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Accumulation of Knowledge by Strategic Public Procurement through Public-Private Partnerships for Service Innovation in Japan

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FOREWORD by EDITOR-in-CHIEF

We are pleased to present the STIPM Journal Vol 4, No. 2, December, 2019. This issue brings together research findings related to science, technology, and innovation policy and management from Japan and Indonesia.

First article was written by **Djisman Simanjuntak et al.** entitled *Exploring the Transition to Eudaimonic Tourism: A Case Study of Bali*. This article discusses innovation in tourism focus on the dynamics of tourism grows. As tourism grows, carrying capacity is stretched or even overstretched in some places and industries. A shift toward more eudaimonic tourism is needed, and the innovative elements of eudaimonia include geographical treasure, biodiversity, and local deep culture.

Taeko Suehiro and Kumiko Miyazaki present an article entitled *Accumulation of Knowledge by Strategic Public Procurement through Public-Private-Partnership for Service Innovation in Japan*. This study focuses on how governments strategically procure public service through Public-Private Partnership (PPP)—or more specifically, Private Finance Initiative (PFI) arrangements.

Erman Aminullah presents *E-Cigarette as Disruptive Innovation: Forecasting of Conventional Cigarette Substitution in Indonesia*. This article intends to forecast conventional cigarette substitution by e-cigarette in the context of disruptive innovation. E-cigarette as disruptive innovation has been driven by technology innovation to create e-cigarette products for global market. The advancement of e-cigarette technology innovation would continue to create smart and less harmful e-cigarette as alternative tobacco products in future.

Kumiko Miyazaki, Santiago Ruiz Navas, and Ryusuke Sato present the fourth article entitled *Evolutionary Path of Development of AI and Patterns of Knowledge Convergence over the Second and Third AI Boom*. AI has been through several booms and we have currently reached the 3rd AI boom which followed the 2nd AI boom centering mainly on expert systems. The current AI boom started around 2013 and AI is beginning to affect corporate management and operations. AI has been evolving over six decades but it seems that the current boom is different from the previous booms.

The fifth article entitled *Predicting Potential Co-Authorship using Random Forest: Case of Scientific Publication in Indonesian Institute of Sciences* by **Rizka Rahmaida, Asep Saefudin, and Bagus Sartono**. Co-authorship network is one of the proxies to evaluate the emerging research collaborations. Co-authorship that happens for the first time among a pair of author plays an important role as the key of success for their co-authorship in the future.

Finally, **Hiroki Idota et al.**, present an article entitled *Conducting Product Innovation by Using Social Media among Japanese Firms*. This article based on a study that attempts to conduct an empirical

analysis of how social media use promotes product innovation in Japanese firms by collaboration with consumers based on survey data from Japanese firms using probit analysis. This study finds that collaboration with consumers by using social media is important for innovation, particularly in developing concepts and devising methods of use.

The *STIPM Journal* is indexed by Google Scholar, ISJD, IPI, DOAJ, BASE, and OCLC World Cat. This makes the journal dissemination wider. We would like to thank all the reviewers for their excellent work and the authors who kindly contributed their papers for this issue. We are also indebted to the *STIPM Journal* editorial office at P2KMI-LIPI and the publishing and production teams at LIPI Press for their assistance in preparation and publication of this issue.

We are expecting that *STIPM* will always provide a higher scientific platform for the authors and the readers, with a comprehensive overview of the most recent STI Policy and Management research and development at the national, regional and international level.

Happy New Year 2020 to all of you...

Jakarta, December 2019

Editor-In-Chief

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Accumulation of Knowledge by Strategic Public Procurement through Public-Private Partnerships for Service Innovation in Japan

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ABSTRACT

This study focuses on how governments strategically procure public service through Public-Private Partnership (PPP)—or more specifically, Private Finance Initiative (PFI) arrangements. PPP/PFI is recognised as a key element of demand-oriented innovation policy in the field of social infrastructure. However, owing to the considerable uncertainty of each project, the benefits of PPP/PFI are subject to debate, as is the role of public procurement in fostering public service innovation. The purpose of this study is to examine how governments strategically procure public services from construction firms in Japan. The results suggest the following: first, municipalities utilise a greater extent of other municipalities' experience through external experts (i.e. Ministry of Environment, advisors, committee members and potential bidders) and standardised service criteria. Second, the codification of tacit knowledge, which both public and private entities have gained from previous projects, is important for securing a robust and routinised service level and reaping the benefits of the scale of repetition. Third, interaction with private companies in the bidding process with an appropriate manner would foster public service innovation. Governments' capability development through the use of internal and external resources can create space for private companies to provide better service by accumulating tacit knowledge within the projects.

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I. INTRODUCTION

A. Public–Private Partnerships

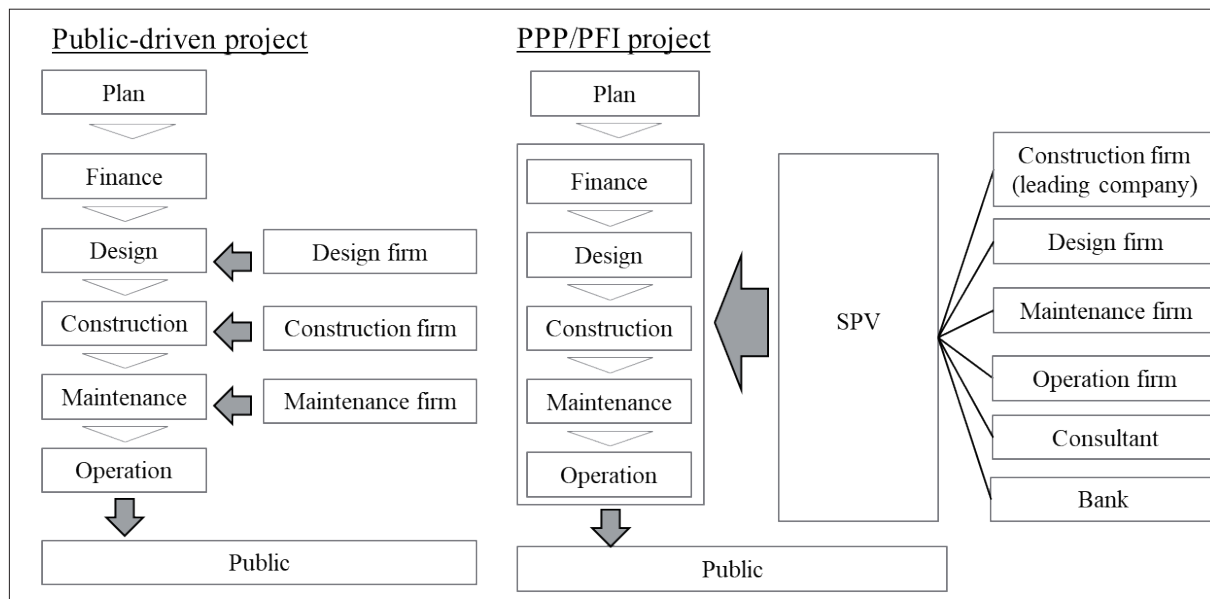
The Japanese government has increasingly required Public-Private Partnership (PPP) and Private Finance Initiative (PFI) arrangements for procuring and managing social infrastructures, such as airports, public facilities (e.g. government offices, schools, and public housing) and waste treatment facilities, owing to pressure to reduce the financial burden on central and municipal governments. In 2018, the Cabinet Office set a goal for introducing PPP/PFI projects (from 2013 to 2022) totalling JPY 12 trillion, which is almost twice the amount set in 2013 (Cabinet Office, 2013, 2018). Guidelines for prioritising the introduction of various PPP/PFI arrangements were introduced in 2015 (Cabinet Office, 2015). These guidelines recommend that local governments, which represent populations of more than 200,000, consider utilising PPP/PFI to build and operate public facilities.

PPP is loosely defined as a cooperative institutional arrangement between public- and private-sector actors. PFI is one type of PPP collaboration that is based on long-term infrastructure contracts led by private actors. PFI was first introduced in the United Kingdom in 1992 and in Japan in 1999 to harness the management skills and

commercial expertise of the private sector and bring discipline to the delivery of public infrastructure (HM Treasury, 2012). PFI-type PPPs involve many forms of contractual arrangements, such as BOT (build-own-transfer), BTO (build-transfer-operate) and BOO (build-own-operate) (for more details, see Savas, 2000). In this study, however, we simply define PPP/PFI as a ‘project that generally involves the design, construction, financing, and maintenance and operation of public infrastructure or a public facility led by the private sector under a long-term contract’ (Campbell, 2001).

PPP/PFI arrangements foster the involvement of private companies, such as construction companies, in roles conventionally assumed by public authorities, such as investment, project management and operation, and maintenance service management. Such PPP/PFI arrangements are expected to improve public service quality and reduce costs. As shown in Figure 1, PPP/PFI projects include a wide range of services from private firms based on long-term contracts.

In conventional public projects, the public sector manages the entire life cycle of the public facilities, including planning, design, finance, construction, operation, and maintenance. Private firms are partly involved at some stage in this life



Source: modified from Cabinet Office (2014)

Figure 1. The difference in the scope of a public-driven project and a PPP/PFI project

cycle, such as design, construction, and maintenance, separately. Once construction companies have completed their work and have passed the final inspection stage, they will usually only take minimal responsibility for the facility in question. Although some maintenance and operation works are outsourced to private firms, the roles of private contractors are generally strictly assigned according to the specifications of the arrangement.

On the contrary, in PPP/PFI projects, the service-related life cycle of public facilities is included in a long-term PPP/PFI contract, such as design, finance, construction, operation, and maintenance, with transferring risk and return for private investment. A long-term commitment to a PPP/PFI contract based on output procurement encourages private companies to undertake innovative actions towards improving the lives of the infrastructure project. Furthermore, PPP/PFI projects have forced suppliers—in many cases, construction companies—to set up special purpose vehicles (SPVs). These act as key coordinating agencies, taking on financial, design and operational responsibilities for the public facilities.

Traditional infrastructure projects, which can be typified as public-driven projects, have received a series of criticisms in terms of poor project implementation, such as miscalculation of the project period, cost overruns on construction, poor design and build quality as well as high maintenance and operation costs (Robinson, Carillo, Anumba, & Patel, 2010). The PPP/PFI arrangement is introduced in infrastructure projects to exploit private finance, effective management and the high expertise of the private actors involved. In theory, PPP/PFI is expected to deliver low whole-life costs and high-quality public service, which essentially mean ‘value for money (VFM)’ in the provision of public infrastructure (Hodge & Greve, 2007; Treasury Committee, 2011) through the active participation of the private sector.

Although PPP/PFI theories emphasise that PPP/PFI could lead to lower total-life costs and better quality of public service, which is represented as higher VFM, the evaluation of PPPs

has delivered contradictory evidence as to their effectiveness in reality.

Actually, the private finance cost is more expensive than government borrowing (Treasury Committee, 2011; Hodge & Greve, 2007) and the gap in financial costs was increased after the economic crisis. According to the Treasury Committee (2011), the cost of capital for typical PFI projects currently stands at over 8%, which is double the long term government gilt rate of approximately 4%. Therefore, PPPs are expected to offset this higher financial cost by means of more effective management of infrastructure associated with innovative activities by private companies compared to public sector actors. However, evidence gathered by previous studies (Treasury Committee, 2011; Hodge & Greve, 2007) could not show a clear improvement of VFM in PPP projects compared to conventional projects. For example, Hodge and Greve (2007) and the Treasury Committee (2011) described several examples from developed countries which show conventional results.

Hall (1998) suggests that the early PFI projects in the United Kingdom could achieve significant savings overall for road projects and two prison contracts that generated about 10% savings compared to publicly financed prisons. Similarly, the analysis of 29 business cases by Arthur Anderson and Enterprise LSE (2000) found 17% cost savings. Moreover, recent reports from Mott-Macdonald (2002) and the National Audit Office (2003) identify PPPs as being delivered on-time and on-budget far more often than traditional procurements.

On the other hand, the Treasury Committee (2011) presented evidence that out-turn costs of construction and service provision are broadly similar between PFI and traditionally procured projects. Furthermore, in terms of quality, the Royal Institute of Architects in the UK stated that the quality of the buildings delivered through PFI-type PPP was lower in many cases compared to traditionally procure ones (Treasury Committee, 2011). This poor design has caused a number of issues, such as rising maintenance costs. Also, Boardman, Poschmann, and Vining (2005) presented evidence from the United States.

According to them, five transportation, water-supply, and waste-disposal projects presented a series of ‘imperfect’ partnership projects with high complexity, high asset specificity, a lack of public sector contract management skills, and a tendency for governments to be unwilling to ‘pull the plug’ on projects once underway. As Hodge and Greve (2007) concluded, the VFM benefits of PPP are still subject to debate because of their considerable uncertainty. Moreover, it is difficult to obtain clear evidence on this in the absence of an accurate and uncontroversial public sector comparison (Hall, 1998).

B. Public Procurement and Innovation

In the public service field, PPP/PFI is recognised as a key element of demand-oriented innovation policy (Brady, Davies, & Gann, 2005; Edler & Georghiou, 2007; National Audit Office, 2007). However, as shown above, owing to the considerable uncertainty of each project, the benefits of PPP/PFI are subject to debate (Hodge & Greve, 2007; National Audit Office, 2018), as is the role of public procurement in fostering public service innovation (Djellal, Gallouja, & Miles, 2013).

Public procurement’s effect of stimulating private sector innovation has been debated particularly in the context of so-called ‘demand-

side’ innovation policies (Uyarra, Edler, Garcia-Estevéz, Georghiou, & Yeow, 2014). By enlarging the market for certain goods and services, public procurement can counteract market and systemic failures that hinder innovation, thus ensuring sufficient critical mass to encourage R&D investment. The use of public procurement has been associated with the emergence of so-called ‘lead markets’ (see e.g. Geroski, 1990; Edler & Georghiou, 2007).

However, there is an obstacle to foster innovation, for example, because the flexibility for interaction during a procurement process is regulated in all countries that have signed on to the Government Procurement Agreement in the WTO and EU Directives. Uyarra et al. (2014) sought to understand how barriers related to processes, competence, procedures and relationships in public procurement influence suppliers’ ability to innovate and reap the benefits of innovation. They found that the main barriers reported by suppliers were lack of interaction with procuring organisations, use of over-specified tenders as opposed to outcome-based specifications, low competence of procurers and poor risk management during the procurement process. Despite this body of work, few studies have investigated thoroughly the specific conditions or mechanisms

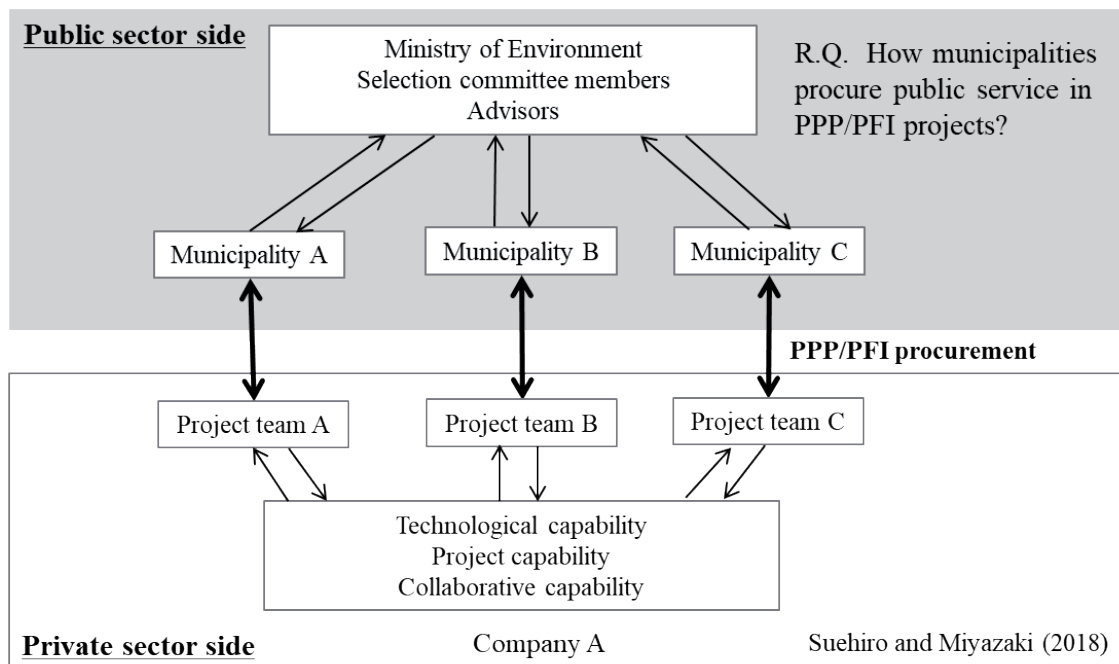


Figure 2. The analytical framework of this study

within public procurement that actually lead to or hinder innovation (Geroski, 1990).

II. RESEARCH PURPOSE AND QUESTIONS

As shown above, previous studies on the effects of PPP/PFI arrangements have mainly focused on evaluating projects; that is, determining whether PPP/PFI is effective for providing public services, which depends on the project (Hodge & Greve, 2007; Treasury Committee, 2011). Although a few studies have focused on the capability development of construction firms as well as governments through PPP/PFI arrangements, most of these studies have also conducted short-term and project-based analyses. Some examples are London Heathrow Terminal 5 project (Davies & Brady, 2016; Davies, Dodgson, & Gann, 2016) and the London Olympics (Worsnop, Miraglia, & Davies, 2016). Therefore, there has been little understanding of the long-term dynamics of the evolution of the capabilities of firms and governments.

Suehiro and Miyazaki (2018) found the construction firm's three types of capability (i.e. technological capability, project capability and collaborative capability) are developed through PPP/PFI arrangements based on the long-term analysis of a construction firm which is one of the most experienced in the field of waste management PPP/PFI. As Djellal et al. (2013) pointed out, client's competence is crucially important to develop service provider's competence development, thus we hypothesize that capability development has occurred among public sector side too through PPP/PFI arrangement.

This study focuses on strategic procurement aimed at fostering service innovation in construction firms through PPP/PFI arrangements. The research questions and theoretical framework are therefore set as below:

R.Q: How do governments strategically procure public services from construction firms through PPP/PFI arrangements in Japan?

III. METHODOLOGY

A. Data and Method

We conducted a quantitative and qualitative analyses of each PPP/PFI project procurement phase: pre-bidding phase, bidding phase and project implementation phase.

First, we reviewed the reports and literature related to PPP/PFI projects in Japan to gather detailed information on the bidding process and project implementation as well as issues regarding PPP/PFI procurement in the waste-to-energy sector.

Second, we analysed the tendering documents of 57 waste-to-energy PPP/PFI projects¹ and conducted interviews with 12 people from construction firms (plant engineering and civil works), SPV for waste-to-energy projects, waste management companies, municipalities and industrial associations.

Third, we focused on the two waste-to-energy PFI projects (i.e. Narumi and Hamamatsu) as case studies to understand the whole PPP/PFI procurement process and how government improved the procedure to procure better public service. Two waste-to-energy PFI cases were selected to compare their bidding process, service criteria and award criteria. These case studies were conducted based on tendering documents and interviews of municipalities, advisers, a tender evaluation committee member and construction companies. Interviews were carried out between August 2014 and May 2018.

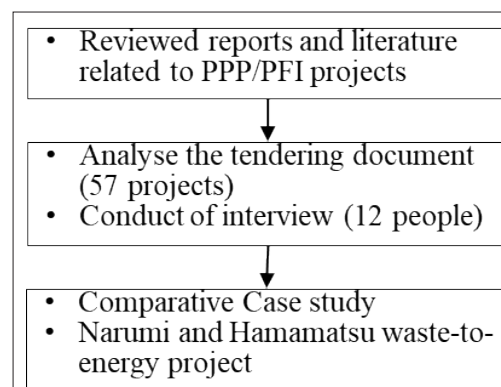


Figure 3. Methodology

¹ Waste-to-energy is a technology for solid waste treatment and power generation that involves the incineration or fermentation of waste. In Japan, PPP/PFI procurement has been introduced in this sector since 2002.

B. Case 1: Narumi Waste-to-Energy Project

The Narumi waste-to-energy plant was the first PFI project in Nagoya, signed PFI contract in December, 2004. The plant was built by build-transfer-operate (BTO) procurement and began operation in 2009. The project was carried out by Narumi Clean System Co., Ltd., the SPV for this project. Table 1 summarises the pertinent details of the Narumi waste-to-energy plant.

A private developer finances and builds a facility and, upon completion, transfers legal ownership to the sponsoring government agency. The agency then leases the facility back to the developer under a long-term lease, during which period the developer operates the facility and has the opportunity to recover his investment and earn a reasonable return from user charges and commercial activity (Savas, 2000).

Table 1.
Summary of Narumi waste-to-energy plant

Capacity	450 tonnes/day
Type of technology	Gasification and melting technology via a direct melting system (Shaft furnace)
Period of project	Signed contract on December/ 2004 Design and construction: March 2005 to June 2009 Operation and maintenance: July 2009 to June 2029 (20 years)
Project company	Narumi Clean System Co., Ltd. (SPV)
Investors (Investment ratio in brackets)	Nippon Steel & Sumikin Engineering Co., Ltd. Eco-manage Co., Ltd., J-Power Co., Ltd., Toho Gas Co., Ltd., Toyota Tsusho Corporation, Metawater Co., Ltd. Taiyu Kensetsu Co., Ltd., Hattorigumi Co., Ltd.

Sources: Narumi Clean System Co., Ltd. (2019)

C. Case 2: Hamamatsu Waste-to-Energy Project

The Hamamatsu waste-to-energy plant signed PFI contract on March 2017. The plant was built by build-transfer-operate (BTO) procurement. This case was chosen because it is a similar capacity and use the same type of technology (Gasification and melting technology) with the Narumi

waste-to-energy plant. Table 2 summarises the pertinent details of the Narumi waste-to-energy plant.

Table 2.
Summary of Hamamatsu waste-to-energy plant

Capacity	399 tonnes/day
Type of technology	Gasification and melting technology via a direct melting system (Shaft furnace)
Period of project	Signed contract on March 2017 Design and construction: March 2017 to March 2024 (6 years) Operation and maintenance: April 2024 to March 2044 (20 years)
Project company	Hamamatsu Clean System Co., Ltd. (SPV)
Investors (Investment ratio in brackets)	Nippon Steel & Sumikin Engineering Co., Ltd. Nippon Steel Environmental Plant Solutions Corporation Nishimatsu Construction Co., Ltd. etc.

Sources: Hamamatsu city. (2018)

IV. FINDINGS

A. Selection process

In PPP/PFI projects, the bidding process and tendering documents are determined by the PFI law and PFI guidelines. Conventionally, a comprehensive evaluation is used to determine the preferred bidder. Unlike simple general competitive bidding, which relies on the lowest price approach, this evaluation method requires bidders to strike a balance between quality and bidding price². In a comprehensive evaluation, the quality and price scores are converted into percentages in accordance with pre-set weightings and the combined score determines the preferred bidder. Quality criteria, such as technical merit and environmental characteristics, are determined on the basis of the focus of the project.

Figure 4 illustrates the bidding procedure for the Narumi project. At the bid announcement stage, the municipality published the bidding documents, such as the output specification, draft of the contract and the award criteria. Then, the pre-qualification and short-listing of interested

² Unlike the bidding process in the UK, in this project, the bidding method did not allow for negotiations after the determination of the preferred bidder.

parties were conducted on the basis of the requirements outlined in the bidding documents. After submission, the proposals were reviewed to ensure the satisfaction of Nagoya's output specification. Finally, the Tender Evaluation Committee evaluated the proposals and determined the preferred bidder according to the award criteria.

After submission, the proposals were reviewed to ensure the satisfaction of Nagoya's output specification. Finally, the Tender Evaluation Committee evaluated the proposals and determined the preferred bidder according to the award criteria.

Based on the comparative case study between the Narumi and Hamamatsu projects, the procedure of the Hamamatsu project mainly added two things: introducing competitive dialogue before submission of proposal and diversifying the expertise of members of the evaluation committee.

The competitive dialogue has been actively introduced in recent PPP/PFI projects to allow official interaction between public procurement agency and private companies who are interested in the tender in order to avoid misunderstanding both needs of governments and business interest of private companies. In the case of Hamamatsu project, private companies clarified specification and contract for execution of the project.

Regarding expertise of evaluation committee members, as shown in Table 3, in Hamamatsu project, there are more committee members who have experience of PPP/PFI execution such as consultants and member of the industrial association as well as city government officers. It implies that Hamamatsu City government prefer involvement of members who have experience of PPP/PFI project execution and directly reflect their opinion on the selection process.

B. Service criteria

During the pre-bidding phase, the municipality specifies the service criteria of the PPP/PFI project through preparing tendering documents, such as output specification and the draft of contract to secure a robust service level and reaping the benefits of the scale of repetition by codifying other municipalities' experience.

Such a codification process relies on the involvement of external experts such as advisors, selection committee members and private companies (through competitive dialogue and the pre-proposal process) during the pre-bidding phase. These external experts prepare tendering documents based on previous projects' tendering documents which are publically available and customise them to fit each municipality's situation based on their experience of participation in several waste-to-energy PPP/PFI projects in the past. Therefore, municipalities can utilise codified knowledge from previous projects.

Ministry of Environment (MOE) also support to utilise previous experience by providing a guideline for standard specification and reviewing the municipality's project plan in the subsidiary application process. Table 4 shows key service criteria of the waste-to-energy project and both Narumi and Hamamatsu projects contain these service criteria in their specification. In 2006, MOE published a guideline for standard specification in order to support municipalities' construction of waste-to-energy plants which are highly complex and normally happen only once a 20–30 years. In the Hamamatsu project, municipality utilised the specification for facility performance criteria and planning conditions.

Table 3.

Members of evaluation committees in Narumi and Hamamatsu

	Narumi project	Hamamatsu project
Professor	4	1
Bank officer	1	1
Consultant		2
Member of industrial association		1
City government officer		3
Total	5	9

Table 4.

Key service criteria of the waste-to-energy project

Service criteria	Coverage of MoE's guideline
Planning conditions	Covered by MoE's guideline but depend on project scope, waste management system and site conditions
Design criteria	
Construction criteria	
Facility performance criteria	Mostly covered by MoE's guideline
Waste disposal capacity	
Exhaust gas emission standard	
Drainage standard	
Molten slag and dissolved fly ash processed material (Content of heavy metal and dioxins)	
Noise	
Vibration	
Odor	
Combustion gas temperature	
Surface temperature of furnace body and boiler casing	
Performance of steam turbine and generator	
Performance of emergency generator (gas turbine and generator)	
Emergency operation test (power receiving, steam turbine generator, emergency power generator)	
Deaerator oxygen content	
Secondary materials, solution chemicals (electric power, fuel, water)	
The purity of recovered metal	
Dioxin concentration in the work environment	
Operation and maintenance criteria	Not covered by MoE's guideline
Personnel organisation	
Education and training	
Acceptance management	
Operation management	
Maintenance management	
Performance reporting	
Resident response	

Sources: modified from Nagoya Environment Department (2013)

C. Award criteria

The award criteria included bidding price and non-price criteria. These award criteria would represent the public sector's expectation of a private company's achievements beyond the minimum requirement of output specification by design innovation and effective management. As shown in Table 5, the non-price criteria were set in view of technological and environmental aspects as well as operation and managerial aspects.

On the one hand, the criteria for disaster prevention was added in the Hamamatsu project in order to reflect the Great East Japan Earthquake's experience. These criteria require such as

ensuring safety during disasters and emergencies, treatment of waste disposal and regional disaster prevention function. The criteria needs highly innovative solutions since few waste-to-energy facilities have such disaster prevention function and the solution is not written in the standard specification of MOE's.

On the other hand, the criteria of stability of the waste processing technology got less score allocation in Hamamatsu project. Based on the interview for a committee member, it reflects the municipality's confidence in securing stabilities of technologies by standard specification combined with the codification of previous projects.

Table 5.

Award criteria of Narumi and Hamamatsu project

Award criteria	Score of Narumi	Score of Hamamatsu
Non-price criteria	100 (100%)	150 (100%)
Project plan	8 (8%)	6 (4%)
Facility layout	12 (12%)	30 (20%)
Stability of the waste processing technology	26 (26%)	16 (11%)
Operation and maintenance plan	15 (15%)	22 (15%)
Environmental sustainability (e.g. Reduction of final disposal/ recycling of residues)	24 (24%)	32 (21%)
Business plan	12 (12%)	16 (11%)
Regional contribution	3 (3%)	14 (9%)
Disaster prevention	-	14 (9%)
Bidding price	100	50
Total	200	200

Sources: modified from Nagoya Environment Department (2013)

V. DISCUSSION

Based on the findings of the comparative case study above, Hamamatsu project has strategically improved than Narumi project from three points of view: utilise other municipalities' experience through external resources, the codification of tacit knowledge and interaction with private companies.

First, the Hamamatsu City improved procurement documents and procedure to utilise a greater extent of other municipalities' experience through external experts (i.e. Ministry of Environment, advisors, committee members and potential bidders) and standardised service criteria. The PPP/PFI was introduced in Japan in 1990, and knowledge and experience have been accumulated to a large extent for the last 20 years in experts of PPP/PFI. Therefore, municipalities can utilise these experiences which is both codified and tacit by assigning external experts (sometime include internal experts who have experience of PPP/PFI project procurement) on the procurement process.

The standardised specification would also attract a large number of bidders and maintaining competitive tension during the bidding phase fosters further codification of private companies' tacit knowledge and induces construction firms' innovative activities, which often involve various players (e.g. operation companies and waste management companies).

As Table 6 shows, the competitive environment had a significant impact especially on the bidding price rather than technical scores. If there is only one bidder, the bidding price will be high and almost reach the target price limit (Avg. 98.0%). The data show that if there are competitors, the winning bid drops significantly to around 70–80% of the target price. Providing an accurate cost estimation is one of the most important capabilities of a construction company, in addition to calculating accurate cost estimations, having highly codified tacit knowledge, such as appropriate design, understanding the detailed construction process as well as estimating future procurement prices on the basis of the experience of previous projects. Especially in long-term PPP projects, understanding how to control various unforeseen risks during a period of 15–20 years would be critical. Moreover, our results suggest that technical score is not directly related to the competitiveness of the bid. Regardless of the number of bidders, bid winners obtain approximately 60–70% of the technical score.

Based on the National Audit Office in the United Kingdom (2007) as well as our evidence from interviewing local government representatives and consultants, strong competition is essential for PFI/PPP deals to achieve the optimal mix of price, quality and risk transfer. Our evidence from the analysis of the bid result also supports this statement.

Table 6.
Influence of competitiveness on the winning bid

Number of bidders	Number of projects	Winning price/Target price (Avg.)	Technical score (Avg.)
1	13	98.0%	70.7%
2	16	80.0%	71.7%
3	16	71.6%	68.0%
4	7	80.6%	61.8%
>4	5	73.9%	68.5%
Total	57	81.7%	69.0%

Second, the codification of tacit knowledge, which both public and private entities have gained from previous projects, is important for securing a robust and routinised service level and reaping the benefits of the scale of repetition.

During the pre-bidding phase, the municipality's codification of service criteria through preparing tendering documents, such as output specification, contract and award criteria, allows for securing a robust and routinised service level and reaping the benefits of the scale of repetition. Such a codification process primarily relies on the involvement of experienced staff, consultants, external experts and private companies (through competitive dialogue and the pre-proposal process) during the pre-bidding phase. External resources, such as consultants and external experts, have participated in several waste-to-energy PPP/PFI projects in the past, and the tendering documents are publically available. Therefore, local governments can utilise codified knowledge from previous projects.

Third, Hamamatsu project conducted better interaction with private companies in the bidding process through competitive dialogue. In the previous study, Uyarra et al. (2014) pointed out that the lack of interaction with public procuring agency is one of the main barrier of innovative activities for public service suppliers. Office of Government Commerce (2004) suggested the need for early interaction in procurement in order to better 'capture innovation'. Systems of innovation approaches emphasise the interactive nature of innovation and in particular the influence of users and user-producer interaction in the

production of innovations. Even more, service innovations need greater user interaction. Interaction in procurement can create an environment of trust that reduces opportunism, the need or costly monitoring and general transaction costs associated with the exchange in instances where there is information asymmetry (Erridge & Nondi, 1994).

VI. CONCLUSION

This study focused on how governments strategically procure public service through PPP/ PFI arrangements. PPP/PFI is recognised as a key element of demand-oriented innovation policy in the field of social infrastructure. However, owing to the considerable uncertainty of each project, the benefits of PPP/PFI are subject to debate, as is the role of public procurement in fostering public service innovation. The purpose of this study is to examine how governments strategically procure public services from construction firms in Japan. We conducted a comparative case study of two waste-to-energy PFI projects to clarify how governments improved the public procurement. Specifically, the results suggest the following:

- 1) (1) Municipalities utilised a greater extent of other municipalities' experience through external experts (i.e. Ministry of Environment, advisors, committee members and potential bidders) and standardised service criteria.
- 2) (2) Codification of tacit knowledge, which both public and private entities have gained from previous projects, is important for securing a robust and routinised service level and reaping the benefits of the scale of repetition.

- 3) (3) Interaction with private companies in the bidding process with an appropriate manner would foster public service innovation. Government' capability development, through the use of internal and external resources, can create space for private companies to provide better service by accumulating tacit knowledge within the projects.

REFERENCES

- Arthur Andersen and Enterprise LSE. (2000). *Value for money drivers in the private finance initiative*. London: U.K. Treasury Taskforce
- Brady, T., Davies, A., & Gann, D. M. (2005). Can integrated solutions business models work in construction? *Building Research & Information*, 33(6), 571–579. <https://doi.org/10.1080/09613210500285064>
- Boardman, A., Poschmann, F., & Vining, A. (2005). North American infrastructure P3s: Examples and lessons learned. In G. Hodge, C. Greve., & A. Boardman (Eds). *The challenge of public – private partnerships: Learning from international experience* (pp. 162–189). Cheltenham, UK: Edward Elgar
- Cabinet Office (2013) *Action plan for drastic reform of PPP/PFI* [in Japanese]. Available from: <https://www8.cao.go.jp/pfi/whatsnew/kiji/actionplan.html> (Accessed: 30 April 2019)
- Cabinet Office. (2015). *Guideline for prioritizing the introduction of various PPP / PFI arrangement* [in Japanese]. Available from: <https://www8.cao.go.jp/pfi/youosenkentou/gaiyou/gaiyou.html> (Accessed: 30 April 2019)
- Cabinet Office. (2018). *Promotion of PFI* [in Japanese]. Available from: <http://www.mlit.go.jp/common/001147421.pdf> (Accessed: 6 June 2019)
- Campbell, G. (2001). *Public private partnerships – A developing market?.* Unpublished manuscript.
- Davies, A. & Brady, T. (2000). Organisational capabilities and learning in complex product systems: Towards repeatable solutions. *Research Policy*, 29, 931–953. [http://dx.doi.org/10.1016/S0048-7333\(00\)00113-X](http://dx.doi.org/10.1016/S0048-7333(00)00113-X)
- Davies, A. & Brady, T. (2016). Explicating the dynamics of project capabilities. *International Journal of Project Management*, 34, 314–327. DOI: 10.1016/j.ijproman.2015.04.006
- Davies, A., Dodgson, M., & Gann, D. (2016). Dynamic capabilities in complex projects: The case of London Heathrow Terminal 5. *Project Management Journal*, 47(2), 26–46. [tps://doi.org/10.1002/pmj.21574](https://doi.org/10.1002/pmj.21574)
- Djellal, F., Gallouja, F., & Miles, I. (2013). Two decades of research on innovation in services: Which place for public services? *Structural Change and Economic Dynamics*, 27, 98–117
- Edler, J. & Georghiou, L. (2007). Public procurement and innovation—Resurrecting the demand side. *Research Policy*, 36, 949–963. [doi:10.1016/j.respol.2007.03.003](https://doi.org/10.1016/j.respol.2007.03.003)
- Erridge, A., & Nondi, R. (1994). Public procurement, competition and partnership. *European Journal of Purchasing & Supply Management*, 1(3), 169–179. [doi:10.1016/0969-7012\(94\)90006X](https://doi.org/10.1016/0969-7012(94)90006X)
- Geroski, P. (1990). Procurement policy as a tool of industrial policy. *International Review of Applied Economics*, 4(2), 182–198. <https://doi.org/10.1080/758523673>
- Hall, J. (1998). Private opportunity, public benefit. *Fiscal Studies*, 19(2), 121–140 <https://doi.org/10.1111/j.1475-5890.1998.tb00280.x>
- Hamamatsu city. (2018). Procurement procedure of new waste-to-energy and recycling facility PFI project [in Japanese]. Available from: <https://www.city.hamamatsu.shizuoka.jp/shori/shinseiso/pfi.html>. Accessed: 30 April 2019.
- HM Treasury. (2012). *A new approach to public private partnerships* [Online]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/205112/pf2_infrastructure_new_approach_to_public_private_partnerships_051212.pdf (Accessed: 10 April 2018)
- Hodge, G. A. & Greve, C. (2007). Public–private partnerships: An international performance review. *Public Administration Review*, 67, 545–558
- Japan, Cabinet Office. (2014). About the implementation situation of PFI projects in Japan [in Japanese]. Available from: https://www8.cao.go.jp/pfi/kaigi/7kai/pdf/shiry0_07-s-.pdf. Accessed: 30 April 2019.
- Mott-Macdonald. (2002). *Review of large public procurement in the UK*. London: Mott-Macdonald [online], Available from: https://www.parliament.vic.gov.au/images/stories/committees/paec/2010-11_Budget_Estimates/Extra_bits/Mott_McDonald_Flyvberg_Blake_Dawson_Waldron_studies.pdf (Accessed: 6 June 2019)

- Nagoya city. (2004). The result of evaluation for selecting a contractor of Narumi waste-to-energy construction and operation project [Japanese]. Available from: <http://www.city.nagoya.jp/kan-kyo/cmsfiles/contents/0000005/5976/11hyoka.pdf> (Accessed: 6 June 2019)
- Nagoya city. (2014). Population of Nagoya [Japanese]. Available from: <http://www.city.nagoya.jp/shisei/category/67-5-5-0-0-0-0-0-0-0.html> (Accessed: 26 July 2014)
- Nagoya Environment Department. (2013). *Narumi waste-to-energy plant* [in Japanese], Available from: <http://www.city.nagoya.jp/kurashi/category/19-14-2-2-0-0-0-0-0-0.html> (Accessed: 6 June 2019)
- Narumi Clean System Co., Ltd. (2019). *Nagoya city Narumi waste-to-energy plant construction and operation project* [in Japanese], Available from: <http://www.narumi-cs.com/index.html> (Accessed: 6 June 2019)
- National Audit Office. (2003). PFI: Construction Performance. London: Her Majesty's Stationery Office. HC 371
- National Audit Office (2007) *Improving the PFI tendering process*, [Online]. Available from: <https://www.nao.org.uk/wp-content/uploads/2007/03/0607149.pdf> (Accessed: 5 May 2019)
- National Audit Office. (2018). *PFI and PF2* [Online]. Available from: <https://www.nao.org.uk/wp-content/uploads/2018/01/PFI-and-PF2.pdf> (Accessed: 30 April 2019)
- Robinson, H. Carillo, P., Anumba, C. J. & Patel, M. (2010). *Governance & knowledge management for Public-Private Partnerships*. West Sussex: John Wiley & Sons Ltd.
- Savas, E. S. (2000). *Public-private partnerships*. Seven Bridge Press, LLC: New York
- Suehiro, T. & Miyazaki, K. (2018). *The evolution of construction firms' organisational capability towards open and service innovation through PPP/PFI in Japan-Towards efficient operation based on ICT technology*. 17th International Schumpeter Society Conference, July 2–4, Seoul
- Treasury Committee. (2011). *Private finance initiative: Seventeenth report of session 2010-12*. London: The Stationery Office Limited
- Office of Government Commerce. (2004). *Capturing innovation: Nurturing suppliers' ideas in the public sector*, [Online]. Available from: https://webarchive.nationalarchives.gov.uk/20100407164828/http://www.ogc.gov.uk/documents/capturing_innovation.pdf (Accessed: 10 April 2018)
- Uyarra, E., Edler, J., Garcia-Estevez, J., Georghiou, L. & Yeow, J. (2014). Barriers to innovation through public procurement: A supplier perspective. *Technovation*, 34(10), 631–645. October. <https://doi.org/10.1016/j.technovation.2014.04.003>
- Worsnop, T., Miraglia, S. & Davies, A. (2016). Balancing open and closed innovation in megaprojects - insights from Crossrail. *Project Management Journal*, 47(4), 79–94 <https://doi.org/10.1177/875697281604700407>