

# Revealing and Resolving Bottlenecks by Multiple Intermediaries in Public Procurement of Innovation

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## **Revealing and Resolving Bottlenecks by Multiple Intermediaries in Public Procurement of Innovation**

**Abstract:** Novel approaches to innovation policies that try to solve societal problems have grown significantly and gained considerable attention recently. Studies argue that while novel innovation policies require significant policy capacity to shape transformational changes, top-down initiative is largely irrelevant; bottom-up policy capacity is needed to shape these changes. However, little is known about how relevant actors are organized to direct bottom-up explorations for impactful innovations. By analyzing a case of public procurement of innovation in Finland, this study demonstrates that by revealing and resolving bottlenecks and dissonances among actors, intermediaries can induce actors to focus bottom-up, exploratory efforts in certain directions that can increase the impact of innovations, and the synergy of multiple intermediaries with different goals can catalyze innovation in a complementary and productive fashion. The study's findings suggest that our understanding of intermediaries should be expanded given the fact that their role in revealing bottlenecks can be essential in inducing explorative activities that increase the impact of innovations has been largely neglected. Our finding that the diversity of

complementary goals of multiple intermediaries matters also suggests that the rich ecology of intermediaries complements the policy capacity of governments.

Keywords: Public procurement of innovation; Innovation intermediaries; Bottlenecks; Policy capacity

## **1. Introduction**

In recent years, novel approaches to innovation policies, that aim at “market creation” rather than “market fixing” (Mazzucato 2016) by “tilting the playing field in such a way that profitable innovation and investment opportunities will reinforce each other synergistically” (Perez 2016), have grown in significance and gained attention, which fundamentally accords with the historical transformation in the capitalist economy (Boyer 2004; Perez 2016). These novel innovation policies have been expected to solve societal problems including sustainability, healthcare and aging, as well as economic problems like secular stagnation, instability and rising inequality. Transformative innovation policies (Weber and Rohracher 2012; Schot and Steinmueller 2018), challenge-driven innovation policy (Mazzucato, Kattel, and Ryan-Collins 2019), grand challenges policies (Kuhlmann and Rip 2018), innovation policy for societal challenges (Wanzenböck and Frenken 2020), and mission-oriented innovation policy (MOIP) (Mazzucato 2018) are the recent conceptions of the novel

innovation policies that embody the idea of “market creation” at their core. Advanced economies have begun large programs in line with these ideas. For instance, while the EU decided to adopt five ‘research and innovation missions’ in *Horizon Europe*, which is a new research and innovation framework program starting in 2021, Japan initiated the *Moonshot Research and Development Program* with seven areas of Moonshot Goals.

Studies, including Valovirta (2015), Karo and Kattel (2018), Kattel and Mazzucato (2018), and Mazzucato, Kattel, and Ryan-Collins (2019), have focused on the policy capacity of states as the dynamic capability of governments to implement innovation policies. The novel innovation policies require distinct and high-level policy capacity to shape the direction of innovations because the policy has to ‘tilt’ the economic ‘playing field’ to encourage innovations in particular directions (Perez 2016, 211) that are not covered by generic policy approaches commonly adopted under the ‘market failure’ and ‘systemic failure’ rationales (Mazzucato 2016; Frenken 2017). Thus, states should play ‘entrepreneurial’ roles (Mazzucato 2013). However, top-down public policy has limits due to the challenging, wicked nature of the problems (Nelson 1977), the openness of the transformative processes (Kuhlmann and Rip 2018), and the limited knowledge of governments on societal challenges (Potts 2020). Therefore, the policy capacity for novel innovation policies necessitates a high level of capacity to learn (Nelson and Winter 1982). Accordingly, Kuhlmann and Rip (2018),

Frenken (2017), and Potts (2020) agree that relevant stakeholders should be flexibly and tentatively assembled (Kuhlmann, Stegmaier, and Konrad 2019) to define and solve problems using bottom–up, interactive learning.

The non-directed, bottom–up exploration of new knowledge can lead to minor, incremental changes along the exiting path due to the limited cognitive capacity and resources (Dosi 1982; Nelson and Winter 1982; Frenken 2017), which is often not consistent with the goal of market creation, which requires measures to focus and direct bottom–up explorations and enlarge the impact of innovation. As the most explorative activities occur locally where societal problems emerge and should be solved through innovation (Uyarra et al. 2017), organizing relevant actors to direct the bottom–up search for innovations with great impact under the highly uncertain conditions is challenging. This question on the organizational foundation of novel innovation policies at the local level is important because ‘[t]he design of a good policy is, to a considerable extent, the design of an organizational structure capable of learning and of adjusting behavior in response to what is learned’ (Nelson and Winter 1982, 384). Unfortunately, however, attention to this question has been scarce.

Public procurement of innovation (PPI) is a typical, powerful tool for novel innovation policies to create markets by addressing grand challenges (Edquist and Zabala-

Iturriagagoitia 2012; Uyarra et al. 2020), where governments try to enhance the innovative capacity of firms by procuring innovative goods or services and creating new markets.

According to a benchmark study (European Commission, 2019), PPI is actively implemented in Finland relative to other European countries; Sweden and Norway are among the top PPI performers. Therefore, this study adopts PPI implementation at the local level in Finland as a case of novel innovation policies.

By focusing on the case of PPI in Finland, this study investigates how activities of relevant actors are organized at the local level, and how they try to focus bottom–up, exploratory efforts in certain directions to increase the impact of innovations. As explained in section 2, this paper particularly focuses on the role of *intermediaries* as important players at the local level and examines the significant roles of intermediaries in PPI. The remainder of this paper is organized as follows. Section 2 provides a conceptual background. Section 3 discusses the research setting, the case of PPI in Finland, and the research methods, while section 4 analyzes the empirical case. Section 5 concludes by discussing the findings and implications.

## 2. Conceptual Background

### *2.1 Public Procurement of Innovation (PPI) and Intermediaries*

This study focuses on the role of intermediaries in PPI. Based on a survey of suppliers for public sector in the UK, Georghiou et al. (2014) and Uyarra et al. (2014) showed barriers inhibiting effective interaction between suppliers and procurers in PPI. Edler and Yeow (2016, 414) argued that intermediation, which ‘serves to establish or enable the link between different actors with complementary skill sets or interests to support the generation and diffusion of innovation,’ is key in connecting these parties. Thus, intermediation constitutes a ‘wider systemic source’ of the policy capacity of PPI (Lember, Kattel, and Kalvet 2015).

Howells (2006, 720) listed ten functions of intermediaries, including foresight and diagnostics, scanning and information processing, gatekeeping and brokering, validation and regulation, and evaluation of outcomes, which goes further beyond the functions of mere middleman. As Stewart and Hyysalo (2008, 296) argued, intermediation is more about creating ‘spaces and opportunities for appropriation and generation of emerging technical or cultural products by others.’ Similarly, Boon et al. (2011), Kivimaa (2014), Agogu e et al. (2017), Matschoss and Heiskanen (2018), Kivimaa et al. (2019), and Van Winden and Carvalho (2019) agreed that intermediaries proactively destabilize the existing cognitive and behavioral rules of actors and activate interactions, including conversations among parties

with a variety of perspectives and values, through which demand for innovation is created (Lester and Piore 2004; Rutten 2017; Uyarra et al. 2017). In sum, rather than just establishing the link between different actors, intermediaries actively try to disrupt cognitive and behavioral rules of actors (Dopfer and Potts 2009), analogous to chemical reactions eased by catalysts that lower the activation energy.

Although the role of intermediaries has been intensively studied, only little attention has been given to how they affect the direction and scale of innovations, in which Matschoss and Heiskanen (2017, 2018) and Vilas-Boas (2020) are among the exceptions. Because procurers and suppliers tend to avoid proposing innovative demands for and ideas of procured products and services due to risk-aversion, the role of intermediaries can be quite important in making public procurement innovative by affecting the direction and scale of innovations. Furthermore, because PPI is assumed to shape the direction of innovation, as argued above, this role of intermediaries is also important for PPI. Hence, this study demonstrates how intermediaries catalyze stakeholders in a PPI project, to influence the direction and scale of innovations.

## ***2.2 Direction and Impact of Innovation***

The direction and impact of technical change and innovation have attracted great attention

from researchers, specifically in two major streams of research. The first area asks how the direction of change is selected, and the second area addresses the question of how the new knowledge, as the base of innovation, is obtained. Broadly speaking, these address the issues of selection and variety generation, respectively, in terms of evolutionary theory (Dosi 1982; Nelson and Winter 1982).

### *2.2.1 Focusing*

In seeking explanations for the direction of technical change distinguished from adaptation to changes in factor prices, Rosenberg (1976) argued that severe constraints, unbalances, and bottlenecks can serve as ‘focusing devices’ for an actor’s effort to induce technical changes in particular directions. Examples of the focusing device include (1) internal compulsions and pressures created inside the complex technologies that initiate exploratory activity in certain directions, (2) fears for strikes that induce efforts to develop labor-saving technology, and (3) disrupted supply of materials that induces development of alternative materials. Thus, this focusing mechanism can be understood as an example of ‘inducement mechanism’ (Hirschman 1958, 24) by which socio-technical changes are endogenously generated.

In line with Rosenberg’s (1976) view that constraints, unbalances, and bottlenecks can be sources of technical change, Stark (2009) argued that dissonance of evaluation

principles among actors can be an important source of innovation. As Stark (2009, 18) calls this kind of dissonance ‘creative friction’, dissonance of evaluation principles can be a source of endogenous socio-technical changes by generating problems to be creatively explored and solved.

Their argument suggests that dissonances facing actors can work as focusing mechanism to induce innovations to certain directions with enhanced impact. In this context, intermediaries can influence the direction and impact of innovations by *revealing*, rather than introducing, bottlenecks and dissonances to actors involved. As the studies on systemic intermediaries have demonstrated, intermediaries can intervene in the innovation processes to disrupt the existing practices and cognitive frameworks in several ways including convening novel actors and intervening in dialogue (Klerkx and Leeuwis 2009; Matchoss and Heiskanen 2018; Kivimaa et al. 2019). By this intervention, intermediaries can make actors recognize and, as a result, reveal dissonances among the existing and potential actors in terms of their expectations and requirements on innovative solutions as well as the resulting bottlenecks, although they do not necessarily introduce dissonances by themselves.

### 2.2.2 *Recombination*

Researchers have widely agreed that innovation is generated by interactive learning among

stakeholders (Lundvall 1992, 13). This interactive nature of learning for innovation is encapsulated as the chain-linked model of innovation (Kline and Rosenberg 1986) and is the cornerstone of the national system of innovation concept (Nelson 1993; Lundvall 1992).

Interactive learning is a process where new products, services, or processes are generated by recombining capabilities of different actors (Jacobs 1969; Arthur 2009). Arthur (2009) persuasively argued that technologies, including social ones, evolve by recombining existing technologies. For instance, the Japanese bullet train (*Shinkansen*) was developed in early 1960s by recombining expertise in two, largely unrelated areas: railroad engineering and aeronautical engineering. By analyzing a simple formal model, Page (2011) demonstrated that actors solve problems in novel ways by recombining cognitively divergent perspectives. Thus, interactive learning is not merely information exchange and transmission, but knowledge generation through recombination of existing knowledge. This explains why catalysis, rather than brokerage, better characterizes the role of intermediaries.

However, the recombination process can be challenging. Factors, such as cognitive distance (Nooteboom 2000), divergent interests, and different evaluation principles, can make recombination difficult. As innovation processes through recombination are highly uncertain and ambiguous, actors require the interpretative process by having ‘conversations’ to discover new meanings (Lester and Piore 2004, 8–9). Lester and Piore (2004) suggested that

recombination requires capacity to utilize interpretative thinking, distinct from analytical thinking, which is dominant in new product development techniques. In this context, intermediaries can affect the direction and scale of innovation by enabling the challenging recombination process, not only by directly linking actors but also by enabling dialogue among them (Edler and Yeow 2016).

In summary, intermediaries can exert influence on the direction and impact of innovations by (1) affecting the focusing mechanisms by *revealing* bottlenecks and dissonances among relevant actors, and (2) enabling the *recombination* mechanisms by simply linking actors as well as spurring dialogue among them.

### **3. Research Context and Methods**

This study adopts an explorative case study approach (Yin 2009) to the case of PPI of energy-saving innovative buildings in Finland. To explore how intermediaries catalyze the stakeholders in a PPI project, and influence the direction and impact of innovations, Section 4 analyzes a case of PPI, energy-saving houses in the city of Naantali, Finland. The houses were innovative as they had not been sold as products in the marketplace. As will be shown in Section 4, this PPI project faced conflicting requirements in the sense that, while the construction cost should be modest to make the public dwellings affordable for the middle-

income citizens, the municipality required the solution should be technologically innovative. In this context, it is justified to adopt this PPI project as a suitable case for this study because it is possible to examine how the intermediaries were involved to introduce these conflicting requirements and creatively solve the problems arising from these. Our unit of analysis is not individual intermediaries, as in many studies, but a PPI project as a whole, because rather than understanding the abstract roles intermediaries play, we seek to understand how and when intermediaries could actually play roles and affect the innovations, including the ways in which the differentiated catalytic activities of multiple intermediaries are jointly influenced. For triangulation, in-depth semi-structured interviews were conducted with participants from all organizations involved in the procurement process: one public procurer, two public intermediaries, one non-profit intermediary, and one private construction company. This information is complemented by public and internal documents of the interviewed organizations, including the final reports of projects, websites, pamphlets, and private documentations by individual members involved. Applying the methodology of qualitative data analysis, the preliminary analysis was almost data-driven, adopting the open-coding approach, without explicitly referring to specific theoretical frameworks, which avoids the risks of neglecting novel insights in the cases (Glaser and Strauss 1967; Eisenhardt 1989). All the interviews were recorded and transcribed, in which relevant codes were

attached to blocks of fractions by using Maxqda software that encapsulate the blocks. Then, the conceptual framework presented in Section 2 was applied and confirmed that the codes obtained by the open-coding approach were neatly fitted to the conceptual framework.

This section is based mainly on interviews, which were each 90 to 120 minutes long: Tekes (March 5, 2013; May 27, 2013; and November 26, 2014), Ara (May 31, 2013 and November 25, 2014), Vaso (March 4, 2013), Rakli (May 31, 2013 and November 27, 2014), and Hartela (June 4, 2013). We are confident that the obtained data, treated as historical data, is valid for our analysis, because the aim of this study is not to examine the current implementation of PPI but to explore the relevant organizational and institutional foundations of PPI.

## **4. Case Study**

### ***4.1 Role of Intermediaries in PPI***

To explore how intermediaries catalyze the innovation process in PPI projects, we examine the procurement of an innovative, energy-saving ‘passive house’ (a building highly insulated from the outside air for energy-savings, especially during winter) in the city of Naantali, Finland.<sup>1</sup> Table 1 summarizes the intermediaries involved in this PPI project.

[Insert Table 1 about here]

*Vaso* (Varsinais-Suomen Asumisoikeus Oy: Right of Occupancy Housing in Southwest Finland), the procurer, is a public corporation owned by several municipalities. *Vaso* owns the social housing system which is affordable to middle- and low-income citizens who buy only the right of occupancy (ROO). The landowner, the city of Naantali, wanted energy-saving public housing. *Ara* (Asuminen Rahoitus- ja Kehittämiskeskus: Housing Finance and Development Center)<sup>2</sup>, affiliated with the Ministry of Environment, provides loans and subsidies to residents and social housing corporations such as *Vaso*, which ensures the supply of high-quality, low-cost dwellings for citizens as an integral part of social policy. *Ara* aims to (1) provide loans and subsidies for providers of social housing, (2) provide loans for those who buy the ROO of social housing, and (3) participate in development projects of social housing. Given the third mission, *Ara* began to subsidize the initial planning phase of construction projects in 2008 to encourage innovative, energy-saving plans that reduce construction and maintenance costs. Hence, *Ara* hired some architects to evaluate the proposed plans and provide advice.

This project started when *Vaso* consulted *Ara* on procuring energy-efficient, new dwellings and obtaining funding from *Ara*. *Ara* required social housing corporations like *Vaso* to meet the requirements of low costs and high quality to obtain *Ara*'s funding. It was particularly challenging for *Vaso* to procure a passive house that met *Ara*'s criteria.

[A vital] thing is that Ara's financing is always under price and quality control. In Finland, there are many passive houses...very often, you have to accept that you do not know how much it costs. When it is ready, you know how huge [the cost is, which is] normally [a] very high cost anyway. However, when we are working with Ara's finance for the right of occupancy housing, the price of [a] building can't be [at] whatever [cost]. So, we have [to determine the price at an early stage] (Interview, Vaso, March 4, 2013).

As Vaso originally intended to adopt the conventional, 'turnkey' procurement method where constructors are fully responsible for design and construction, it should be challenging, per Ara's view, to contain costs while adopting innovative ideas to reduce energy consumption with high-quality buildings. Hence, Ara proposed that Vaso should apply for funding via *Tekes (Business Finland, as of now)*, affiliated with the Ministry of Economic Affairs and Employment, for which Vaso had to develop a more innovative plan than it originally assumed. Tekes primarily funds selected development projects mainly for small and medium-sized enterprises. In 2008, it provided funding for PPI projects chiefly in municipalities, in which Tekes funded only the initial planning phase of the whole project to impact the funded PPI projects in the most cost-effective way. According to Tekes, although the crucial decisions were made in the initial planning phase, it was common for public sector organizations not to allocate enough resources to that phase due to hard budget constraints,

which explains why Tekes's funding focused on the initial planning phase, costing much less than the actual construction phase in the cases of construction projects.

A salient feature of the application process for Tekes's funding was that an intensive discussion between Vaso and Tekes already occurred before Vaso submitted the proposal, enabling Vaso to improve it significantly. Vaso contacted Tekes 4 months before it submitted the proposal, and Tekes assigned designated specialists to Vaso to help prepare the application documents with more innovative features. Meanwhile, Tekes also introduced qualified specialists such as external engineers, architects, and technical consultants to Vaso to help Vaso achieve the ambitious target. As described in the following quote, Tekes's essential role was to 'raise the bar' for the applicants by holding intensive discussions while ensuring the project's technical feasibility.

We ask the tricky questions; that's our role. Our role is not to say that you should work in this way, use this method, or work with these companies... But we can do that in a different way [by asking] questions [...] to really make our clients think [for] themselves [about whether] they really have the right expertise or [...] the right options; that is our role... Also, we know different people and different companies; so, we can give them the right contact to network in the networking phase (Interview, Tekes, March 5, 2013).

Although applicants need not consult Tekes before competitive selection, even though Vaso did so, Tekes understood that it is an important opportunity to ensure that the proposals are innovative such that they deserve funding:

This is a very important part of the whole procedure (of funding) on our side because that's the point where we can [influence] the project and [...] use our knowledge about [...] similar projects... So, I would say that if somebody would send us the application directly (without prior consultation), I would be rather certain... that it's not eligible; (that is), we cannot finance it because they do not reach our level of expectations... (It's not required that they contact us before[hand]. But most do, and it's the best solution for both sides [...] that we have this discussion before they submit the proposal (Interview, Tekes, May 27, 2013).

According to Tekes, at the beginning of the 4-month consultation, the technical target set by Vaso was not at all challenging because Vaso originally intended to utilize the ordinary turnkey, cost-based procurement. Finally, Vaso accepted Tekes's challenging suggestion to procure low-cost, technically advanced passive houses by utilizing innovative procurement methods, including intensive dialogue among stakeholders. Finally, Vaso completed and submitted the ambitious proposal in October 2009. It was innovative enough to be accepted by Tekes in December 2009, following a competition where only half the applicants could

obtain funding. As was usually the case, Tekes funded only half the cost of the initial planning phase. Meanwhile, Ara also funded part of the cost of the planning phase.

In summary, Tekes essentially encouraged applicants to take risks, and mobilized and combined resources to enable applicants to realize their ambitious plans. Note that Tekes completed these important roles when the applicants prepared their applications, which suggests that Tekes was significantly catalytic outside its main funding role in enhancing applicants' capacity to innovate.<sup>3</sup>

The following organizations and specialists participated in the design phase along with Vaso and Ara: an architect firm, an energy consultant company, a project consultant company, the city of Naantali, and eleven construction companies including Hartela, which finally won the competition. *Rakli* (Finnish Association of Building Owners and Construction Clients), an association representing real estate owners, played a crucial role in the design phase by managing dialogue and negotiations among the above participants. In the series of dialogues, Rakli implemented its methodology and started to sell as a product, named 'procurement clinic,' in which all stakeholders, including *potential* constructors, gathered and intensively discussed relevant issues for 9 months before the tender (Kuronen and Vaara 2012). The issues included design principles of the dwellings, the form of contracts, procurement methods, and the bidding criteria. Rakli developed this 'clinic' method to

promote the well-being of building owners and users, which was a common interest for the association's members, by promoting intensive dialogue between procurers and suppliers (Rakli and Vaso 2011). The basic idea behind the clinic was as follows:

After all, when we saw that gathering all the different parties involved in any kind of project have [similar] open interaction between them, it's self-evident; but in business life, it's not self-evident. I mean, in [the] construction and real estate business, the interaction is not the basic case. If you think about our goal [that] the built environment will create well-being for its end-users and, of course, for the economy itself, ... the interaction is needed (Interview, Rakli, May 31, 2013).

Vaso decided to buy the 'procurement clinic' service from Rakli who then invited relevant stakeholders to the clinic, which continued between February and November, 2010, to manage the dialogue and negotiations. Constructors did not participate in the first phase of the clinic meetings aimed at developing several outlines, where the current residents of Vaso's other social housing were invited to learn from their experiences. Despite being before the bid process, eleven rival constructors participated in the second phase of the clinic meetings beginning in June 2010. Rakli invited constructors to examine whether it was possible to build dwellings as cheaply as Vaso planned in the first phase of the clinic. Since constructors tried to avoid disclosing relevant information in front of competitors at the meetings, Vaso held separate meetings with each constructor to facilitate the information

disclosure. Accordingly, Vaso could change the original design and the plan for implementation to contain costs effectively. Ara also tried to curb the cost:

We all [offer] guidance... I [present] the plans, and if I realize that [...] it's too expensive because, for example, it's very complicated [...], (then I) can [...] already [tell that] it's probably more expensive than [a simpler alternative]... We try to reduce the cost by giving advice, and the engineers... [are also] calculating the rental rates and whether [it is acceptable] (Interview, Ara, May 31, 2013).

Eventually, eleven constructors that bid for the construction contract in November 2010 failed because the cost was 25% higher than planned. The constructors realized that the calculated cost was much higher than they expected before the tender. The initial plan was modified in early 2011; the biggest modification was that the original, one-storied buildings were changed to two-storied buildings. Vaso also had to reconsider the requirements and granted more space to the constructors to devise better, more cost-effective solutions. The renewed competitive bidding process was in March 2011, and Hartela won the contract. The detailed design and construction phases started in May and November 2011, respectively. Vaso applied for Ara funding again for construction costs, and, finally, Ara made a funding decision.

For *Hartela*, the company that won the contract, this construction project turned out to be highly demanding. Before the tender, the company decided to take part in the clinic meetings to obtain many novel competences, because the passive house project was demanding in terms of technology and cost. *Hartela* did not expect the project to yield profits but intended to leverage the acquired competences for other energy-efficient housing constructions.

Toyota has engaged in the F1 car development projects in order to utilize the knowledge obtained during the F1 projects to the ordinary car development projects. We understood what the F1 projects meant for Toyota was just what the passive house project meant for us because generally passive house is quite demanding compared with the ordinal energy-efficient building (Interview, *Hartela*, June 4, 2013).

*Hartela* could obtain novel technical competences, such as calculating and reducing energy consumption while using wood as the basic material. These competences have been transferred to and utilized in more common, energy-efficient construction projects. The company expected it would be 5 to 10 years before the high-standard, low-cost passive houses, like the one developed in this project, would diffuse, which means that this PPI project might have long-term benefits for *Hartela*. This suggests that public procurers should

try to provide companies with opportunities to develop competences that have long-term, significant spillover effects on their *multiple* innovative products.

#### **4.2 Summary**

Table 2 summarizes the analyzed case based on the framework presented in Section 3, which demonstrates that by combining *revealing*, *recombination*, and other mechanisms, intermediaries influence the direction and impact of innovation in different, complementary ways.

[Insert Table 2 about here]

It is noteworthy that the revealing mechanism by Tekes did not enforce any specific targets and technologies of the passive house but strongly encouraged Vaso to enhance the impact of innovation by asking relevant questions and causing Vaso to reflect on the original, non-innovative specifications, technologies, and procurement processes. Through dialogue, Tekes extended the impact of innovation without suppressing the bottom-up, exploratory effort by Vaso. The funding by Tekes in the initial planning phase also expanded the scale of innovation by allocating resources to that phase where the procurers lacked ample resources.

The revealing mechanism by Ara demonstrates a different focus from Tekes. While Tekes emphasized the use of innovative technologies and procurement methods, Ara stressed

a balance between modest cost and high quality. Hence, this PPI project received different focusing directions. Without Ara, the novel, passive house technique would find it difficult to diffuse broadly. Meanwhile, Tekes's catalytic activities would be necessary for the project's innovativeness.

Furthermore, while the revealing mechanism of Rakli shared the same, 'ensuring cost and quality' goal with Ara in the design phase, Rakli enacted different revealing roles. While Ara influenced the detailed design through dialogue with Vaso, Rakli granted Vaso with the best knowledge of the constructors and residents to significantly improve the original design by 'animating conversations across borders' (Lester and Piore 2004, 49) between the procurer, current residents of existing social housing, and constructors.

## **5. Discussion and Concluding Remarks**

While the extant research has argued that novel innovation policies require policy capacity of states to find and focus the direction of innovative effort in top-down manner, it has been emphasized bottom-up, explorative effort is indispensable due to the inevitable limit of the state capacity. By investigating how intermediaries can be involved in bottom-up explorations to influence the direction and impact of innovations in the case of a PPI project, this study helps to fill this research gap.

Our analysis demonstrated how the intermediaries can catalyze actors in a PPI project to influence the direction and impact of innovation. First, intermediaries helped the procurer to reveal bottlenecks and dissonances among the relevant actors, the procurer and suppliers in this case, which induces further efforts to extend the impact of innovation. Both Tekes and Ara encouraged Vaso to have an ambitious plan with the latest technological solutions, modest cost, high quality, and the innovative procurement method, which induced innovations to overcome constraints. Tekes and Ara also enhanced the plan's ambition by providing funding to Vaso exclusively for the planning phase where resources are seldomly allocated. By providing dialogical consultations and funding at the initial planning phase, rather than providing incentive provisions or assigning targets as in the typical NPM (new public management) practices, intermediaries introduced dissonances to the interactive learning process.

Second, intermediaries can induce innovations in certain directions with greater impact by promoting interactions among actors that creatively resolve dissonances by recombining capabilities of actors. In this case, while Tekes introduced relevant specialists to Vaso, Rakli managed the dialogue among Vaso, the residents, and the constructors, which enabled Vaso to introduce novel, innovative features to the initial plan and the detailed design.

In summary, intermediaries can affect the direction and impact of innovations in PPI projects by (1) revealing: encouraging actors to recognize and face dissonances in the interactive learning process, and by (2) recombination: helping resolve the dissonances by enabling dialogue between the relevant actors. While previous studies on intermediaries have extensively examined the second role, the first role has been almost overlooked, where “solving, avoiding, or mitigating potential conflicts of interests” (Agogué et al. 2017) has been seen as one of the chief roles of intermediaries. As this case shows, the first role of intermediaries to reveal dissonances can be essential in inducing explorative activities that increase the impact of innovations. Therefore, this case demonstrates that understanding of the role of intermediaries should be expanded.

Additionally, this case suggests that PPI can benefit from the existence of *multiple* intermediaries with diverse goals and capabilities. While the previous studies have emphasized different *functions* of intermediaries (e.g., Howells 2006; Stewart and Hyysalo 2008), little attention have been paid to the different *goals* of intermediaries, resulted from their different evaluation principles (Stark 2009), that can result in different, complementary *constraints* on the innovation processes. On the one hand, Tekes and Ara, as intermediaries with distinct goals, presented different, complementary constraints in the innovation process. On the other hand, Rakli, sharing the same goal with Ara but with different capabilities,

catalyzed the innovation process differently by managing the dialogue. Thus, the innovation process had multiple, complementary catalytic effects with multiple constraints and enablers. It should also be noted that, although Ara and Rakli were not innovation intermediaries, in fact they catalyzed the innovation process without intending to become innovation intermediaries. This means that diversity of intermediaries is important because intermediaries other than innovation intermediaries can activate the innovation process. It should also be emphasized that the diversity of intermediaries is not enough for innovativeness of PPI, as diverse, conflicting bottlenecks can cause paralysis in innovation processes. To avoid this adversity, it is necessary to find creative alternatives and compromises to replace the trade-offs arising from the conflicting bottlenecks introduced by diverse intermediaries, which is enabled by the recombinational activities of intermediaries such as introducing relevant actors who own necessary competences and promoting open dialogue among actors, as this case suggests.

As it is difficult for an intermediary to have broad set of catalytic capacities due to limited goals of each intermediary, it is highly likely that multiple catalytic roles are played by multiple, not a single, intermediaries. Then, it is suggested that the rich ecology of intermediaries (Stewart and Hyysalo 2008) enables the implementation of PPI by complementing the policy capacity of the state, which will heavily depend on the socio-

economic conditions of each country. In fact, the policy capacity of the state to catalyze the interactive learning processes of innovation can be often limited due to limited knowledge as well as cognitive, organizational and political constraint. Studies have emphasized the policy capacity of the state for implementing novel innovation policies including PPI while overlooking the ecology of intermediaries as an essential socio-economic foundation for these policies (Valovirta 2015; Karo and Kattel 2018; Kattel and Mazzucato 2018; Mazzucato, Kattel, and Ryan-Collins 2019). Therefore, this important research topic should be explored from the comparative institutionalist perspective in future studies.

This study has several limitations. Due to the limited number of cases, additional research based on the questionnaire survey is necessary to statistically confirm whether the catalytic roles of intermediaries can enhance the innovativeness of PPI. Comparative studies with different institutional contexts should elaborate on the meanings of the Nordic model in relation to the policy capacity for novel innovation policies including PPI. In addition, future studies should examine the management practices of the intermediaries (De Silva, Howells, and Meyer 2018), among which hiring practices and strategies can be an important focus.

## References

- Agogu , Marine, Elsa Berthet, Tobias Fredberg, Pascal Le Masson, Blanche Segrestin, Martin Stoetzel, Martin Wiener, and Anna Ystr m. 2017. "Explicating the Role of Innovation Intermediaries in the "Unknown": A Contingency Approach." *Journal of Strategy and Management* 10 (1): 19–39.
- Ara. 2013. *Asumisen Uudistaminen 2009–2012: Loppuraportti*. ARA. Tengbom Eriksson Arkkitehdit Oy, and Gaia Consulting Oy.
- Arthur, Brian. 2009. *The Nature of Technology: What It Is and How It Evolves*. New York: The Free Press.
- Boon, Wouter P. C., Ellen H. M. Moors, Stefan Kuhlmann, and Ruud E. H. M. Smits. 2011. "Demand Articulation in Emerging Technologies: Intermediary User Organizations as Co-Producers?" *Research Policy* 40 (2): 242–252.
- Boyer, Robert. 2004. *The Future of Economic Growth: As New Becomes Old*. Cheltenham: Edward Elgar.
- Business Finland. 2019. *Evaluation of Smart Procurement, Built Environment and Witty City Programmes*. Business Finland.
- De Silva, Muthu, Jeremy Howells, and Martin Meyer. 2018. "Innovation Intermediaries and Collaboration: Knowledge-based Practices and Internal Value Creation." *Research Policy* 47 (1): 70–87.
- Dopfer, Kurt, and Jason Potts. 2009. "On the Theory of Economic Evolution." *Evolutionary and Institutional Economics Review* 6 (1): 23–44.
- Dosi, Giovanni. 1982. "Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change." *Research Policy* 11 (3): 147–162.

- Edler, Jakob, and Jillian Yeow. 2016. "Connecting Demand and Supply: The Role of Intermediation in Public Procurement of Innovation." *Research Policy* 45 (2): 414–426.
- Edquist, Charles, and Jon Mikel Zabala-Iturriagoitia. 2012. "Public Procurement for Innovation as Mission-Oriented Innovation Policy." *Research Policy* 41 (10): 1757–1769.
- Eisenhardt, Kathleen M. 1989. "Building Theories from Case Study Research." *Academy of Management Review* 14 (4): 532–550.
- European Commission. 2019. *The Strategic Use of Public Procurement for Innovation in the Digital Economy: Comparative Analysis of Results from Benchmarking National Policy Frameworks for Innovation Procurement*. Brussels.
- Frenken, Koen. 2017. "A Complexity-Theoretic Perspective on Innovation Policy." *Complexity, Innovation and Policy* 3 (1): 35–47.
- Georghiou, Luke, Jakob Edler, Elvira Uyerra, and Jillian Yeow. 2014. "Policy Instruments for Public Procurement of Innovation: Choice, Design and Assessment." *Technology Forecasting and Social Change* 86: 1–12.
- Glaser, Barney G., and Anselm L. Strauss. 1967. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago: Aldine Publishing Company.
- Hirschman, Albert O. 1958. *The Strategy of Economic Development*. New Haven: Yale University Press.
- Howells, Jeremy. 2006. "Intermediation and the Role of Intermediaries in Innovation." *Research Policy* 35 (5): 715–728.
- Jacobs, Jane. 1969. *The Economy of Cities*. New York: Random House.

- Kattel, Rainer, and Mariana Mazzucato. 2018. "Mission-Oriented Innovation Policy and Dynamic Capabilities in the Public Sector." *Industrial and Corporate Change* 27 (5): 787–801.
- Karo, Erkki, and Rainer Kattel. 2018. "Innovation and the State: Towards an Evolutionary Theory of Policy Capacity." In *Policy Capacity and Governance: Assessing Governmental Competences and Capabilities in Theory and Practice*, edited by Xun Wu, Michael Howlett, and M. Ramesh. Cham: Palgrave Macmillan.
- Kivimaa, Paula. 2014. "Government-Affiliated Intermediary Organisations as Actors in System-Level Transitions." *Research Policy* 43 (8): 1370–1380.
- Kivimaa, Paula, Wouter Boon, Sampsa Hyysalo, and Laurens Klerkx. 2019. "Towards a Typology of Intermediaries in Sustainability Transition: Systemic Review and a Research Agenda." *Research Policy* 48 (4): 1062–1075.
- Klerkx, Laurens, and Cees Leeuwis. 2009. "Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector." *Technological Forecasting and Social Change* 76 (6), 849-860.
- Kline, Stephen J., and Nathan Rosenberg. 1986. "An Overview of Innovation." In *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, edited by Ralph Landau, and Nathan Rosenberg. Washington DC: National Academy Press.
- Kuhlmann, Stefan, and Arie Rip. 2018. "Next-Generation Innovation Policy and Grand Challenges." *Science and Public Policy* 45 (4): 448–454.
- Kuhlmann, Stefan, Peter Stegmaier, and Kornelia Konrad. 2019. "The Tentative Governance of Emerging Science and Technology: A Conceptual Introduction." *Research Policy* 48 (5): 1091–1097.

- Kuronen, Matti, and Pekka Vaara. 2012. "Purchasing Clinics" in *Public Procurement and Urban Development*. Paper presented at the 19th annual European Real Estate Society Conference, Edinburgh, Scotland.
- Lember, Veiko, Rainer Kattel, and Tarmo Kalvet. 2015. "Quo Vadis Public Procurement of Innovation?" *Innovation: The European Journal of Social Science Research* 28 (3): 403–421.
- Lester, Richard, and Michael Piore. 2004. *Innovation: The Missing Dimension*. Cambridge, MA: Harvard University Press.
- Lundvall, Bengt-Ake (ed.). 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London: Pinter.
- Matschoss, Kaisa, and Eva Heiskanen. 2017. "Making It Experimental in Several Ways: The Work of Intermediaries in Raising the Ambition Level in Local Climate Initiatives." *Journal of Cleaner Production* 169 (15): 85–93.
- Matschoss, Kaisa, and Eva Heiskanen. 2018. "Innovation Intermediary Challenging the Energy Incumbent: Enactment of Local Socio-Technical Transition Pathways by Destabilisation of Regime Rules." *Technology Analysis and Strategic Management* 30 (12): 1455–1469.
- Mazzucato, Mariana. 2013. *The Entrepreneurial State: Debunking Public vs. Private Myths*. London: Anthem Press.
- Mazzucato, Mariana. 2016. "From Market Fixing to Market-Creating: A New Framework for Innovation Policy." *Industry and Innovation* 23 (2): 140–156.
- Mazzucato, Mariana. 2018. "Mission-Oriented Innovation Policies: Challenges and Opportunities." *Industrial and Corporate Change* 27 (5): 803–815.

- Mazzucato, Mariana, Rainer Kattel, and Josh Ryan-Collins. 2019. "Challenge-Driven Innovation Policy: Towards a New Policy Toolkit." *Journal of Industry, Competition and Trade* 20: 421–437.
- Nelson, Richard R. 1977. *The Moon and the Ghetto: An Essay on Public Policy Analysis*. New York: W.W. Norton and Company.
- Nelson, Richard R., and Sidney G. Winter. 1982. *An Evolutionary Theory of Economic Change*. Cambridge, MA: The Belknap Press of Harvard University Press.
- Nelson, Richard R. (ed.). 1993. *National Innovation Systems: A Comparative Analysis*. Oxford: Oxford University Press.
- Nooteboom, Bart. 2000. *Learning and Innovation in Organizations and Economies*. Oxford: Oxford University Press.
- Obstfeld, David. 2017. *Getting New Things Done: Networks, Brokerage, and the Assembly of Innovative Action*. Redwood City, CA: Stanford University Press.
- Page, Scott E. 2011. *Diversity and Complexity*. Princeton: Princeton University Press.
- Perez, Carlota. 2016. "Capitalism, Technology and a Green Global Golden Age: The Role of History in Helping to Shape the Future." In *Rethinking Capitalism: Economics and Policy for Sustainable and Inclusive Growth*, edited by Michael Jacobs and Mariana Mazzucato. West Sussex: Wiley-Blackwell.
- Potts, Jason. 2020. *Innovation Commons: The Origin of Economic Growth*. New York: Oxford University Press.
- RAKLI and Vaso. 2011. *Vaso/Soininen-hankintaklinikka: Tulosraportti*. Rakli.
- Rosenberg, Nathan. 1976. *Perspectives on Technology*. Cambridge: Cambridge University Press.

- Rutten, Roel. 2017. "Beyond Proximities: The Socio-Spatial Dynamics of Knowledge Creation." *Progress in Human Geography* 41 (2): 159–177.
- Schot, Johan, and W. Edward Steinmueller. 2018. "Three Frames for Innovation Policy: R&D, Systems of Innovation and Transformative Change." *Research Policy* 47 (9): 1554–1567.
- Stark, David. 2009. *The Sense of Dissonance: Accounts of Worth in Economic Life*. Princeton: Princeton University Press.
- Stewart, James, and Sampsa Hyysalo. 2008. "Intermediaries, Users and Social Learning in Technological Innovation." *International Journal of Innovation Management* 12 (3): 295–325.
- Tokumaru, Norio. 2018. "Transforming the Role of Public Policies for Innovation: The Role of Institutional Foundations in Finland as a Nordic State." In *Evolving Diversity and Interdependence of Capitalisms: Transformations of regional Integration in EU and Asia*, edited by Robert Boyer, Hiroyasu Uemura, Toshio Yamada, and Lei Song. Tokyo: Springer.
- Uyarra, Elvira, Jakob Edler, Javier Garcia-Estevez, Luke Georghiou, and Jillian Yeow. 2014. "Barriers to Innovation through Public Procurement: A Supplier Perspective." *Technovation* 34 (10): 631–645.
- Uyarra, Elvira, Kieron Flanagan, Edurne Magro, and Jon Mikel Zabala-Iturriagoitia. 2017. "Anchoring the Innovation Impacts of Public Procurement to Place: The Role of Conversations." *Environment and Planning C: Politics and Space* 35 (5): 828–848.
- Uyarra, Elvira, Jon Mikel Zabala-Iturriagoitia, Kieron Flanagan, and Edurne Magro. 2020. "Public Procurement, Innovation and Industrial Policy: Rationales, Roles, Capabilities and Implementation." *Research Policy* 49 (1): 103844.

- Valovirta, Ville. 2015. "Building Capability for Public Procurement of Innovation." In *Public Procurement for Innovation*, edited by Charles Edquist, Nicholas S. Vonortas, Jon Mikel Zabala-Iturriagagoita, and Jakob Edler. Cheltenham: Edward Elgar.
- Van Winden, Willem, and Luis Carvalho. 2019. "Intermediation in Public Procurement of Innovation: How Amsterdam's Startup-in-residence Programme Connects Startups to Urban Challenges." *Research Policy* 48 (9): 103789.
- Vilas-Boas, Jean. 2020. *Directionality and Systemic Governance: Lessons from Brazilian Pig System Transformations from the 1960s to Date*. PhD Thesis, Wageningen University, Wageningen, The Netherlands.
- Wanzenböck, Iris, and Koen Frenken. 2020. "The Subsidiarity Principle in Innovation Policy for Societal Challenge." *Global Transitions* 2: 51–59.
- Weber, K. Matthias, and Harald Rohracher. 2012. "Legitimizing Research, Technology and Innovation Policies for Transformative Change: Combining Insights from Innovation Systems and Multi-Level Perspective in a Comprehensive 'Failures' Framework." *Research Policy* 41 (6): 1037–1047.
- Yin, Robert. 2009. *Case Study Research: Design and Methods*. 4th ed. Thousand Oaks, CA: Sage.

Table 1. Outline of the intermediaries in the case

<b>Intermediary</b>	<b>Type of organization</b>	<b>Profile</b>
Tekes	Affiliated with the Ministry of the Economic Affairs and Employment	Promoting innovative solutions and products and enhancing international competitiveness of Finnish companies. Providing subsidies, grants and loans to inter-sectoral, collaborative projects to promote inter-organizational networks.
Ara	Affiliated with the Ministry of Environment	Responsible to the implementation of social housing policy. Giving subsidies, grants and guarantees for housing and construction. Participating in projects that develop housing and expertise. Promoting sustainable, high-quality housing with reasonable prices.
Rakli	Non-profit organization	Representing residential and commercial properties and infrastructure owners including both private and public sector organizations. Lobbying for policies to ensure sustainable, functional, and attractive built environment.

Table 2. Summary of the PPI case

Intermediary	Mechanisms	Catalytic activities	Phase
Tekes	<b>I. Revealing</b>	<b><u>Encouraging adoption of innovative technologies and innovative procurement</u></b> : Having intensive dialogue before submitting the proposal for funding; suggesting the possibility for better technical solutions; suggesting the innovative method of procurement.	Planning
	<b>II. Recombination</b>	Introducing architect, energy consultant, and Rakli.	Planning
	<b>III. Others</b>	Provided funding for the initial planning phase.	Planning
Ara	<b>I. Revealing</b>	<b><u>Ensuring cost and quality</u></b> : Giving cost estimations; suggesting alternative designs to contain the cost while maintaining the quality; chief criteria for funding.	Design
	<b>II. Recombination</b>	Introducing Tekes.	Planning
	<b>III. Others</b>	Provided funding for the initial planning phase and the construction phase.	Planning; Construction
Rakli	<b>I. Revealing</b>	<b><u>Ensuring cost and quality</u></b> : Developing the clinic as a method to promote well-being of building owners and users.	Design
	<b>II. Recombination</b>	Managing the dialogue between stakeholders by utilizing the clinic methods.	Design
	<b>III. Others</b>	N/A	N/A

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1 For the historical evolution of innovation policies in Finland and the EU, see Tokumaru (2018).

2 Regarding Ara and its engagement in this project, see Ara (2013).

3 Tekes (Business Finland, as of now) has completed three funding programs for innovative public procurement: Witty City, Built Environment, and Smart Procurement. For an evaluation report, see Business Finland (2019), where more than half of the participants answered that these programs helped them forge new collaborations and adopt new procurement methods and practices.