Boundary spanners as a key to value creation in infrastructure procurement

Johanna Maria Liljeroos-Cork
Faculty of Management and Business, Tampere University, Tampere, Finland, and

Kaisu Laitinen
Faculty of Built Environment, Tampere University, Tampere, Finland

Received 11 July 2023
Revised 29 January 2024
Accepted 25 March 2024

Abstract

Purpose – Infrastructure forms a basis for the operations and sustainability of the modern society. This paper aims to recognize value creation from the infrastructure procurement ecosystem perspective to achieve those goals. The pursuit of enhancing value creation involves an examination of infrastructure procurement challenges, boundaries as well as boundary spanners that facilitate effective knowledge transfer and interaction.

Design/methodology/approach – The qualitative study is based on content analysis of 25 thematic interviews. Data was transcribed and coded via Atlas.ti software.

Findings – Infrastructure procurement value creation challenges appear complex and related to boundaries that hamper collaboration, coordination and knowledge sharing. Our results show that these boundaries locate within and between different levels of procurement ecosystem. Therefore, value creation in infrastructure procurement requires boundary spanners for leveraging knowledge sharing and interaction. Artifacts, discussion, processes and brokers as identified boundary spanners are strongly nested and interrelated in the industry. Special attention should be given to supporting individuals to act as brokers, since they play the key roles in trust building, culture steering and usage of other boundary spanners.

Social implications – Promoting value creation in infrastructure procurement helps to achieve socio-economic development goals.

Originality/value – This study offers a unique perspective on value creation in the context of infrastructure by adopting an ecosystem lens and examining boundary crossing mechanisms. The results support future development of collaboration and knowledge sharing practices fostering procurement productivity.

Keywords Infrastructure ecosystem, Boundary objects, Boundary spanners, Brokers, Knowledge sharing, Procurement, Value creation

Paper type Research paper

The authors would like to thank Professors Elias Pekkola, Jan-Erik Johanson and Kalle Vaismaa for supporting and advising on the research work, and infrastructure sector representatives that were involved in the interviews.

Funding: This research was executed under the ProDigial research program that is funded by the Finnish Transport Infrastructure Agency (FTIA) and cities of Espoo, Helsinki, Jyväskylä, Kuopio, Lahti, Lappeenranta, Oulu, Tampere, Turku and Vantaa.

Conflicts of interest: The funding sponsors had no role in the design of the study; in the collection, analyses or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

Journal of Public Procurement
Vol. 24 No. 4, 2024
pp. 393-414
Emerald Publishing Limited
1535-0118
DOI 10.1108/JOPP-07-2023-0046

Introduction

Infrastructure can be seen as the backbone of modern societies as it acts as a catalyst to social, industrial, manufacturing and agricultural activities. Therefore, socioeconomic development is highly dependent on the availability of quality infrastructure (Singh *et al.*, 2023). Characteristic to infrastructure investments is that the production and maintenance of infrastructure is predominantly outsourced to private producers, i.e. their value is created mainly through public procurement. The infrastructure industry has demonstrated steady growth worldwide in recent years. The forecast for the global output value of infrastructure during 2021–2025 is expected to achieve a record compound annual growth rate of over 4%, according to GlobalData (2021). Beyond the economic aspects, it is essential to adopt a broader perspective to value creation that recognizes e.g. the importance of strategic goals, the impact of infrastructure procurement on environment and the social implications of built environment. Therefore, value creation is an important research topic in ensuring effective public procurement.

Recent literature on public procurement has covered themes such as sustainable procurement (Berg *et al.*, 2022), innovations through public procurement (Uyarra *et al.*, 2014, 2020; Uyarra and Flanagan, 2010) and public–private procurement relationships (Rutkowski *et al.*, 2021). All of these are also linked to value creation through procurement. However, many studies have taken on especially the viewpoint of value creation in public procurement, e.g. looking at value creation in the international public procurement market (Muñoz-Garcia and Vila, 2019), scrutinizing the role of public procurement in fostering social equity and justice (Gyori, 2022) and understanding the relationship of social value and public services procurement (Maher, 2019). What is less understood and studied is how the value creation chains form in the procurement processes and do they always lead to value creation. Our research addresses this knowledge gap.

We take on a wide perspective into public procurement, considering it an ecosystem where multiple actors cocreate value and are dependent on each other's resources and resource integration (Trischler *et al.*, 2023; Trischler and Charles, 2019; Wieland *et al.*, 2016). This is due to the infrastructure industry being highly hybrid in nature (Vakkuri and Johanson, 2020), joining together public, private and third sector parties through public procurement processes. We adopt the concept of *social world* (Strauss, 1978) to describe the different actors within the industry to illustrate that it is not always by default that ecosystems or service systems create value but it is possible that they even destroy it (Dudau *et al.*, 2019; Echeverri and Skålén, 2021) due to discontinuities in action and interaction, i.e. knowledge sharing practices (Akkerman and Bakker, 2011). We deploy the concept of boundary spanners (see e.g. Beaulieu *et al.*, 2023; Kimble *et al.*, 2010; van Meerkerk and Edelenbos, 2018; Williams, 2012) to mitigate the sensemaking, knowledge sharing and interaction challenges in infrastructure procurement.

The purpose of this article is to understand value creation in infrastructure procurement ecosystem. To achieve this, we aim to shed light on value creation challenges and how to promote value creation in public infrastructure procurement. The research was guided by the main research question:

RQ1. How does value creation form in public infrastructure procurement through knowledge sharing?

It is supported by two subresearch questions: a) What kind of value creation challenges can be identified in knowledge sharing processes within public infrastructure procurement? and b) How can boundary spanners promote value creation in infrastructure procurement?

This paper is structured as follows. We first build our theoretical lens by addressing the value creation and value destruction in infrastructure procurement, what could explain the value creation challenges and how these challenges can be managed and mitigated with the help of boundary spanners. We then go on to explain our methodological approach and data analysis. Finally, we present our results, discussion and conclusions.

Theoretical framework

Value creation and destruction in infrastructure procurement

A characteristic of infrastructure production and maintenance is that it is predominantly outsourced to private producers, i.e. their value is created mainly through procurement. This puts infrastructure procurement at the heart of productivity development and value creation. Public procurement, however, has wider effects than merely creating economic value. The concept of public value opens possibilities to consider e.g. social, environmental and societal values. However, public value is a contested concept and has been given nuanced meanings since Moore's (1995) introduction to the notion. Although Moore (1995) approached public value more from what quality public management is, Jørgensen and Bozeman (2007) provided an overall impression of the scope of public values such as accountability, effectiveness, parsimony and user democracy. Meynhardt (2009), on the other hand, rooted the concept to psychological epistemology and argued that public value should be based on human basic needs, i.e. public value is subjective to valuation of what is valuable.

In infrastructure procurement, public values are reflected in the conduct of the procurement process by public service professionals. Additionally, public value can be created through various activities, including the establishment of transportation networks, defining service levels and maintenance standards and promoting sustainability. The value ascribed to infrastructure assets depends on their type and the perspectives of the beneficiaries. It is important to note that infrastructure procurement encompasses both the construction of new infrastructure and the maintenance of existing assets. Ultimately, the worth and functionality of the infrastructure are evaluated by the end-users, the citizens themselves.

The value creation chain of infrastructure procurement is highly hybrid (see e.g. Vakkuri and Johanson, 2020 about hybridity) by nature as it joins together public, private and sometimes even third-sector parties. The infrastructure is produced and maintained considerably by project organizations where actors involved cocreate value and are dependent on each other's resources and resource integration (Edvardsson *et al.*, 2012; Vargo *et al.*, 2008; Vargo and Lusch, 2004, 2008). New developments in public service context are to look at value cocreation within an ecosystem, where value is "a) cocreated through the integration of resources provided by multiple actors and b) is coordinated through actor-generated institutions and institutional arrangements" (Trischler and Charles, 2019, p. 29). Nevertheless, these parties or actors can have a very differing view to value creation, i.e. they have differing value creation logics. It is often put forth that the public sector creates public value, the private sector produces shareholder value and the third sector generates social value. These different parties can also be viewed as different social worlds (Strauss, 1978), communities of practice (Wenger, 1999) or bodies of knowledge (Gieryn, 1983). Different social worlds are essentially communities characterized by collective dedication to specific endeavors, pooling diverse resources to attain their objectives and constructing unified ideologies regarding their operational approaches (Becker, 1974, 1986; Strauss, 1978;

Strauss *et al.*, 1964). These different social worlds are limited by the boundaries of effective communication.

Boundaries can be conceptualized as sociocultural differences that can lead to discontinuities in action and interaction (Akkerman and Bakker, 2011). These discontinuities can also be viewed as potential for performance gaps or value destruction instead of value creation. Within ecosystems, it can be inferred that numerous significant cases of value codestruction are specifically interconnected with the gaps between parts and phases (Echeverri, 2021). Value (co-)destruction in public procurement can occur for example due to limited interaction and collaboration between the parties, poor management practices, knowledge gaps, inadequate competencies among procurers and suboptimization during the procurement process (Plepys and Richter, 2016; Uyarra *et al.*, 2014). Furthermore, trust development and goal incongruence are seen to hamper the traditional procurement processes, leading to cost overruns, delays and dissatisfaction on both the client and service producer side (Snippert *et al.*, 2015). Next, we look at how these challenges can be mitigated by managing knowledge sharing across the communities involved in procurement processes.

Managing knowledge sharing across boundaries

The infrastructure industry consists of epistemically distinct social worlds or communities of practice with different areas of expertise and professional cultures. Despite these differences, actors in the industry are highly interdependent as infrastructure projects are typically executed by project organizations. Boundaries between actors in the procurement chain can arise from differences in task-specific knowledge or dependencies on collaborative knowledge (Carlile, 2002; Carlile and Rebentisch, 2003). These boundaries can result in miscommunication and discontinuities in action. Akkerman and Bakker (2011) found that boundaries can exist not only across domains but also within domains. In this study, we explore how these boundaries can be managed to address these challenges using framework of syntactic, semantic and pragmatic approaches to boundaries.

Carlile's (2002) *syntactic* approach refers to information processing perspective in organization theory (Galbraith, 1973; Lawrence and Lorsch, 1967) that has its roots in mathematical capacity to process a syntax (Shannon and Weaver, 1949). This means a common lexicon exists that sufficiently specifies the differences and dependencies of consequence at the boundary, proving the boundary unproblematic and enables knowledge transfer across the boundary. However, stable conditions are often required for the common lexicon to adequately function as common knowledge. In a stable condition, boundary objects such as a common database can be used to mitigate the boundary as transferring knowledge or information. When the conditions change and novelty arises, the current lexicon proves no longer sufficient to represent the differences and dependencies. The presence of syntactic knowledge boundaries can be attributed to discrepancies in the terminology used or the unavailability of crucial facts and data that require sharing among actors (Rehm and Goel, 2015).

The stable conditions can change, e.g. due to new requirements, new actors and interpretive differences in what something means. As these novelties arise and make the differences and dependencies unclear and meanings ambiguous, they create a need for a transition from syntactic to a *semantic* approach. Therefore, processes of creating shared understanding and making sense of the changes are needed (Weick, 1995). Means for shared understanding can be boundary objects such as best practices (Davenport and Prusak, 1998) or individuals working as boundary spanners (Haas, 2015). Thus, there is a need for learning

about the sources of differences, negotiating interests and making trade-offs between actors (Brown and Duguid, 1998; Wenger, 1999), i.e. translating knowledge (Carlile, 2004).

A ***pragmatic*** approach to boundaries recognizes a requirement to deal with negative consequences by transforming existing knowledge in conditions where differences, dependencies and novelty are all present (Carlile, 2002). The challenge at this boundary is that knowledge is localized, embedded and invested in practice and people are usually not so willing to change their knowledge or abandon their commitments to particular activities as it can be costly (Carlile, 2002; Clarke, 1991). Nevertheless, the pragmatic differences resulting in negative consequences may also generate costs to the actors involved. Resolving them needs boundary objects that enable collaborative sensemaking where actors can exchange and collaboratively modify models or maps as part of this process (Rehm and Goel, 2015). Sensemaking offers a valuable approach to reveal the social psychological mechanisms influencing organizational results, as opposed to concentrating solely on the outcomes (Weick, 1995). We now turn to look at these boundary objects or spanners more closely and how they can mitigate the value creation in the infrastructure procurement.

Boundary objects and brokers as boundary spanners

As seen above, boundaries act as the in-betweens or middle ground, simultaneously dividing and connecting different sides. Thus, they create a need for something to help with crossing the boundary and bridging the different sides together. Boundary objects can be tools for this as they are objects, artifacts or mechanisms facilitating collaboration and used to creating a sense of unity among different social worlds or communities (Carlile, 2002, 2004; Leigh Star, 2010), i.e. they are a way of establishing a shared understanding between collaborating communities (Star and Griesemer, 1989) and making sense of how different meanings are assigned to the same event (Helms Mills *et al.*, 2010).

Boundary objects do not lead to value creation by default, but their effectiveness depends on the incentives, motivations and abilities of the communities (Carlile, 2004; Kimble *et al.*, 2010). Therefore, for a boundary object to operate effectively, it must function for all communities (Uppström and Lönn, 2017). Furthermore, Uppström and Lönn (2017) found in their research that it is difficult to define value cocreation and value codestruction when the boundaries between collaborating communities are complex, and the risk of value codestruction outcomes increases as boundary complexity increases. Thus, boundary objects should be "plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star and Griesemer, 1989, p. 393).

Boundary objects can have different roles given to them. They can be collectively oriented, giving opportunities for collaboration as they function on different levels, or they can be individually oriented where their role is more to function as an intermediary object simply transferring information (Kimble *et al.*, 2010). Thus, when geared toward collaboration, boundary objects have the potential to share meaning (translate knowledge) but also to learn (transform knowledge) from each other's perspectives (Fox, 2011).

Previous literature has assumed that the selection of boundary objects is more or less technical in nature (Harvey and Chrisman, 1998; Smeds and Alvesalo, 2003), but Kimble *et al.* (2010) found in their study that in reality the process is more complex and dynamic. The selection of the boundary objects can be political in nature where an individual can use the boundary object to support his own objectives rather than facilitating collaboration. This kind of suboptimization can lead to value destruction rather than in value creation.

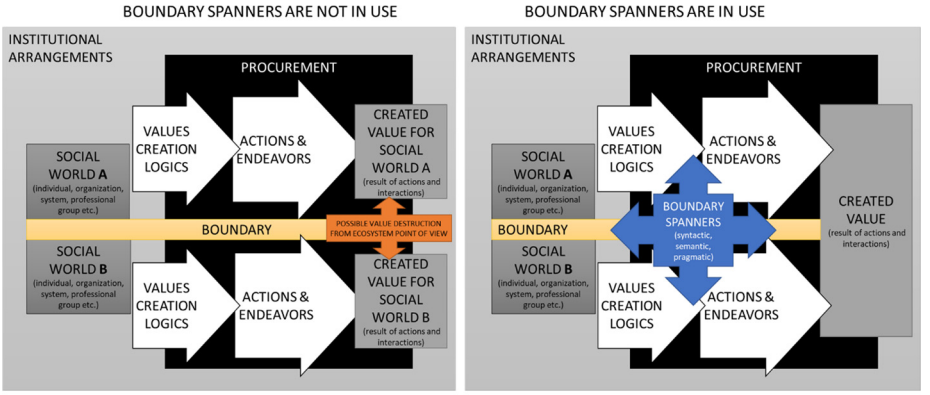
In addition to boundary objects, brokers play a crucial role in facilitating effective connections between different groups within the infrastructure industry. While boundary

objects are inanimate objects that aid in knowledge transfer, brokers are living individuals who operate at the boundaries of their organization or team. Boundary brokers can be understood as actors who can link their organization with its environment, exchange information, translate across boundaries and mobilize support for network developments (van Meerkerk and Edelenbos, 2018). Brokers enable coordination by creating opportunities for learning and exchange, helping to transfer, translate and transform knowledge among actors (Carlile, 2004), i.e. making sense of the organizing (Weick, 1995). In an optimal situation, brokers build sustainable relationships, increase information flow and foster mutual understanding between network actors. Trust is important for reducing transaction costs, facilitating cooperation and increasing commitment in governance networks (van Meerkerk and Edelenbos, 2018). Nevertheless, to be effective, brokers must possess legitimacy and authority, allowing them to influence groups and develop practices. They also need the ability to establish interpersonal relationships, evaluate knowledge produced by different groups and act as intermediaries or translators, gaining trust and respect (Kimble *et al.*, 2010; Williams, 2012). Furthermore, Beaulieu *et al.* (2023) in their study recognized reflexivity as an integral boundary spanning skill that enables brokers to question their own assumptions and preconceptions, as well as those of their partners, and to explore alternative perspectives and solutions. Williams (2012) identifies four distinct roles for brokers, or "spanners," each with its own set of competencies. As a reticulist, the broker requires political skills such as diplomacy, negotiation and persuasion. As an interpreter/communicator, interpersonal skills like effective communication, sensemaking, trust-building and conflict management are essential. The coordinator role demands administrative competencies, including planning, monitoring and coordination. Finally, the entrepreneurial role requires competencies in brokering, holistic thinking and being opportunistic. By fulfilling these roles and demonstrating the related competencies, brokers can facilitate knowledge sharing, collaboration and effective boundary spanning within the infrastructure industry.

The role of boundary spanners in the coordination of value creation in infrastructure procurement

As established above, different social worlds and their value creation logics are divided by different sociocultural boundaries. These boundaries can cause discontinuities in action and interaction, leading to value codestruction instead of value cocreation. This creates a need for boundary spanners to connect the different social worlds, mitigating knowledge sharing, creation of shared understanding and a sense of unity. The boundary spanners, when used accordingly, will help to manage a complex ecosystem such as infrastructure procurement, leading to shared value creation, as illustrated in Figure 1.

Spatial and temporal orientations acquire attention as they define what kind of boundary spanners are genuinely effective at each time and situation. In complex ecosystems like infrastructure industry, boundary spanners should be flexible rather than fixed. Thus syntactic, semantic and pragmatic boundary objects and brokers are to be viewed from a needs perspective, meaning that it is necessary to create shared understanding or making sense of the objectives before choosing the boundary spanners. Furthermore, for the boundary spanners to be effective, they must function for all communities, adapting to local needs and constrains of the parties employing them.



Source: Created by authors

Figure 1.
The role of boundary spanners in the coordination of value creation in infrastructure procurement

Materials and methods

Research strategy

The aim of this article is to understand the challenges associated with value creation in infrastructure procurement and, on the other hand, how these challenges can be overcome, and value can be created throughout the entire procurement chain. It is precisely this goal of understanding that connects the research to the phenomenological research strategy, which focuses on how things manifest themselves in human consciousness (originally Husserl (1970) later on Heidegger). The study is based on 25 thematic interviews conducted with experts in the infrastructure industry from various functions and levels. We consider it particularly important that we approached the challenges of value creation in procurement qualitatively from different perspectives through the interviews. This allowed for a broader understanding of the phenomenon than could not have been achieved by interviewing experts solely focused on procurement. According to hermeneutic phenomenology, human understanding is strongly connected to the context that influences their choices and gives meanings to lived experiences (Heidegger, 1962).

Data collection

The interviews were conducted remotely via Teams platform and a total of 25 interviews took place between January and April in 2022. The themes of the interviews stemmed from a categorization formed based on a literature review we conducted on value destruction in the construction industry. We applied the top classes as our interview themes, leaving us with five themes: values and attitudes, knowledge, skills and experience, collaboration, management and governance (laws, regulations, contracts). In addition, we asked about the general productivity in the industry: how does it form and how it can be improved. The interviews varied from 47–111 min in length, in total of over 33 h of recordings. All the interviews were transcribed, leading to a total of 232 pages (verdana, 8) of text. List of informants is provided as a supplementary file *supplementary-file-list-of-informants.docx*.

The interviewees encompassed diverse actors from different functions and levels within the Finnish infra sector. The interviewees represented the system level, client perspective, designer perspective, contractor points of view and various stakeholder groups as energy and water infrastructure clients, digitalization specialists and wholesalers. The interviewees

from the "system level" comprised of individuals with extensive experience and/or specialization in the industry, granting them a broad perspective. The client representatives consisted of prominent public entities responsible for organizing logistics infrastructures, such as streets and highways, in Finland.

Data analysis

The 25 transcribed interviews were taken to Atlas.ti and analyzed using the software. Our analysis occurred in two rounds. The first round was guided by two analysis questions:

Q1. Where does value destruction occur; and

Q2. How are the value destruction mechanisms transformed into value creation activity?

The first question allowed us to identify the *locus* of value destruction and pick a sample of such activities within the procurement process. This sample entailed 139 citations that were then further analyzed by three subsequent analysis questions:

Q3. What is the actual challenge within the procurement process?

Q4. Which parties are affected by the action; and

Q5. What are the root causes of the challenge?

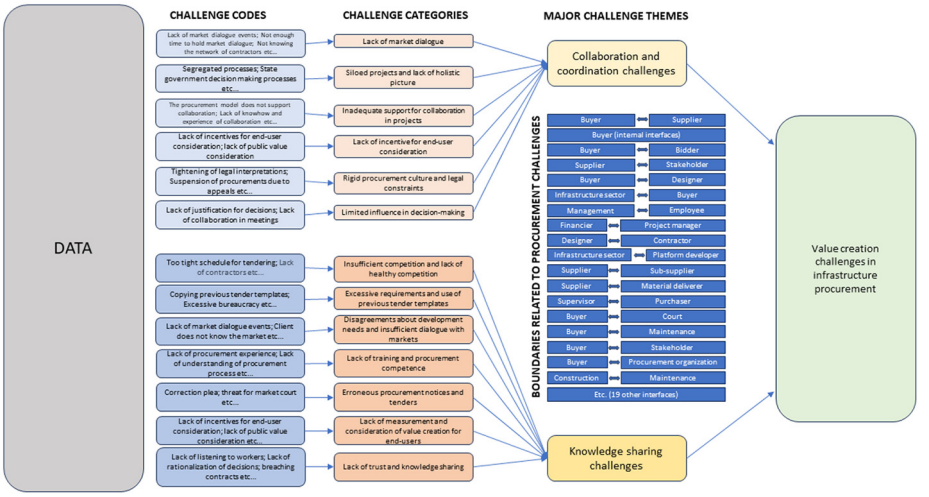
The second first-round question contained 48 citations and allowed us to understand how the experts would mitigate the problems that occur in procurement. Here, we take on a normative approach to the phenomenon which means that the value creation mechanisms the interviewees bring forth might not exist in infrastructure procurement yet but are more needs and suggested solutions to mitigating the challenges they confront in their environment.

We approached these questions in an inductive manner, allowing us to explore all possibilities and potentials inherent in the data (Corbin and Strauss, 2008). Initially, the researchers independently coded the data without predetermined coding schemes (ibid). However, to overcome the lack of systematic and accurate rules to analysis (Kyngäs *et al.*, 2019), we adopted a collaborative approach where we regularly met to discuss our analysis and how our thinking evolved throughout the process. This allowed us to make corrections and realign our analysis whenever it deviated from the initial starting points. The second round of analysis concentrating to boundary objects and categorizing the codes, we followed the coding strategy of Saldaña (2013) from codes to categories and themes and finally to theory (see Figure 2). This was done together to continuously discuss and deeper understand the problems and heuristics of value creation.

Results

Value creation challenges in infrastructure procurement

When the interviewees described the challenges of infrastructure procurement, certain themes started to take shape. Many of the problems stemmed from infrastructure sector being a hybrid context of cross-boundary arrangements and multiorganizational collaboration where knowledge transfer is highly challenged. Here, we look at the problems in more detail through themes of collaboration and coordination challenges and knowledge sharing challenges. We then elaborate on the boundaries that these challenges manifest on



Source: Created by authors

Figure 2. Visualization of coding strategy (Saldaña, 2013), main challenge themes and boundaries

and lastly, we examine how these challenges and boundaries can be mitigated through boundary spanners.

Collaboration and coordination challenges

Lack of market dialogue. The absence of effective communication and dialogue with the market actors poses a significant challenge in developing procurement strategies and conducting strategic procurement analysis. Without sufficient understanding of market needs, preferences and capabilities, it becomes difficult to align procurement models with market dynamics. This lack of market dialogue can result in suboptimal procurement strategies that fail to leverage market potential and may not address the specific requirements of projects:

> *If we truly want to achieve good results and improve the [procurement] process in every aspect, it is essential to engage in extensive market dialogues with field experts and market players. However, it requires a significant number of resources and time.* (I9)

Siloed projects and lack of holistic picture. When projects are divided into silos or stakeholders lack the ability or will to consider the bigger picture, coordination and collaboration suffer. Procurement processes become fragmented, hindering the ability to achieve synergies and optimize procurement outcomes. Without a holistic view to procurement activities, it becomes challenging to identify and exploit potential efficiencies, leading to suboptimal results across projects. Furthermore, insufficient anticipation of challenges and inadequate on-site support can hamper collaboration during the implementation phase of procurement projects. Failure to consider logistics, provide clear guidelines, and offer on-site support to contractors can result in delays, conflicts, errors and repeated addressing of the same issues.

> *This is a question of how assets' value and periodicity proceed. From my point of view, it should be timely actions. Beforehand planned steps, how the design phase goes and how the construction phase is put out to tender and executed in the way that the structures were designed. And finally, we*

need to be able to measure how the assets serve the end user. These things need to be considered not as single factors but as interconnected entities. (I22)

What often leads to the lack of holistic view is the distance between the political, administrative and operational activities. Asset management becomes very difficult when, for example, the political decision makers prefer making infra-investments over the operational economy. This will easily lead to a situation where there is constantly new infrastructure produced but not enough funds to maintain it.

Inadequate support for collaboration in projects. Effective collaboration among all parties involved in procurement projects is crucial for success. However, challenges arise when procurement practices and contract models do not support collaboration or consider overall productivity. Traditional procurement models that prioritize individual goals over collective objectives can hinder cooperation and prevent the realization of potential synergies.

Lack of incentive for end-user consideration. When procurement decisions are primarily driven by price considerations and fail to prioritize the value created for end-users, collaboration and coordination suffer. Traditional procurement models that prioritize cost savings over quality and user experience can lead to subpar outcomes and hinder collaboration efforts:

The procurement model itself has a significant impact on whether there are conditions in place for managing the market, understanding the revenue logic of the actors involved, and the contractual models used. Even though an alliance is complex, I argue that there is a certain trick to it from a productivity perspective. It creates value beyond just fast construction. In my opinion, productivity should also be measured by factors that may not have generated the same value using traditional models, such as smooth traffic arrangements during the project, a positive perception among the workforce, and value for the customer and end-user. (I16)

Rigid procurement culture and legal constraints. A rigid procurement culture and increasingly strict legal interpretations can impede collaboration and coordination efforts. The fear of appeals and administrative court decisions may lead to a risk-averse approach, interrupting procurement processes and discouraging innovation and collaboration.

Limited influence in decision-making. When producers perceive limited influence in decision-making processes, collaboration can be hindered. Slow decision-making and internal politics may discourage stakeholders from actively participating in the procurement process, leading to disengagement and reduced collaboration:

If decision-making is not transparent, then those who are affected by the decision get frustrated. It's just human nature - if we were machines, we wouldn't get frustrated, but people do when decision-making is closed off and lacks justification. It simply doesn't work. (I24)

Knowledge sharing challenges

Inefficient competition and lack of healthy competition. The underdevelopment of markets and inefficient competition can hinder knowledge sharing. When contractors cannot afford to bid on alliance projects due to the burden of the bidding phase and small project margins, valuable knowledge and expertise may not be shared among industry players. Limited competition and the absence of healthy competition restrict the flow of ideas, best practices and innovation, impeding knowledge sharing within the procurement ecosystem.

Excessive requirements and use of previous tender templates. Excessive requirements and the use of previous tender templates can slow down market development. When procurement processes impose numerous and stringent requirements that are not specific to the project at hand, it discourages potential bidders, resulting in fewer bids and limited knowledge sharing. This challenge prevents the exchange of diverse perspectives and

innovative solutions, hindering the overall knowledge sharing within the procurement domain:

> *And then, in the procurement documents and requirements, there are certain demands that restrict competition. There are cases where the more overlapping requirements the client includes in the documents, or when they simply copy them from previous ones or from larger city's procurement documents, the fewer bids and less competition there will be. It could result in receiving only one bid. These are the issues that we frequently encounter in infrastructure operations.* (I4)

Disagreements about development needs and insufficient dialogue with markets. Difficulties in developing procurement models arise from disagreements about development needs and insufficient dialogue with the markets. When there is a lack of effective communication and collaboration between procurement stakeholders and the market, valuable insights and knowledge from market actors may not be adequately incorporated into procurement models and strategies. This hampers knowledge sharing and prevents the integration of industry expertise and best practices.

Lack of training and procurement competence. Difficulties in personnel management include issues such as a lack of training among staff, resulting in a lack of procurement competence. When procurement teams lack the necessary skills, knowledge and training, it becomes challenging to effectively share and disseminate procurement-related knowledge within the organization. This knowledge gap hinders the adoption of best practices, impedes innovation and restricts knowledge sharing across the procurement workforce:

> *There is a lot of waste involved if the client makes mistakes in the procurement process and a company that ends up in second or third place in the competition complains about it. Then a new procurement decision and a new round must be made, and that is really, it causes a lot of waste* (I4)

Erroneous procurement notices and tenders. Problems related to drafting and publishing tenders often lead to the interruption of procurement. This can be due to a lack of expertise on the part of the client and rigid procurement cultures. Such interruptions hamper the flow of knowledge and information between clients and producers, resulting in delays, confusion and a lack of clarity in knowledge sharing.

Lack of measurement and consideration of value creation for end-users. When procurement practices prioritize cost savings or other factors over the value delivered to end-users, it limits the sharing of knowledge regarding user-centric design, customer satisfaction and service quality. This hinders the exchange of insights and expertise in creating value for end-users and may lead to suboptimal outcomes.

Lack of trust and knowledge sharing. Risk preparedness of producers often stems from lack of trust or uncertainty in initial information, unclear responsibilities and objectives. This can lead to cost-inefficient and expensive procurements because the producer cannot do exact calculations based on the initial data and therefore must prepare to take a risk or account it for in their pricing:

> *If there are gaps in the design or if the client withholds information about certain risks, then it practically becomes something that the bidders try to account for in their pricing. If those risks are obvious enough for all bidders to include in their pricing, then there is essentially some 'air' or padding within the project.* (I11)

Boundaries in infrastructure procurement

Discontinuities in action and interaction. Boundaries, being sociocultural differences causing discontinuities in action and interaction, position in several different levels of organization and operations based on the procurement challenges. Boundaries are located

within and between strategic, tactical and operational procurement functions, but on the other hand they are also connected to the surrounding environment. They are located in the interfaces of organizations (e.g. client – supplier), hierarchical roles (e.g. subordinate – management or worker – foreman), activities (e.g. construction – design – supervision), professional groups (e.g. traffic – geotechnics – water supply – energy), institutions (e.g. markets – education – regulation) and social identity (e.g. infrastructure sector – citizen). Thus, infrastructure procurement is more of an ecosystem than a linear chain of activities or hierarchical management.

Multirelational interaction. Challenges related to procurement value creation are typically linked to not only one but several interaction boundaries. According to the interviewees, this may lead to blaming outsider parties instead of enhancing the interrelation at hand. Also, deficiencies in mapping the bigger picture causes difficulties in finding solutions to improve knowledge sharing and value creation. Thus, procurement knowledge sharing challenges seem to relate stronger to the phenomenon of having to deal with multiple interfaces than to certain interfaces with a group of challenges, i.e. infrastructure industry is a hybrid context of cross-boundary arrangements and multiorganizational collaboration where knowledge transfer is highly challenged:

> *Everything can be targeted to those who perform procurement, who purchase, make decisions, the ones who execute, who implement the purchase orders. We shouldn't blame the contractors for value destruction since it starts to evolve in the other layers. I think the question is between the ears of those in the upper [procurement steering and management] structure.* (I3)

Clients' *role.* Clients' role is widely seen centric to causing and solving value creation challenges. However, challenges related to client-related interaction boundaries also involve boundaries outside the clients' reach. Hence, client is in a centric role, but does not alone possess all required means for solving procurement value creation challenges:

> *Interaction becomes essential in it [procurement planning and control]. It doesn't work in way that the procurer at his or her desk defines and thinks of what is needed at the site. That is also a single-sided insight, likewise as done solely at the site, which is also an incomplete perception. It should be done collaboratively, together with designer, related sub-contractors, site workers and supervision, and the company's larger entity, together in order to achieve a reasonable result.* (I13)

Having reviewed the challenges and the boundaries of procurement value creation in the infrastructure sector, the following section will focus on the boundary spanners that are needed to resolve the value creation issues.

Boundary spanners

Based on the data analysis, *four types of boundary spanners* can be distinguished: 1) artifacts, 2) discourses, 3) processes and 4) brokers (see Table 1). The first three are inanimate boundary objects whereas the latter one is an individual working at the boundaries. Identified artifacts in infrastructure procurement were objects that merely transfer knowledge over a boundary such as documents and information systems. Identified discourses are various kinds of negotiations, interpretations and sharing of experiences that aim not only to cross a boundary but also to create shared understanding. Processes are boundary objects such as different kinds of models, schemes, programs and procedures that mainly aim at standardizing and coordinating activities. Brokers as boundary spanners were identified to work mainly at semantic and pragmatic boundaries with capabilities such as knowing people, creating open dialogue and trust, possessing mental models that aim at productivity and value creation and initiating and promoting participatory activities and collaboration.

Boundaries \ Boundary spanners	Artifacts Artifacts articulate meanings across the boundaries in a commonly recognizable structure. General examples: documents, technologies, data, models	Discourse Discourses aim at creating shared understanding through negotiations, interpretations and sharing of experiences	Processes Processes are models, schemes, programs and procedures aiming at standardizing and coordinating activities	Brokers Individuals crossing and building bridges across the boundaries between different worlds
Syntactic boundary spanners	*Procurement environment:* Procurement Act *Strategic procurement:* procurement documents, common procurement document templates for municipalities, contract model, tender request templates, grounds for funding, organizational goals *Tactical procurement:* framework arrangement, portfolio, procurement schedule, collaboration ground rules *Operational procurement:* request for tender, procurement requirements, reward mechanism, collaboration model, contract requirements, tender request material, source information, rectification claim	*Tactical procurement:* common rules *Operational procurement:* open sharing of information about risks	*Tactical procurement:* a model for verifying qualifications, reference management	*Operational procurement:* the project manager's authority to make decisions
Semantic boundary spanners	*Procurement environment:* scenario model (consideration and review of variables) *Strategic procurement:* capability test, quality proofing, indicators *Tactical procurement:* procedures, instructions, process description, feedback *Operational procurement:* tender phase, questions, work specification, contract	*Procurement environment:* interpretation of the Procurement Act *Strategic procurement:* processing of interests, sharing experiences, forming the overall picture *Tactical procurement:* golden time frame, clarification of processes, outlining alternatives	*Strategic procurement:* forecasting and prognosis *Tactical procurement:* training and education, maintaining competence, information sharing model *Operational procurement:* seminar etc. industry development days, monitoring of the implementation of the agreement, design review, monitoring of compliance with contract requirements	*Strategic procurement:* incentives, the value basis of the selection criteria *Tactical procurement:* procurement expertise, knowing people *Operational procurement:* open dialogue, a shared image

(*continued*)

Table 1.
Boundary spanners responding to challenges and boundaries of value creation in infrastructure procurement

Table 1.

Boundaries \ Boundary spanners	Artifacts Artifacts articulate meanings across the boundaries in a commonly recognizable structure. General examples: documents, technologies, data, models	Discourse Discourses aim at creating shared understanding through negotiations, interpretations and sharing of experiences	Processes Processes are models, schemes, programs and procedures aiming at standardizing and coordinating activities	Brokers Individuals crossing and building bridges across the boundaries between different worlds
		Operational procurement: interpretation of procurement documents, negotiation of interpretations, common goals		
Pragmatic boundary spanners	-	*Strategic procurement*: procurement model renewal work *Tactical procurement*: negotiation of execution methods operational: negotiation	*Strategic procurement:* active collaboration with suppliers, development of life cycle calculations, procurement outsourcing, development process of quality requirements, operating model of project as a development platform, development of the operating model *Tactical procurement:* budgeting, project scheme planning, improvement of procurement templates, selecting procurement methods, preparation of the procurement program, breaking down entities, resource allocation, master-apprentice model, decision making process, formulating a plan, application of request for tender templates, coordination and synchronization *Operational procurement:* procurement preparation, procurement process, coordination, market dialogue, management of change situations, negotiation procedure, reflection, site service from the designer, mutually agreed operating models, work control, work planning	*Procurement environment:* mental models of productivity, value creation, procurement, business and information sharing *trategic procurement:* mental models of processing, procurement process, acquiring services, effective competition, risk sharing, effective execution, contract requirements and collaboration *Tactical procurement:* participatory method development, trust, lifecycle thinking, impact thinking, ideation ability, competence, social skills, know-how and experiences of collaboration *Operational procurement:* open decision-making, open collaboration, custom of continuous improvement, participatory meeting, participatory decision-making, collaboration in risk management, collaborative work and schedule planning

Source: Created by authors

> *In this new modelling based operational model we have plenty of digital tools, but in addition we need processes and promotors to ensure that development, implementation, or production stays on the move*. (I24)

While challenges lie in different boundaries, *boundary spanners divide accordingly into different levels* of the infrastructure value creation ecosystem: procurement environment, strategic procurement, tactical procurement and operational procurement. Procurement environment constitutes the needs, conditions and frames for infrastructure procurement, involving for example user needs, regulation and market situation. Strategic procurement establishes procurement aims and strategies, as well as creates outlines for organizational processes and models. Strategic procurement also takes partners and market situations into consideration. Tactical procurement organizes procurement strategies into actionable procurement programs by arranging budgets, schedules and general procurement methods. Operative procurement again puts tactical procurement plans into practice, including, for example, purchase and agreement management. All in all, boundary spanners are necessary for value creation within and between these levels or domains to share and create knowledge across the procurement entity:

> *In construction market conditions have an impact. At the moment, there is a lack of both materials and human resources. These affect the street construction and in one case, due to the increase in material prices, they had to cut off parts of the project and postpone them to next year. We have a certain yearly budget, and we schedule and select projects to the yearly budget based on guessing the prices.* (I6)

Boundary spanners have *spatial and temporal orientations*. Syntactic boundary spanners function for known tasks, semantic for tasks involving some novelty and pragmatic for highly novel tasks. The effectiveness of a boundary spanner in facilitating knowledge sharing varies depending on its specific characteristics and the way it is utilized. For example, a contract for some may merely be an artifact transferring information, but some consider it a process for creating shared understanding. The boundary spanners also possess the ability to evolve in time. An example of this is a meeting that initially serves as a forum for creating shared understanding but later is sufficient for mere information transfer. It is worth noting that while these boundary spanners are classified in Table 1 according to their primary appearance in our data, many of them may also be used or understood in different ways.

Interestingly, interviewees suggest concrete solutions regarding syntactic boundary spanners and to some extent also semantic boundary spanners, but with respect to pragmatic boundary spanners they mainly express needs more than actual solutions. Syntactic boundary spanners contain mostly artifacts, while pragmatic boundary spanners are strongly centered in processes and brokers. Semantic boundary spanners divide more even to all types of boundary spanners. Consequently, there is a *distinct urge for improving transformative knowledge sharing*, for which the pragmatic boundary spanners offer means.

Boundary spanners and boundary spanner types seem to be *significantly nested and dependent on each other*. They have the ability to enhance and give rise to other boundary spanners. For example, reflection can be executed through an artifact such as a form with an associated process but might eventually develop into a mental model and individual capability. On the other hand, individual capabilities often enable finding operable artifacts or processes and utilizing them successfully. Thus, boundary spanners can be tools for the development of individual and cultural capabilities, leading to value creation.

Discussion and practical implications

Our research explored value creation in infrastructure procurement, examining the formation of value creation chains and the challenges they entail. Taking a broad perspective, we investigated cross-boundary arrangements and multiorganizational collaboration within infrastructure procurement through main research question, *How does value creation form in public infrastructure procurement through knowledge sharing?* and sub-research questions, a) What kind of value creation challenges can be identified in knowledge sharing processes within public infrastructure procurement? and b) How can boundary spanners promote value creation in infrastructure procurement?

Our results show that value creation cannot be taken for granted in a complex and dynamic environment, and it can even lead to value destruction (Cui and Osborne, 2022; Dudau *et al.*, 2019; Plé, 2017; Plé and Chumpitaz Cáceres, 2010). We identified various challenges related to coordination, collaboration and knowledge sharing, which often arise at the boundaries between different social worlds or communities of practice (Strauss, 1978; Wenger, 1999). Furthermore, we identified several different social worlds in the infrastructure industry such as professional groups, institutions, organizations, roles and social identities. These groups exhibit sociocultural differences that create discontinuities in action and interaction (Akkerman and Bakker, 2011) within the procurement ecosystem. Our findings confirm the specific interconnection between value codestruction and gaps within the ecosystem (Echeverri, 2021) such as between market and the service system or educational system and infrastructure industry, between the strategic, tactical and operational procurement, between the client and the producer or between a foreman and a subordinate. Thus, the results illustrate the hybrid nature of the infrastructure industry (Vakkuri and Johanson, 2020) and prove that the risk of value codestruction outcomes increase when the boundary complexity increases (Uppström and Lönn, 2017).

As seen above, value creation in infrastructure procurement is not a linear process but rather takes place within a complex ecosystem. This ecosystem involves multiple actors collaborating and integrating resources to cocreate value (Edvardsson *et al.*, 2012; Vargo and Akaka, 2012; Vargo and Lusch, 2008). The interplay between these actors, system levels and institutional mechanisms contributes to the complexity of value creation in this context (Trischler *et al.*, 2023). Our findings demonstrate that the challenges faced in procurement can have diverse root causes and emerge at different stages of the process. For instance, decisions made at the political level, such as inadequate funding for maintenance, can lead to significant problems in the future. Neglecting collaboration during the early stages of a project, known as the "golden window," can result in difficulties during construction or maintenance. Excessive requirements imposed by the client, unrelated to the specific project, can discourage potential bidders and hinder market development. These examples highlight the complexity and interconnectedness of value creation challenges in the infrastructure procurement ecosystem. Successfully addressing these challenges requires a comprehensive understanding of the dynamics among actors, systems and institutional factors involved. Developing effective strategies to navigate these complexities is essential for promoting successful value creation in infrastructure procurement.

Infrastructure procurement, as a context, highlights both the diversity in knowledge requirements for tasks and the interdependencies across these knowledge differences necessary for effective collaboration (Carlile, 2002; Carlile and Rebentisch, 2003). Adopting an ecosystem perspective on procurement reveals the extensive range of knowledge needed to plan, execute and implement procurement, including knowledge in politics, law, social sciences, engineering, education, economics and more. This demonstrates the existence of sociocultural boundaries within the infrastructure procurement domain and between

different domains (Akkerman and Bakker, 2011). Moreover, these knowledge types are highly interdependent, as each contributes to the formation of a coherent and successful procurement process that aligns with its objectives. Failure to align and integrate these diverse knowledge types can result in value destruction rather than value creation within procurement. Therefore, recognizing and managing the sociocultural boundaries and interdependencies of knowledge is crucial to ensure effective and value-creating infrastructure procurement.

In terms of institutional arrangements, our findings reveal instances where they can inadvertently lead to value destruction instead of value creation. Although standardization is generally beneficial for coordinating operations and reducing inefficiencies, certain practices within infrastructure procurement appear to impede value creation. Examples of such cases include the imposition of excessive requirements and the utilization of outdated tender templates, a rigid procurement culture characterized by overly stringent legal interpretations, a disproportionate emphasis on price as the primary factor in procurement decisions, fragmented and siloed organizational structures within procurement and the adoption of inappropriate procurement models. Consequently, there is a need to reassess and reform these institutional arrangements to better align them with the dynamics and requirements of value creation in infrastructure procurement.

The existence of boundaries within the infrastructure procurement context necessitates the sharing of knowledge and sensemaking across different silos to facilitate value creation. Previous research emphasizes the importance of enabling participation and interaction to achieve this (Akkerman and Bakker, 2011). Given the novel nature of each infrastructure procurement project, where designs, production and maintenance vary, a shift from a syntactic to a semantic approach is often required to establish shared understanding (Carlile, 2004). In fact, the whole public procurement system itself can possess different meanings and value targets for different actors. Our findings indicate the presence of effective boundary spanners within specific silos to some extent. However, the complex environment of infrastructure procurement demands that these boundary spanners are linked to realize value creation. Successful crossing of boundaries necessitates pragmatic boundary spanners that facilitate collaboration and knowledge sharing (Rehm and Goel, 2015). For instance, while silo-specific terminologies are often stable, collaboration across different terminologies can lead to misunderstandings. Therefore, transformative boundary spanners facilitate the recognition and implementation of a new common syntax that transforms the previous one. Carlile (2004) highlights that complex boundaries have differences, dependencies and novelty. Therefore, given the complexity and breadth of the infrastructure procurement ecosystem, it is crucial to effectively manage and address relevant boundaries using appropriate boundary spanners.

An intriguing finding is that the infrastructure sector recognizes and provides solutions for syntactic and increasingly semantic boundary spanners, such as artifacts and processes. However, there is a lack of attention given to pragmatic boundary spanners; discourse and brokers, as they are often acknowledged for their needs and challenges but not accompanied by concrete solutions. In practice, this is evident in the heavy reliance on procurement documents and models, while the actual nurturing of collaboration lacks concrete practices. A similar observation can be found in literature on infrastructure and construction productivity (Ofori *et al.*, 2021). This highlights the need for a greater focus and strengthening of understanding and utilization of various types of pragmatic boundary spanners in value creation within infrastructure procurement. Akkerman and Bakker (2011) suggested that learning mechanisms for crossing boundaries include identification, coordination, reflection and transformation. Therefore, we suggest there is significant

potential for improvement in value creation in the identification, coordination, reflection and enhancement of capabilities related to adaptively implementing boundary spanners as a means of collaboration, coordination, development and knowledge sharing.

One of the most significant findings is the influential role of individuals in the infrastructure industry, as they have the power to either enhance or diminish value creation. The data indicates that these influential individuals play a crucial role in shaping political and developmental goals and measures (Williams, 2012). However, the creation of public value in infrastructure necessitates inclusive, human-centric reflection that considers all relevant stakeholders. Therefore, it is essential to avoid suboptimization that solely emphasizes the value perspective of a single organization. The data also highlights a need for specific qualities and roles required from a broker, such as reticulist, interpreter/communicator, coordinator and entrepreneur (Rehm and Goel, 2015; Williams, 2012). A notable challenge in knowledge sharing in infrastructure industry is the lack of trust, which leads to withholding knowledge. In this context, a broker plays a significant role in building trust and facilitating open interaction (Beaulieu *et al.*, 2023; van Meerkerk and Edelenbos, 2018).

Practical implications of our research point that addressing the collaboration, coordination and knowledge sharing challenges in procurement requires a multifaceted approach. This approach involves promoting open communication channels, fostering a collaborative culture and incorporating market insights into procurement strategies. It also entails prioritizing and measuring end-user value, embracing flexibility within legal frameworks, improving procurement documentation and processes and empowering stakeholders to participate in decision-making processes. Additionally, investing in training and development programs for procurement professionals are crucial for addressing knowledge sharing challenges. By implementing these strategies, organizations can enhance collaboration, coordination and knowledge sharing in procurement, leading to improved outcomes and increased efficiency, i.e. value creation.

Conclusions

Our qualitative research focused on infrastructure procurement, trying to understand how value creation chains form in procurement processes, what kind of challenges they might entail and how value creation can be enhanced. Our results show that value creation in the infrastructure procurement does not form a linear chain, a process or even a network but rather an ecosystem comprising of multiple actors that cocreate value by integrating resources. However, value creation cannot be taken for granted in a complex and dynamic environment, but suboptimization and the lack of alignment of syntactic, semantic and pragmatic knowledge sharing approaches can easily lead to value destruction. Our results show it is vital to operate the relevant boundaries with effective and appropriate boundary spanners, i.e. artifacts, discourses, processes and brokers. Especially the brokers appear to play key roles in either destructing or creating value. Thus, individuals should be trained to act as brokers, building trust and open interaction. Due to the high level of novelty in infrastructure procurement, pragmatic approach to knowledge sharing is vital. Therefore, value creation requires more focus and strengthening in the understanding and exploitation of versatile types of pragmatic boundary spanners. The study has limitations as the dataset presents only a small sample of the infrastructure sector. However, the study aimed to illustrate the different value creation mechanisms of infrastructure procurement rather than a comprehensive description of boundary spanner details, portions and relations. Further research is needed to study infrastructure procurement as an ecosystem from the value creation perspective to better understand the complex interplay between the multiple actors,

system levels and institutional mechanisms. For example, case studies and action research could help to shed light into implementation of effective boundary spanners in the hybrid contexts of cross-boundary arrangements and multiorganizational collaboration where knowledge transfer is highly challenged.

References

Akkerman, S.F. and Bakker, A. (2011), "Boundary crossing and boundary objects", *Review of Educational Research*, Vol. 81 No. 2, pp. 132-169, doi: 10.3102/0034654311404435.

Beaulieu, M., Rebolledo, C. and Lissillour, R. (2023), "Collaborative research competencies in supply chain management: the role of boundary spanning and reflexivity", *The International Journal of Logistics Management*, doi: 10.1108/IJLM-07-2022-0277.

Becker, H.S. (1974), "Art as collective action", *American Sociological Review*, Vol. 39 No. 6, pp. 767-776, doi: 10.2307/2094151.

Becker, H.S. (1986), "Doing things together: Selected papers".

Berg, A., Alhola, K., Peltomaa, J. and Tietari, S. (2022), "Developing together: the Finnish way of promoting sustainable public procurement", *Journal of Public Procurement*, Vol. 22 No. 4, pp. 245-264, doi: 10.1108/JOPP-11-2021-0072.

Brown, J.S. and Duguid, P. (1998), "Organizing knowledge", *California Management Review*, Vol. 40 No. 3, pp. 90-111.

Carlile, P.R. (2002), "A pragmatic view of knowledge and boundaries: boundary objects in new product development", *Organization Science*, Vol. 13 No. 4, pp. 442-455, doi: 10.1287/orsc.13.4.442.2953.

Carlile, P.R. (2004), "Transferring, translating, and transforming: an integrative framework for managing knowledge across boundaries", *Organization Science*, Vol. 15 No. 5, pp. 555-568, doi: 10.1287/orsc.1040.0094.

Carlile, P.R. and Rebentisch, E.S. (2003), "Into the black box: the knowledge transformation cycle", *Management Science*, Vol. 49 No. 9, pp. 1180-1195, doi: 10.1287/mnsc.49.9.1180.16564.

Clarke, A. (1991), "Social worlds/arenas theory as organizational theory", *Social Organization and Social Process: Essays in Honor of Anselm Strauss*, Aldine De Gryuter, New York, NY.

Corbin, J. and Strauss, A. (2008), *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, 3rd ed., Sage Publications, London, p. 379, doi: 10.4135/9781452230153.

Cui, T. and Osborne, S.P. (2022), "Unpacking value destruction at the intersection between public and private value", *Public Administration*, Vol. 101 No. 4, p. 12850, doi: 10.1111/padm.12850.

Davenport, T.H. and Prusak, L. (1998), "Working knowledge: how organizations manage what they know", Harvard Business School Press, available at: http://libproxy.tuni.fi/login?url=https://search.ebscohost.com/login.aspx?direct=true&AuthType=cookie,ip,uid&db=nlebk&AN=7259&site=ehost-live&scope=site

Dudau, A., Glennon, R. and Verschuere, B. (2019), "Following the yellow brick road? (dis)enchantment with co-design, co-production and value co-creation in public services", *Public Management Review*, Vol. 21 No. 11, pp. 1577-1594, doi: 10.1080/14719037.2019.1653604.

Echeverri, P. (2021), "Not so 'eco' service ecosystems: value co-destruction practices affecting vulnerable patients in special transport", *Journal of Creating Value*, Vol. 7 No. 1, pp. 103-116, doi: 10.1177/23949643211012137.

Echeverri, P. and Skålén, P. (2021), "Value co-destruction: review and conceptualization of interactive value formation", *Marketing Theory*, Vol. 21 No. 2, pp. 227-249, doi: 10.1177/1470593120983390.

Edvardsson, B., Skålén, P. and Tronvoll, B. (2012), "Service systems as a foundation for resource integration and value co-creation", in Vargo, S.L. and Lusch, R.F. (Eds), *Review of Marketing Research*, Emerald Group Publishing, Bingley, Vol. 9, pp. 79-126, doi: 10.1108/S1548-6435(2012)0000009008.

Fox, N.J. (2011), "Boundary objects, social meanings and the success of new technologies", *Sociology*, Vol. 45 No. 1, pp. 70-85, doi: 10.1177/0038038510387196.

Galbraith, J.R. (1973), *Designing Complex Organizations*, Addison-Wesley, Boston, MA.

Gieryn, T.F. (1983), "Boundary-work and the demarcation of science from non-science: strains and interests in professional ideologies of scientists", *American Sociological Review*, Vol. 48 No. 6, pp. 781-795, doi: 10.2307/2095325.

Gyori, G. (2022), "The role of public procurement to foster social equity and justice: critical reflections on the circular procurement concept", *Local Environment*, Vol. 27 Nos 10/11, pp. 1242-1253, doi: 10.1080/13549839.2021.2001798.

Haas, A. (2015), "Crowding at the frontier: boundary spanners, gatekeepers and knowledge brokers", *Journal of Knowledge Management*, Vol. 19 No. 5, pp. 1029-1047, doi: 10.1108/JKM-01-2015-0036.

Harvey, F. and Chrisman, N. (1998), "Boundary objects and the social construction of GIS technology", *Environment and Planning A: Economy and Space*, Vol. 30 No. 9, pp. 1683-1694, doi: 10.1068/a301683.

Heidegger, M. (1962), *Being and Time. In Being and time Being and Time*, in Macquarrie, J. and Robinson, E. (Eds), Harper and Row, New York, NY.

Helms Mills, J., Thurlow, A. and Mills, A.J. (2010), "Making sense of sensemaking: the critical sensemaking approach", *Qualitative Research in Organizations and Management: An International Journal*, Vol. 5 No. 2, pp. 182-195, doi: 10.1108/17465641011068857.

Husserl, E. (1970), *Logical Investigations*, in Findlay, J.N. (Trans) Routledge and Kegan Paul, Humanities Press, London.

Jørgensen, T.B. and Bozeman, B. (2007), "Public values: an inventory", *Administration and Society*, Vol. 39 No. 3, pp. 354-381, doi: 10.1177/0095399707300703.

Kimble, C., Grenier, C. and Goglio-Primard, K. (2010), "Innovation and knowledge sharing across professional boundaries: political interplay between boundary objects and brokers. Post-Print, article halshs", p. 510393, available at: https://ideas.repec.org//p/hal/journl/halshs-00510393.html

Kyngäs, H., Mikkonen, K. and Kääriäinen, M. (2019), *The Application of Content Analysis in Nursing Science Research*, Springer International Publishing, AG, doi: 10.1007/978-3-030-30199-6.

Lawrence, P.R. and Lorsch, J.W. (1967), "Differentiation and integration in complex organizations", *Administrative Science Quarterly*, Vol. 12 No. 1, p. 1, doi: 10.2307/2391211.

Leigh Star, S. (2010), "This is not a boundary object: reflections on the origin of a concept", *Science, Technology, and Human Values*, Vol. 35 No. 5, pp. 601-617, doi: 10.1177/0162243910377624.

Maher, C. (2019), "Social value and public services procurement", *Handbook of Research on Value Creation for Small and Micro Social Enterprises*, IGI Global, PA, pp. 293-310, doi: 10.4018/978-1-5225-6298-6.ch015.

Meynhardt, T. (2009), "Public value inside: what is public value creation?", *International Journal of Public Administration*, Vol. 32 Nos 3/4, pp. 192-219, doi: 10.1080/01900690902732632.

Moore, M.H. (1995), "Creating public value: strategic management in government", available at: https://books.google.fi/books?hl=fi&lr=&id=Hm9uKVj0qDYC&oi=fnd&pg=PR11&dq=moore+public+value&ots=5HFhy4RBOL&sig=1oG8djBb1in0FwxTwyC4JFm-Yk8&redir_esc=y#v=onepage&q=moore%20public%20value&f=false

Muñoz-Garcia, C. and Vila, J. (2019), "Value creation in the international public procurement market: in search of springbok firms", *Journal of Business Research*, Vol. 101, pp. 516-521, doi: 10.1016/j.jbusres.2018.12.041.

Ofori, G., Zhang, Z. and Ling, F.Y.Y. (2021), "Initiatives that enable Singapore contractors to improve construction productivity", *Built Environment Project and Asset Management*, Vol. 11 No. 5, pp. 785-803, doi: 10.1108/BEPAM-11-2020-0175.

Plé, L. (2017), "Why do we need research on value Co-destruction?", *Journal of Creating Value*, Vol. 3 No. 2, pp. 162-169, doi: 10.1177/2394964317726451.

Plé, L. and Chumpitaz Cáceres, R. (2010), "Not always co-creation: introducing interactional co-destruction of value in service-dominant logic", *Journal of Services Marketing*, Vol. 24 No. 6, pp. 430-437, doi: 10.1108/08876041011072546.

Plepys, A. and Richter, J.L. (2016), "Public procurement barriers in promoting market uptake of innovative LED lighting", 2016 Electronics Goes Green 2016+ (EGG), pp. 1-8, doi: 10.1109/EGG.2016.7829864

Rehm, S.-V. and Goel, L. (2015), "The emergence of boundary clusters in inter-organizational innovation", *Information and Organization*, Vol. 25 No. 1, pp. 27-51, doi: 10.1016/j.infoandorg.2014.12.001.

Rutkowski, C.J., Eboch, K., Carr, A. and Greer, B.M. (2021), "Strategic procurement collaboration for the common good: private and public procurement relationship during a pandemic", *Journal of Public Procurement*, Vol. 22 No. 1, pp. 43-63, doi: 10.1108/JOPP-10-2020-0076.

Saldaña, J. (2013), *The Coding Manual for Qualitative Researchers*, 2nd ed, Vol. 2013, SAGE Publ, London.

Shannon, C. and Weaver, W. (1949), *The Mathematical Theory of Communication*, University of IL Press, IL.

Singh, K., Singh, A. and Prakash, P. (2023), "Policy actions for developing the infrastructure sector: learnings from the Indian experience", *Journal of Public Affairs*, Vol. 23 No. 1, p. e2837, doi: 10.1002/pa.2837.

Smeds, R. and Alvesalo, J. (2003), "Global business process development in a virtual community of practice", *Production Planning and Control*, Vol. 14 No. 4, pp. 361-371, doi: 10.1080/0953728031000117931.

Snippert, T., Witteveen, W., Boes, H. and Voordijk, H. (2015), "Barriers to realizing a stewardship relation between client and vendor: the best value approach", *Construction Management and Economics*, Vol. 33 No. 7, pp. 569-586, doi: 10.1080/01446193.2015.1078902.

Star, S.L. and Griesemer, J.R. (1989), "Institutional ecology, 'translations' and boundary objects: amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907-39", *Social Studies of Science*, Vol. 19 No. 3, pp. 387-420, doi: 10.1177/030631289019003001.

Strauss, A.L. (1978), "A social world perspective", *Studies in Symbolic Interaction*, Vol. 1978 No. 1, pp. 119-128.

Strauss, A.L., Schatzman, L., Bucher, R., Erlich, D. and Sabshin, M. (1964), *Psychiatric Ideologies and Institutions*, Free Press of Glencoe, London.

Trischler, J. and Charles, M. (2019), "The application of a service ecosystems lens to public policy analysis and design: exploring the frontiers", *Journal of Public Policy and Marketing*, Vol. 38 No. 1, pp. 19-35, doi: 10.1177/0743915618818566.

Trischler, J., Røhnebæk, M., Edvardsson, B. and Tronvoll, B. (2023), "Advancing public service logic: moving towards an ecosystemic framework for value creation in the public service context", *Public Management Review*, pp. 1-29, doi: 10.1080/14719037.2023.2229836.

Uppström, E. and Lönn, C.-M. (2017), "Explaining value co-creation and co-destruction in e-government using boundary object theory", *Government Information Quarterly*, Vol. 34 No. 3, pp. 406-420, doi: 10.1016/j.giq.2017.08.001.

Uyarra, E. and Flanagan, K. (2010), "Understanding the innovation impacts of public procurement", *European Planning Studies*, Vol. 18 No. 1, pp. 123-143, doi: 10.1080/09654310903343567.

Uyarra, E., Edler, J., Garcia-Estevez, J., Georghiou, L. and Yeow, J. (2014), "Barriers to innovation through public procurement: a supplier perspective", *Technovation*, Vol. 34 No. 10, pp. 631-645, doi: 10.1016/j.technovation.2014.04.003.

Uyarra, E., Zabala-Iturriagagoitia, J.M., Flanagan, K. and Magro, E. (2020), "Public procurement, innovation and industrial policy: rationales, roles, capabilities and implementation", *Research Policy*, Vol. 49 No. 1, available at: https://econpapers.repec.org/article/eeerespol/v_3a49_3ay_3a2020_3ai_3a1_3as0048733319301635.htm

Vakkuri, J. and Johanson, J.-E. (2020), "Hybrid governance, organisations and society: value creation perspectives", Taylor and Francis Group, available at: http://ebookcentral.proquest.com/lib/tampere/detail.action?docID=6305316

van Meerkerk, I. and Edelenbos, J. (2018), "Facilitating conditions for boundary-spanning behaviour in governance networks", *Public Management Review*, Vol. 20 No. 4, pp. 503-524.

Vargo, S.L. and Akaka, M.A. (2012), "Value cocreation and service systems (re)formation: a service ecosystems view", *Service Science*, Vol. 4 No. 3, pp. 207-217, doi: 10.1287/serv.1120.0019.

Vargo, S.L. and Lusch, R.F. (2004), "Evolving to a new dominant logic for marketing", *Journal of Marketing*, Vol. 68 No. 1, pp. 1-17.

Vargo, S.L. and Lusch, R.F. (2008), "Service-dominant logic: continuing the evolution", *Journal of the Academy of Marketing Science*, Vol. 36 No. 1, pp. 1-10, doi: 10.1007/s11747-007-0069-6.

Vargo, S.L., Maglio, P.P. and Akaka, M.A. (2008), "On value and value co-creation: a service systems and service logic perspective", *European Management Journal*, Vol. 26 No. 3, pp. 145-152, doi: 10.1016/j.emj.2008.04.003.

Weick, K.E. (1995), *Sensemaking in Organizations*, Sage Publications, Thousand Oaks, available at: http://archive.org/details/trent_0116403577194

Wenger, E. (1999), *Communities of Practice: Learning, Meaning, and Identity*, Cambridge University Press, Cambridge.

Wieland, H., Koskela-Huotari, K. and Vargo, S.L. (2016), "Extending actor participation in value creation: an institutional view", *Journal of Strategic Marketing*, Vol. 24 Nos 3/4, pp. 210-226, doi: 10.1080/0965254X.2015.1095225.

Williams, P. (2012), "Collaboration in public policy and practice: perspectives on boundary spanners", available at: https://web-p-ebscohost-com.libproxy.tuni.fi/ehost/ebookviewer/ebook/ZTAwMHh3d19fNDMwNjkzX19BTg2?sid=86bcb220-0506-44b7-93a7-f2414915fc2a@redis&vid=0&format=EB&rid=1

Supplementary material

The supplementary material for this article can be found online.

Corresponding author

Johanna Maria Liljeroos-Cork can be contacted at: johanna.liljeroos-cork@tuni.fi