

CLIENT STRATEGIES FOR STIMULATING INNOVATION IN CONSTRUCTION

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The construction industry is often described as a fragmented, loosely coupled industry, slow to innovate and lacking in productivity. In order to address these issues, the role of client organizations is commonly acknowledged as a key actor for change. However, what this role constitutes of is less clear e.g. questions arise such as: should innovation be mainly supplier-led or client-led? The aim of the research is to explore different strategies clients can adapt in realizing innovation in transportation infrastructure. The method used to fulfil the aim can be described as a case study performed at the Sweden's largest transportation infrastructure client, exploring two strategies deployed simultaneously to stimulate innovation. The organization is on the one hand trying to stimulate innovation through providing more flexibility in projects, enabling suppliers to propose new solutions and emphasising competition on the market; while on the other hand, found in the implementation of Building Information Modelling (BIM), the client is trying to dictate demands and actively influencing the supply chain, which builds on innovation being actively led by the client. Although the strategies essentially deal with different types of innovation, either a known innovation in the case of BIM, or an unknown innovation for the client organization; the research finds that the simultaneous use of both these strategies has created tensions within the organization, causing the favouring of one strategy over the other. The findings provide insights in different strategies clients can use in order to stimulate innovation.

Keywords: client, fragmentation, innovation, integration

INTRODUCTION

Fragmentation is a multifaceted concept and it has been suggested to hamper innovation and performance in the construction industry (Dulaimi *et al.*, 2002). In the construction industry, for example, fragmentation of actors involved in construction projects threatens incentive chains for innovation (Winch 1998) and fragmented project teams raises concerns of liability and risk in implementing product innovations (Rose and Manley 2014). While fragmentation of the production process hampers transferring knowledge between actors involved in different stages (Dubois and Gadde 2002; Rose and Manley 2014), and supposedly creates barriers for coordinating innovation efforts (Dulaimi *et al.*, 2002). Thus, fragmentation has received a somewhat bad reputation, something the industry should aim to reduce by

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emphasizing more integrated processes in construction projects (Blayse and Manley 2004). However, as Fellows and Liu (2012) states, fragmentation is simply the consequence of differentiation and high degree of specialization among actors in an industry, two words with far more positive associations.

Innovation in construction typically happens in projects (Harty 2008; Winch 1998), Harty (2008) suggest that the dominant model of innovation in construction is that it either happens in response to client needs or by implementing innovation originating from elsewhere; similar to a technology-push and demand-pull model of innovation (cf. Bygballe and Ingemansson 2011; Loosemore 2015). Bygballe and Ingemansson (2011) further elaborates on the implications of such 'push-and-pull' model and suggest that in such market-based view of innovation, innovation is mainly driven by the forces of price and demand. But such 'push-and-pull' model does not seem to fit well in how innovation is developed in construction, since much of the innovative activity is happening in in projects, in response to problems (cf. Harty 2008; Loosemore 2015); thus, some researchers have argued that this creates a need for interaction among organizations for innovation to happen, viewing innovation as something that is co-created, requiring interaction and cooperation among actors (cf. Bygballe and Ingemansson 2011; Loosemore 2015). In a similar vein, Harty (2008) suggested that the relatively unboundedness of innovation in construction i.e. the effects of an innovation extends beyond the implementer, creates a need for cooperation or alignment of multiple actors across different organizations in order for innovation to be successfully implemented. Although the strong emphasis on cooperation- and collaboration efforts in much research, Dubois and Gadde (2002) suggest that there exist two camps prescribing two different solutions on the assumed poor performance of the industry: either a focus on competition or on cooperation to increase the performance of the construction industry.

Clients are often acknowledged as playing a key role in creating the right conditions for innovation in construction (Blayse and Manley 2004; Bygballe and Ingemansson 2011; Loosemore 2015; Winch 1998). However, research has reported and suggested several different roles clients could enact to support innovation. Some research has indicated that clients might be in a particular good position to facilitate cooperation and coordination in projects, for example Nam and Tatum (1997) emphasized clients' active involvement in projects, showing commitment and leadership in projects; and Kulatunga *et al.*, (2011) suggest that client's influence can decrease the fragmentation of different stakeholders and facilitate innovation activities. However, in Bygballe and Ingemansson's (2011) study on public policy and innovation in the Swedish and Norwegian construction industries, they suggest that the principal effort clients had made to support innovation is through emphasizing competition. They further suggest that such view of innovation being developed by a single actor fails to address the interdependencies and interaction among actors that requires attention for innovation to be implemented in construction projects.

In Sweden, the Swedish Transportation Administration (STA) is the client organization responsible for investment and maintenance of state transportation infrastructure. The STA have through government directives the explicit mission to stimulate and facilitate for increased productivity and innovation in Sweden's transportation infrastructure industry (cf. SFS 2010:185). Based on this mission, the STA has initiated several initiatives to support innovation and change within the industry. Among these, is one initiative communicated as the 'professional client', which incorporates efforts in order to adopt the client role necessary to facilitate for

supplier-led innovation in the industry. This 'new' role entails giving more responsibilities to the suppliers performing the design and production of the construction projects and promoting competition on the market. Furthermore, the STA has also adopted an initiative to support the implementation of BIM in the Swedish transportation infrastructure industry by actively demanding BIM use in projects. Previous research studying the BIM initiative at the STA has highlighted the difficulties for clients to act as change agents and highlighted the existence of various degrees of intra-organizational acceptance of the BIM initiative (Lindblad and Karrbom Gustavsson 2017). These two initiatives seem to build on two different ideas about the client role in stimulating innovation and change in the industry, either emphasizing competition or a more demanding role of change in a specific direction.

The aim of this paper is to explore the client role in stimulating innovation in the construction industry, more specifically by presenting findings addressing the STA's initiatives to on the one hand facilitate supplier-led innovation and on the other hand to demand BIM in projects. The objectives are; to present the rationale behind these two initiatives; to analyse the strategic implications of the two initiatives at the STA; and to discuss how the two strategies interact with each other.

Client Role in Construction Innovation

Construction innovation distinguishes itself from other fields in which innovation takes place, generally because constructed facilities are large, complex, long lasting and is developed by a temporary project team with various disciplines (Slaughter 1998). All types of innovation in construction are not equal, and therefore present different opportunities and require different actions in order to be successfully implemented. Slaughter (1998) presents a set of innovation models which organizes types of innovation based on, the magnitude of change and the expected linkages between the innovation and other components in the system. For example, the incremental innovation, providing small improvements to isolated components; and the system innovation, influencing most, if not all components in the system which is a construction project or even the projects entire lifecycle (ibid). System innovations can be understood as "a situation where an innovation system goes beyond the boundaries of a single organization, and multiple innovations need to be co-ordinated" (Midgley and Lindhult 2017: 2). In contrast to the simple incremental innovation that requires only a small change (Slaughter 1998), system innovations require coordination between different actors (Taylor and Levitt 2004).

As one of the currently most discussed innovations in construction, BIM has been described as a typical systemic innovation (Cao *et al.*, 2017). From the perspective of innovation models described by Slaughter (1998), this understanding provides insight in how BIM can influence different actors in a project. The role of public client organizations is emphasized for implementation of systemic innovation and often described as critical for BIM implementation (Azhar 2011; Smith 2014). The client organization has also been found to be able to benefit from a diffusion of the systemic innovation even when without a direct need for systemic innovation, as this diffusion might fulfil other client needs (Singh 2014). Client organizations has also been described as 'innovation champions', able to support the diffusion of the innovation by establishing a supportive environment through promotions, incentives regulation and guidelines (Kulatunga *et al.*, 2011; Singh 2014).

The client representatives in projects, often the project manager, have also been found to play an important role in the implementation of systemic innovation. This

individual is described as a 'systems integrator' (Winch 1998; Tylor and Levitt 2004). However, in order for the 'systems integrator' to be successful, they need to be convinced of the merits of the innovation and have the necessary skills to integrate the specific innovation in the system (Nam and Tatum 1997; Winch 1998). Slaughter (1998: 228) argues that these individuals have to be "able to exercise the technical competence and project responsibility and control to achieve coordination cooperation across the system(s)". Without these prerequisites, implementation will be slow or not taking place at all. Therefore, Winch (1998) and Slaughter (1998) emphasise the importance of 'systems integrators' in mediating the implementation of systemic innovation. How large degrees of freedom various actors have in relation to the implementation of systemic innovation have also been found to be a relevant factor in the implementation process. For 'systems integrators', large degrees of freedom have been found to be desirable as it enables adaption to the preconditions in the specific case (Singh 2014). For other actors influenced by the systemic innovation, large degrees of freedom are un-desirable from an innovation diffusion standpoint as it may enable actors to disregard the implementation process.

METHOD

The aim of the research presented in this paper is met by adopting a case study approach, assessing how the STA tries to stimulate innovation, more specifically the two initiatives: 'professional client'- and 'BIM' initiative have been explored. The two initiatives serve as empirical examples of innovation promoting actions with resulting strategies to support innovation in the industry. The two initiatives have been developed in coexistence and demonstrate different understandings of the client role in stimulating innovation in construction and expose how these two initiatives interact with each other. Even though the actions taken in the two initiatives are very different, their objectives are similar, supporting innovation. BIM is in this paper viewed as a specific systemic innovation. Thus, STA's strategic efforts to implement BIM, following the BIM initiative, are viewed as an innovation strategy; whereas, the strategic efforts to stimulate innovation in the industry in line with the 'professional client' initiative are viewed as an alternative innovation strategy.

The empirical material presented in this paper is the result from joining two research projects (Project A and Project B). Each project was independently led by one of the two authors of this paper and was conducted at the STA. The main purpose of Project A was to explore the project manager role at the STA to support supplier-led innovation. Whereas the main purpose of Project B was to investigate STA's efforts to support implementation of BIM in the Swedish transportation infrastructure industry. The aggregated empirical material presented in this paper is extracted from these two research projects.

Data in Project A was collected during 2017-2018 and includes official reports, internal documents and interviews. Fourteen semi-structured interviews were held with project managers at the STA, ranging between 1-2 hours. Official reports and internal documents were used to understand the rationale behind STA's 'professional client' initiative and how it is understood to support innovation. Data from the interviews, official documents and internal documents were used to understand the strategic implications of the STA's initiative to support innovation.

Data in Project B was collected during 2013-2018 and includes official reports, internal documents, interviews, observations of 2 workshops and 8 meeting where the development of new BIM related documents were discussed. A total of 28, 1-2 hours,

semi-structured interviews were conducted with project managers, BIM-coordinators and participants in the BIM implementation project. Interviews with BIM-coordinators, official reports and internal documents were used to describe the rationale of STA's initiative to support implementation of BIM in the industry. The data extracted from the interviews and internal documents was used to understand the strategic implications of the STA's policies to implement BIM at the STA. Furthermore, data from interviews, observations from meetings and workshops from Project B were used to understand how the BIM initiative interact with perceptions of the client role based on the strategic implications of the 'professional client' initiative.

Findings are discussed to illuminate different roles clients can take in stimulating innovation in transportation infrastructure. Further, the underlying arguments behind the two innovation initiatives have been evaluated as well as exploring how the two initiatives interact and influence each other.

FINDINGS

The Professional Client Initiative

The STA was founded by merging two public agencies responsible for road- and railway infrastructure separately. Since the merger, the STA has started an initiative to define their role as a client, which has been communicated both internally and externally as becoming a 'professional client'. According to government directives, stating the mission of the agencies, it explicitly states that STA has the mission to increase productivity and innovation on the Swedish market for infrastructure investments (SFS 2010:185). From STA's official website (retrieved in February 2018) it is communicated that the purpose of the 'professional client' initiative can be broken down to four main purposes which are; increase (1) innovation-, (2) productivity-, and (3) competition on the market, and, (4) clearly defined roles of the STA and its suppliers. Clearly defined roles is communicated as the STA should aim to assign more responsibility to suppliers for developing infrastructure project while STA's role is to purchase their services and govern the development of the projects. In interviews with project managers at the STA, their description of their role to support innovation was coherent with the communicated 'professional client'. The project managers explained their role to stimulate innovation as to open up for the possibility for the market to come up with new solution, as one project manager defined the STA's role to support innovation: "Our role is to provide freedom to our suppliers through our contracts, that allows them to come up with their own solutions".

This new role is realized by three main strategic principles according to STA's official website. First principle, the client has strategically aimed at increasing fixed-price commissions to consultants responsible for the early design-phases of investment projects. This has been communicated with a strategic goal of at least 40% by 2018. From interviews with project managers, it was understood that they should aim at having fixed-price. The reason of using fixed-price is maybe best illustrated by one of the project manager's elaboration of the rationale and benefits of using fixed-price: "In these relatively complex projects with a lot of technicians you need a lot of coordination in the project team... by using fixed-price the consultant is responsible for this coordination and thus has incentives to work as efficient as possible... Another benefit is that the STA has to define the initial project mission more clearly and thus prepare the project more competently".

Second principle, the STA has strategically been working toward increasing Design Build (DB) contracts, stated once as a goal that at least 50% of the procured volume should be by DB contracts. The interviewed project managers were generally in agreement that using DB contracts is the way to go in order to facilitate for innovation, one project manager stated “in a DB contract you always leave the contractor with more possibilities [compared to a Design Bid Build contract] to make their own decisions”.

Third principle, to favour the use of performance-based specifications in the contracts instead of using detailed technical solutions. The idea by using performance-based specifications is to allow the contractor to come up with their own solution, thus, using contractors' expertise instead of dictating and prescribing solutions in the contracts. From the interviews, most project managers emphasized the use of performance-based specifications as one of the main principles to facilitate for supplier-led innovation. By using performance-based specifications, the project managers suggested this would give contractors the possibility to come up with new innovative solutions, one project manager stated “if I have performance-based specifications it is up to the contractor to come up with the innovation, you give the possibility to the market to come with their own solution”.

The BIM Initiative

At the time the STA was founded, a couple of project managers got interested in the new innovation of BIM. These project managers tried out the technology in their projects and group themselves into a BIM-network to exchange experiences and improve their BIM competence. The BIM-network later influenced the outcomes in a Swedish government official report, which expressed suggestions of how the STA could improve productivity and drive innovation in the construction industry (SOU 2012:39). In the official report, the possibilities with the BIM technology are presented and suggestions are made in regard to how the STA should work towards implementing BIM in the infrastructure industry. Based on the suggestions in the official report, the general director at the STA made a formal decision to implement BIM in the whole client organization. This decision was made in 2013 and follows the same rationale as in the official report i.e. STA should implement BIM to increase efficiency and productivity both internally and the infrastructure industry.

After the general director's decision, the BIM issue gained legitimacy at the STA and a BIM-implementation project was started. Fourteen individuals from various departments at the STA were involved in this project and it was conducted until late 2014. As per the project specification, the BIM-implementation project's objectives were outlined as follows: BIM shall be used by all infrastructure projects to some extent from 2015 and onwards; make the client organization more efficient; establish the organization as a professional client procuring BIM in both design and production.

At its conclusion the BIM-implementation project delivered a handful of new- and developed documents specifying the use of BIM models in projects. Among these was a new BIM strategy for the STA in which BIM is described as: “the use of information models in a linked information flow through the work processes relating to buildings and other facilities” (TDOK 2013:0688, 1). Further, new guidance documents were created, specifying the creation and maintenance of models throughout the project process. Together with an updated version of procurement templates these new guidance documents specifies how projects should be procured using BIM-models, thereby establishing a demand for BIM-use among project

participants. More specifically, the new procurement template demands the delivery of coordinated BIM models as a deliverable from the main contractor. This is in turn was expected to incentivise the main contractor to work collaboratively with other actors in the project using BIM-centric work practices.

After the completion of the BIM-implementation project, the BIM implementation has been continued in other forms at the STA. The guidance documents and procurement templates have been continuously updated to better support the change towards BIM. However, several interviews with project managers at the STA have shown how project managers have large degrees of freedom when they specify procurement documents in their projects. Thereby project managers have a large opportunity to choose which parts of BIM to include in the procurement in their specific project, resulting in a situation where BIM is currently implemented to varying degrees in different projects. The main purpose of promoting BIM-use as described in the official report (SOU 2012:39), for the client to act as an innovation champion of BIM, has therefore been problematic to achieve.

When the new BIM guidance documents were implemented several problems arose. According to the individual responsible for implementing the documents into one of STA's departments, the guidelines and demands specified in relation to BIM was perceived to be in conflict with other policies. Mainly the problems were perceived to arise from the limitations presented by the 'professional client' initiative. The issue of how the people responsible for the BIM initiative perceived the limitations established by the 'professional client' initiative and how these could be circumvented was discussed at length at several meetings linked to the BIM implementation project and in following development of BIM related documents. Actors within the BIM-implementation project expressed that by limiting the demands to performance-based specifications; it was not possible for the BIM initiative to specify demands for BIM-centric work practices. Thus, in order for the new BIM guidance documents to be implemented, changes had to be made in the guidance documents. All demands for specific work practices were removed to be in line with the directives dictated by the 'professional client' initiative. Instead the documents focused on establishing incentives for projects' participants to work collaboratively with BIM. This was mainly achieved by demanding a 'coordinated information model' from the main contractor. The proposed model (or models) should include all project related information and should be made available at project meetings throughout the project. This demand was intended to incentivise the main contractor to lead the BIM implementation in their project, as it is expected to be simpler and cheaper to create such models when working collaboratively in the project coalition rather than create them before each meeting. Thus, the 'professional client' initiative directly influenced the actions taken in the BIM implementation. Among the individuals leading the BIM implementation these limitations were seen as problematic and hindering in the process of influencing the industry to change towards BIM-usage.

DISCUSSION

Public client organizations are widely discussed in terms of their role in supporting innovation in the construction industry. The specific client organization this paper builds upon has undertaken two initiatives to influence and stimulate innovation in the industry, initiatives following two different innovation strategies: 'supplier-led' and 'client-led' innovation.

The communicated purpose of the ‘professional client’ initiative is explicitly stated to increase competition, innovation and productivity by giving more responsibilities to their suppliers. The strategic efforts within the ‘professional client’ initiative, what we call a ‘supplier-led’ innovation strategy, is mainly through competition, more specifically through: emphasizing fixed-price commissions of consultants; giving more responsibility to contractors by promoting DB contracts, and; performance-based specifications. Bygballe and Ingemansson (2011) concluded that public policy in Sweden tend to view innovation as a being achieved through competition between single actors, mainly through the mechanisms of “push-and-pull”. Our results indicate that this view is prevalent at the STA, these results may not be so surprising since the studied client organization to a large extent is guided by the reports Bygballe and Ingemansson (2011) based their conclusions on.

The other studied innovation initiative, the ‘BIM’ initiative, was developed to increase efficiency and productivity, thereby sharing the same underlying rationale as the ‘professional client’ initiative. However, BIM is by itself an example of a systemic innovation (Cao *et al.*, 2017), and is understood to require changes among all actors linked to a construction project. The strategic efforts of implementing BIM, the ‘client-led’ innovation strategy, entails actions to directly influence industry actors to change towards BIM-centric work practices. These strategic implications of the ‘BIM’ initiative is directly in line with earlier research which has argued that clients can act as innovation facilitators by demanding innovation (Loosemore and Richard 2015) and support innovation (Gambatese and Hallowell 2011).

Findings suggest that the focus of giving more responsibility to suppliers in the contracts by using performance-based specifications in accordance to the ‘supplier-led’ innovation strategy was seen as problematic and even in conflict with the desired client role in the BIM implementation project. The ‘professional client’ initiative was perceived to weakened STA’s ability to dictate and demand the solutions they want in their contracts; thus, limiting efforts to implement BIM. BIM is described as a typical systemic innovation (Cao *et al.*, 2017), and the client's demands are argued as one of the most important aspects in implementation of BIM or other systemic innovations in construction projects (Azhar 2011; Smith 2014). Although the benefits of clients using performance-based specifications are lauded by researchers as a means to facilitate innovation (cf. Blayse and Manley 2004; Loosemore and Richard 2015; Rose and Manley 2014), our findings suggest that the dominant rationale of the STA to emphasize a ‘supplier-led’ innovation- rather than ‘client-led’ innovation strategy seemed to hamper effort to facilitate and drive complex innovations that BIM is an example of. Whereas researchers have emphasized clients' active involvement, commitment and leadership facilitates and may even drive innovation (Kulatunga *et al.*, 2011; Loosemore and Richard 2015; Nam and Tatum 1997), our findings suggest that such efforts are restricted in favour of the ‘supplier-led’ innovation strategy.

Findings from interviews with project managers suggest great individual variations in how and to what degree BIM is implemented in STA's project. One potential explanation is that the lack of clear demands in STA's guidelines to implement BIM has led to high degree of flexibility to individual client project managers to dictate the use of BIM in their projects. In a similar vein, Nam and Tatum (1997) suggest in their study of innovations in ten projects, that every observed account of innovation implementation seemed to be very dependent on individuals with competence and authority. However, as individual dependence certainly can create novel solutions and drive innovation, it may prevent the implementation throughout an organization.

Even though the motives behind the two initiatives are similar, improving efficiency and productivity in the construction industry, the actions taken to reach this objective is very different. The ‘professional client’ initiative is aiming to stimulate industry actors to propose and use innovative solutions in projects, innovations unknown to the STA. Whereas the BIM initiative takes its departure from a known innovation, which the STA wants industry actors to adopt. This difference has given rise to two separate client strategies for stimulating innovation and highlights two different roles client organizations can enact to stimulate innovation in transportation infrastructure. Findings suggest that the difference between the two innovation strategies has given rise to intra-organizational tension when they are applied simultaneously.

CONCLUSION

The two initiatives presented in this paper reveal two examples of how a public client organization has worked strategically to influence and stimulate innovation in the transportation infrastructure industry. The two strategies deployed by the client are either to: give more responsibilities to suppliers in order to enable suppliers to propose innovative solutions; or to demand the use of a specific innovation, thereby ensuring its use. The differences between the innovation strategies have led to organizational tension as it has been difficult to apply them simultaneously, especially when referring to the same innovation. However, the findings display how the two innovation strategies relate to very different types of innovations. Either the innovation is unknown and the innovation process is initiated by the supplier, or there is a specific, in the studied case a systemic innovation, which is requested by the client. Because of the difference in innovation sought, the strategies do not have to hinder each other. The ‘supplier-led’ innovation strategy can be applied in order to establish an environment where industry actors are able to find the best solution to the client's performance-based specifications, taking advantage of the fragmented nature of the construction industry and the competitive environment it brings; whereas in case of a ‘client-led’ innovation strategy, the client can influence the industry in a specific direction, enhance collaboration between actors to ensure change in a sought after direction. However, as the findings shows how ‘supplier-led’ innovation limits the actions in the ‘client-led’ innovation strategy, this paper argues for a more flexible approach towards the role of the client in stimulating innovation in transportation infrastructure and hence choice of innovation strategy. Instead of consistently choosing one, client organizations could make use of both innovation strategies depending on the type of innovation they seek to stimulate.

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