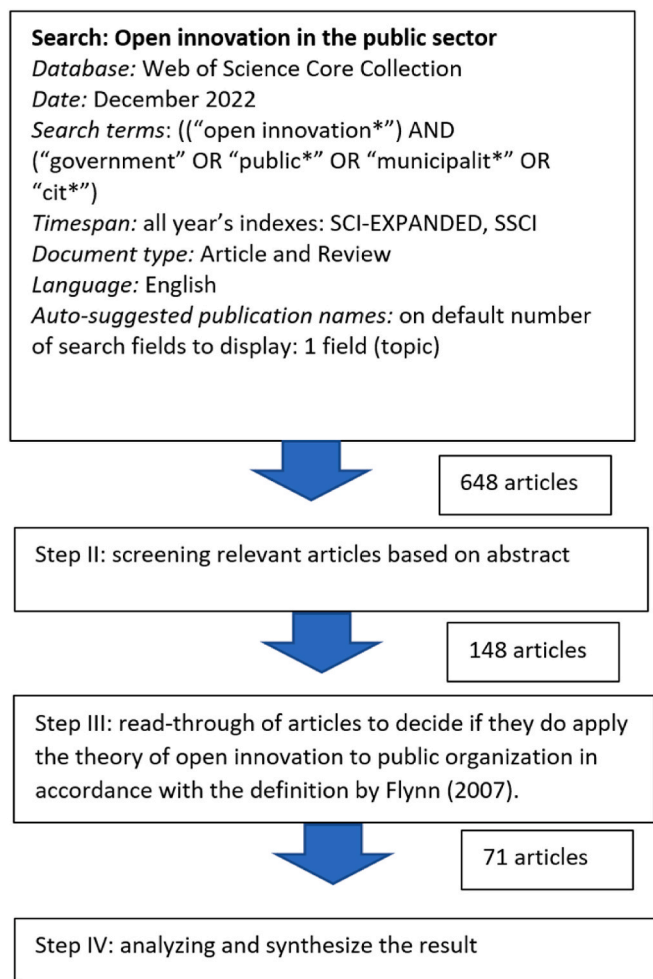


Fig. 3. Literature search and process of selecting papers.

4. Results

To answer the research question – which aspects of boundaries open in public sector open innovation, and to which actors – the following section provide an analysis of the opening of boundaries between the public organization and each of the four external actors, as well as an analysis of cross-boundary factors across actors.

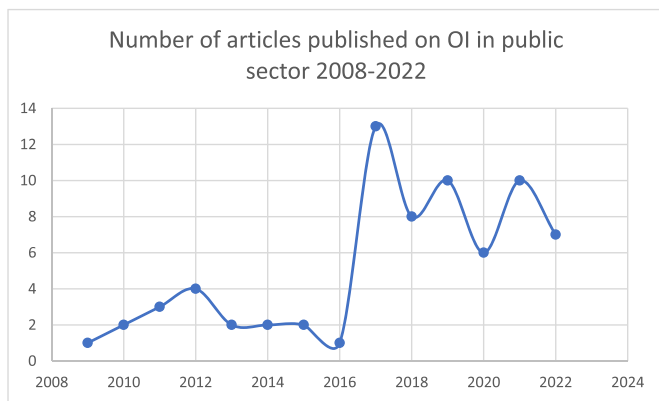


Fig. 4. The number of articles published on OI in public sector over 2008–2022.

4.1. Boundaries and actors

4.1.1. Citizens/individuals

The opening of competence boundaries through crowdsourcing is the most described relation between the public organization and citizens. Local government typically open competence boundaries by sharing a challenge with the public, and citizens offer their competence through ideas and suggestions (Baek and Kim, 2018; Cappa et al., 2020; Chatwin and Arku, 2018; Hosseini et al., 2018; Konsti-Laakso and Rantala, 2018; Vasiliki, 2017; Vieira et al., 2018). Hence, most papers explain various ways of including citizens into idea generation and design phases (Almirall et al., 2014). The emphasis is on how to attract citizens, how to engage citizens, and how to increase citizens' acceptance of local government's decisions, and barriers to citizens' participation. Wijnhoven et al. (2015) found that individual reasons for not participating in OI projects run by local government are the disbelief that their ideas will be heard or whether their contribution is valuable to the project due to its perceived level of complexity.

Furthermore, there is evidence of local government being reluctant to open boundaries of power and identity with citizens, leading to most projects not moving beyond boundaries of competence. However, there are some exceptions. Studying hackathons, Yuan and Gasco-Hernandez (2021) found that the relationship building was mainly between public employees and citizens from the IT community. The relationship was mostly characterized as informal, however, the local government frequently hired from the pool of hackers attending. This created a bridge between the government and society, suggesting the opening of identity boundaries between the two. Another example is of citizens taking the lead of government-initiated projects, often related to social innovation (Bertello et al., 2022; Scozzi et al., 2017; Yun et al., 2011). When end-users were allowed a voice and participation into the innovation process, they were engaged and intrinsically motivated to participate. This suggests the opening of boundaries of competence, power, and identity.

Finally, civic crowdfunding is particularly interesting since it represents a case of citizens initiating and controlling projects, which is otherwise rare. Carè et al. (2018) found that when the crowd raises funding for a project, it has local commitment and engagement leading to more successful projects. Boundaries of power and identity are opened, but this time from the civic side including local government by offering funding and competence. Social inclusion and assistance were the main drivers for funding these projects. Findings suggest that opening boundaries of identity and power to citizens by local government has great potential in terms of higher engagement, quality, and time allocation by citizens.

4.1.2. Firms/private sector

The public-private relation seems to be a necessary, yet challenging relation in public sector OI. While firms offer valuable knowledge in terms of technologies and insights into markets, they are fundamentally different from public organizations in that they seek to maximize profits for their shareholders, while the public organization seeks to maximize satisfaction with public services. There are many accounts of barriers to this relation identified in this review, such as differences in culture, organizational structure, access to resources and legal framework (Almirall et al., 2014; Carè et al., 2018; Chatwin and Arku, 2018; Lee et al., 2012; Mergel, 2018; Simiyu et al., 2010; Smith et al., 2019). Furthermore, Smith et al. (2019) identified that a mismatch in the perception of barriers created conflicts between the two parties, indicating further complexities to the relationship. Despite the many barriers, the opening of boundaries between the public organization and firms/private sector occurs in almost half of all papers in this review. The relation is dominated by the opening of competence boundaries, often represented by firms participating in local government hackathons, living labs, or crowdsourcing meetings (Almirall et al., 2014).

An interesting exception is the paper of Parjanen and Rantala (2021) studying the motivation of private actors to participate in an open innovation platform focusing on increasing development processes in the city centre. Their study shows that participation in the open innovation platform opened boundaries of competence and power through the exchange of information related to future business plans, which would otherwise be kept private. Furthermore, users of the platform identified missing actors and accordingly missing information that was relevant, suggesting that more effort is required to have relevant actors participate and share information (Parjanen and Rantala, 2021).

Furthermore, they find that local government takes on two roles depending on the development focus: both the role of a participant and a facilitator (Parjanen and Rantala, 2021). This corresponds with other literature finding that governments and firms change their roles according to which actors that are involved, the characteristics of the project and the level of perceived risk (Ferraris et al., 2018; Mei and Zhang, 2022; van Genuchten et al., 2019). Governments risk that the project is dominated by private interests, neglecting the common good and common interests, and later being accused of letting the firm take over. The firm's lack of financial gain and control over IP rights, leading to holding the government at an arm's length in projects. This indicates not moving beyond boundaries of power. In particular, this is evident in complex projects where the potential outcome has commercial value and roles, and responsibilities are unclear. In a less complex project such as a crowdsourcing initiative, the risk is perceived low, and roles tend not to change. Consequently, the relation between the public organization and firms could be enhanced by some form of intermediary ensuring trust and understanding between the two.

4.1.3. Other public organizations

Contrary to OI in the private sector, where there is inter-firm collaboration (Bogers et al., 2017), there is little evidence of inter-government collaboration. We therefore do not know to what extent governments cooperate in OI efforts. This corresponds with findings of Pedersen (2020). He suggests that inter-government collaboration might occur to a larger extent than we know since they could be achieved without public reporting. However, when governments do open boundaries to other governments, they tend to open all boundaries to achieve success with their projects. Their main drivers for opening boundaries are typically grand challenges such as an aging population and a lack of resources making sharing of resources necessary (Feller et al., 2011). Bevilacqua et al. (2020) investigated some projects, including public parties run by the mayor's office in Boston. Interestingly, these projects were freed of common barriers to public sector OI such as strict regulations and risk aversion. Consequently, they opened all four boundaries achieving learnings that they shared between each other and with similar local governments all over the world.

Furthermore, [Feller et al. \(2011\)](#) found that the collaboration between six municipalities over time resulted in improved public services and cost reductions. These two cases of opening boundaries imply that inter-governmental collaboration can achieve great benefits for the public community.

4.1.4. Academia/research

This literature review found little evidence of the public organizations opening boundaries to academia/research. However, in the few papers studying this relationship, the role of researchers are emphasized as crucial to a successful OI outcome. [Paskaleva and Cooper \(2018\)](#) found that projects with researchers participating outperformed those that did not. Furthermore, [Konsti-Laakso & Rantala \(2018\)](#) found that researchers were used as facilitators of the OI process hugely contributing to the success of the project by being perceived as neutral and hence trustworthy. [Greco et al. \(2017\)](#) found that one main driver for firms to open boundaries of competence was to collaborate with universities, gaining insights and access into their knowledge and innovation. According to [Roper and Hewitt-Dundas \(2012\)](#) universities tend to have more external connections than private research centres, and are therefore more likely to transfer knowledge to external parties than private centres. This suggests that universities open boundaries of competence and power to a larger degree than private centres. Hence, the public organization could potentially attract firms by offering them access to researchers, given that they have established sound relationships with this sector. Consequently, it is suggested that the opening of boundaries between the public organization and academia has the potential to highly increase OI outcome for the public organization by increased access to knowledge and the attraction of private firms.

4.2. Cross-boundary factors

4.2.1. Intermediaries

Perhaps the most successful public initiative to open boundaries across actors are the use of intermediaries. An intermediary may take many forms; either as an online tool, a living lab or the hiring of people dedicated to facilitating communication between parties ([Bakici et al., 2013](#); [Gagliardi et al., 2017](#); [Gascó, 2017](#); [Parjanen and Rantala, 2021](#); [Randhawa et al., 2018](#); [Yuan and Gasco-Hernandez, 2021](#)). Challenges mentioned above between each actor and the public organization such as poor communication, lack of trust, perceived risk and barriers, and cultural differences can be mitigated using intermediaries. Focusing on social relations between actors, the outcome is that participants feel that their values and initiatives are taken care of and appreciated, further enhancing the quality of public services.

[Bakici et al. \(2013\)](#) focus on public open innovation intermediaries and how they play an important role in acting as a bridge between local government and external stakeholders, enabling the public organization to establish and maintain an innovation ecosystem. Their main role is to maintain active networks and to facilitate the opening of boundaries. Furthermore, [Randhawa et al. \(2018\)](#) observed that the role of the intermediary changed throughout the process from first being a mere platform provider, to being an integrated service provider to in the end having the role as a co-creator. This suggests that when boundaries open between actors, the intermediary is also able to integrate itself deeper into the project. Intermediaries is therefore of major importance in succeeding with the opening of boundaries between actors in public OI projects.

4.2.2. Public management

Poor management skills within public organizations seems to be one of the significant challenges to opening boundaries with external actors. Sound management skills in public organizations are emphasized by many authors ([García-Muiña et al., 2019](#); [Mergel, 2018](#); [Simiyu et al., 2010](#); [Tate et al., 2018](#); [Zhang et al., 2017](#)), and a few lists key qualifications that managers should inhibit to be successful. These are securing

top-management support, creating a management group that supports open collaboration and inclusive decision-making processes through internal communication ([García-Muiña et al., 2019](#)), and to be able to motivate external and internal actors ([Mergel and Desouza, 2013](#); [Schmidhuber et al., 2019](#); [Wijnhoven et al., 2015](#)).

However, successful public management are dependent on the individuals holding these positions and their motivation and skills to ensure the opening of boundaries with external actors. [Ferraris et al. \(2020\)](#) found that public managers avoid entering long-term projects due to the personal risk of not being there to enjoy the fruits of the project. Hence, prioritizing personal ambitions over the interest of local government hinders OI. Furthermore, [Parjanen & Rantala \(2021\)](#) identified social distance between actors caused by public managers as a challenge. Finally, [Ciasullo et al. \(2021\)](#) found that public experts were reluctant to open boundaries of power and identity with lay people, at best boundaries of competence were opened. Consequently, the lack of sound public management could be a barrier to opening boundaries of public OI projects.

5. Discussion

5.1. Sequence of boundary opening and full openness

The literature review has revealed actors and boundary opening in public sector OIs from a theoretical lens of four aspects of organizational boundary. Such insights offer a new theoretical perspective on the openness of public organizations and connect to barriers and drivers in a nuanced way and redefines the concept of “maturity” of OI. [Enkel et al. \(2020\)](#) argue from a private firm perspective that there are degrees of OI maturity and not all companies require the same degree of openness. Hence, they introduce a maturity model where management transition from the role of traditionalist to modernist to visionary based on their cultural level of OI adoption without touching upon the concept of organizational boundary. Thus, with the understanding of openness being various patterns of boundary opening based on this study, the “maturity” model should be redefined and re-examined. That is, it is made possible to research the sequence of boundary opening and how to achieve full openness and whether it is making sense to be fully open in all aspects of organizational boundaries.

By reviewing the literature, we identified a phenomenon in the literature that challenges the notion of boundaries being open sequentially by first opening boundaries of efficiency and competence, and thereafter by opening boundaries of identity and power. Grant challenges can accelerate the boundary opening and some cases of full openness are presented.

There have been a few papers on the public sector related to grand challenges, in the context of COVID-19, demonstrating how grand challenges can increase the pace and motivation of opening boundaries between actors ([Bertello et al., 2022](#); [Boeing and Wang, 2021](#); [Ciasullo et al., 2021](#); [Colovic et al., 2022](#); [Ibáñez et al., 2022](#); [Patrucco et al., 2022](#); [Scotti et al., 2022](#)). [Scotti et al. \(2022\)](#) study the sharing of mobility data between a social network and research community, finding that there is no relation between the two parties but that of transferring data from one to the other. This is interesting, since it indicates the opening of power boundaries, without having a close relation, which is otherwise assumed. This suggests that grand challenges offer a way to leapfrog the normal maturity process of organizations and individuals and directly reach full maturity. Furthermore, the significant impact on boundaries of a shared common goal is evident when studying these cases. This is demonstrated in the community-based digital tracing project in Wuhan ([Boeing and Wang, 2021](#)) including enterprises, citizens and the government where the key aspect of the innovation was for citizens to voluntarily share their mobility data. Hence, it is a case of outside-in innovation where the government receives valuable data from the outside to create value for the public. This is a rare case of the opening of power boundaries where it is citizens that open their

boundaries rather than the government. Giving up power of one’s mobility data is a potential risk for individuals, and therefore require great care from the government in handling these data. This case illustrates that it is not just governments and enterprises that face potential risk when opening their boundaries, same goes for individuals. Finally, due to the burning platform approach grand challenges such as a pandemic requires, the time to market is reduced compared to OI observed in local challenges (Scotti et al., 2022). This indicates that the potential lag effect of OI discussed by Pedersen (2020) is not an issue when OI is applied to grand challenges. Hence, grand challenges increase the pace of OI, acceptance of solutions within society and time to market.

The opening of all four boundaries is rare. In this review there are four articles where all boundaries open to all actors (Feller et al., 2011; Heimstädt and Reischauer, 2019; Paskaleva and Cooper, 2018; van Genuchten et al., 2019) and two articles where all boundaries open to some actors (Bevilacqua et al., 2020; Colovic et al., 2022). Interestingly, they do have some features in common. First, they are all cases of local government that have an external pressure to open such as either a grand challenge or ambitious targets set locally or nationally. Second, even though some are project-based, they turned out to be long-term allowing for relations to form and strengthen over time. Consequently, interdependencies emerged making the involved actors more likely to open boundaries over time. For example, Feller et al. (2011) found that the six municipalities working together developed strong interdependencies over time resulting in specialized units in each of the municipalities meaning that each unit had less variety of competences and tasks. These interdependencies are hard to reverse, and hence act as a further push to open boundaries. Third, they all had some projects that were characterized as highly complex and with unclear objectives. These projects therefore required more actors and insight. Hence, all boundaries open between the involved actors when trying to solve these challenges (Colovic et al., 2022). Fourth, management skills seems crucial to the opening of all four boundaries. Paskaleva and Cooper (2019) stress the importance of managers enhancing actors’ skills throughout the process to ensure quality and successful progression of the project. Each project had managers that were engaged in the process and attended OI events to connect with externals, thus facilitating the foundation of sound relationships and trust over time. The idea that there are varying degrees of openness, if it is examined from different aspects of boundary opening, offer a new and interesting approach to manage public sector OI.

6. Future research

Below we offer some suggestions for future research.

6.1. Future research recommendations

- Future research should investigate how academic actors can be included as intermediaries in public sector OI.
- Future research should analyze public manager’s individual motivation, or the lack of it, when opening boundaries. Given their importance to the maturity of public sector OI, it is crucial that their interests are aligned with that of the organizations.

- Future research should investigate if inter-government collaboration is present in some other literature streams, or whether this is an under-researched field.
- Future research should focus on the interrelation between boundaries in public sector OI to identify to what extent this exists, and whether there are ways to increase this.
- Future research should apply the boundary framework of Santos and Eisenhardt (2005) to obtain a consistent analysis of the opening of boundaries in OI literature. Furthermore, the boundary framework offers a more informed lens into why OI sometimes fails in the public sector. By separating actors and type of boundary, it is possible to “diagnose” what went wrong; in example a mismatch in the opening of boundaries between actors where one party is ready to open boundaries of power and identity, whereas the other is only prepared to open boundaries of competence.
- Future research should focus on quantitative studies with the aim of looking for the opening of each boundary in large scale. This could be the analysis of public sector contracts with external actors, and whether these are categorised as formal or more flexible. See Zobel and Hagedoorn (2020) for similar research of private sector OI.
- Future research should compare the opening of boundaries between public and private organizations to look for differences in strategies and antecedents.

7. Conclusion

This systematic review aimed to reveal which boundaries that open in public sector innovation and to which actors, by applying a boundary framework. By analyzing the boundaries of open innovation, it is possible to decide the level of maturity of OI and thereby decide how to move forward.

This review suggests two main conclusions. First, most of the research has focused the relation between public organizations and citizens. Therefore, future researchers are urged to investigate the relation between the public organization and other external actors. These insights could potentially increase value creation and capture of OI in public sector projects. Furthermore, increased insights into the interrelatedness of public sector OI boundaries would enrich the OI literature and enhance public managers’ understanding of their OI context.

Second, this review found that boundaries of efficiency and competence are most common within public sector OI projects. It is therefore important that future research study how public sector projects can achieve the opening of other boundaries, particularly those of power and identity. The opening of these boundaries might hold the key to achieving a higher level of success through closer collaboration, leading to improved innovations, services, and adoption.

Overall, public sector OI is a research field with many interesting gaps that offer future researchers a wide scope of questions to investigate.

Data availability

Data will be made available on request.

Appendix A. an overview of boundaries per actor identified in the literature

	Citizens	Firms	Other Public org.	Universities
Efficiency	Bevilacqua et al. (2020) Ciasullo et al. (2021) Feller et al. (2011) Heimstädt and Reischauer (2019)	Bevilacqua et al. (2020) Ciasullo et al. (2021) Colovic et al. (2022) Errichiello and Micera (2018)	Bevilacqua et al. (2020) Colovic et al. (2022) Feller et al. (2011) Heimstädt and Reischauer (2019)	Feller et al. (2011) Heimstädt and Reischauer (2019) Paskaleva and Cooper (2018) Van Genuchten et al. (2019)

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(continued)

	Citizens	Firms	Other Public org.	Universities
	Paskaleva and Cooper (2018) Van Genuchten et al. (2019)	Feller et al. (2011) Ferraris et al. (2018) Heimstädt and Reischauer (2019) Mei and Zhang (2022) Paskaleva and Cooper (2018) Smith et al. (2019) Van Genuchten et al. (2019)	Lee et al. (2017) Paskaleva and Cooper (2018) Van Genuchten et al. (2019)	
Competence	Baek and Kim (2018) Bakici et al. (2013) Bevilacqua et al. (2020) Bullinger et al. (2012) Cappa et al. (2020) Care et al. (2017) Chatwin and Arku (2018) Ciasullo et al. (2021) Dezi et al. (2018) Errichiello and Micera (2018) Feller et al. (2011) Gascó (2017) Gershman et al. (2019) Gustetic et al. (2015) Heimstädt and Reischauer (2019) Hosseini et al. (2018) Konsti-Laakso (2017) Konsti-Laakso and Rantala (2018) Paskaleva and Cooper (2018) Scozzi et al. (2017) Secundo et al. (2019) Specht et al. (2016) Steils et al. (2021) Tate et al. (2018) Van Genuchten et al. (2019) Vasiliki (2017) Wijnhoven et al. (2015) Yun et al. (2011) Zhang et al. (2017)	Baek and Kim (2018) Bakici et al. (2013) Bevilacqua et al. (2020) Cheah et al. (2019) Colovic et al. (2022) Dezi et al. (2018) Feller et al. (2011) Ferraris et al. (2018) Gascó (2017) Gershman et al. (2019) Greco et al. (2017) Heimstädt and Reischauer (2019) Konsti-Laakso (2017) Konsti-Laakso and Rantala (2018) Mei and Zhang (2022) Parjanen and Rantala (2021) Paskaleva and Cooper (2018) Schillo and Kinder (2017) Smith et al. (2019) Specht et al. (2016) Steils et al. (2021) Tate et al. (2018) Van Genuchten et al. (2019) Vasiliki (2017) Zhang et al. (2017)	Bakici et al. (2013) Bevilacqua et al. (2020) Colovic et al. (2022) Errichiello and Micera (2018) Feller et al. (2011) Gascó (2017) Heimstädt and Reischauer (2019) Konsti-Laakso and Rantala (2018) Paskaleva and Cooper (2018) Paskaleva and Cooper (2018) Roper and Hewitt-Dundas (2012) Steils et al. (2021) Tate et al. (2018) Van Genuchten et al. (2019) Zhang et al. (2017)	Bakici et al. (2013) Bullinger et al. (2012) Feller et al. (2011) Gascó (2017) Heimstädt and Reischauer (2019) Konsti-Laakso and Rantala (2018) Paskaleva and Cooper (2018) Steils et al. (2021) Tate et al. (2018) Van Genuchten et al. (2019)
Power	Baek and Kim (2018) Care et al. (2017) Feller et al. (2011) Gagliardi et al. (2017) Heimstädt and Reischauer (2019) Paskaleva and Cooper (2018) Scozzi et al. (2017) Secundo et al. (2019) Van Genuchten et al. (2019) Yun et al. (2011)	Bertello et al. (2022) Bevilacqua et al. (2020) Boeing and Wang (2021) Chatfield and Reddick (2017) Colovic et al. (2022) Colvic et al. (2014) Dezi et al. (2018) Feller et al. (2011) Heimstädt and Reischauer (2019) Mei and Zhang (2022) Parjanen and Rantala (2021) Paskaleva and Cooper (2018) Scotti et al. (2013) Van Genuchten et al. (2019)	Bevilacqua et al. (2020) Colovic et al. (2022) Feller et al. (2011) Heimstädt and Reischauer (2019) Paskaleva and Cooper (2018) Roper and Hewitt-Dundas (2012) Van Genuchten et al. (2019)	Bertello et al. (2022) Feller et al. (2011) Heimstädt and Reischauer (2019) Paskaleva and Cooper (2018) Van Genuchten et al. (2019)
Identity	Baek and Kim (2018) Bertello et al. (2022) Bevilacqua et al. (2020) Feller et al. (2011) Heimstädt and Reischauer (2019) Konsti-Laakso and Rantala (2018) Paskaleva and Cooper (2018) Scozzi et al. (2017) Van Genuchten et al. (2019) Yuan and Gasco-Hernandez (2021) Yun et al. (2011)	Bertello et al. (2022) Bevilacqua et al. (2020) Colovic et al. (2022) Dezi et al. (2018) Feller et al. (2011) Ferraris et al. (2018) Heimstädt and Reischauer (2019) Konsti-Laakso and Rantala (2018) Paskaleva and Cooper (2018) Van Genuchten et al. (2019)	Bevilacqua et al. (2020) Colovic et al. (2022) Feller et al. (2011) Heimstädt and Reischauer (2019) Paskaleva and Cooper (2018) Van Genuchten et al. (2019)	Bertello et al. (2022) Feller et al. (2011) Heimstädt and Reischauer (2019) Konsti-Laakso and Rantala (2018) Paskaleva and Cooper (2018) Van Genuchten et al. (2019)

References

- Albury, D., 2005. Fostering innovation in public services. *Publ. Money Manag.* 25 (1) <https://doi.org/10.1111/j.1467-9302.2005.00450.x>.
- Almirall, E., Lee, M., Majchrzak, A., 2014. Open innovation requires integrated competition-community ecosystems: lessons learned from civic open innovation. *Bus. Horiz.* 57 (3), 391–400. <https://doi.org/10.1016/j.bushor.2013.12.009>.
- Baek, S., Kim, S., 2018. Participatory public service design by Gov.3.0 design group. *Sustainability* 10 (1). <https://doi.org/10.3390/su10010245>.
- Bakici, T., Almirall, E., Wareham, J., 2013. The role of public open innovation intermediaries in local government and the public sector. *Technol. Anal. Strateg. Manag.* 25 (3), 311–327. <https://doi.org/10.1080/09537325.2013.764983>.
- Bekkers, V., Tummers, L., 2018. Innovation in the public sector: towards an open and collaborative approach. *Int. Rev. Adm. Sci.* 84 (2), 209–213. <https://doi.org/10.1177/0020852318761797>.
- Bertello, A., Bogers, M.L.A.M., De Bernardi, P., 2022. Open innovation in the face of the COVID-19 grand challenge: insights from the Pan-European hackathon 'EUvsVirus'. *R D Manag.* 52 (2), 178–192. <https://doi.org/10.1111/radm.12456>.
- Bevilacqua, C., Ou, Y., Pizzimenti, P., Minervino, G., 2020. New public institutional forms and social innovation in urban governance: insights from the "mayor's office of new urban mechanics" (MONUM) in Boston. *Sustainability* 12 (1). <https://doi.org/10.3390/su12010023>.
- Boeing, P., Wang, Y., 2021. Decoding China's COVID-19 'virus exceptionalism': community-based digital contact tracing in Wuhan. *R D Manag.* 51 (4), 339–351. <https://doi.org/10.1111/radm.12464>.

- Bogers, M., Zobel, A.K., Afuah, A., Almirall, E., Brunswicker, S., Dahlander, L., Frederiksen, L., Gawer, A., Gruber, M., Haefliger, S., Hagedoorn, J., Hilgers, D., Laursen, K., Magnusson, M.G., Majchrzak, A., McCarthy, I.P., Moeslein, K.M., Nambisan, S., Piller, F.T., et al., 2017. The open innovation research landscape: established perspectives and emerging themes across different levels of analysis. *Ind. Innovat.* 24 (1), 8–40. <https://doi.org/10.1080/13662716.2016.1240068>.
- Bommert, B., 2010. The international public management review IPMR: the e-journal of the IPMN. *Int. Pub. Manag. Rev.* 11 (1), 15–33. <http://journals.sfu.ca/ipmr/index.php/ipmr/article/view/73>.
- Bullinger, A.C., Rass, M., Adamczyk, S., Moeslein, K.M., Sohn, S., 2012. Open innovation in health care: analysis of an open health platform. *Health Pol.* 105 (2–3), 165–175.
- Cappa, F., Rosso, F., Capaldo, A., 2020. Visitor-sensing: involving the crowd in cultural heritage organizations. *Sustainability* 12 (4), 1–14. <https://doi.org/10.3390/su12041445>.
- Carè, S., Trotta, A., Carè, R., Rizzello, A., 2018. Crowdfunding for the development of smart cities. *Bus. Horiz.* 61 (4), 501–509. <https://doi.org/10.1016/j.bushor.2017.12.001>.
- Chatwin, M., Arku, G., 2018. Co-Creating an open government action plan: the case of sekondi-takoradi metropolitan assembly, Ghana. *Growth Change* 49 (2), 374–393. <https://doi.org/10.1111/grow.12234>.
- Chesbrough, H., 2020. *Open Innovation Results* (First). Oxford University Press.
- Chesbrough, H., Bogers, M., 2014. Explicating open innovation: clarifying an emerging paradigm for understanding innovation. In: Chesbrough, H., Vanhaverbeke, W., West, J. (Eds.), *New Frontiers in Open Innovation* (First). Oxford University Press.
- Ciasullo, M.V., Carli, M., Lim, W.M., Palumbo, R., 2021. An open innovation approach to co-produce scientific knowledge: an examination of citizen science in the healthcare ecosystem. *Eur. J. Innovat. Manag.* 25 (6), 365–392. <https://doi.org/10.1108/EJIM-02-2021-0109>.
- Colovic, A., Caloffi, A., Rossi, F., 2022. Crowdsourcing and COVID-19: how public administrations mobilize crowds to find solutions to problems posed by the pandemic. *Publ. Adm. Rev.* 82 (4), 756–763. <https://doi.org/10.1111/puar.13489>.
- De Coninck, B., Gascó-Hernández, M., Viaene, S., Leysen, J., 2021. Determinants of open innovation adoption in public organizations: a systematic review. *Publ. Manag. Rev.* 00 (00), 1–25. <https://doi.org/10.1080/14719037.2021.2003106>.
- De Vries, H., Bekkers, V., Tummers, L., 2016. Innovation in the public sector: a systematic review and future research agenda. *Publ. Adm.* 94 (1), 146–166. <https://doi.org/10.1111/padm.12209>.
- Dezi, L., Pisano, P., Pironti, M., Papa, A., 2018. Unpacking open innovation neighborhoods: le milieu of the lean smart city. *Manag. Decis.* 56 (6), 1247–1270.
- Enkel, E., Bogers, M., Chesbrough, H., 2020. Exploring open innovation in the digital age: a maturity model and future research directions. *R D Manag.* 50 (1), 161–168.
- Erriichiello, L., Micera, R., 2018. Leveraging smart open innovation for achieving cultural sustainability: learning from a new city museum project. *Sustainability* 10 (6), 1964.
- Feller, J., Finnegan, P., Nilsson, O., 2011. Open innovation and public administration: transformational typologies and business model impacts. *Eur. J. Inf. Syst.* 20 (3), 358–374. <https://doi.org/10.1057/ejis.2010.65>.
- Ferraris, A., Santoro, G., Papa, A., 2018. The cities of the future: hybrid alliances for open innovation projects. *Futures* 103 (May 2017), 51–60. <https://doi.org/10.1016/j.futures.2018.03.012>.
- Ferraris, A., Santoro, G., Pellicelli, A.C., 2020. “Openness” of public governments in smart cities: removing the barriers for innovation and entrepreneurship. *Int. Entrepren. Manag. J.* 16 (4), 1259–1280. <https://doi.org/10.1007/s11365-020-00651-4>.
- Flynn, N., 2007. *Public Sector Management, fifth ed.* Sage Publications.
- Gagliardi, D., Schina, L., Sarcinella, M.L., Mangialardi, G., Niglia, F., Corallo, A., 2017. Information and communication technologies and public participation: interactive maps and value added for citizens. *Govern. Inf. Q.* 34 (1), 153–166. <https://doi.org/10.1016/j.giq.2016.09.002>.
- García-Muina, F.E., Fuentes-Moraleda, L., Vacas-Guerrero, T., Rienda-Gómez, J.J., 2019. Understanding open innovation in small and medium-sized museums and exhibition halls: an analysis model. *Int. J. Contemp. Hospit. Manag.* 31 (11), 4357–4379. <https://doi.org/10.1108/IJCHM-03-2018-0260>.
- Gascó, M., 2017. Living labs: implementing open innovation in the public sector. *Govern. Inf. Q.* 34 (1), 90–98. <https://doi.org/10.1016/j.giq.2016.09.003>.
- Gershman, M., Roud, V., Thurner, T.W., 2019. Open innovation in Russian state-owned enterprises. *Ind. Innovat.* 26 (2), 199–217.
- Greco, M., Grimaldi, M., Cricelli, L., 2017. Hitting the nail on the head: exploring the relationship between public subsidies and open innovation efficiency. *Technol. Forecast. Soc. Change* 118, 213–225. <https://doi.org/10.1016/j.techfore.2017.02.022>.
- Gustetic, J.L., Crusan, J., Rader, S., Ortega, S., 2015. Outcome-driven open innovation at NASA. *Space Pol.* 34, 11–17.
- Heimstädt, M., Reischauer, G., 2019. Framing innovation practices in interstitial issue fields: open innovation in the NYC administration. *Innovat. Manag. Pol. Pract.* 21 (1), 128–150. <https://doi.org/10.1080/14479338.2018.1514259>.
- Hilgers, D., Ihl, C., 2010. Citizensourcing: applying the concept of open innovation to the public sector. *Int. J. Pub. Participat.* 4 (1), 67–88.
- Hosseini, S., Frank, L., Fridgen, G., Heger, S., 2018. Do not forget about smart towns: how to bring customized digital innovation to rural areas. *Bus. Inform. Syst. Eng.* 60 (3), 243–257. <https://doi.org/10.1007/s12599-018-0536-2>.
- Ibáñez, M.J., Guerrero, M., Yáñez-Valdés, C., Barros-Celume, S., 2022. Digital social entrepreneurship: the N-Helix response to stakeholders’ COVID-19 needs. *J. Technol. Tran.* 47 (2), 556–579. <https://doi.org/10.1007/s10961-021-09855-4>.
- Kankanhalli, A., Zuiderwijk, A., Tayi, G.K., 2017. Open innovation in the public sector: a research agenda. *Govern. Inf. Q.* 34 (1), 84–89. <https://doi.org/10.1016/j.giq.2016.12.002>.
- Konsti-Laakso, S., 2017. Stolen snow shovels and good ideas: the search for and generation of local knowledge in the social media community. *Govern. Inf. Q.* 34 (1), 134–139.
- Konsti-Laakso, S., Rantala, T., 2018. Managing community engagement: a process model for urban planning. *Eur. J. Oper. Res.* 268 (3), 1040–1049. <https://doi.org/10.1016/j.ejor.2017.12.002>.
- Lee, S.M., Hwang, T., Choi, D., 2012. Open innovation in the public sector of leading countries. *Manag. Decis.* 50 (1), 147–162. <https://doi.org/10.1108/00251741211194921>.
- Mei, L., Zhang, N., 2022. Transformer in navigation: diverse government roles for open innovation in China’s high-speed rail. *Long. Range Plan.* 55 (1), 102069. <https://doi.org/10.1016/j.lrp.2020.102069>.
- Mergel, I., 2018. Open innovation in the public sector: drivers and barriers for the adoption of Challenge.gov. *Publ. Manag. Rev.* 20 (5), 726–745. <https://doi.org/10.1080/14719037.2017.1320044>.
- Mergel, I., Desouza, K.C., 2013. Implementing open innovation in the public sector: the case of Challenge.gov. *Publ. Adm. Rev.* 73 (6), 882–890. <https://doi.org/10.1111/puar.12141>.
- Moore, M.H., 2005. Break-through innovations and continuous improvement: two different models of innovative processes in the public sector. *Publ. Money Manag.* 25 (1), 43–50. <https://doi.org/10.1111/j.1467-9302.2005.00449.x>.
- Mu, R., Wang, H., 2020. A systematic literature review of open innovation in the public sector: comparing barriers and governance strategies of digital and non-digital open innovation. *Publ. Manag. Rev.* 00 (00), 1–23. <https://doi.org/10.1080/14719037.2020.1838787>.
- Mu, R., Wang, H., 2022. A systematic literature review of open innovation in the public sector: comparing barriers and governance strategies of digital and non-digital open innovation. *Publ. Manag. Rev.* 24 (4), 489–511. <https://doi.org/10.1080/14719037.2020.1838787>.
- Mulgan, G., 2007. *Ready or Not?: Taking Innovation In the Public Sector Seriously* (April). NESTA Provocation.
- Parjanen, S., Rantala, T., 2021. Building an open innovation platform as a part of city renewal initiatives. *Eur. Plann. Stud.* 29 (12), 2165–2183. <https://doi.org/10.1080/09654313.2021.1903397>.
- Paskaleva, K., Cooper, I., 2018. Open innovation and the evaluation of internet-enabled public services in smart cities. *Technovation* 78 (June), 4–14. <https://doi.org/10.1016/j.technovation.2018.07.003>.
- Paskaleva, K., Cooper, I., 2019. Innovations in co-created smart city services. In: Rodriguez, B., Pedro, M. (Eds.), *Setting Foundations for the Creation of Public Value in Smart Cities*. Springer, pp. 165–195. <https://doi.org/10.1007/978-3-319-98953-2>.
- Patrucco, A.S., Trabucchi, D., Frattini, F., Lynch, J., 2022. The impact of Covid-19 on innovation policies promoting Open Innovation. *R D Manag.* 52 (2), 273–293. <https://doi.org/10.1111/radm.12495>.
- Pedersen, K., 2020. What can open innovation be used for and how does it create value? *Govern. Inf. Q.* 37 (2), 101459. <https://doi.org/10.1016/j.giq.2020.101459>.
- Randhawa, K., Wilden, R., Gudergan, S., 2018. Open service innovation: the role of intermediary capabilities. *J. Prod. Innovat. Manag.* 35 (5), 808–838. <https://doi.org/10.1111/jpim.12460>.
- Roper, S., Hewitt-Dundas, N., 2012. Catalysing open innovation through publicly-funded R&D: a comparison of university and company-based research centres. *Int. Small Bus. J.* 31 (3), 275–295. <https://doi.org/10.1177/0266242612454671>.
- Santos, F.M., Eisenhardt, K.M., 2005. Organizational boundaries and theories of organization. *Organ. Sci.* 16 (5), 491–508. <https://doi.org/10.1287/orsc.1050.0152>.
- Schmidhuber, L., Piller, F., Bogers, M., Hilgers, D., 2019. Citizen participation in public administration: investigating open government for social innovation. *R D Manag.* 49 (3), 343–355. <https://doi.org/10.1111/radm.12365>.
- Scotti, F., Pierri, F., Bonaccorsi, G., Flori, A., 2022. Responsiveness of open innovation to COVID-19 pandemic: the case of data for good. *PLoS One* 17 (4 April), 1–19. <https://doi.org/10.1371/journal.pone.0267100>.
- Scozzi, B., Bellantuono, N., Pontrandolfo, P., 2017. Managing open innovation in urban labs. *Group Decis. Negot.* 26 (5), 857–874. <https://doi.org/10.1007/s10726-017-9524-z>.
- Secundo, G., Toma, A., Schiuma, G., Passiante, G., 2019. Knowledge transfer in open innovation: a classification framework for healthcare ecosystems. *Bus. Process Manag. J.* 25 (1), 144–163. <https://doi.org/10.1108/BPMJ-06-2017-0173>.
- Simiyu, K., Masum, H., Chakma, J., Singer, P.A., 2010. Turning science into health solutions: KEMRIs challenges as Kenya health product pathfinder. *BMC Int. Health Hum. Right* 10 (Suppl. 1), 1–9. <https://doi.org/10.1186/1472-698X-10-S1-S10>.
- Smith, G., Sochor, J., Karlsson, I.C.M.A., 2019. Public-private innovation: barriers in the case of mobility as a service in West Sweden. *Publ. Manag. Rev.* 21 (1), 116–137. <https://doi.org/10.1080/14719037.2018.1462399>.
- Specht, K., Zoll, F., Siebert, R., 2016. Application and evaluation of a participatory “open innovation” approach (ROIR): the case of introducing zero-acreage farming in Berlin. *Landsch. Urban Plann.* 151, 45–54.
- Steils, N., Hanine, S., Rochdane, H., Hamdani, S., 2021. Urban crowdsourcing: stakeholder selection and dynamic knowledge flows in high and low complexity projects. *Ind. Market. Manag.* 94 (January), 164–173. <https://doi.org/10.1016/j.indmarman.2021.02.011>.
- Tate, M., Bongiovanni, I., Kowalkiewicz, M., Townson, P., 2018. Managing the “Fuzzy front end” of open digital service innovation in the public sector: a methodology. *Int. J. Inf. Manag.* 39 (July 2017), 186–198. <https://doi.org/10.1016/j.ijinfomgt.2017.11.008>.
- Tranfield, D., Denyer, D., Smart, P., 2003. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *Br. J. Manag.* 14 (3), 207–222. <https://doi.org/10.1111/1467-8551.00375>.

- van Genuchten, E., Calderón González, A., Mulder, I., 2019. Open innovation strategies for sustainable urban living. *Sustainability* 11 (12), 3310. <https://doi.org/10.3390/su11123310>.
- Vasiliki, B., 2017. Co-creating an open platform at the local governance level: how openness is enacted in Zambia. *Govern. Inf. Q.* 34 (1), 140–152.
- Vieira, F.C., Do Vale, H.V., May, M.R., 2018. Open innovation and business model: embrapa forestry case study. *Revista de Administracao Mackenzie* 19 (4). <https://doi.org/10.1590/1678-6971/eRAMR180011>.
- West, J., Bogers, M., 2017. Open innovation: current status and research opportunities. *Innovation* 19 (1), 43–50. <https://doi.org/10.1080/14479338.2016.1258995>.
- Wijnhoven, F., Ehrenhard, M., Kuhn, J., 2015. Open government objectives and participation motivations. *Govern. Inf. Q.* 32 (1), 30–42. <https://doi.org/10.1016/j.giq.2014.10.002>.
- Yuan, Q., Gasco-Hernandez, M., 2021. Open innovation in the public sector: creating public value through civic hackathons. *Publ. Manag. Rev.* 23 (4), 523–544. <https://doi.org/10.1080/14719037.2019.1695884>.
- Yun, J.H., Park, S., Avvari, M.V., 2011. Development and social diffusion of technological innovation: cases based on mobile telecommunications in National Emergency Management. *Sci. Technol. Soc.* 16 (2), 215–234. <https://doi.org/10.1177/097172181001600205>.
- Zhang, N., Zhao, X., Zhang, Z., Meng, Q., Tan, H., 2017. What factors drive open innovation in China's public sector? A case study of official document exchange via microblogging (ODEM) in Haining. *Govern. Inf. Q.* 34 (1), 126–133. <https://doi.org/10.1016/j.giq.2016.11.002>.
- Zobel, A.K., Hagedoorn, J., 2020. Implications of open innovation for organizational boundaries and the governance of contractual relations. *Acad. Manag. Perspect.* 34 (3), 400–423. <https://doi.org/10.5465/amp.2016.0175>.