

# INCENTIVISING SUPPLIER INNOVATION IN MEGA INFRASTRUCTURE PROJECTS: EXPLORING THE RESULT OF INNOVATION BONUSES

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Prior research emphasizes that public clients need to use their client role and their procurement strategies to facilitate supplier innovation to accelerate sustainable development of the built environment. The purpose of this paper is to increase the understanding of Swedish Traffic Administration (STA), as the largest public client of infrastructure in Sweden, implementation of procurement strategies may influence supplier innovation. This paper explores an initiative by the STA to promote supplier innovation through offering innovation bonuses to four engineering consultancy firms, contracted for the early planning and design stage of the East Link mega project. The study is based on secondary data from STA's documentation of 51 innovation proposals submitted by the four firms. The result indicates that while innovation bonuses generate proposals of supplier innovation, public clients carefully need to consider how to formulate appropriate incentives and reward systems for specific windows of opportunity.

Keywords: innovation; procurement; incentivisation; public client

## INTRODUCTION

During the 21st century, public demand has increasingly been emphasized as a major potential source of innovation in Europe (Hommen and Rolfstam 2009; Obwegeser and Dueholm Müller 2018). Public procurement is especially important when it comes to influencing innovation related to “wicked problems” and grand societal challenges, such as climate change, public health, and security (Edquist and Zabala-Iturriagoitia 2012; Uyerra *et al.*, 2020). Although public procurement occurs across a wide range of sectors, it is especially prominent in construction, health, and transport (Georghiou *et al.*, 2014), where large public clients play critical roles in shaping their markets.

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Accordingly, many policy initiatives have highlighted the important role of the client in stimulating innovation that helps developing the built environment (e.g., Wolstenholme *et al.*, 2009; Barbosa *et al.*, 2017). More specifically, many studies have identified the construction client's procurement strategies as a key determinant for facilitating different types of innovation in construction projects (Tawiah and Russell, 2008; Eriksson 2017). According to Eriksson and Kadefors (2015), investigating a previous effort from STA with innovation bonuses, the client needs to carefully design and implement incentive systems that maintain an active focus in the design team. Similarly, Ninan *et al.*, (2022) argues that although incentives and rewards can motivate innovation, there is a need for an overall vision to guide preferred innovation. Despite its alleged importance, prior literature also argues that there is a lack of knowledge on public procurement of innovation, and especially on public clients' implementation of procurement strategies to spur supplier innovation (Uyarra *et al.*, 2020). More specifically, there is a lack of knowledge on how different aspects of procurement strategies affect different innovation dimensions (Larsson *et al.*, 2022).

The Swedish Transport Administration (STA), which is one of Sweden's largest public client organisations, is in a situation where "the challenges of today and the future demand both innovation and transition" (Trafikverket, 2023), not least to achieve the goals in Agenda 2030. Since the STA procures for approx. 60 billion SEK per year, it has recognized that procurement and contracting may serve as a strategic development tool for not only the STA, but for the whole Swedish construction industry. More specifically, this study explores an initiative by the STA to promote innovation through offering innovation bonuses to engineering consultancy firms in a mega infrastructure project.

Innovation is generally perceived as a multi-dimensional concept, but the specific dimensions discussed vary across different studies in different contexts (Crossan and Apaydin 2010; Larsson *et al.*, 2022). In this study, for the sake of understanding how clients can influence suppliers to innovate, three aspects of innovation are particularly interesting in; what is being innovated, how novel the new solution is, and its origin. This corresponds to the dimensions of 'type' (product or process), 'novelty' (ranging from incremental to radical) and 'origin' (generation or adoption).

### **Type of Innovation**

In prior innovation management literature, regardless of context, innovations are typically divided into two main types: product and process innovations (Tidd 2001). Product innovation involves changes to either material goods or intangible services (Hommen and Rolfstam 2009; Edquist and Zabala-Iturriagoitia 2012; Obwegeser and Dueholm Müller 2018). In the construction context, these changes often relate to advances in physical components, materials, or technical specifications (Rose and Manley 2014). Process innovation may be described as the "introduction of new production methods, new management approaches, and new technology that can be used to improve production and management processes" (Wang and Ahmed 2004).

### **Novelty of Innovation**

When discussing degree of novelty (or newness) most innovation scholars classify innovations into a continuous scale from incremental to radical (e.g., Tidd 2001; Crossan and Apaydin 2010). Incremental innovation involves a variation (or small changes) in existing technologies, routines, and practices (Garcia and Calantone 2002), whereas radical innovation relates to more fundamental changes and a clear

departure from existing practices and knowledge found within the organization (Crossan and Apaydin, 2010). As radical innovations mostly involve more extensive investments and high-risk, many firms often prefer more incremental innovation with lower risk and immediate reward (Dougherty and Hardy 1996).

### **Origin of Innovation**

Some scholars in the innovation management field have distinguished between “innovation as the development (generation) and/or use (adoption) of new ideas or behaviours” (Damanpour and Schneider 2009). The generation of innovation involves a development process resulting in an outcome that is new to any organization, whereas the adoption of innovation is a process resulting in the assimilation of an existing product or process that is new to the adopting organization (Damanpour and Wischnevsky 2006; Damanpour and Schneider 2009).

### **Reward System**

In the construction procurement literature, there are several studies on how delivery system (e.g., Rose and Manley 2014), partner selection (e.g., Kadefors *et al.*, 2007), and collaboration model (Eriksson 2017) are used as components of clients' procurement strategies and how they affect innovation. There are fewer studies on how the reward system (i.e., fixed price and cost reimbursement) influences innovation. Järvenpää *et al.* (2022) found that a fixed price may either stimulate or inhibit innovation. On the one hand, a fixed price may arguably give the supplier incentives to innovate to reduce the production cost of the project. On the other hand, the fixed price may make the supplier reluctant to try other innovative solutions since they may or may not be more costly than planned. Hence, fixed price will not incentivize innovations for other reasons than cost reduction. In more collaborative projects, cost reimbursement coupled with incentives/bonuses tied to innovation performance may be a better way to facilitate innovation (Eriksson and Westerberg 2011).

Winch (1998) also pointed to reward systems with gainsharing and partnering as part of moving from business-as-usual to more innovative type of practices. In relation to mega infrastructure projects, Davies *et al.* (2014) developed a framework that identified four opportunities, or windows, for clients to promote innovation in a megaproject, here as specified by Sergeeva and Zanello (2018): 1) the bridging window during the front-end when innovative ideas are generated, 2) the engaging window when tendering and contractual processes are used by the client to encourage suppliers to develop innovative ideas, 3) the leveraging window when all the parties involved are mobilised to develop innovative ideas, 4) the exchanging window at the back-end when innovative ideas can be combined with those of other projects in the innovation ecosystem. This framework is used to discuss the initiative by STA in terms of incentivizing supplier innovation short-term (in individual projects) and long-term (across projects).

## **METHOD**

This study explores an initiative by the STA to promote innovation through innovation bonuses in a mega infrastructure project, The East Link Project, involving design and production of a new railroad. The study is primarily based on secondary data, in terms of reviewing of contract documents with four consultancy firms (describing type of incentivisation), and the project's internal documentation including 51 innovation proposals across the four firms. The empirical study focuses on reviewing

the consultancy firms' innovation proposals, the STA's evaluation of them, and the effects of the evaluation in terms of the amount of the innovation reward (not the outcome of any actual innovation process). The material includes STA's correspondence with the suppliers including justification for not approved proposals.

In addition, semi-structured interviews with two individuals involved in the innovation council (evaluating the proposals) were conducted, one with a manager in the projects (also initiator of the council), and one with a specialist. When analysing the secondary data, each proposed innovation has been categorised in what *type* of innovation (process or product), the degree of *novelty* (incremental or radical) and its *origin* (generation or adoption). The categorisation is based on the written innovation proposals from the suppliers and comments by STA. The suppliers describe the origin of the proposal, for example: *"this technical solution is used internationally"* or *"we have developed this process"*. Similarly, the *novelty* of the innovation was categorised based on whether the proposal was an improvement of an existing solution, or if the proposal was new to STA. The *type* of innovation was in a similar way traced from the descriptions of the proposal and meeting minutes such as: *"improvement of assigned system"* or *"extended requirement from STA for automation"*.

## **FINDINGS**

Each of the four consultancy contracts comprise the same tasks: developing a pre-study and railway inquiry, with the delivery of permits, railway plans, and early design of the technical system required for the railroad. Table 1 gives a contextual description including a timeline for the studied period.

*Table 1: Contextual description for the studied period*

Year	Activity
2013	The mega project was established
2014	Consultancy firms 1 and 2 were procured
2015	Consultancy firm 3 was procured
2016	Consultancy firm 4 was procured
2017-09	Innovation council was defined
2020-08	New organisation was established
2021-04	Updated assignment for the innovation council
2021-02	List of approved innovation was published

Included in the contract documents for each contract is the formulation concerning innovation defined by STA:

“The client will reward initiative to innovation during the assignment that render in cost-saving by optimisation of design for construction and maintenance of the facility. The cost-savings can relate to design as well as construction and/or maintenance of the facility. The approved innovation does not need to be new technology or an invention; it can also be an application of existing technology and knowledge - important is that it leads to cost reduction in design, production and/or maintenance.

A bonus of maximum 2.5 million SEK could be rewarded. Smaller amount or nothing can be disbursed and in lump sum or spread out. The client’s project management decide if, and when, the reward is paid after processing in the steering board for cooperation.”

The decisions, whether a proposal was rewarded or not, was initially determined by the project management and the steering group. In 2017, an innovation council was

established to systemise the handling of innovation proposals. The purpose of the council was to increase innovation, generate more applications for innovation bonuses and coordinate the decisions. In 2017, only a few proposals had been handed in, after which the manager of the innovation council told each project manager to encourage the consultancies to send in innovation proposals.

According to the interviewees, there were doubts about the benefits of working with innovation proposals in the internal organisation of the project. In 2019, the question whether the innovation council should be shut down or not was raised. A list of approved innovations was published in the beginning of 2021 on the common share-point. The list, that includes descriptions/instructions of 17 approved proposals, was made accessible for all involved consultants. Initially there were no specific plans for dissemination, instead, according to the interviewed manager, they tried to disseminate the approved proposals through each project manager. In some of the approved proposals, for the consultancy firm to get the bonus, the innovation council had the prerequisite that the firm should develop instructions, or in another way make the idea possible to diffuse to others. Table 2 summarises the amount of approved/not approved proposals from each consultancy firm. The table also lists the type of reward system for each contract, fixed price (FB) or cost reimbursement (CR).

There is a remarkable difference between the two types of reward systems regarding the outcome of suggested proposals. The consultancy firms with FP-contracts have not been as successful, as those with CR-contracts, in getting proposals approved for bonus. In the FP-contracts, only 2 have been approved and 20 have been rejected, whereas in CR-contracts, 17 have been approved and 9 have been rejected.

Table 2: Summary of approved/not approved proposals

Consultancy firm	Approved	Not approved	Reimbursement
I	11	7	CR
II	6	2	CR
III	0	5	FP
IIII	2	15	FP

One proposal from firm 2 were noted as approved, but not on the list for diffusion and no notification documentation and another proposal was approved but withdrawn, in that case the firm referred no to be able to fulfil the requirement for diffusion.

Table 3 describes the categorisation of approved proposals. The approved proposals are mostly incremental process innovations and involve adaptive processes. More specifically, many proposals address improvements connected to the assigned system for sharing information between the client organisation and the consultancies, such as handling of 3D-models, VR-models, and GIS information.

The approved product proposals were all about railroad specific material, such as canalisation, duct, or electric supply system. However, some of the proposed products that were approved for innovation bonus were latter not implemented in the project, due to that the project itself could not solely decide on which railroad specific material to use. There is a specific process in STA for approval of technical material for railroad.

*Table 3: Categorisation of approved proposals*

Type	Novelty	Origin	Number
Process	Incremental	Adaptive	14
Product	Incremental	Adaptive	2
Product	Radical	Adaptive	1
Product	Radical	Developmental	1
Process	Incremental	Developmental	1

In Table 4 the different approved bonuses are summarised, and the numbers in brackets indicate the number of bonuses corresponding to the same category and amount of bonus reward (SEK).

*Table 4: Summary of approved bonuses*

Bonuses SEK	Category of proposals
500 000	Process/incremental/adaptive
350 000	Process/incremental/adaptive
300 000	Process/incremental/adaptive
200 000	(Information of the proposal is missing)
150 000	Process/incremental/adaptive
100 000 (3)	Process/incremental/adaptive
100 000	Product/radical/developmental
50 000	Product/incremental/developmental
50 000	Product/radical/incremental
50 000 (6)	Process/incremental/adaptive

As seen in Table 4 there is a predomination of process improvements that were rewarded larger bonuses, where most of them regarded improvement in the assigned digital environment. There are also many bonuses with value of 50 000 SEK (8). This indicates that “good ideas” were rewarded regardless of whether the proposals could be implemented or not. The decision on how to value the benefit of the proposals was under discussion and was documented in the notes from the meetings: “*if the proposal is interesting, we can pay a smaller amount, so the consultant investigate the proposed innovation further*”. Several of the proposed innovations reappear in the documentations from the councils' meetings, where STA requires additional description, or investigation, before decision-making. A general question to the contributors of the proposals, according to the correspondence with the firms, was about “*What is the benefit/contribution of the proposal*”. Generally, specialists from the specific area determined the final value for bonuses of approved proposals, according to the interviewed specialist. The interviewed specialist mentioned that it sometimes was difficult to determine if a proposal was an innovation, or not, because the specialist from STA was in some cases involved in the development of the idea, as part of the “normal” exchange between STA and suppliers.

Table 5 shows proposals that were not approved and here there is a similar pattern, with most proposals aiming for process improvement. Overall, there is a similarity between approved/not approved proposals regarding type, novelty, and origin.

Table 5: Categorisation of not approved proposals

Type	Novelty	Origin	Number
Process	Incremental	Adaptive	18
Product	Incremental	Adaptive	7
Product	Radical	Adaptive	2
Product	Radical	Developmental	1
Process	Incremental	Developmental	1

There was a larger discrepancy in the topics for the not approved process improvements, compared to the approved. Both improvement of the assigned digital environment and improvement of operation methods can be found in the material.

The rejected proposals have been divided in categories depending on the argumentation from the innovation council, see Table 6.

Table 6: Argument for not approval

Argument	Total number	CR	FP
Included in the normal work for the consultant	4		4
Similar solution already exists	4		4
Not considered as an innovation	8	1	7
Already ingoing development in STA	5	3	2
Regarded as a good idea, but difficult to diffuse to another consultant	3	1	2
Not allowed in STA to use cloud solutions	2	2	
Not applicable in the project, change in specification	1	1	
Uncertainty of the practical application, not described	1		1
Not a subject for STA to handle	1	1	

The summary of rejected proposals shows a predominance of arguments related to that the proposals were not considered an innovation. Three of the proposals were considered as “good ideas”, but not possible to diffuse to other consultants (mostly describing internal work processes). Table 6 also reveals that the three most common reasons for rejecting proposals in FP-contracts were: “*not considered as an innovation*”, “*similar solutions already exist*” and that the innovation is considered as part of “*normal work*” for consultants. As these arguments are not at all common for rejecting innovation proposals in CR-contracts, it seems as the reward system affects the suppliers' possibilities to receive innovation bonuses.

## CONCLUSIONS

There are several interesting results from this study of STA's initiative to incentivize supplier innovation in a mega infrastructure project. Through an innovation council, innovation proposals from consultancy firms in the early planning and design stage were evaluated and rewarded an innovation bonus if considered innovative and useful from a cost reduction point of view. This corresponds to the “engaging window” (Davis *et al.*, 2014) as STA uses tendering and contractual processes in terms of innovation bonuses to encourage suppliers to develop innovative ideas. The results are discussed in relation to two interesting aspects of the study: 1) the variation of the reward systems in terms of cost reimbursement (CR) vs. fixed price (FP) (i.e., an

independent variable) and 2) in relation to the three innovation dimensions in focus of this study: type, novelty, and origin (i.e., three dependent variables).

Starting with the reward system, the firms with CR contracts produced about the same number of proposals (26) as the firms with FP contracts (22 proposals) whereas the former got more proposals approved for bonus; 17 (CR) compared to 2 (FP). Thus, whereas prior research suggests that FP can make suppliers reluctant to innovate due to the risk of increased costs (Järvenpää *et al.*, 2022), our findings indicate that suppliers may be willing to innovate but that the client does not necessarily identify this as innovation. Several of the non-approved proposals were regarded as “*part of normal work*” for a consultant in the early stage of a project, even if the proposed idea was considered “*good*”. This demonstrates the difficulty of distinguishing potential innovations from expectations of normal work based on a broad definition of innovation. It appears particularly difficult in relation to potential innovations targeting cost reductions for suppliers within an FP contract, as this is to be expected also without an innovation bonus.

Regarding the innovation dimension “*type*”, it appears that most proposals concerned process innovation and that these also rendered the highest rewards. This indicates that this type of innovation was deemed most useful from the client's point of view of resulting in cost reduction. It may also suggest that product innovation is harder to implement. Regarding the two other innovation dimensions, “*novelty*” and “*origin*”, there were mainly incremental innovations (Garcia and Calantone 2002) and adaption (e.g., Damanpour and Schneider 2009) detected in this study. In several suggestions for innovation from the suppliers, they refer to “*ongoing development within their own organisation*” as origin for the idea. Evidently, the suppliers were referring to developments of their own processes that were taking place regardless of any client-initiated incentives. These developments may, however, not have become part of the specific project had the innovation bonus not been presented.

In some cases, the council considered the proposed innovation as good, but the diffusion to the other consultants was perceived as difficult, which resulted in non-approval for bonus. This can be interpreted as difficulty in linking the “*engaging*” and “*exchanging*” windows (Davies *et al.*, 2014) - i.e., tendering/contractual processes as incentivizing and then how to diffuse it to other projects. Thus, not all “*good ideas*” were considered easy to implement, specifically ideas concerning “*process innovation*”. Process innovation is also more time-dependent, the ideas must be applied in the right time in the process. As seen in this study, some ideas were regarded as “*too late*” to implement. Therefore, public clients carefully need consider what window of opportunity for promoting supplier innovation to target and in what way, in terms of connecting the purpose of promoting innovation, to the timing of the targeted window and to appropriate incentive- and reward systems.

Previous research has highlighted the construction clients' procurement to stimulate innovation (Tawiah and Russell 2008; Eriksson 2017). Any innovation initiative from a client (Ninan *et al.*, 2022) should consider what to achieve, in this case short time cost-reduction in a specific project or long-term cost reduction. In relation to the framework by Davies *et al.* (2014) there needs to be an awareness of the different windows of opportunity, which window is aimed for and identifying the appropriate kind of incentives and reward systems for the prerequisites of that specific “*window*”, or how to connect the opportunities of different windows if needed.



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