

PROJECT-BASED INNOVATION: PERSPECTIVE OF CONSTRUCTION ORGANIZATIONS

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ABSTRACT

Project-based organizations differ from ‘conventional’ organizations due to their engagement in unique, novel and transient work and delivering custom-made outputs to clients. While innovation with respect to ‘conventional’ organizations has been widely researched, there is limited research conducted on project-based organizations, especially at the project level. Construction represents a major project-based industry responsible for creating physical assets beneficial for humankind. As the organisers of construction projects, clients have a significant role to play to drive innovation in construction projects. Innovation at the project level is not researched much up to now and the paper fills this knowledge gap. Using scant research literature available on project level innovation and combining with other relevant innovation research, the paper examines the performance of innovation at the project level of construction organizations. An extensive literature review conducted on the subject has enabled identifying fundamental mechanisms that can be initiated by construction clients to foster innovation in construction projects at the execution level. These mechanisms are idea harnessing, relationship enhancement, incentivisation, and project team fitness. The purpose of this paper is to introduce and discuss these fundamental mechanisms and explain how they facilitate innovation. The study is aimed to supplement the relatively small body of knowledge on project level innovation in construction projects.

Key words: *innovation, project-based, construction, project-level, mechanisms*

INTRODUCTION

Project-based organization differs from the ‘conventional’ organization. Project-based organization focuses on the production and/or delivery side of a firm’s business, and is characterized by ‘the coexistence of a continuing organization structure, typically based on functional departments with a temporary organizational structure based on project teams’ (Barrett & Sexton, 2006). According to Keegan and Turner (2002), project based firms are engaged in unique, novel and transient work, delivering bespoke outputs to clients and working to customised specifications in both capital and new product development projects. All project based firms use teams, usually multi-disciplinary, to achieve their goals. Because no two projects are the same, project based firms deal with change as a matter of their daily commercial reality. Further, because they produce once-off offerings rather than commodities (project based firms do not mass produce and stockpile bridges, advertisements or hospitals), customer orientation is always a strategic concern (Keegan & Turner, 2002).

Project-based firms use projects to provide unique services to their clients. These services can be combinations of custom-designed products and related services. Examples are

engineering and construction companies, consultancies and system integrators (Blindenbach-Driessen & van den Ende, 2006).

Construction forms a significant portion of project-based industries. It is generally driven by single and unique projects, each creating and disbanding project teams (Barrett & Sexton, 2006). Horta et al. (2013) identified construction as a major industry worldwide accounting for a sizeable proportion of most countries gross domestic product (GDP). According to them, the global construction industry (CI) makes up approximately 9% of the world's GDP. This sector is the largest industrial employer in most countries, accounting to around 7% of the total employment worldwide (Horta et al., 2013). Construction industry can benefit much from innovation.

Although innovation in 'conventional' organizations has been widely researched, it is apparent that little research has been conducted on project-based organizations. Discussing firms operating in design, engineering and construction, Gann and Salter (2000) argued that they are not adequately addressed in the innovation literature. Keegan and Turner (2002) also stated that there remains a dearth of studies on innovation in project based firms. They singled out the main reason for this as project management is a relatively new area, which first came to in the 1950's (Keegan & Turner, 2002). This paper is an attempt to fill in the above knowledge gap and focuses on innovation with respect to the engineering construction industry.

BACKGROUND

Benefits of innovation

Innovation is highly beneficial to the construction industry. One benefit of innovation is its contribution to increase productivity. According to the Australian Innovation System Report published by the Australian Department of Innovation, Industry, Science and Research, there are a number of avenues to increase productivity but innovation is the most significant factor (DIISR, 2011). Gans & Stern (2003) confirmed this by stating that innovation can drive productivity improvement across all industrial sectors. In addition, there are a number of other benefits. In their research on construction industry innovation, Gambatese and Hallowell (2011) found decreased cost, competitive advantage, higher quality and increased productivity were the most highly rated benefits from innovations in construction projects. Furthermore, Dulaimi et al., (2005) showed that innovative practices could increase organizational effectiveness and bring long-term benefits to construction firms. Innovation also can result in increased organizational commitment and higher organizational motivation (Dulaimi et al., 2003); (Lu & Sexton, 2006). When considering all these factors, innovation is highly beneficial to the construction industry. However, quoting other researchers, Kulatunga et al. (2011) pointed out that the construction industry is lagging behind in innovation as compared to other industries.

Defining Innovation

Before commencing on the discussion, it is worthwhile defining innovation with respect to the construction industry. Barker (2001) defined innovation as the application of the new technology or process to a new product, service, or production or management process. However, the definition given by Slaughter (1998), which is "the actual use of a nontrivial change and improvement in a process, product or system that is novel to the

institution developing the change”, has been more popular in describing innovation related to the construction industry. In 2013, Ling provided a more comprehensive definition in the context of construction innovation. According to Ling (2003), innovation is “a new idea that is implemented in a construction project with the intention of deriving additional benefits although there might have been associated risks and uncertainties”. Ling’s definition refers to new design, technology, material component or construction method.

Innovation at the Project Level

According to Russell et al. (2006), innovation can occur at the project delivery level at one or more of the project stages/phases—design, construction, and operation and maintenance. Innovations appear to be ubiquitous in design and construction (Russell et al., 2006).

Explaining construction projects, Blayse & Manley (2003) said “many players are required to execute a construction project. They include the client, major contractor, subcontractors and suppliers. However, the most important role in a construction project is played by the client as the organiser of the project. Clients are commonly considered to have enormous capacity to exert influence on firms and individuals involved in construction in a manner that fosters innovation” (Blayse & Manley, 2003). In construction, it is well known that the owner is not a mere buyer of the end product: the owner is one of the key players before and during project execution (Nam & Tatum, 1997). Therefore, when looking at innovation in construction projects, it is important to look at the role of the client.

To facilitate innovation in a construction project, the client has to take a leadership role. Many researchers have commented on the role of the client in facilitating innovation in a construction project. For example, Nam and Tatum (1997) stated that a high level of owner involvement in the project, including risk sharing, commitment to innovation and leadership in project planning and execution, appear to be critical for the success of the innovation process. Kulatunga et al. (2011) supported this finding by stating that there is compelling evidence from other industries to confirm the influence that a client can exert on the generation of innovation. They further added that the position of client as the organiser of the project appear to influence the project environment by encouraging more integration among project participants (Kulatunga et al., 2011). This paper focuses on the actions that clients can undertake to enhance innovation at the project level of construction projects.

Knowledge Gap

With respect to innovation in the construction industry, there are two aspects to look at: innovation in firms engaging in the construction industry and innovation at the project level. Many researchers have looked at the innovation performance of construction firms. However, not much focus has been given to innovation at the project level (i.e. during the execution of a construction project, which involves phases such as planning, design and construction). This research focuses on innovation performance at the project level.

Even the few studies available on project level innovation concentrate mainly on general factors such as project size and complexity, market conditions, government policies and regulations, most of which are difficult for key players to change. Research on factors that could be influenced by key players, especially the client, is essential to promote innovation at the project level. This is because such factors can be easily applied when executing projects. After undertaking a considerable literature review involving over 100 journal papers, it is apparent that no research has been conducted comprehensively to study

actions that could be implemented by the client to enhance innovation performance at the execution level of construction projects. This leaves a knowledge gap to explore.

Key Objectives of the Study

The paper discusses the theoretical part of a major study undertaken to analyse the actions that clients can undertake to enhance innovation at the project level of construction projects. It covers the following:

- Categorising the actions of clients to enhance innovation.
- Describing these categories using findings from a literature review.
- Explaining the importance of these categories to enhance innovation.

The paper is based on a comprehensive literature review.

Categorising actions of Clients

There is abundant literature on the actions that clients can undertake to enhance innovation in workplace situations, some of which can be applied at the execution phase of construction projects. In addition, limited literature is available on actions of the client at the project level that facilitate innovation. An extensive literature review has enabled to collect these together and group them. This exercise has led to identify fundamental groups of actions or mechanisms that can be initiated by construction clients to foster innovation in construction projects without external interventions.

These mechanisms are:

- Idea harnessing (use of new and beneficial ideas)
- Relationship enhancement (employing actions to improve relationship between parties)
- Incentivisation (providing incentives/ rewards to promote innovative activities) and
- Project team fitness (deliberate actions taken at the project level to strengthen the project team and improving its capability to focus on innovative activities).

The word ‘mechanisms’ here refers to drivers or stimulants deliberately implemented in a construction project by the client (either by the client organization’s senior management directly or through the client’s project team) that facilitate the generation of innovative actions. They are explained in detail below together with their importance to enhance innovation at the execution level of construction projects. The first mechanism is idea harnessing.

Idea Harnessing

Idea harnessing is generating new and beneficial ideas and implementing them. It forms a core characteristic of innovation because innovation is the successful implementation of novel ideas (Shalley et al., 2004). Commenting on idea harnessing in her book on ‘Innovation and Ontologies: structuring the early stages of innovation management’, Angelika Bullinger (2008) stated that “an innovative idea marks the starting point of any innovative activity. It is the more or less vague perception of a combination of purpose and means, qualitatively different from existing forms. It might become a novel solution to a problem” (Bullinger, 2008). In construction projects, innovations generally happen within teams. For

teams to be innovative, team members need to generate creative ideas and must critically process them so as to discard those ideas that seem useless and implement those with promise (Somech, A. and Drach-Zahavy, 2013). Therefore, idea harnessing is extremely important to managing innovation.

In order to discuss harnessing of ideas, it is necessary to look at the sources of ideas. Scott and Bruce (1994) wrote "since the foundation of innovation is ideas, and it is people who develop, carry, react to, and modify ideas" (Scott & Bruce, 1994). With this context, it is interesting to explore how people could generate and develop ideas at the project level of a construction project.

Idea Generation

Literature identifies several ways of generating new and beneficial ideas in construction project. They are:

- Expose project team members to outsiders who have considerable background and experience: According to Núñez (2011), it has been shown that more new ideas are generated when people are exposed to others who do not belong to their cohesive group. Furthermore, those organizations that want to foster innovation should provide an environment where people from different backgrounds and experiences can interact and build on others' knowledge (Núñez, 2011).
- Seek ideas from others who are not directly involved with the project: In particular, involving knowledgeable people in a spectrum of relevant disciplines such as planning, designs, construction and maintenance is more advantageous than taking decisions by scholars specialized only in one area. External experts, in particular, can bring in many new ideas. Tatum (1989) highlighted the importance of this by saying that the early involvement of construction representatives is a vital part of a supportive context for innovation in construction projects.
- Engage suppliers earlier on in the process: Briscoe et al. (2004) highlighted the benefits of using strategies that involve suppliers earlier on in the process. The procurement models such as design and build, early contractor involvement and alliance contracts are developed along this concept. For example, purchasing and making use of the best ideas of unsuccessful contractors in design and construct contracts is one of the strategies in harnessing new ideas. There was particular enthusiasm, according to Briscoe et al. (2004), for the use of design and build contracts because information generation and control are the responsibility of the main contractor rather than the client. Due to the same reason, Rahman and Alhassan (2012) have identified early contractor involvement contracts (a form of contracts where the input of a contractor is sought at the early stage to develop the design to a point where it can be confidently estimated) as an innovative form of contracts, highlighting the importance of contractor's expertise, experience and understanding of the construction process and the consideration of build ability issues earlier in the design process.

There are other strategies as well to generate new and beneficial ideas when executing a construction project. Effective knowledge transfer through client actions such as sharing knowledge from completed projects, providing opportunities for industry and overseas practices exposure have the potential to enhance innovation.

Tools for Generating Ideas

Several tools can be used to generate ideas in construction projects. For example, Barker and Coy (2004) have identified a number of tools which can be used to generate new ideas, especially during the planning and design phases of construction projects. According to them, it is a disappointing reality that many people are aware of these tools and yet do not use them for the exploration of new ideas. These tools are:

- Brainstorming, which is based on the principle of free and associative thinking.
- ‘Thinking hats’ tool introduced by Edward de Bono to explore ideas from a range of perspectives by allowing participants to concentrate on one aspect of an issue at a time.
- Scenario planning, which involves speculation regarding the interplay and impact of a number of driving forces and generation of stories based on information. (Barker & Coy, 2004).

According to Tatum (1984), value engineering is one method that fosters innovative approaches, by offering a critical analysis of functional requirements for a facility and selection of the least-cost alternative that meets those requirements. This method opposes the engineer's tendency to routinely apply design standards and experience from previous projects rather than investigate innovative approaches with potential cost savings (Tatum, 1984). Researching on innovation diffusion process in Australian architectural and engineering design organizations, Panuwatwanich (2008), identified the following additional tools in relation to innovation in construction projects: value management; quality function deployment; constructability review; and life cycle costing.

Generating ideas is not sufficient - it is necessary to develop and implement them. This requires appointing a capable team, consisting of highly motivated and well-experienced team members. The idea generator should be a member, if not the leader, of this team. In addition, the team needs to be given encouragement and the support required. Once the team accomplishes its task, it needs to be recognised and appropriately rewarded.

The above provided a discussion on idea harnessing. The next mechanism is relationship enhancement.

Relationship Enhancement

Construction is considered largely as a “team” industry where many parties come together to complete a project. According to Li et al. (2000), construction projects rely on the integrated efforts of several hierarchically linked parties (including architects, engineers, surveyors, general contractors, subcontractors, suppliers, etc.) by using their differentiated skills, knowledge and technology. These parties are usually independent organizations with separate sets of objectives and goals, management styles and operating procedures. Due to the fragmented nature of the construction, problems such as communication and co-ordination are encountered frequently, which can affect the performance and productivity of projects (Li et al., 2000). As a result, adversarial behaviour is common between parties associated with construction projects. This was confirmed by Bower et al. (2002), who said “relationships in the construction industry are often adversarial with the parties resorting to contractual claims and litigation, which lengthen time scales and increase costs” (Bower et al., 2002). Research

conducted by Ling (2003) on Singaporean construction companies showed that an adversarial relationship between parties hinder innovation. Therefore, it is essential that there should be a cordial relationship among the parties dealing with the construction in order for innovation to flourish. According to Eriksson et al. (2007), successful innovation often requires effective cooperation, coordination and working relationships between the different parties in specific projects.

Relationship enhancement concerns employing actions to improve relationship between parties at the project level of a construction project. At the lowest end, relationship enhancement is removing adversarial behaviour between parties. At the high end, this means creating a shared vision, working towards common objectives, devising and using an agreed method of dispute resolution, active search for continuous improvement, working towards the betterment of the project, measuring progress and sharing gains, adopting a win: win philosophy and establishing a culture of trust, free and open communication, cooperation and collaboration and joint problem resolution. Benefits of relationship management include less paperwork and people feel their work to be more enjoyable. People are also more helpful, less destructive and more proactive (Cheung & Rowlinson, 2011).

Providing relationship enhancement is a responsibility of the client. According to Kulatunga (2011), a productive innovation process is a function of positive team work and positive client's own action. However, success of the team work is highly influenced by the client characteristics. The ability to initiate strong relationships among team members driving the whole team towards the innovative solutions is a championing behaviour of a client who is in pursuit of innovation. (Kulatunga et al., 2011). There are many ways that relationships could be enhanced in a construction project. However, one of the best ways to do this is to use special forms of contracts that facilitate enhanced relationship between parties.

Different forms of contracts have been formed in recent years to manage relationships between parties engaged in contracts. They fall into the category of relational contracting. According to Cheung and Rowlinson (2011), relationship contracting is based on recognition of and striving for mutual benefits and win-win scenarios through more cooperative relationships between the parties. Relationship contracting embraces and underpins various approaches, such as partnering, alliancing, joint venturing, and other collaborative working arrangements and equitable risk sharing mechanisms (Cheung & Rowlinson, 2011). Partnering and alliancing are the two forms of relationship contracting popular in the construction industry. It is worthwhile looking at these in some detail.

Partnering

Partnering is a relationship between parties in which:

- Trust and open communications are encouraged and expected from all
- Issues and problems are resolved promptly and at the lowest possible level
- Solutions are developed that strive to be agreeable and meet the needs of everyone involved (win-win approach)
- Common goals are identified for the project and
- All seek input from each other in an effort to find better solutions to the problems and issues at hand.

It is a process applied outside the contract (in most contracts) to align goals and objectives and to facilitate good communication, teamwork and joint problem solving. Quoting other literature, Li et al. (2000) explained the partnering process as follows: “Partnering is generally established through a structured, facilitated process that is designed to provide an environment, especially the use of workshops, for developing a co-operative atmosphere within the partnership. Essentially, a partnering process is a method systematically initializing, implementing and internalizing partnering concepts” (Li et al., 2000).

The partnering process is associated with the following tools and techniques:

- Charters and dispute resolution mechanisms
- Teambuilding exercises and facilitation workshops
- Continuous improvement processes
- Total quality management
- Business process mapping and
- Benchmarking. (Bresnen & Marshall, 2000)

Alliancing

Anvuur and Kumaraswamy (2007) described alliancing as follows: “Project alliancing is, probably best described as a deeper form of partnering, which contractually links the financial success of each of the parties directly to the overall success of the project. The alliance agreement is drawn up as an overarching legal agreement or constitutes the sole contract, which binds the parties to agreed targets, risk sharing, and reward mechanisms” (Anvuur & Kumaraswamy, 2007). Davis and Love (2011) identified an alliance as a form of innovative contracts and underlined the importance of collaboration and improved relationship in enhancing innovative outcomes.

If the client can use improved contract types, leadership qualities or other means to improve relationship between parties, it will contribute substantially to enhance innovative outcomes of the project. Therefore, relationship enhancement is a vital mechanism, which could be used by the client to facilitate innovation in a construction project. The next mechanism to be discussed is incentivisation.

Incentivisation

Incentivisation is the name given to the provision of incentives and/or rewards to enhance the motivation of those engaged in the project to work on innovative activities. It is not a new word. Previous researchers such as Ejohwomu and Hughes (2008), Bower et al. (2002) and Rose and Manley (2005) also have used this word in connection with innovation.

In construction projects, rewards can often be used to motivate the client’s team. According to Price (2002), rewards encourage team members to work harder and compete more effectively since they directly benefit from their efforts. Rewards also expose the organization’s priorities and show its commitment (Price 2002). Researching on the construction industry, Dulaimi et al. (2002) found that successful innovation may come about if companies establish a reward system to recognize innovators and to promote innovation. Commenting on the management of innovation in construction, Winch (1998) said “Business

life is complex and dynamic; humans have limited cognitive capability. They tend to focus upon those things that solve their most immediate problems and the only way to encourage innovation is to give it sufficient salience. Exhortation is not enough; the incentives which motivate actors in particular directions need to favour innovation. Thus the route to the successful management of attention is through the incentive structures that inform decision-making; the corollary is that if incentive structures do not favour innovation, then innovation is unlikely to take place.” He further said that the essence of incentive structures that favour innovation is the appropriation of the rewards of innovation by those that take the risks of innovation (Winch, 1998).

At the same time, incentives could be used often to motivate other parties engaged in the construction project, such as contractors. Discussing the use of incentives in construction contracts, Bower et al. (2002) commented that:

- The role of incentives is to motivate the contractor to adopt the client’s project objectives.
 - It creates a more proactive, cooperative relationship between the contracting parties and reinforces the cultural shift away from the traditional, adversarial approach to contracting.
 - The basic principle of incentive contracting is simply to take advantage of a contractor’s general objective to maximize his profits by giving him the opportunity to earn a greater profit if he performs the contract efficiently.

(Bower et al. 2002).

The above discussion shows the importance of incentivisation in construction projects. It used the two words “incentive” and “reward”, which are sometimes used in the wrong context. An incentive is a thing that motivates or encourages one to do something. A reward is a thing given in recognition of service, effort, or achievement, or a fair return for good behaviour. Incentives are offered before work starts and rewards are offered after the work is completed. The reward could be the prize that an employee receives as a result of offering the incentive. Therefore, the incentive could be viewed as a cause and the reward is an effect.

It is also to be noted that not all types of rewards equally promote innovation. Commenting on the types of rewards, Ahmed (1998) stated the following: “Rewarding individuals for their contribution to the organization is widely used by corporations. However, while recognition can take many forms there is a common distinction: rewards can be either extrinsic or intrinsic. Extrinsic rewards are things such as pay increases, bonuses and shares and stock options. Intrinsic rewards are those that are based on internal feelings of accomplishment by the recipient. For an example, being personally thanked by the CEO, or being recognised by the peer group, being awarded an award or trophy. Innovative companies appear to rely heavily on personalised intrinsic awards, both for individuals as well as groups. Less innovative companies tend to place almost exclusive emphasis on extrinsic awards. It appears that when individuals are motivated more by intrinsic desires than extrinsic desires then there is greater creative thought and action. Nevertheless, it has to be stated that extrinsic rewards have to be present at a base level in order to ensure that individuals are at least comfortable with their salary. Beyond the base salary thresholds it appears that innovation is primarily driven by self-esteem level rather than external monetary rewards. It appears that extrinsic rewards often yield only temporary compliance. Extrinsic

rewards promote competitive behaviours which disrupt workplace relationships, inhibit openness and learning, discourage risk-taking, and can effectively undermine interest in work itself. When extrinsic rewards are used, individuals tend to channel their energies in trying to get the extrinsic reward rather than unleash their creative potential” (Ahmed, 1998).

There are many ways that rewards/ incentives could be provided in construction contracts between parties working on the project. Looking at rewards/ incentives used in construction projects, Winch (1998) said “Incentives for innovation in construction cannot be improved without the development of a gain-sharing approach, where rewards are split between clients and the actors in the project coalition. The shift from competitive tendering to partnering provides one of the most important opportunities for moving towards such an approach. Those in a position to innovate need to be rewarded for taking such risks. If they are so rewarded, they will have incentives both to adopt new ideas from outside the firm, and to capture the learning from problem solving to propose better ways of doing things to the client” (Winch, 1998). Eriksson et al. (2007) added the following: “contracts can also be designed on a win-win basis to include incentives and rewards for all participants involved in innovation. This is important because innovation is facilitated if all firms are motivated and optimistic about sharing the potential benefits” (Eriksson et al., 2007).

Discussing incentives practiced in construction projects, Bower et al. (2002) said that cost incentives are generally thought of as a combination of an inducement and threat. However, with regard to promoting innovation, the use of threat is not conducive at all. It is also to be noted that mere provision of incentives in construction contracts may not contribute to enhanced performance with respect to innovation. Rose and Manley (2005) noted that if incentives are implemented in a project relationship that is plagued by underlying suspicions, the incentives are unlikely to induce a deep level of motivation and commitment, and could be seen as exploitation (a psychological response), causing their effectiveness to suffer significantly.

Having discussed incentivisation, the next mechanism is project team fitness.

Project Team Fitness

All the mechanisms discussed above may not work unless the client’s team is knowledgeable, motivated and have necessary resources and encouragement to engage in innovative activities. ‘Project team fitness’ concerns the deliberate actions that can be taken by the client to strengthen the project team and improving its capability to facilitate innovation. The term ‘fitness’ is used here to describe the possession of the ability by the team to focus on innovative activities.

The client actions for project team fitness can be broadly grouped into the following components:

- Create a capable project team by appointing suitable team members and develop the team to undertake activities to enhance innovation performance.
- Establish a strong supportive environment for the project team to undertake innovative activities.

Creating a capable project team

Creating a capable project team includes the following:

- Appointing a capable project manager by considering for leadership characteristics and for past innovation history.
- Appointing a capable project team by recruiting technically knowledgeable and experienced project team members from diverse backgrounds.
- Developing the project team by inculcating team innovative culture and developing it as a high-performing team.

The project manager is influential at the project level in driving innovation. Such a project manager capable of driving innovation should have special attributes. Dulaimi et al. (2005) pointed out that project managers need technical, administrative and social skills to effectively sell new ideas in the project. Kulatunga et al. (2011) wrote “It is evident that client’s personal characteristics such as competence, value judgment on innovation, foresight and vision towards innovation promotion, self-motivation, flexibility and receptiveness to change and receptiveness to risks had an empowering effect on the client’s roles thus influencing all aspects of innovation”.

In order to have strong team capable of facilitating innovation in construction projects, it is also necessary to form and build a capable team and creating a conducive environment. According to Somech, A. and Drach-Zahavy(2013), team composition has a powerful influence on innovation. Individuals who have access to a range of alternatives are more likely to make connections, use wider categorizations, and generate more divergent solutions, which could lead to higher team creativity. In addition, creativity can be fostered in the work group itself, through diversity in team members’ roles. Functionally heterogeneous teams assemble people from different disciplines and functions who have pertinent expertise in the proposed course of action. Assembling people with different organizational roles, who possess a broad array of skills, knowledge, and expertise, helps the team solve the complex task of developing new products or procedures. Team diversity triggers communication with members outside the team, which in turn leads to the incorporation of diverse kinds of information, broadens team members’ perspectives, and facilitates the generation of new approaches and ideas (Somech et al., 2013).

Many researchers have identified a number of characteristics in a team environment that contribute to innovation. They include creating a psychologically safe environment to expresses ideas freely and a cohesive environment where sharing of values exist. According to Barrett et al. (2013), a psychologically safe environment created by a more inclusive, socially cohesive group dynamic is more likely to promote creativity. Citing other researchers, Scott and Bruce (1994) suggested that: the cohesiveness of a work group determines the degree to which individuals believe that they can introduce ideas without personal censure, collaborative effort among peers is crucial to idea generation (Scott & Bruce, 1994). While emphasizing the importance of the cohesiveness and “sharedness” of a team towards innovation, Barrett et al. (2013) also stated that if opportunities for innovation are omitted from these shared values or receive low priority, then a group norm will have developed in which innovation does not form part of the accepted focus or task effort.

Another pre-requisite for innovation is an innovative team climate, which is identified as a predictor of innovation outcomes (Panuwatwanichet et al., 2008). Somech, A. and Drach-Zahavy(2013) emphasized that the success or failure of a work team depends greatly upon the

team's context or environment. The research undertaken by them showed that team creativity would translate to innovation implementation only under high levels of climate for innovation. A climate in which it is safe to speak up and take risks is suggested to complement the adaptation and implementation of innovation (Somechet al., 2013).

Risks are inherent in innovation as the purpose is to travel in uncharted waters. Barretet al. (2013) stated that project participants are more likely to take risks if they are part of a cohesive team which promotes psychological safety and adopts a shared value of risk acceptance.

The above discussion highlights the importance of innovative climate of the project team to engage in innovative activities, particularly focussing on the cohesiveness of a work group providing psychological safety and adopting a shared value of risk acceptance.

Supportive Environment for the Project Team

There are further actions that clients can take to make the project team stronger and more capable of engaging in innovative activities. One such action is to ensure adequate support is provided for innovative activities. Scott and Bruce (1994) stated that adequate supplies of such resources as equipment, facilities, and time are critical to innovation, and the supply of such resources is another manifestation of the organizational support for innovation (Scott & Bruce, 1994). Commenting on the subject, Somech, A. and Drach-Zahavy (2013) wrote "support for innovation means the expectation, approval, and practical support for attempts to introduce new and improved ways of doing things in the work environment. Support for innovation varies across teams to the extent that it is both articulated, by personnel documents, policy statements, or word of mouth, and enacted, by active promotion of innovative behaviour such as sufficient time for producing novel work in the domain or availability of training. Aside from the obvious practical support required to implement new products or methods, perceptions of the adequacy of resources may affect teammates psychologically by leading to beliefs about the intrinsic value of the projects they have undertaken, which in turn enhance their willingness to dedicate time, share resources, and cooperate in implementing their creative ideas" (Somech, A. and Drach-Zahavy, 2013).

It is obvious that the senior management of the project team and the client organization should be knowledgeable on and highly motivated to promote innovation, if adequate support and encouragement are to be provided to the project team. For example, Supervisors supportive of entrepreneurship and innovation can promote employees' feelings of self-determination and personal initiative at work, allowing employees to consider, develop, and ultimately contribute more creative outcomes (Palmer, 2005). Scott and Bruce (1994) stated that when managers expect subordinates to be innovative, the subordinates will perceive the managers as encouraging and facilitating their innovative effort. These behaviours will be seen as representative of their organizations at large, and therefore the organizations will be perceived as supportive of innovation (Scott & Bruce, 1994).

Parent organization

The task of promoting innovation is easier if the client organization, itself, is innovative. Research by Dulaimiet al. (2005) showed that construction organizations could foster innovation on projects by creating proper organizational climate. Tatum (1989) stated

“the firms producing construction innovations appeared to contain several common elements of an innovation culture. This included persistent pursuit of improved productivity, the arrogance to question everything and a pride in winning competition to find ways to improve”.

Quoting many others researching on architecture and engineering design firms, Panuwatwanichet al. (2008) emphasised the important role of the organization in the successful management and diffusion of innovation. They stated that even though an organization decided to adopt a particular innovation, such innovation is not likely to be fully utilised if the employees perceive no encouragement and support from the firm. It is easy to establish a strong supportive environment if the client organization, itself, is innovative. Such innovative organizations have the culture and climate conducive to innovation (Panuwatwanich et al, 2008).

FINDINGS AND DISCUSSION

This paper discussed innovation with respect to a project-based industry, construction. It introduced four fundamental mechanisms that clients of construction projects could focus on to reap benefits from innovation, i.e. idea harnessing, relationship enhancement, incentivisation, and project team fitness. They can be shown in a framework as given in figure 1.

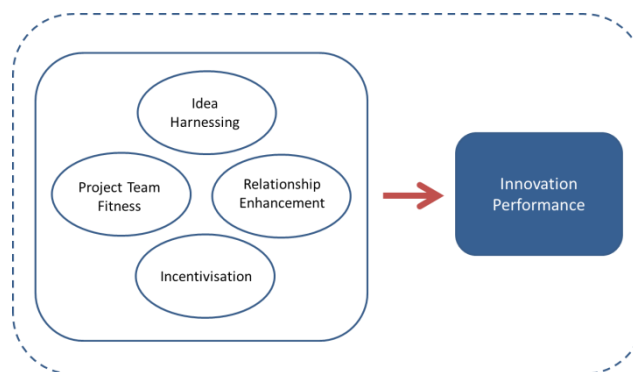


Figure 1 Framework showing innovation mechanisms

The importance of the mechanisms to promote innovative activities in construction projects was discussed identifying how they could be applied in executing projects. The tools and practices required to employ the mechanisms were also highlighted.

The mechanisms introduced differ from many innovation drivers discovered by other researchers as they do not depend on external conditions, such as market conditions and government intervention, for implementation. Therefore, they could be easily implemented by clients interested in enhancing project outcomes through innovation.

Salient findings from the paper are the following:

Construction innovation

- Productivity improvement is a major benefit for the construction industry achieved through innovation.

Ways of generating ideas

- Expose project team members to outsiders who have relevant background and experience.
- Engage suppliers earlier on in the process.
- Seek ideas from those who are not directly involved with the project.

Relationship enhancement

- Adversarial behaviour is common between parties associated with construction projects and it is necessary to remove this to promote innovation.
- Establishing a culture of trust, free and open communication, cooperation and collaboration and joint problem resolution promote innovation in construction projects.
- There are special forms of contracts that facilitate enhanced relationship between parties.
- Partnering and alliancing promote innovation in construction projects.

Incentivisation

- Rewards and incentives expose the organization's priorities and show its commitment towards innovation, which motivate team members to engage more in innovative activities.
- Not all types of rewards equally promote innovation. As compared to extrinsic rewards, intrinsic rewards promote innovation more.
- Rewards and incentives create a more proactive, cooperative relationship between the contracting parties.
- If incentives are implemented in a project relationship that is plagued by underlying suspicions, the incentives are unlikely to induce a deep level of motivation and commitment, and could be seen as exploitation.

Project team fitness

- A project manager capable of driving innovation should have special attributes.
- Innovative climate is important for the project team to engage in innovative activities, which provides the cohesiveness resulting in psychological safety and the ability to adopt a shared value of risk acceptance.
- The task of promoting innovation is easier if the client organization, itself, is innovative.

CONCLUSIONS

The paper covered the hitherto scant research area of project-level innovation with respect to construction projects. It was based on an extensive literature review, drawing relevant research on the actions that clients can undertake to enhance innovation in workplace situations and combining them with limited literature available on direct actions of the client at the project level.

Although the work presented in the paper consists of the initial findings of a large research project, it bridges a significant knowledge gap existed on the subject area. Further work on this research includes the development of a model to represent the mechanisms that facilitate innovation at the execution level of construction projects and validating the model.

Further work on the mechanisms introduced by this research has the potential to benefit construction related organizations, especially the client, contractor and designer organizations, due to cost savings through increased productivity. Increased benefits to stakeholders of construction projects are also likely as a result of enhanced project outcomes.

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