UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Master Degree Project in Knowledge-based Entrepreneurship

# Enhancing Innovation in Projects

A qualitative study on how the Swedish Transport Administration can enhance innovation during the time of a contract

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Enhancing Innovation in Projects.

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# ABSTRACT

The purpose of this study was to investigate how Trafikverket as the client can enhance innovation during the time of a contract. Trafikverket is a large client with a significant number of suppliers working for them in infrastructure projects. The project-based industry seems to be not as explored as the firm-level regarding the process of innovation. The aim of this paper was to further explore what factors that are important and can support innovation on a project-based level involving different actors, with Trafikverket as the client. Due to the role as a client, it is also of value to evaluate innovation due to incentives connected to innovation. To gather data, the first step was a single case study of an infrastructure project with innovation focus. Second, four interviews with contractor companies and six interviews with consultancy companies were performed. Third, to get a perspective from the client organization, a workshop with project managers from Trafikverket was conducted. Several factors which can be important to improve the process have been found such as an early involvement, knowledge management and project champions. Also the importance of creating a culture in which new ideas can be encouraged can be crucial. However, one significant barrier seems to be in the internal processes of the client, which can have a big impact on whether how many ideas that can be evaluated and implemented during the time of o contract. The final recommendation includes further work on how to minimize this barrier which can be crucial to enhance innovation during the time of a contract.

Key words: innovation, project-based innovation, Trafikverket, incremental innovation, innovation process, evaluating innovation, innovation management.

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# 1 INTRODUCTION

"*Innovation is the engine of change*" (Ahmed, 1998, p. 38). Governments promote innovation activities in both the public and private sector since innovation is acknowledged to be a key driver for economic growth (Aschoff & Sofka, 2009; Salter & Alexy, 2014). The Swedish government have high ambitions regarding productivity and increase the willingness of innovations in the public sector (Nilsson, Bergman, Mandell, Nyström, & Pyddoke, 2012).

The increased internationalization, new regulations, and the technological development provides the public sector with changes in capacity requirements and functionality. Procurements and regulations affect the innovation climate. It is important that public organizations contribute for an increase of development and innovation in the industry, to meet the demands of the society. (The ministry of Industry, 2004)

According to a report from the Swedish Government in 2008, it was assessed that the construction industry has low productivity, development and that the capability for innovation is weak (2008/09:35, 2008). There are according to Loosermore, 2015; Ozorhon, Oral & Demirkesen, 2015; Gambatese & Hallowell, 2011) widely stated that the construction industry has low innovation and development. However, it is also suggested that the construction sector is different to other industries such as the uniqueness of the construction projects as one example (Rundquist, Emmitt, Halila, Hjort, & Larsson, 2013). Loosermore (2015) suggest that there is misinformation by data and methodologies designed to measure innovation in the construction industry compared to other industries.

## 1.1 ORGANIZATIONAL INTRODUCTION

This thesis is performed on behalf of the Swedish Transport Administration which further on in this report will be called Trafikverket. Trafikverket is a governmental organization which is responsible for the long-term infrastructure planning for road and rail traffic in Sweden. They are also responsible for constructing and operating roads and railways (Trafikverket, 2016). According to a report from the Swedish Competition Authority (2014), the yearly amounts of public procurements in Sweden are among 600 – 800 Billion SEK which is approximately 16-22 percent of GDP. Trafikverket purchases goods and services for around 40 Billion SEK annually (Swedish National Audit Office, 2012).

## 1.2 BACKGROUND

As mentioned in the organizational introduction, there are high amounts of services purchased annually from Trafikverket. Therefore, Trafikverket is and will be referred as the client in this paper. This implies that there are significant numbers of suppliers working for them on contract in projects to construct or maintain roads and railways. One example is provided in chapter 4.1.1 where the background to an infrastructure project is introduced. The public procurement is a process in order for purchasing goods and services by public organizations which are regulated by law. According to Eriksson & Lind (2016) are procurement strategies important to guide the actors' behaviour that can affect the project performance. However, the focus of

this report is on how innovation can occur during the time of a contract, i.e. after the procurement is performed. Earlier studies within in the Swedish construction sector shows the importance of increased innovation through development in projects (Eriksson & Hane, 2014).

## 1.3 PURPOSE AND RESEARCH QUESTIONS

The purpose of this paper is to investigate how Trafikverket as the client can enhance innovation during the time of a contract. In order to do this, it is important to understand important factors in project processes that make innovation possible. Both external and internal sources have been considered to receive an overview upon the topic. Since it is a project-based industry, it is crucial to understand how innovation can be enhanced on a project level. Today, most literature about innovation is conducted on a firm level and there seem to be a lack of literature that investigates innovation on a project level, which also is mentioned by Ozorhon et al. (2015).

Furthermore, since 2014 a systematic method is used by Trafikverket to evaluate the suppliers in various areas, including innovation as one of them. An incentives and bonus model is also attached to this systematic method. Therefore, in order to enhance innovation, it is also of value to have a good evaluation of innovation, from the perspective as a client. The second objective of this paper is therefore to investigate how innovation can be evaluated in projects. Evaluation of innovation on a project level is also considered to be a complex task and is according to Loosermore (2015) one reason for why the construction industry is considered to have low development.

There is also another value of this paper. As explained in the organizational introduction, Trafikverket is a large client with many companies working for them in projects. The aim of this paper is therefore to provide recommendations on key findings on how Trafikverket as a client can stimulate to more innovation and development within projects. Both factors that might be a barrier for the process as well as support the process will be considered.

### 1.3.1 Research questions

- How can Trafikverket as the client enhance innovation during the time of a contract?
    - What factors can support the innovation process in construction projects?
    - What are the barriers to innovation?
    - How can innovation in projects be evaluated?

## 1.4 LIMITATIONS

This paper has a few limitations. First, the purpose of the paper is to investigate how innovation can be enhanced during the time of a contract. This implies that factors that relate to the procurements and other aspects that might take place before the contract not will be considered in this report. Second, several factors have been identified to be important to enhance innovation. However, no factor has been analysed in-depth. The findings and recommendations are based upon the findings from the literature and the empirical data. This implies that no factor has been tested in its relation to innovation. Third, only ten interviews have been performed due to time constraints of the thesis.

## 1.5 STRUCTURE OF REPORT

*The figure below shows the disposition of the thesis.*

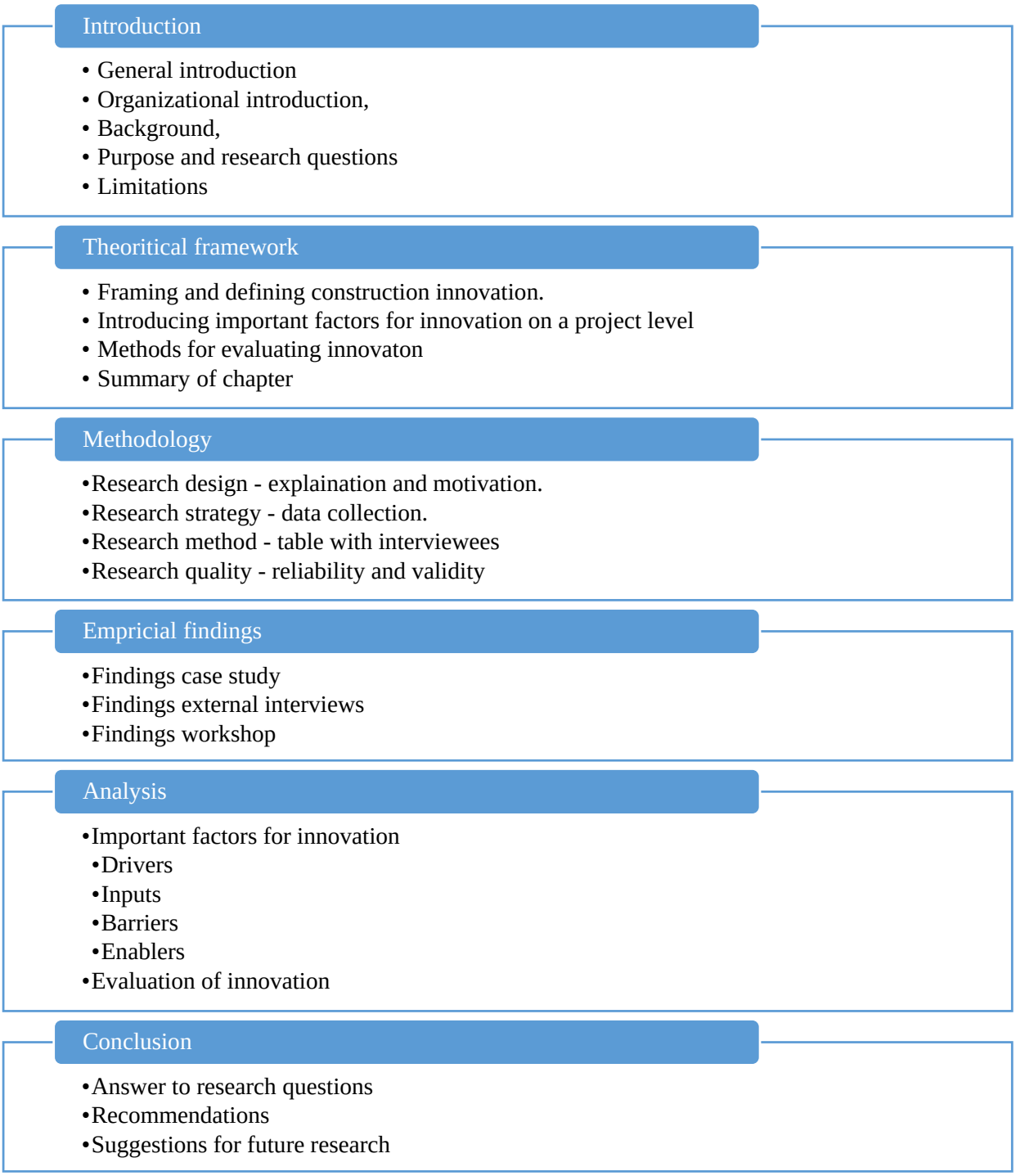


*Figure 1.5 Disposition of paper*

# 2 THEORETICAL FRAMEWORK

*This chapter will be divided into four different chapters. Chapter 2.1 briefly introduces a definition of innovation in the construction industry. Chapter 2.2 introduces factors which can create a basis to answer the first and second sub-question. Chapter 2.2.14 provides a summary of the chapter. The third part aims to create an understanding of how innovation can be evaluated and thus answer the third sub-question. Chapter 2.3.4 provides a summary. Chapter 2.2 and 2.3 together creates the foundation to answer the main research question: How can Trafikverket as the client enhance innovation during the time of a contract?*

## 2.1 DEFINITION OF INNOVATION

According to Adams, Bessant & Phelps (2006) does innovation both lack a single definition and measure. Russel, Tawiah & Zoysa (2006) state that innovation can be described in different ways regarding processes, products, technologies and organizational practices. Russel et al. (2006, p.1523) define innovation as: "*the use of advanced technologies, methodologies and creative concept that result in a positive incremental change in basic project performance metrics*. Slaughter (1998, p.1) defines innovation as "*Innovation 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*. According to (Blayse & Manley , 2004) is this definition from Slaughter (1998) a broadly accepted definition by participants and academics in construction. Gambatese & Hallowell (2011) suggests that a positive change after implementing a new idea is an innovation in the simplest form.

According to Loosermore (2015) is innovation in construction mostly about incremental improvements in services and products. A process or product innovation might be the mean through which the client´s objectives for a specific project can be achieved or for the company itself across different projects (Slaughter S. E., 2000). Ozorhon et al. (2014) define incremental innovation as a small change based on current knowledge and a radical innovation is a breakthrough innovation. When organizations invest in innovations it often addresses incremental improvements. These improvements can refer to day-to-day operations with lower risk in comparison to radical innovations (Dodgson, Gann & Phillips, 2014).

## 2.2 FACTORS FOR THE PROCESS OF CONSTRUCTION INNOVATION

*"Good quality is born from a good system"* (Akao & Mazur, 2003, p. 32)

Benefits on both a project and corporate level can be achieved with a more systematic management of innovation activities (Ozorhon, 2013). With a strategy related to innovation, an organization can decide the right things to do, and the innovation process helps to do things in the right way (Dodgson, Gann & Salter, 2008). According to Loosermore (2015), it is common that innovation late in arises due to a problem instead of looking for opportunities early with a different management approach.

There is much literature such as Russel et al (2006), Ozorhon et al. (2015), Ozorhon, (2013), and (Russel et al. 2006) that analyses drivers and barriers for innovation in the Construction industry. Ozorhon et al (2015) identified 38 factors that are related to innovation in the

construction industry. Russel et al (2006) identified 22 factors that can work as a driver or barrier for innovation in infrastructure projects. Ozorhon et al. (2014) present a framework (figure 2.2) visualizing the innovation process and its main components.

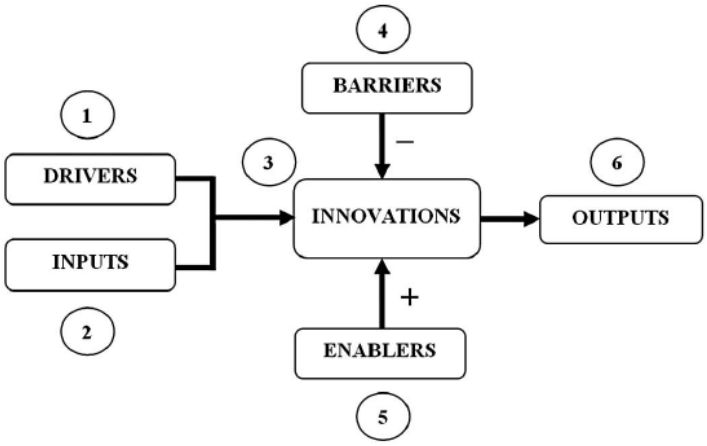


*Figure 2.2 - The innovation process (Ozorhon et al. 2014, p.258)*

Drivers are the main reason for investments in innovation (Ozorhon et al. 2015). Inputs refer to the resources, strategies and tools used in the process (Ozorhon et al 2014). A barrier is defined by Ozorhon et al (2015) as a problem or challenge in the innovation process. Enablers can be of value to minimize the challenges for innovation (Ozorhon et al. 2015). The outputs refer to the project level value (Ozorhon et al. 2014). Each component consists of several factors and how they contribute to innovation is determined by the project context as well as the procurement mode (Russel et al. 2006). Based upon this, the factors will in the following sub-chapters be presented and grouped into the different components in chapter five, analysis.

### 2.2.1 Project-specific factors

Innovation and projects are closely connected and projects can play a fundamental role as the engine for innovation (Davies, 2014). Project process tend to be temporary and unique while business processes are repetitive and ongoing (Gann & Salter, 2000). Since the work of construction firms often is unique, it makes them often innovate at the project level (Ozorhon, 2013). In a project-based production there are often broken learning and feedback loops in which the management of innovation can be complicated (Gann & Salter, 2000). Construction innovation is often developed in collaboration at the project level (Ozorhon, 2013). Davies (2014) state that projects have long been considered to be the essence of innovation and that project managers today must create innovation and also manage the plan in time, within budget and meeting the quality requirements. An analysis of innovation at the project level is essential in the construction sector (Ozorhon, 2013). Gann & Salter (2000) suggest that the learning and management of knowledge on a project level needed to be coordinated across different business units and project groups.

The type of the project determines whether innovations are suitable or not. A large-scale transportation project such as a tunnel, bridge or a road create a more variety of possible design solutions. Maximizing these design solution elements can generate in more equipment-intensive production processes that might lead to economies of scale. Furthermore, innovation

is influenced by the size and scope of the project. Complex projects can require expertize such as labour, equipment and material. Complexity can involve both technical skills in processes related to the construction process as well as the ability to finance the project. (Russel et al. 2006)

Russel et al. (2006) argues that the complexity of the project both can be a driver and a barrier for innovation. Barriers for innovation in complex projects can be factors such as lack of prior experience, established guidelines or standards. The driver for innovation in complex in complex projects is a necessity for novel solutions such as methods, techniques and concepts that can expand the boundaries of existing standards and guidelines. Also the uniqueness of the projects in construction and highly varying site conditions can reduce the opportunity for transferring knowledge between different projects. (Russel et al. 2006).

### 2.2.2 Client requirements

Briscoe et al (2004) in their study of the U.K construction industry shows that the client is a key driver to improve the performance or innovations. The client can have a significant role for innovation (Gambatese & Hallowell, 2011) including factors such as leadership, environment for innovation, financial incentives and risk minimisation (Brandon & Lu, 2008). According to Kulatunga, Kulatunga, Amaratunga & Haigh (2011) can the willingness of the client related to factors such as risk sharing, commitment and leadership be crucial for the process of innovation. Further, a demand from the client is one of the main drivers for innovation as well as motivate the team to engage in innovative activities (Kulatunga et al. 2011).

Loosermore (2015) in his study of construction firms from U.K and Australia, suggests that it appear that the firms are depending on the client to create an innovation and to have the ability if using their creative capabilities. However, the firms don't rely on the client (Loosermore, 2015). Ozorhon (2013) argues that the clients play a crucial role to create the right project conditions including understanding and communicating end user needs to the project team. Russel et al. (2006) suggest that if the client have too many requirements it can increase the risks of penalties connected to novel technologies and therefore be a barrier for innovation. Various factors that creates uncertainties can represent challenges for sustained and successful innovations (Tao, Probert & Phaal, 2010). It is hard to predict the future and therefore can innovation increase the uncertainty of the project objectives (Freeman and Soete 1997, referred in Davies, 2014).

### 2.2.3 Early involvement

Briscoe et al. (2004) found that an involvement of the suppliers in an early stage increased the chances for innovation. This was mainly due to an improved communication and a better understanding about the project objectives of the client. According to Ozorhon et al. (2015), early involvement can build up trust among the different parties in the project. According to (Meng & Humphreys, 2015) can early contractor involvement (ECI) be crucial for the project success in terms of cost and time performance. Further, in complex projects can ECI be even more important to the design process (Meng & Humphreys, 2015).

According to Adams et al. (2006) and Ahmed (1998), the early stages of the innovation process has been identified to be a fuzzy period. Koen et al. (2001) suggest that the fuzzy front end

includes factors such as idea generation, idea selection, concept development and opportunity identification.

### 2.2.4 Idea generation phase

The first step is the idea generation phase, the fuzzy front end (Ahmed, 1998). Here are ideas screened and the feasible ideas are proceeding to next stage (Ahmed, 1998). According to Gambatese & Hallowell (2011) is idea generation crucial for construction innovation. Paulus & Yang (2000) suggests that the idea process performed in the right way can be an important tool to improve the creativity and innovation within an organization.

Ideas for innovation in practice often emerge from different sources that requires diverse insights (Dodgson et al, 2014). High levels of organizational, technological and commercial integration are of importance to capture that diversity of insights (Dodgson et al. 2014) Adams et al. (2006) state that it doesn't cost too much to generate and screen ideas but it can have a big impact in the end. Further, according to Adams et al. (2006) there are often uncertainties in the evaluation and selecting of innovation projects.

### 2.2.5 Idea selection

According to Blayse & Manley (2004) there are a low number of firms in construction that has its own R&D department which means that it is crucial to have an effective implementation process of innovation. Factors such as absorptive capacity, champions, culture and knowledge are mentioned as important (Blayse & Manley, 2004). Further, according to Adams et al. (2006) is formal processes including tools and techniques important for organizations that will innovate. Frameworks such as the technological readiness level (TRM) and the stage-gate model can provide guidance for managing the development phase Tao et al. (2010). Adams et al. (2006) also suggest methods such as phased development; product and cycle-excellence; and total design for innovation project management. All these methodologies are based upon gates in which a decision to go/stop is needed. However, according to Adams et al. (2006) is the stage-gate model probably the most used of these.

Systematic processes are of importance to succeed in the development process (Cooper, Wiley.com, 2010). The stage-gate system can work as a guide to build in the best practices and make sure key activities and decisions are handled faster with better quality (Cooper, Wiley.com, 2010). The stage-gate model can be seen as a blueprint for the development phase (Cooper, 2008). A number of stages are involved in the process in which the project team does the work and analysis of it. Thereafter at the gate there will be a decision whether to kill or continue with the idea/project. It is crucial to define who the gatekeeper is and the criteria in order to proceed to next stage. Figure 2.2.5 below illustrates a new product launch, however, the model can according to Cooper (2008) be adjusted to organization, complexity and whether it is a product or process innovation.

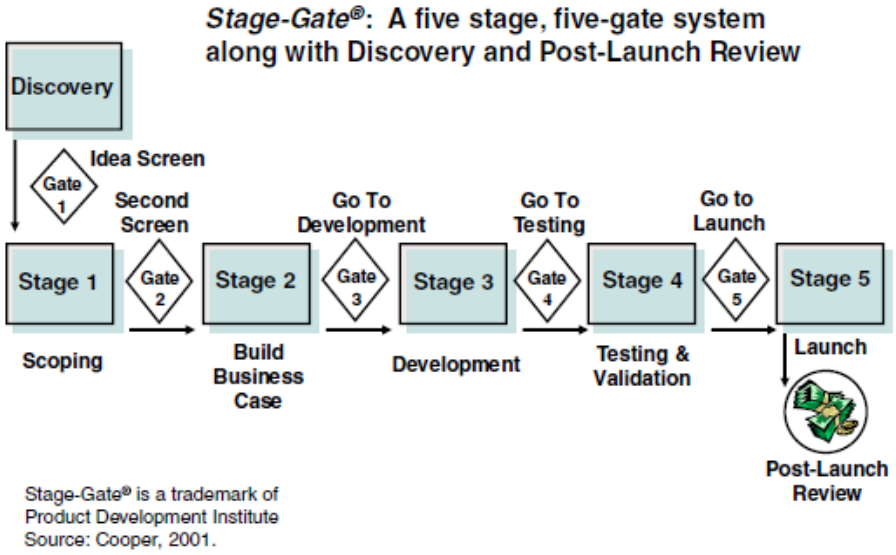


*Figure 2.2.5 - Stage-Gate™ Model (Cooper, 2008, p.215)*

An ideation stage is the beginning of the phase and is then followed by some steps and last a post-launch review. In order to proceed with the idea, it should pass the different stages based on pre-set of required criteria at each stage. At every stage, the purpose is to receive information to lower the uncertainties and risks for the project. Further, the activities in each stage are done in parallel. The model can be seen as a map to get from A to B. (Cooper, 2008)

In order to evaluate the ideas at the different gates a scorecard can be used based on key criteria for the function of the end solution/product. These scorecards and criteria can be different from project to project. One of the greatest challenges according to Cooper (2008) is to make the gates work. However, the model fits projects with different complexity and if there is a process development or a product development there might be different versions of the stage-gate model needed.

The dynamic process of organising construction innovation needs to be adjusted due to the different stages of the project (Loosermore, 2015). The innovation process is often iterative and run in parallel (Ahmed, 1998). Kulatunga et al. (2011) found in their case study that support from a technical division had direct influence on the project success. It allowed the project managers with speed to communicate with the relevant people.

### 2.2.6 Culture

To enhance innovation, it is crucial to have a culture that encourages the generation and acceptance of new ideas (Gambatese & Hallowell, 2011). The culture is a system in which people communicate and interact which has impact for the producing groups (Phillips, 2014). Dodgson et al (2008) argues that the challenge is to create a culture in which innovation can flourish as well as to create a culture that benefits of well-managed, systematic and routine operations. Adams et al (2006) state that a shared vision can enhance the culture which can lead to a more focused development and idea assessment.

According to Aronson & Lechler (2009) can an innovation or learning culture often include risk taking and an openness to new ideas. Loosermore (2015) suggest that it is important for

leaders to encourage project members to bring new ideas in confidence and to have a culture that embraces tolerance, transparency, trust and openness. In a project, culture can be referred to the social and cognitive environment, collective beliefs, value systems and the view of reality in the behaviour of the team members (Aronson & Lechler, 2009). Blayse & Manley (2004) suggest three characteristics for an innovation culture to be favourable for innovations. First, new ways of working should not be penalized if they don't work. Second, an open climate where individuals can question how things are working without fear of penalty. Third, a better understanding of each other´s goals and an openness to new ideas is important to enhance probability of an innovation culture within the project.

Schein (1992) referred in (Phillips, 2014 p.487) describes three levels of culture. The first level refers to strong unconscious beliefs that are taken for granted among the employees in an organization. The seconds level refers to the values of the organization. The third level includes processes, structures and language. Schein 1992 referred in Phillips 2014). To be innovative requires a culture and climate that makes it possible for organizational members to strive for innovation and creativity (Ahmed, 1998). If innovation will be accepted or rejected within an organization can be determined by the organizational culture (Phillips, 2014). Just deciding that an organization should be innovative is not enough, actions that create an innovation-friendly environment must back up that decision (Ahmed, 1998). Dougherty & Hardy (1996) found that innovation can occur in a system, but not necessarily because of the system". Use of systems and tools are important to support the innovation process (Adams et al. 2006; Cooper, 2008). Leaders should aim to create an environment in which it is able to create innovations, instead of just focusing to come up with the next great innovation (Ahmed, 1998). Even perfect innovations have trouble in an unfavourable organizational environment. (Phillips, 2014). According to (Phillips, 2014), research shows that the organizational context plays a crucial role whether the innovations will be successful or not.

Ahmed (1998) argues that the most innovative companies in the future will be those who manage to create a culture and climate in which the members can strive towards innovation. Gann & Salter (2000) argues that the winning construction firms are those that can adept cultural changes while maintaining its skills in technology and engineering. Ozorhon (2013) also suggest that an unsupportive organizational culture towards change is one of the main barriers of innovation in the construction industry.

### 2.2.7 Cooperation

In the construction industry, innovation is shaped due to the project requirements and is co-created in an environment involving several actors (Ozorhon et al. 2013). According to Dodgson (2014), most organizations need to cooperate in some form to innovate. Infrastructure projects may be performed by several firms and involve various stakeholders such as governments, end users and developers (Russel et al. 2006). According to the study by Ozorhon (2013) are external sources essential for idea generation and development. Innovations are developed by the individuals working in the project (Loosermore, 2015).

*"Production processes and their output in terms of constructed products are performed in inter-organizational project-based relationships in which clients and their suppliers (e.g. contractors and their subcontractors together create sustainable value"* (Eriksson & Lind, 2016, p. 8).

According to Ozorhon (2013) has much of the literature on innovation processes being concentrated on the firm level. Innovation can also be seen as an outcome of an interactive process between the firm and its environment. The interaction can be between a wide variety of internal and external actors (Mention, 2011). Gann & Salter (2010) state that the variety of capabilities a firm need is rarely to be found within one single enterprise. Mention (2011) suggests that co-operation can be considered as an innovation stimulus and is expected to bring benefits like accessing complementary knowledge or reducing uncertainty. Other project participants such as consultants, suppliers, contractors, subcontractors, clients and designers have a co-developing role in the innovation process (Ozorhon, 2013). Gann and Salter (2000) argues that firms need to manage uncertainty within networks of interdependent suppliers. Further, Schilling (2013) also suggests that a significant amount of innovations emerges from multiple individuals or organizations. Collaboration can benefit in lower cost, risk and a higher pace to achieve the goals (Schilling, 2013). Gambatese and Hallowell (2011) argue that inter-organizational management is crucial to reach success in construction projects.

Change can according to Dodgson et al (2008) often need collaboration and networking within an organization. Dodgson et al (2008) argues that involvement of larger number of actors can make the innovation process even more complex. One reason for this complexity is the need of a good network and team composition to secure the knowledge for the innovation process.

### 2.2.8 Teams

Much of the literature has identified teamwork to be an important factor for success in innovation projects (Hoegl & Gemuended, 2001). Penrose (1995) argues that there are the services that the resources can perform in a production process that is important, not the resources themselves. The organisation is an important factor that affects the innovation process (Tao et al. 2010). According to Dodgson et al (2008), there are often more opportunities for innovation than resources available. In order to reach effective operations qualified staff and special resources are critical (Ozorhon et al. 2015; Russel et al 2006; Slaughter, 1998). Russel et al (2006) suggest that the ability to drive innovation in a project can be related to its previous experience of the project group and especially to innovation projects. A specific form of the project organization can be needed when innovation is related to uncertainty (Davies, 2014). Personality traits and characteristics of the individuals that works in the project is crucial to reach project innovation (Russel et al (2006). Furthermore, Russel et al. (2006) state that it is crucial that the project objectives are in line with the motivation of the team.

### 2.2.9 Leadership

*"If a leader can influence his or her followers so that desired organizational goals are met, then there is no reason why those goals can´t be related to innovation"* (Phillips, 2014, p. 489).

According to Ozorhon et al. (2014) is leadership is one of the main enablers for innovation. Nam & Tatum (1997) argues that effective leadership and technological competence is crucial for construction innovation. Loosermore (2015) state that leadership is crucial to attract new ideas. With innovation leadership means adoption and integration of new practices in a community (Denning & Dunham, 2010). To shape the motivation, the leadership plays a crucial role (Ozorhon et al. 2015). The leaders also play a crucial role to create a culture of

tolerance, transparency, trust, openness and to give individuals the confidence to take calculated risks (Loosermore, 2015)

The management and mobilization of a variety of capabilities is of importance when constructing complex products and systems (Gann & Salter, 2000). In order to reach a supportive and effective innovation process it is of importance to integrate different skill sets and professions (Dodgson et al. 2014).

### 2.2.10 Project champions

To foster innovations, experienced managers that can act as innovation champions is crucial (Ozorhon et al. 2015; Blindenbach-Driessen & Ende, (2006). Also Russel et al (2006) suggests that the project team should include innovation champions and make it possible for innovation to arrive from several sources. A project champion is a senior member with power and authority to support and fight for a project (Schilling, 2013). Also the communication and cooperation between different functional groups involved in the development process can be encouraged with a senior project champion (Schilling, 2013). In their study of US construction companies, Gambatese & Hallowell (2011) found that including a champion was the factor with the most impact for the innovation process. However, worth to mention that the sample of this study was small.

### 2.2.11 Knowledge management

In order for organizations to create improvements and innovations, the management of knowledge is a crucial aspect (Kamara et al. 2002). Ribeiro (2009) state that when people communicate and share best practices, learnings, experiences and insights, then the project performance can become better. It is also suggested that this learning and exchange of knowledge across organizational units can lead to strategic benefits (Ribeiro, 2009). Ribeiro (2009) also argues that in the construction industry which is project-based, then the knowledge created by the individuals are crucial in order for improvements. According to Ozorhon (2014) is the sharing of knowledge crucial to implement innovation. In their case study they found that the sharing of knowledge in an efficient way was crucial to bring new ideas and its implementation. This is both due to bring the right ideas into a project but also ensure that these ideas are communicated to everyone in the project team as well as future projects. Adams et al. (2006) also mentions the absorptive capacity as an important factor. Absorptive capacity means the ability to bring in new knowledge and use it (Adams et al. 2006).

### 2.2.12 Time constraints

Often there are pressure in the delivery of construction projects within time and budget constraints which is a barrier for the introduction of new ideas (Ozorhon et al 2015). Time can be both a driver and barrier for innovation due to the project delivery phase (Russel et al 2006). Further, Russel et al. (2006) in their study observed that it is important to identify which constraints that can be challenged and thus changed or removed. Time frames are one important factor that determines the likelihood for an extended innovation process (Russel et al. 2006).

### 2.2.13 Reward schemes / Incentives

The Cambridge dictionary defines incentive as; *"something that encourages a person to do something"* (CambridgeDictionaries, 2016). Monetary rewards are the most common incentives but they can also be nonfinancial (Kadefors & Badenfelt, 2009).

The use of incentives in construction projects can be seen as an important way of collaborate in the short term and build trust in the long term (Bresnen & Marshall, 2000). Financial incentives are often considered to be essential to create common goals and collaboration in construction projects (Kadefors & Badenfelt, 2009). Pesämaa et al (2009) suggests that an incentive-based compensation can increase the likelihood of increased cooperation and successful problem solving. According to Loosermore (2015) can incentives encourage innovation and it is important to have common metrics to measure the performance.

Kadefors & Badenfelt (2009) identified three roles of financial incentives in the relationship among different organizations. First, incentives can be a source of extrinsic motivation which means that the power to directly influence the motivation of an organization is in focus. One risk with this approach is that the involved actors can be rewarded for behaviour which does not fully reflect the organisational goals. Second, symbolic roles of incentives refer to symbolic roles such as trust, collaboration and intrinsic motivation. Depending on the underlying reasons behind the incentive this might be enhanced or hampered. The third role relates to incentives as process generators on organizational processes. Performance assessment can generate communication processes in which the knowledge can be exchanged. If the communication perceives as controlling, negative effects can occur. In their interviews with Swedish contractors, Kadefors & Badenfelt (2009) state the most important process effect that was mentioned was transparency to gain trust and collaboration. Further, the interviews in their research argued that it was highly dependent on the client's attitude and management strategy (Kadefors & Badenfelt, 2009).

According to Pesämaa et al. (2009) should cost reductions due to an innovative design solution be shared among the partner often on the total project cost. Further, they argue that to encourage team work and innovation, then the incentives should be based upon the performance of the team. In the case study by Ozorhon et al. (2014) the contractor introduced a scheme called "innovator of the month" with the purpose to reward individuals with excellent contributions. Ozorhon et al. (2014) suggest that measurement systems for innovation is one important tool for enabling innovation.

### 2.2.14 Summary of chapter 2.2

This chapter have introduced several factors identified as important to enhance innovation in construction projects. They are summarized in figure 2.2.14. However, during the literature review it seemed like most of the literature on innovation is conducted on a firm level which also is supported by Ozorhon et al. (2015) and Russel et al. (2006).

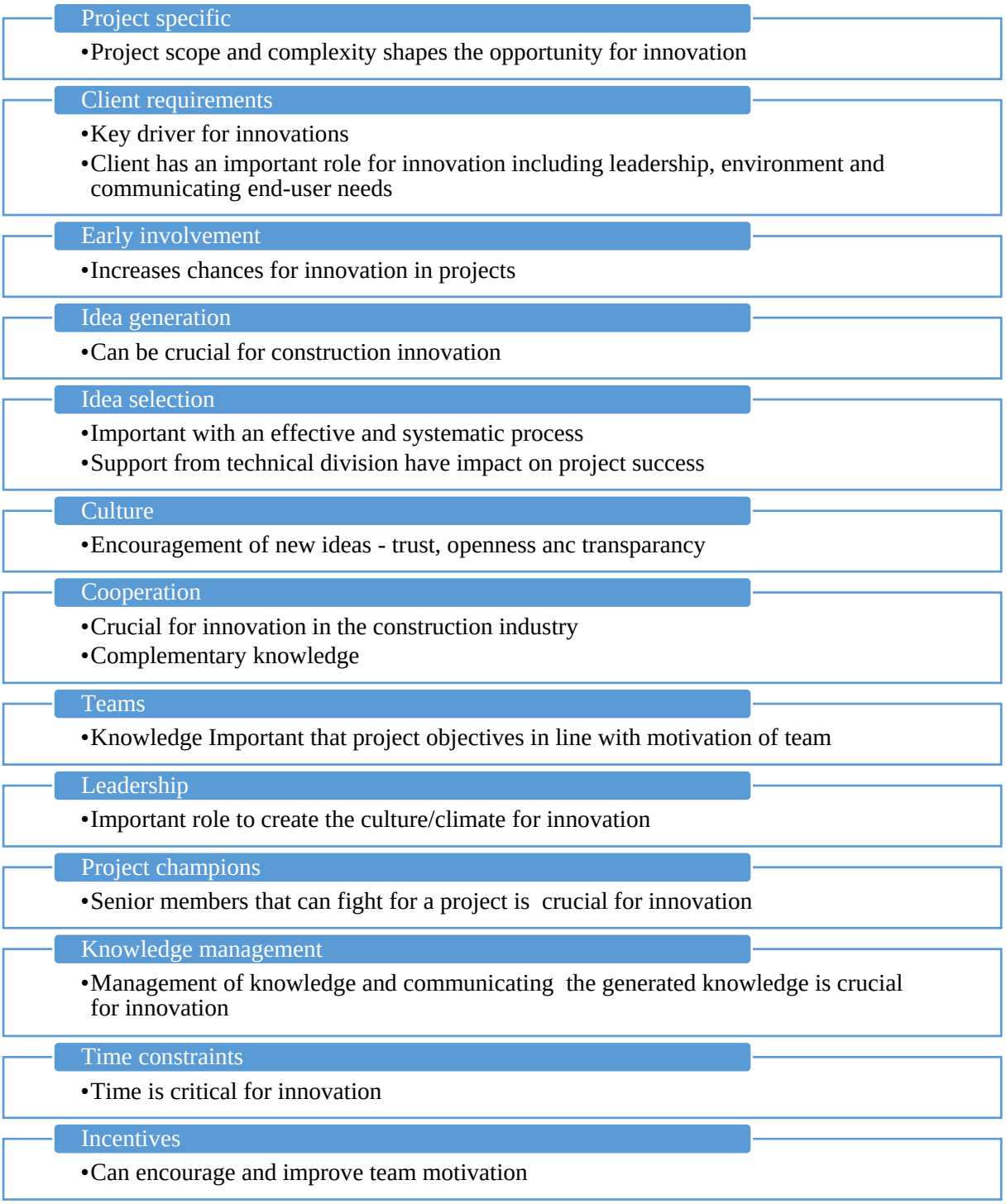


*Figure 2.2.14 - Summary theoretical framework*

## 2.3 EVALUATION OF INNOVATION

A common saying is that one needs to measure the things that needs to be increased or improved (Denning & Dunham, 2010). It is also suggested by Davila, Epstein & Shelton (2006) that an innovation measurement system that is not designed in the right way can do more harm than good. Smith (2009) state that the comparisons of the measurements should be in quantitative terms. To determine the innovation performance of a firm, a crucial factor is the measurement (Ozorhon et al. 2015). Further, the management of innovation performance is considered to be a complex process with high uncertainty (Janssen, Moeller & Schlaefke 2011) and it is complicated to measure the outcomes (Ozorhon et al. 2015). Russel et al. (2006) argues that it is important to assess the factors related to innovation on the specific project context. Further, Russel et al (2006) state that it is impossible to conduct an analysis that fits all project types and contexts. Gambatese & Hallowell (2011) found that there are many organizational factors that impacts innovation on a project level. Toole, Hallowell & Chinowsky (2013) state that the practical application of metrics found in existing literature is limited. Furthermore, according to Loosermore (2015) is much innovation unnoticed in the construction industry due to the fact that most innovations are incremental and not generated in a laboratory.

### 2.3.1 Criteria for evaluating innovation

The oxford dictionary defines criteria as; "*a principle or standard by which something may be judged or decided* (Oxforddictionaries, 2016). Ozorhon (2013) argues that the innovation performance should be evaluated based on innovation objectives and don't limit the performance to standard project management performance criteria.

When evaluating a project, a first step is to compare the expectations with the actual outcomes (Slaughter, 2000). There are a wide variety of stakeholders in infrastructure projects in which metrics such as safety, durability and environmental impact playing a role in the measurement of the benefits of innovative solutions (Russel et al. 2006). It is also suggested by Ozorhon (2013) that if the innovation is connected to for example environment, then measures such as reduction in waste, energy consumption and carbon emission should be considered. Furthermore, Smith (2009) argues that technical measurements are only seldom valuable across products. The criteria involved in early evaluation of the project should be reviewed and updated based upon the experience with the innovation (Slaughter, 2000).

### 2.3.2 Innovation metrics

In previous literature, there are according to Janssen et al. (2011) suggested that innovation metrics should be implemented as part of a systematic innovation management framework. The purpose is to provide relevant information to decision makers as well as to identify key success factors within the innovation process. Janssen et al (2011) presents a framework in which can assist managers in evaluating and designing innovation metrics as well as deciding whether these metrics have potential value for the development process. The framework consists of four different layers; the context, the capturing, coupling and fourth, the control and knowledge generated by previous layers.

The first layer (context) involves internal and external factors that influences the organizational processes. The second layer consists of capturing performance drivers within the input, process,

output and outcome categories. It is suggested that the criteria for evaluating innovation should be considered at this point. The third layer is coupling the different performance drivers in order to identify relationships about important factors for the specific project. The fourth layer consists of knowledge acquired from the previous layers in form of actions and create the ability of adjust the design of the measurement system. The drivers of performance need to be revised regularly by stimulating continuous learning which also can be used for testing different scenarios. However, below will factors from the second layer, capturing performance drivers be introduced.

#### *2.3.2.1 Input*

Input metrics measure the resources provided such as ideas, people, funds, equipment and time (Jansen et al. 2011), (Davila et al. 2006), (Ozorhon et al. 2014). Adams et al. (2006) also argues that the education, skills and experience relates to the input of people. Further, Davila et al. (2006) state that intangibles such as motivation and culture are important. Equipment and personnel are often among the factors with high costs in new-product development and can be measured through both quantitative and qualitative metrics. How efficient the inputs are used is more important than its quantity (Jansen et al. 2011).

#### *2.3.2.2 Process metrics*

Process metrics measure the current activities towards the creation of innovation outputs (Davila et al. 2006). Also the project execution related to time, cost, and quality objectives (Jansen et al. 2011), (Davila et al. 2006). Process metrics can also give learning to future projects (Janssen et al. 2011; Werner & Souder, (1997). Deviations in the innovations process can be identified while measuring the process (Janssen et al. 2011). During the time of a project can process measures be crucial due to that they can signal the need of change (Davila et al. 2006).

Adams et al. 2006) argues that is should be possible to measure the accumulated knowledge during a project. One example of measurement could be number of feasible ideas during the project. Information flows are important to allow the development of new ideas during a project (Adams et al. 2006). Davila (2006) state that innovation relies on communication and exchange of ideas among different individuals and it is important to facilitate the ongoing discussion. To measure the effectiveness of for example a brain storming session, can give the organization an understanding whether sufficient resources are provided or not.

#### *2.3.2.3 Output metrics*

According to Davila et al. (2006) is output the result of what the innovation efforts have delivered. Output metrics can be absolute such as new innovations implemented or relative such as new ideas as a whole (Janssen et al (2011). Gambatese & Hallowell (2011) suggests that comparing the design of a project with the traditional way can be a direct way to measure innovation. By comparing the present state with a previous state can determine whether a change has occurred and if the change is due to a new idea or concept then it could be considered innovation. In their case study of an award winning project in U.K, Ozorhon et al. (2014) also suggests that comparing two similar phases regarding size and type can be a way to measure innovation. In the case study, the comparison was between a traditional method and the other

based on lean construction which lead to an understanding about the changes in various factors such as project duration, community impact, waste, safety in working environment, costs and quality. Outcome describes value creation. Davila et al. (2006) argues that one way to measure this is to compare the life cycle value and compare it with applicable projects.

### 2.3.3 Summary chapter 2.3

*Gambatese & Hallowell (2011) argues that key steps to manage innovation is to understand the innovation process and how it can be measured. Table 2.3.3 summarized criteria found in the literature to evaluate innovation. It shows both input, process and output criteria.*

| Category | Criteria | Source |
|---|---|---|
| **Input** | Tangible resources for innovation activities (financing, human resources, physical resources) | (Jansen et al. 2011), Adams et al (2006), (Ozorhon et al. 2014) |
| **Input** | Intangible resources: motivation, culture, knowledge | (Davila et al. 2006) |
| **Input** | Generating of new ideas | Adams et al (2006)<br>(Davila et al. 2006) |
| **Process** | Knowledge management, absorptive capacity, information flows, new ideas | (Adams et al. 2006)<br>Gambatese & Hallowell, 2011) |
| **Process** | Extent of open communication channels | (Gambatese & Hallowell 2011) |
| **Process** | Feasible new ideas generated and tested | (Gambatese & Hallowell 2011) |
| **Process** | Speed in which the new ideas are diffused | (Gambatese & Hallowell 2011) |
| **Output** | Impact on cost, time, quality, safe working environment | (Gambatese & Hallowell 2011), (Ozorhon et al. 2014) |
| **Output** | Environmental impact, durability, safety, impact on local community, | (Russel et al. 2006), (Ozorhon, 2013) |
| **Output** | Change as a result of the implementation of new idea during the project | (Gambatese & Hallowell 2011), (Jansen et al, 2011) |
| **Outcome** | Project profitability | (Davila et al. 2006) |

*Table 2.3.3 - Evaluation criteria*

# 3 METHODOLOGY

*This chapter will explain the methodology used for answering the research questions. It aims to motivate why this methodology is suitable and how it has been conducted in an accurate way.*

## 3.1 RESEARCH DESIGN

In order to answer the research questions for this paper, the study was divided into four different parts; literature review, study of an innovation project, interviews with external companies and a workshop with project managers that works for Trafikverket.

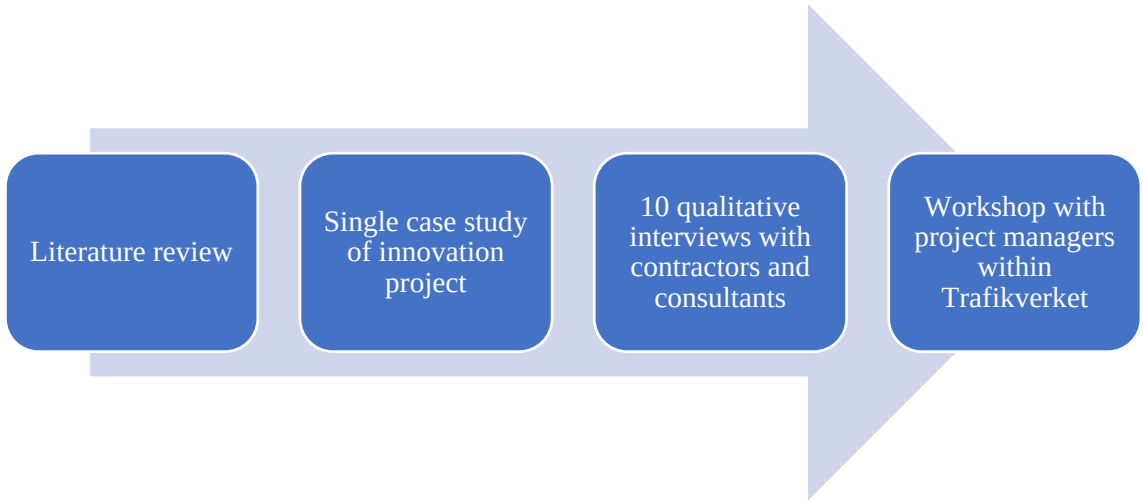


*Figure 3.1 Research design*

### 3.1.1 Literature review

The first part of the study contained of a literature review of the research and theory within the area of the research questions. The aim has been to find literature within construction innovation because the firms that perform projects to Trafikverket are in the construction industry. Literature in innovation management have also been used as a complement. Further, there seem to be lacking in literature that investigates the process of innovation in construction projects on a project-level. Therefore, a combination of literature has been used for this paper with the purpose to understand innovation and how the innovation process can be enhanced. There are factors identified by different authors that can act as drivers, barriers and enablers for innovation in the construction industry. The interview guidelines were shaped by the first part of literature review. However, due to the constraints and limitations of the scope of this paper, the factors used has been those relevant to the research question as well as communicated in the interviews.

### 3.1.2 Single case study of innovation project

The second part consisted of a single case study of an innovation project with Trafikverket as the client. Further in the text, this project will be named as project X. This project is currently in progress and focuses on the innovation process and how the result can be optimized. Therefore, the purpose was to understand the practical implications and learn about what factors that can enhance the innovation process in projects. This was of value for the first research question. The case study also gave insights for the third question on whether how innovation

can be evaluated. However, since the project is currently in progress, no significant conclusions can be drawn about evaluation in this stage since the outcome is unknown.

A qualitative interview with the project manager of Trafikverket was performed as well as with the project manager from the consultancy firm. This knowledge was also important to the researcher of this paper when constructing the interview guideline for the interviews with the external companies.

### 3.1.3 Qualitative interviews with external companies

The third part contained of qualitative interviews with external companies. A list of respondents and how they were chosen can be read in chapter (3.3.1). Trafikverket is the client and want to enhance innovation during the time of a contract. In order to do this, it is important to get a viewpoint from the companies that are working for Trafikverket. Therefore, was ten interviews conducted with external companies. The purpose was to understand factors that can drive, support and be a barrier for innovation to answer the first and second sub-questions including factors that can support the process and what factors that are barriers for innovation. Further, the aim was also to gain understanding of how innovation can be evaluated which is connected to the second sub-question: *How can innovation in projects be evaluated?* At last, the purpose with these interviews was also to understand what is working and not working today to provide recommendations to Trafikverket. The interview guideline was as mentioned earlier based on the findings from the literature review as well as the single case study.

### 3.1.4 Workshop project managers of Trafikverket

The fourth part took form of a workshop with seven project managers within Trafikverket. When referring to this workshop in the analysis and conclusion, it will be named as workshop. Due to time constraints the length was limited to one hour and took place as a "lunch-workshop". The purpose was to enhance the understanding about the internal view on how innovations can be enhanced during the time of a contract. Due to time constraints as mentioned, two questions were asked. The first question was how Trafikverket can stimulate new ideas in projects. The second question was how these ideas can be taken care of and evaluated in projects. These questions were based upon the findings from the external interviews. The findings help to answer the question of what factors that can support the innovation process. However, the main contribution is to the question of barriers for innovation which also are of value for future recommendations.

### 3.1.5 Motivation of design

This research design was chosen due the opportunity to collect data from various sources to increase the likelihood of a good outcome of the research. The author of this paper would argue that each part of the research design contributes to the understanding of the topic and the ability to answer the research questions. At first, a review of the literature showed that the most literature about innovation processes is on firm level and that there is a need for more research about innovation processes at a project-level. With this in mind and due to the fact of different actors involved in projects, one can argue that it is important to get input from various sources that are involved. Therefore, the case study showed some important factors for enhancing innovation during the time of a project. Also how it can be evaluated and its practical difficulties

was of importance. The literature review showed many theoretical measurements of innovation, but rather few practical. However, the key phase of this research was the interviews with external companies. To enhance innovation from the perspective of the client, it can be seen as crucial to understand the viewpoint of the companies that will perform the innovation. At last, the workshop gives understanding about the innovation process from an internal perspective of Trafikverket. This was of value to answering the questions of factors that can support and be a barrier for innovation.

## 3.2 RESEARCH STRATEGY

A qualitative research strategy has been chosen for this study to answer the research questions. Bryman and Bell (2011) describe that a qualitative study refers to words rather than numbers in the data collection. The purpose was to get a deeper understanding on how innovation can be enhanced (Bryman & Bell , 2011). Because there is not much literature specifically on the process of construction innovation on a project level and how to evaluate the outcomes of it, an inductive strategy has been used for this research. The process has been iterative between the collected data and theory based on the findings in the data collection methods (Bryman & Bell , 2011).

### 3.2.1 Data collection

The data collected for this research has been both primary and secondary. The primary data was collected through semi-structured interviews and one workshop with project managers within Trafikverket. The secondary data were collected through academic journals, books and reports about innovation in the Swedish construction industry.

## 3.3 RESEARCH METHOD

As mentioned earlier in the chapter with research design, one single case study, ten interviews with external companies and one workshop with project managers within Trafikverket have been conducted. The main method in the case study as well as with the external interviews has been through semi-structured interviews.

For the semi-structured interviews an interview guideline was prepared by the research based on general findings in the literature about the topic. Two different guidelines were prepared based on the interview and follow-up questions prepared due to the answers. The aim has been to have as open questions as possible and to not lead the respondent. However, based on the discussion of the respondent, different follow up questions were asked focusing on the area of interest. Further, the overall questions were sent to the respondent one-day prior the interview in order to plant a seed at them and to make them think a bit about the topic.

As mentioned earlier, the workshop was conducted with seven project managers within Trafikverket and due to time constraints lasted for one hour. Sticky notes were used in the workshop and the discussions were also recorded in order for the researcher to go back and listen once more. The project managers were chosen by recommendations by employees in the purchasing department due to the focus of innovation.

### 3.3.1 Interviews

The interviews were performed between March 30 and April 11, 2016. All the interviews were performed in Swedish and therefore are the quotes introduced in chapter four translated to English. Due to anonymity the different companies will just be called company and a letter behind, see table 2 below. In the text they will be referred to interviewee and the letter, for example, "Interviewee A". The order of the companies in the list is not chronological due to when the interviews were conducted.

| Company (letter) | Type of company | Position | Duration |
|---|---|---|---|
| **Company A** | Consultancy company | Regional director | 56 min |
| **Company B** | Consultancy company | Project manager | 50min |
| **Company C** | Consultancy company | Project manager | 29min |
| **Company D** | Consultancy company | Head of department | 1h, 6min |
| **Company E** | Consultancy company | Project manager | 52min |
| **Company F** | Consultancy company | Regional director | 1h, 13min |
| **Company G** | Contractor | Regional director | 47min |
| **Company H** | Contractor | Chief Estimator | 45min |
| **Company I** | Contractor | Regional & Technical boss | 54min |
| **Company J** | Contractor | Estimator & Project boss | 1h |
| **Trafikverket** | Case study | Project manager | 59min |

*Table 3.3.1 - List of respondents*

The respondents were chosen on recommendation by employees at the purchasing department of Trafikverket due to the focus on innovation. Further, the topic was briefly explained for the respondent in phone to make a good match for the interview. All the interviews have been recorded with approval of the respondents. Ten of the interviews have been conducted face-to-face and one interview on Skype.

### 3.3.2 Data analysis

All the interviews have been transcribed with all the content of the interviews. However, no other sounds such as "hm" and similar have been written down, only what they actually spoke about in the interview have been documented. Then the data was categorized depending on the answers and discussions among the respondents.

## 3.4 RESEARCH QUALITY

### 3.4.1 Reliability

Reliability refers to how repeatable the results of a study are (Bryman & Bell , 2011). In order to ensure the reliability of this study, the researcher considered a few factors. First of all, a total of ten interviews have been conducted with companies that works on contract towards Trafikverket. The researcher also recognized in the last interviews that many of them had the same arguments in several questions in which the study can be seen as reliable and no more interviews were needed. Second, the interviewees have been selected by recommendation internally in Trafikverket due to their knowledge and perception to the question about innovation. The topic was also briefly described while booking the interviews and they could be confirmed as good individuals to answer these questions. Third, all the interviews have been recorded and transcribed afterwards so no information have been left out. This also gave the

interviewer the opportunity to listen more carefully and establish rapport during the interview. Fourth, all the interviews took place at silent rooms at the respondent company and the interviews was conducted in a calm environment to decrease the risk of distractions.

### 3.4.2 Validity

Validity refers to if one measures what one claims to measure and can be internal and external (Bryman & Bell , 2011). According to Bryman & Bell (2013) the internal validity refers to how good the researchers match is between the observations and theoretical ideas developed. External validity refers to the possibility of generalize the findings (Bryman & Bell , 2011). To ensure the internal validity of this research the researcher of the paper aimed to be very well prepared for each interview including being as clear as possible, creating rapport and try to get the respondent to speak. However, qualitative interviews can be seen as subjective and since there are only one researcher in this project that might enhance the chance of a biased result. External validity and how the findings can be generalized can be a weakness since eight of ten interviewees interviewed has their base in the area round Gothenburg. However, the question whether other results might be collected in other areas in Sweden can be asked. The findings do present a deeper understanding for the problem itself and can generate theory for the problem of interest.

# 4 EMPIRICAL FINDINGS

*The empirical findings from the data collection will be presented in this chapter. At first, results from the case study will be presented, second, results from the qualitative interviews will be presented and third, results from the workshop with project managers from Trafikverket will be presented. All the interviews were conducted in Swedish and ten out of eleven interviews have been face-to-face. One interview has been on Skype due to time and distance limitations. The workshop was also conducted in Swedish.*

## 4.1 SINGLE CASE STUDY - PROJECT

*This chapter describes the findings of a project with innovation focus within Trafikverket. The purpose was to get practical insights and knowledge about innovation in an infrastructure project. At first, a background information will be presented. Second, important factors for the process of innovation will be presented. Third, evaluation of innovation will be presented. This chapter is based on the interview with the project manager of Trafikverket. The interview guideline will be presented in the appendix (8.1). Furthermore, it is important to mention that this project is currently in progress.*

### 4.1.1 Background of project

The project is an infrastructure project where the main thing is to build a new railway. However, due to the surrounding environment, there are roads, tunnels and bridges that need to be rebuilt. The project is comprehensive with a big investment cost. In the early phase when an uncertainty analysis was conducted, a big uncertainty related to the cost was detected. This because it was many factors to consider in the project that had a huge impact. One factor was a 500-meter-wide passageway to consider and how to optimize where in this passageway the railway should be built. Further, due to cross points of other infrastructure such as power lines, roads and other railways, a crucial question was whether the railway should be built above, in between or in any other pattern for an optimized way. When asked 15 individuals from both Trafikverket, consultants and contractors with a wide range of competence, a cost difference of 500 million SEK was estimated, depending on which way to choose. Further, the interviewee describes; "when no one could tell what would be the best way and with such big difference in the cost, it triggered the work to find the best possible solution". Therefore, it was of great importance to create possibilities for the consultant who got the project to think free and be able to find the most optimal solution. Furthermore, it was important to be prepared to add more hours and spend more money. The cost was one important factor to consider but also several other factors such as less impact on traffic, environmentally friendly, safe working environment, shorter production time, lower production cost, mass optimization, lower the risks of groundwater impact and socioeconomic value.

### 4.1.2 Innovation in the project

In this project, it was of great value for the client to together with the consultant come up with new innovative solutions. However, innovation in this case was not only connected to a completely new solution or an invention but could also be a new application of an already known technology or knowledge. Further, optimization is also considered to be equal to

innovation if the solution can be showed to be optimized from several perspectives. The interviewee argues about the term innovation and it can be discussed what it is and how you define it. *"In some cases, an optimized projecting is extremely much more valuable"*.

### 4.1.3 Important factors in the process of innovation

#### *4.1.3.1 Early phase*

The interviewee argues that it is especially in the early phases where you can have big impact with a relatively small cost. In comparison, if these things would be stimulated in later phase, then one can think about how much money that is worth to spend. This is due to the fact that the longer you are in the project process, the more locked you will be in different considerations.

"*If you will work with innovation and creativity, the earlier you start, the more value can be created"*

##### 4.1.3.1.1 Workshops

The aim of the workshops was to focus on smart solutions in applicable areas such as the crossing point of all the infrastructure. This because it is impossible to run in every direction and it is important to focus on a few areas. The interviewee further argues that this dialogue in the early phase of the project is a key to include into the process, already when you are starting.

To evaluate the different ideas from the workshops, group exercises with 8-10 individuals evaluated each solution based on a pre-set of questions. After that, it was up to project management of Trafikverket and the consultancy firm to together evaluate these solutions and its evaluations.

#### *4.1.3.2 Time*

The interviewee argues that it has to be time to get the opportunity to reflect and think. If there will be room to "turn around several stones" and really think big, then it has to be allowed to take more time than what normally is allowed. Also to have an open dialogue about time so the situation can be avoided in which one comes and say; now we don't have time to think free anymore and have to finish the project in the fastest way. Moreover, the project manager from the consultancy firm argues that the early stage might be more expensive, however, next stage might be cheaper but how much is hard to estimate.

#### *4.1.3.3 Knowledge management*

In the early phase, there was a discussion in order to identify areas of both technological and geographical possibilities for innovation and technical solutions. The interviewee argues that one crucial factor in the collaboration is continuous reconciliations about what happens in the project. The fact that the client takes time to start a good collaboration is also emphasized by the project manager from the consultancy firm. The interviewee argues that the client needs to take a part during the journey in order to tell the consultants about the conditions during the projecting. Due to the complexity, it is even more important for the client to be active to provide answers to the consultants. Therefore, the interviewee argues that these meetings are a key factor.

Another factor that is highlighted is to have meetings with the only purpose to discuss the projecting. Otherwise, the interviewee argues that it can be easy to only take time to talk money, time and resources. This can be seen as a success factor and also to take advantage of the knowledge among the involved individuals in these meetings. In parallel, it is important to give answers to the consultant when needed in order for efficiency. The interview also suggests that one important factor in the process of innovation is to meet in different forums and then don't limit the group of people.

#### *4.1.3.4 Innovation culture*

The importance of creating a culture that foster innovation and creativity is described as a key factor in the project specification for this project. The interviewee argues that it is crucial to create a culture without any prestige and in which every individual can say what they think. Further, it is argued that this is easy to write in the project specification, but it is very important as the project manager to act with a good example. No idea can be bad and it is crucial to consider them all. Everyone should be able to speak, otherwise, no results will be reached. The project manager from the consultancy firm also emphasises the value of the open climate and discussions which also is experienced as much better than in other projects towards Trafikverket as the client.

#### *4.1.3.5 Incentives*

The interviewee argues that if the client rewards with incentives and bonuses because it can be expected to cost less money in the end, then this project was definitely the right one to use it on. This project is very open and not locked as some other projects can be.

### 4.1.4 Evaluation

As mentioned in the introduction to chapter 4.1, this project is currently running and there are discussions about how to show these four innovations. This will be evaluated during the fall of 2016. The interviewee argues that the process of implementing a new way of working where there are possibilities for innovations is important. This is argued to be a good approach instead of just showing four new technological innovations. Furthermore, it is also important to consider that in some projects it is much harder to find anything.

The interviewee describes that there was a discussion on how to measure this and there was no exact science behind the number of four innovations. However, four was considered to be a good number in case of something was found in the first month and the goal was reached already then. It is argued that it´s important to stimulate the creativity even though you already found something. In this project all the factors mentioned in chapter 4.1.1 were important. The interview also argues that the different factors could be weighted depending on importance, e.g. short construction time. However, the interviewee further state that this could lead into the wrong direction in this specific project because there were so many important factors to consider. Further, in other projects, it is argued that it might be beneficial.

For the project, the criteria were set on the project management from the consultant and it was argued that it is their freedom to put together people with right competence based on the project. Furthermore, the project manager state that it is an interesting thought to evaluate the project

team as well, however it can also increase the complexity of the evaluation due to a high number of people involved.

### 4.1.5 Summary of chapter 4.1

Chapter 4.1 have described an ongoing project which has a focus on innovation. Figure (4.1.5) summarizes the chapter. This study especially aims to provide data to answer the research question on what factors that are can support the innovation process. Regarding evaluation, the project is as mentioned currently in progress and therefore no conclusions can be drawn from the evaluation of innovation in this project.

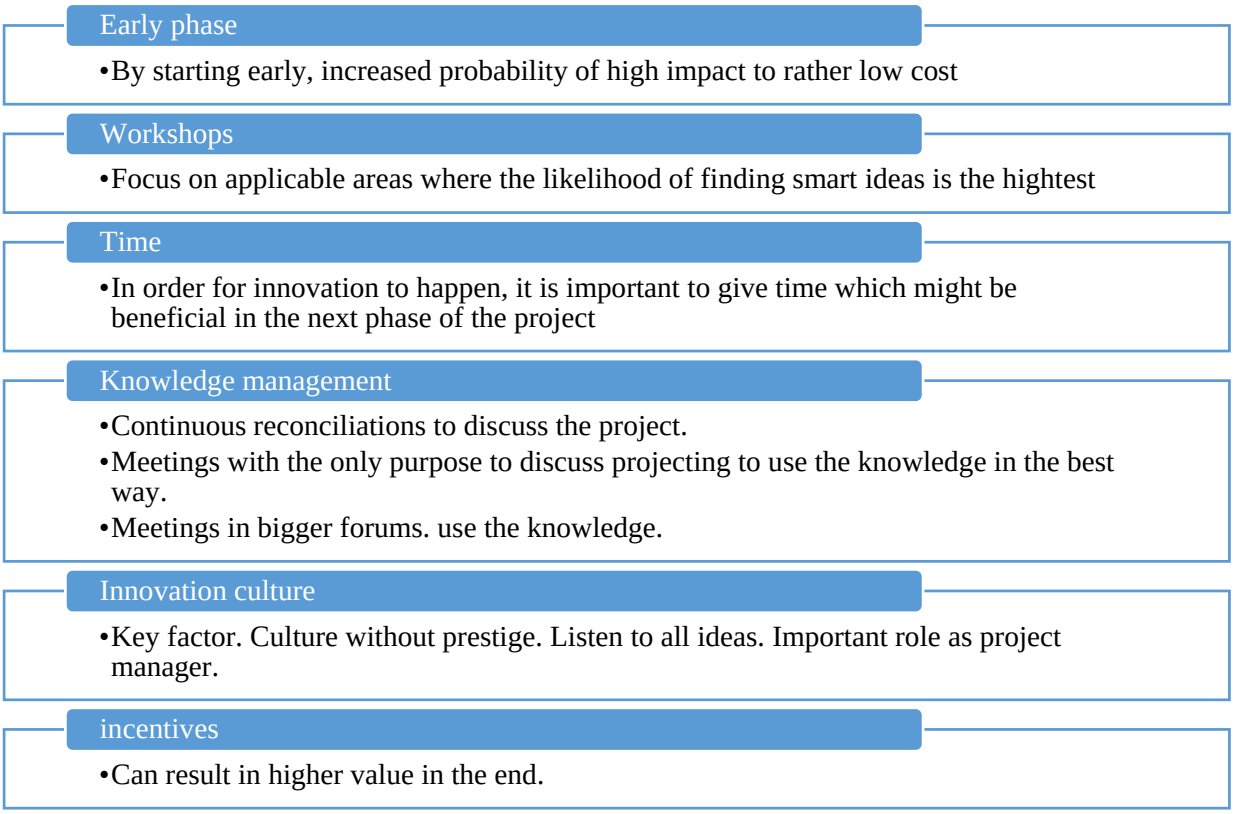


*Figure 4.1.5 - Summary Case study*

## 4.2 EMPIRICAL FINDINGS FROM EXTERNAL INTERVIEWS

*In this chapter, the findings will be presented from the ten different companies interviewed. The structure will be similar to the literature review, with the difference of the identified barriers presented in chapter 4.2.2.9.*

### 4.2.1 Definition of innovation

Among the interviewees, there were several different definitions of innovation. However, it was clear that the term innovation is hard to define. Interviewee D wants to downsize the word innovation and state that the term innovation is quite fuzzy. Interviewee A argues that innovation can be a hard concept, however often the question of innovation is not even being raised but are assumed to be part of the project. Further, interviewee A compares the situation of today with earlier where you could go and sell an idea and charge money for this idea. To

sell an idea with the intention to improve the business of the client is argued to be hard in the year of 2016. Below, the different definitions from the various respondents will be presented.

*As an advisor, it is obvious to be innovative, otherwise, you are not a good advisor"*

*"Often projecting is about to find the smartest solution, and that is what we are trying to do all the time, so what is a good smart solution and an innovation is quite hard to define for us".*

*"New ideas on methods, products and working processes"*

"A *new technical solution which has not being tested before and has potential to save costs or a new methodology such as using more drone technology to do the measuring instead of running around with traditional equipment "*

*"Innovation in this industry can be a method which might be tested but not in Sweden, and it might be an innovation if you take this method to the region then. It can also be an improvement of an earlier method or working process. Breakthrough innovations rarely happen in this industry"*

*"Innovation is created by experience, by doing similar things over and over again which then creates innovations by itself in some way by taking it one step further all the time. Small steps are the things that drives it forward. Big inventions such as the wheel do not happen very often"*

*"Innovation is involvement and developing within the project. It is more about to develop the individuals within the different projects. Involvement meetings with clients, contractors, employees, suppliers and those who work. It is very important to put the right individuals in the projects that can work with development within the projects. So innovation is performed within the projects with these people and in the current project."*

***"**Develop new products, technical products or new concepts. Within the construction site, it is very much about how the project is executed. There are often limitations in the technical or third party, therefore, it is important to be innovative in how the project is executed and disturb the surrounding environment as little as possible. "*

*"Develop new things from a R&D project. In general, when it is spoken about innovation it is argued that you go down in Europe and look at new methods and bring them back to Sweden. However, this is not argued to be an innovation but to expand the point of view, which should have been done a long time ago"*

*"Thinking new and bringing new ideas"*

### 4.2.2 Factors for the process of construction innovation

Chapter 4.2.2 introduces the findings relating to important factors to enhance innovation.

#### *4.2.2.1 Client requirements*

The interviewees highlight the importance of a willingness from the client to demand more innovation and development. Interviewee A emphasizes this clearly;

"*The client has to show that they are willing to do this. This is not showed today and it can be said twice, this is not showed today."*

Further, interviewee A argues that it is important to reach a point where the clients want to buy creativity and innovation. Interviewee I also emphasizes the importance of that someone in the client organization is open to it and not only says no because it is planned in a particular way. It has to be someone who sees positive in new things and solutions. Further, interviewee G also suggests that the client plays a big role in order to require certain competences to make innovation possible. This is also suggested by interviewee A that state that any kind of competence can be asked for, by the client and whatever this competence is, most of the firms will acquire this competence to get the project. Further, it is discussed that if the client thinks in a way to create these conditions, it can be a driver for innovation.

*"Alone it is hard to be innovative, the client must want to have it" (Interviewee A)*

Another important factor that interviewee A highlight is that sometimes these topics are discussed in an early phase of the project, but during the project, there have been new circumstances not similar to the early discussion. Interviewee I argues that if one believes in creativity and innovation in the construction industry then it has to be some kind of policy instruments. Also internally within Trafikverket, that the top management and those who are working out in the projects are on the same level.

#### *4.2.2.2 Early involvement*

Early involvement is widely stated to be a crucial factor for innovation. The contractor companies all argues that being included in an earlier stage is of great importance. A current project on E20 is highlighted by several of the firms where the contractor is involved in an early stage before the plan of the road and where the road should be placed. Interviewee J argues that sometimes a contractor might know more about what can most financial beneficial in an early stage. Interviewee H also suggests that in a contract agreement, this might enhance a new view of innovation even though not much is tested yet.

"*Involving contractors, consultants and client in an early stage together, that is great factors" (interviewee G)*

Interviewee J further argues that early involvement is important especially due to the time factor. However, the process is often long and has to go through several instances for approval and the time for this process could potentially be added within the time frame of the project. Interviewee J doesn't see this as impossible. Interviewee H also highlights the time factor and argues that it should be time to investigate and maybe change the working plan.

Interviewee H argues that for Trafikverket there might be many important factors such as don't disturb the traffic, environment and similar things. For company H it is very clear what things can be done to protect the environment, some things are as expressed more "black and white". There is one month to finish, point. With an early involvement in this process, a solution can be found that both becomes cheaper and is of advantage for the traffic. Interviewee C also emphasizes the importance of early involvement and especially when building railways where you have to request time two years ahead.

*"The procurement is important, however, the most important phase is the start of the project" (Interviewee D)*

#### *4.2.2.3 Idea generation and selecting*

According to interviewee B and D, it was more common some years ago to have an initial phase of idea generation, interviewee D argues it has been fallen into oblivion. Interviewee B describes that a reason for this might be that Trafikverket wants to "slim" their projects. However, starting the projects with an idea generation phase is emphasized as a really good factor.

"*Allow us to go inside a room, shut the doors or whatever, and give some wise individuals the chance to generate new ideas together. That is the thing!" (Interviewee D)*

Interviewee D further argues that the new concept Trafikverket implemented as a "pure client", which in its foundation is right, that the details are on the supplier. Trafikverket should describe that they want a road from A to B which should meet certain requirements and then it is up for the consultants to project a solution that fulfils this. However, in some contexts, Trafikverket have a way too strict interpretation on this and interviewee D really highlights this. Just because a project now is ordered, we are not speaking to each other anymore, but it is the responsibility of the supplier to bring a solution and deliver to the client.

This is argued to be the opposite against to collaborate during the project and collaboration should be in every project, not in the details but for example in the idea generation process. Because both the client and the firm has a lot of knowledge to contribute with and there we can help each other.

Interview D and E both argues that it would be good to establish a working model for how new ideas that arises in the project can be taken care of. Interviewee E argues that no formalized ways of working towards new ideas are established and this could improve the performance. Interviewee D describes that it should be an agreement within the project for which systematic that will be used to analyse and make a decision on whether to proceed with the idea or not. Interviewee D argues that with respect to the desire of the client, if time is the most important aspect it is not respectful to start to question everything that has been done. However, if the quality is more important, than it might be better if a solution can be achieved together.

Further, interviewee D suggested that next level could be to create a system on how the different actors in the project can collaborate to generate ideas which then are systematically handled. Furthermore, it is argued that there is no need to change any form of procurement form at all. This is due to the argument that if something else then the original solution presented in the offer will be performed, it can be normal change management.

#### *4.2.2.4 Culture and climate for innovation*

Eight out of ten interviews discuss the importance of creating a culture or climate in the projects that can foster innovation. Interviewee D argues that the important thing is to create a culture within the project which cannot be done in the specifications for the project. According to interviewee F, one of the most important drivers for innovation is an environment that supports it and the client has a big role in creating it. Interviewee J discusses that it is crucial to have a

group that has no prestige where everyone can bring new ideas without being judged. Furthermore, it is stated that nine of ten ideas can be terrible but you won´t reach idea number ten if you are not allowed think "crazy" sometimes. Interviewee D also argues that it is important to let go for the fear of failure if the innovation will result in something. Interviewee B emphasizes the importance of an open climate and provides one example. There have been some projects where Trafikverket "draws a line on the table" and says it is all up to the firm to solve the problem and then the discussion is hard to even raise.

*"The thing I really want to communicate in this thesis and with Trafikverket as the client, is that the most important factor in the project is to create an innovation-friendly culture" (Interviewee D)*

Interviewee D argues that the most important factors to create a good culture is openness and also to put prestige and suspiciousness completely at the side. An open dialogue and confidence are important and if Trafikverket as the client, for example would say; yes, let's go for that. Then they show trust which the supplier has to manage and don't waste. Both interviewee A and D argues that when they have found something that has great potential, they would like to go back to the client and say; hey, we found something and it seems to be very smart.

*"The client needs to listen to us more. It is devastating when you come up with ideas and every time will hear: no, that is not possible" (Interviewee F)*

Interviewee G suggests that the client has the most important role to create this good climate and to have open books so all the competence can be showed and used. Interviewee F also emphasizes that the client has a big role in creating the client because every project is ordered. Due to this, interviewee G argues that it is important that the client asks for the specific competence and then it is up to the supplier to meet these expectations.

*"Sometimes when we suggest something today we are faced by suspiciousness that we want do something else than in the offer just because we want to earn more money. That has to be put to the side. With that discussion, we will get nowhere with innovation" (Interviewee D)*

Furthermore, interviewee D argues that the culture is shaped when the project is starting. Then you start to interact with each other and a systematic can be created. Also to decide which level of ambition that is suitable for the project because it is unreasonable to create an innovation-friendly culture in every project, there are a number of projects that just are normal projecting. Interviewee F suggests that the client organization should be more open to new ideas, a new way of thinking and trust the other party to a much higher extent. Also, to build a good climate, trust is a crucial factor and the interviewee argues that this starts internally in Trafikverket. If the project managers can get working space and have the courage to do more, because if they don't dare to do more, then no good working environment will be created in the end.

Interviewee H also suggests that it is a lot about to create a good climate and when things are going good, then there is no problem. However, it is argued that when a problem occurs, then it is easy to get stuck. If then it is discussed in an initial stage about how it should be handled, both parties know what is expecting. If no agreement can be reached the project might be infected which shouldn't be needed if a plan for this was initiated in an early stage. Interviewee

G also highlights the importance of getting to know each other and to understand underlying reasons behind some decisions and roles.

*" It is when you start working you start to see the problems as well, and then it is important with a good attitude towards change and that will also create a good working environment. Innovation is created in the environment where you trust each other" (Interviewee F)*

Interviewee J also highlights the importance of trust, not only from Trafikverket but from all parties. It is crucial to build up a trust to each other and to get the desired result should be a collaboration. As a contractor, it is crucial to put together an organization that has the right experience and knowledge. "*It is as important for us to build up the trust towards Trafikverket as it is for them to build trust for us, it is a collaboration" (interviewee J)*

#### *4.2.2.5 Cooperation*

Cooperation is another factor that is widely emphasized among the interviewees. Interviewee A argues that communication is a key word and the clarity within it is crucial. This is based on trust and confidence and other relevant things that make both parties to feel in this way. For the process to work the collaboration climate need to work in the right way. *"You have to do it together and you have to trust each other"*. (Interviewee A)

It is impossible to be creative unless both parties have the willingness to be so. A common goal is important to get the project to the finish line, not just for innovation but also for the collaboration part, which is very important for the innovation process. Interviewee E further argues that it is important to look at the challenges and possibilities together of doing something innovative. According to Interviewee E, it is common to say something such as; that is how we always do. In order to increase the level of innovation it is important to be more active and look at potential solutions. Interviewee A state that Trafikverket play a crucial role in the process of collaboration, both in specifications and also the willingness of doing the same as the consultant/contractor. That is argued to be one crucial factor to create an innovative power in projects, or that you have innovation as a goal and you do it together.

Interviewee G also highlights the good in partnering contracts, which however is outside the scope of this thesis. But the important aspects such as open books are used in the project, all the invoices are shown, the calculations and a collaborative thinking is used between the client and contractor. The advantage is that the client and contractor are looking at the same thing and it is sometimes difficult to know how it will look like when you start digging in the ground. Then the respondent further argues that partnering with open books is the biggest driving force.

Interviewee H further argues that it feels like that the consultants have become more specialized on projecting, Trafikverket more specialized in its role as a client and there might be a lack of knowledge about what is important for the constructor companies in order to construct in a good way. It is crucial to put together an organization that fits the project. According to interviewee F, it is common in project-based industries that the problems is not solved together such as with the client, consultant and contractor.

*"We have our goals, the client has its goals, it is better to create common goals and work towards them for the best possible project" (Interviewee H)*

Good communication, collaboration and to understand each other is important. Interviewee H emphasises the ability of fast decisions and to understand what factors that are driving costs for each other if a problem arises. This could minimize the consequences for each party in the project. One other important aspect is the willingness of development and to go outside the box. There are a lot of regulations within Trafikverket but perhaps it is important to have the courage to try something else and see what happens, if it then wouldn't work, then this might be investigated together.

Interviewee J emphasizes the collaboration climate because the client and supplier are not on two different sides and everyone benefits of a good collaboration and then the right organization for the project is of great importance. Further, it is suggested that without a good collaboration where you cannot bring any ideas, it can cost a lot of more money in the long run. It is also important to try new ideas and don't push down the ones that bring them. It is argued to be important to have a good argument for why and have the courage to test.

"*The collaboration is worth more than any bonus or incentive" (Interviewee J)*

#### *4.2.2.6 Leadership and project team*

Interviewee J also highlights the personal relations; to know who you are doing business with. Trafikverket is a huge organization with several personalities and it is important to know when you can put the energy and not. The experience of the project management of the client is argued to be very important. Further, it is argued that sometimes it might be easier for the client organization to say no because it might be easier not to try because then you wouldn't do anything wrong. Just as the supplier are trying to get the right resources in the right spot, it is as important for Trafikverket to consider what people that work in and leading some projects. Interviewee G also emphasises the importance to include the right individuals that can work with development within the projects. Therefore, it is suggested that innovation is performed within projects by the people.

#### *4.2.2.7 Knowledge management*

*"It is way too common that you go through the whole project and a while after you meet and have meetings to exchange experience and this project that have been going for some years, it is quite hard to remember what we did two and a half years ago, no one remembers that" (Interviewee D)*

Interviewee D describes that there is a value in sharing knowledge and experience for upcoming projects, however, if it is done during the current project the learnings can be valuable right away. If this is not done regularly it is easy that some important things will be forgotten. Interviewee E argues that it is very project specific, however, it is important and has not been done earlier in any large extent. Further interviewee E argues that this could be one benefit with the turnkey approach where the consultant and contractor working closer to each other. Then the consultant is closer to the end product in comparison to otherwise when one works one step

before and then it is procured. Then you are unconnected even though there might have been "1000 things" to reconnect on. The feedback in both directions is important. This is also highlighted by interviewee B that argues that the whole industry could get better in this. It is also suggested that this could be improved since Trafikverket started to focus more on turnkeys.

Interviewee F argues that in these meetings you tend to be best friends but the day after you might be back where there is a conflict about something. It is argued to be important to create a working environment in which you can contact each other whenever a problem arises. Further interviewee F suggest that it is important to speak about the future and not only the past month and the factors which have not worked in this time period. It is crucial to focus on the upcoming month and see how that can be more efficient and better. Furthermore, it is suggested that when you are stuck in the behaviour in which you only speak about the problems in the past, no problems will be solved but rather created.

*"If you only speak about the last month, then every month would be the same" (Interviewee F)*

Interviewee B also argues that meetings with regular reconciliations is an important factor to know what was good or what things that needs to be improved. This also emphasized as crucial of interviewee D. Interviewee E argues that an iterative process in which all parties have an understanding for each other and are involved in generating ideas or seeds for ideas is important.

Interviewee G further argues that a pressure from top management in both organizations might be needed to introduce it during the time of the project. It also depends on the size of the project but it also has to be active experience feedback, follow up on the goals and work active with these questions. Further, simplicity is important so it doesn't become too much of administration and systems to enter for various things. Interviewee J also emphasizes the lack of information on the outcomes of certain solutions and that should be interesting for both parties.

Interviewee G argues that building trust and have open books is crucial and individuals with those skills need to be assigned and that might be a management question in both the contractor and client. Interviewee F also state that when you start to trust people they start to work more.

*"Talk the individuals who are drilling in the ground, what is he doing, what can be improved and try to work there and start talking to the people who executes. Not only to the consultant and professor, even though everyone is needed" (Interviewee G)*

#### *4.2.2.8 Reward schemes / Incentives*

Nine out of ten interviewees are positive towards incentives in order to stimulate innovation. Interviewee B state that incentives can give some extra motivation. However, as interviewee A argues that, as it is today and when the consultants are evaluated on for example innovation. The evaluation criteria can be perceived as, was that really that innovative? It is like, now we need to find a new formulation on one innovation in the project and then receive 200 000, just because we had it as preconditions. Interviewee A argues that an economic incentive can work as a driving force in both directions. The client with the purpose to save money and the consultancy company can earn more money by charging a higher fee by using employees with excellent skills which can make the deal better in both directions.

Interviewee I argues that it cannot be in that way that if you come up with a new solution you will be rewarded with one million. That is not an incentive, however what is an incentive is what is specified in the contract and what activity that can make it cheaper that together is valued as good. Not in the way that you have to return money. If the criteria are that that you have to come up with three new smart ideas and will receive one million for that, it is suggested that it can be difficult to evaluate what a smart idea is. This is also argued by interviewee J that state that it can be hard to go into a project and say that you will find a lot of solutions. Further it is argued that these ideas are something that you develop by working in the project.

*"The best for the client and contractor is if you set some form of incentive where the earnings can be shared if any smart ideas are found" (interviewee G)*

All contractors argue that a good incentive could be to share the savings of the project. It is argued that if the cost of a project will become 10 million cheaper or similar, then the savings can be shared between the client and contractor in different percentages. As one interview argues, if Trafikverket can save 40 percent, then it will still be four million cheaper for the taxpayers.

##### 4.2.2.8.1 Innovation bonus

Interviewee B and D are very positive to innovation bonuses that will give the project members a reward, such as a study trip or similar. Further interviewee D argued that this is an excellent way in order to raise the commitment of the individuals which are working in the project. For bonuses that goes direct into the company doesn't affect the project team as much even though the managers will be satisfied. Interviewee B also argues that this can spur the team members to think a bit more. Further, interviewee D argues that if the bonus will be too big, such as one million, then there can be speculations in the stage of offering because then the price can be lower due to expectations of receiving the bonus and then it won't have any effect.

Interviewee F also argues that the money is not significant, however the gesture is more important. Instead of being punished and having to pay extra for any delays every week and instead of being rewarded for doing something good and innovative. That is a big difference and the interviewee argues that Trafikverket could earn much more in the long run to work with rewards instead of punishments, not necessarily money but something that rewards. Further it is argued that is crucial to focus on what is good and not the bad things, then it would be more fun to come up with new things due to the fact that if you are being rejected all the time and focus is on what is wrong, then you are not very energized to do something more than needed.

#### *4.2.2.9 Barriers for innovation*

*The factors that are mostly communicated as barriers for innovation through the interviews are time, financial, regulations, culture and internal processes at Trafikverket. Culture have in chapter* (4.2.2.4) been introduced and why it is not presented again here.

Interviewee G emphasizes the difficulties to assure the quality in a new thing when there is a warranty time on ten years. It can be hard to know the actual outcome after four years on a slimmer road construction for example. Interview H state that it is hard to know the

functionality of something that has not been tested before. Furthermore, it can be difficult to prove that the new solution is equal or better than the initial solution.

Interviewee I argues that when a new solution is proposed there is a need to show an extremely high proof of evidence that is a reason for why it might be not chosen. Further, this is argued to wrong when you as a company also have a functional responsibility of ten years. Then it shouldn't need to be verified in this way. From a contractor point of view, this can make it hard to these innovations. With the turnkey form, when the contractor should take responsibility for the projecting, Trafikverket have not really released these parts. On top on that, the contractor should have responsibility for the functionality after construction. However, Trafikverket is still in the old need of having control as when they did everything. (Interviewee I)

#### 4.2.2.9.1 Time

Interviewee D describes that tight time plans are another barrier for innovation in the end product. Interviewee A describes that innovation and creativity is something that is much discussed but then no room is left for this in the project and that is a disappointment. And then maybe everything is controlled by time and money. Further, interviewee B argues that it is important to allow it to take some more time now in order to win something in a later stage. Often in this industry, many people tend to be busy and there are a lot of things to do.

Interviewee D describes that if the road will be built in the same way as is has been in the previous hundred years, then it is much easier to calculate the time. If something then is discovered during the project that needs to be tested, then the timeframe will need to be longer. Further, is argued that this is very much dependent on how "time critical" the project is. The respondent argues that one "safe" way to deal with this can be let the normal "projecting" (run in parallel with this new idea. Interviewee J describes projects in which they had concrete ideas but after a while the time was just running way due to a long process. Then the original idea had to be used anyway despite ideas in which time and money could be saved. Interviewee J also emphasizes that if the contractors are given time, it is crucial that that time is utilized in the right way and not by using that time in another project.

#### 4.2.2.9.2 Financial

Interviewee A argues that the cheapest option doesn´t have to be the most financial beneficial for a project. "if we have an idea, we can go to a private sector customer, with this idea you will save 100 million SEK. The same could be done towards Trafikverket but that is not applicable in the current procurement model. But if that would mean that we have an hourly rate of 1500 SEK and our competitor 700 SEK an hour, then the client would probably buy the one for 700 and don't think about this with an idea. Just because 700 is lower than 1500 doesn't mean it is the most financial beneficial. The low margins is also highlighted by interviewee C which can make it hard to be innovative.

Suspiciousness for that the contractor only try to earn more money is another factor that is brought up by the interviewee H. Also interviewee I brings up the fact that if the client is afraid of the contractor will earn more money and tries to stop that, then the willingness of innovation will stop. For the company it is to reach a better result and in the next project this smart idea may be used again to get a lower price. When the climate is reached when the client

organization have a goal that the work will be done in this way, and more smart ideas can be proposed and also used in the project, then the client also will get more road for the money.

#### 4.2.2.9.3 Regulations

Interviewee C argues that a huge barrier for innovation is that everything is so controlled. Also interviewee D describes that if the client is really though on these boundaries, then there is no much left to do. Interviewee E further explains that when you reach down to detailed specifications and technical solutions and everything that is inhibitory. According to interviewee H is there much more trust towards other clients and in Trafikverket it is the regulations that controls. Interviewee J argues that Trafikverket is a huge organization and that the regulatory framework not always is very modern. Further, the interview argues that it is obvious to follow laws and rules and it is experienced that the project managers doesn't always have the energy towards its own organization to get any new ideas through.

As interviewee E argued, if the regulations are never being challenged, they will probably remain the same. Even though security is an important factor in many infrastructure projects, which is crucial, there should be areas with new development where new more efficient solutions can be performed.

#### 4.2.2.9.4 Internal processes at the client (Trafikverket)

Interview E experiences a change of the project management in the client organization the recent years. Not as many have background in the technical or road constructing which might lead that it is hard to get down to the root of the question. There are not many openings for thinking new or projecting something that is new. Examples is provided by the interviewee in which ideas that are proven to work in other places are proposed and rejected. The reason behind is explained to be that it might be hard for the project manager of the client to reach the technical specialists.

*"I have almost never experienced the client to support us to think in a new way" (interviewee F)*

Interviewee F don't believe that the project managers feel the freedom to encourage innovation. The experience of the project managers of the client is emphasized as important. Without long experience it is described that it can be hard to explain for higher management if someone would raise critique. It is mentioned that they are almost forced to continue that road as in the specifications to reach the destination, the whole capability of thinking ourselves and the whole innovation, nothing is left state interviewee F.

Interview H describes that there might be a long way to reach a decision in Trafikverket compared to private companies. If the project manager goes to his/her technology department it can be like they defend their construction and if they go to the people who constructed the regulations, they will defend the regulations as well. The same of the ones who projected the solution, they will also defend it.

"*The project managers have little incentives to try something new, especially if it´s any risk involved". (Interviewee H)*

Further, interviewee H argues that if things are not going as planned the, project manager of the client will get blamed for it. This is argued to be a barrier for innovation. Interviewee I argue that it is different views from top management in Trafikverket and the project managers.

*"It is a very far distance between top management and those who control out there, and then they blame lawyers, LOU and they do as they want to. I feel this is a big concern and now I am speaking in general also for some other big actors that we meet sometimes" (Interviewee I)*

Interview J further argues that there are many instances that need to process a decision. And there is often tight with time in the projects and then it will end with that the original plan is followed. Also interviewee G argues that due to potential changes in any project it has much to do with the individuals at the client and contractor organization. The project manager might not have the technical knowledge and have to go to technical specialists. However, an experienced manager might dare to take faster decisions and also possess the right contacts to reach the technical specialists. This is important and can lead to savings for both the client and contractor. Without that competence and experience it is easier to say no and stick to the original plan.

"*It is important to let go of the prestige and think in the other way, which was smart could they have said instead. That is worth a bonus" (interviewee F)*

### 4.2.3 Evaluation of innovation

Several interviewees highlight the importance of frame the concept of innovation and the intention to evaluate it. Interviewee B argues that many can be locked with the thought that an innovation should be a revolutionizing new technical solution, but maybe it can be on a more modest level and maybe more focus on the actual process. Also interviewee H argues that innovation should be more about to cooperate in a better way and create opportunities for innovation that can be developed.

When it comes to evaluation it is according to interviewee G important that the goals are not too fuzzy but trying to set up concrete goals which the people in the project can work towards and that is understandable. It is important to involve so it is not just a fancy thing, so the working people are involved. Also Interviewee H argues that it should be focus on cooperation and in early stage discuss what goals there are for the project as well as different roles and the vision. Also interviewee A argues that the more concrete the evaluation can get, the better. Further interviewee describes that if the client is serious with for example environment and sustainable solutions, then it is important to find criteria that are important such as build a more energy-efficient road, less consuming energy in the production part or to the fact that the people that are driving on the road consume less fuel due to a smart coating of asphalt.

There are according to interviewee A several factors that are important to consider when working towards more innovative goals. As Trafikverket state it "more road for the money", if a contractor can show that they constructed a better economical solution and still keep the quality. The end goal should be to earn or save money.

*"I believe in starting early instead of evaluating in a late stage, then it´s possible to improve during the ongoing project" (interview H)*

Interviewee D argues that it is good that innovation is one part that is evaluated, however, the evaluation there can be a bit gawky in terms of how innovative is it possible to be in this kind of project, so it will be achieved even if it hasn't been that innovative in a way. Other factors such as financial is much easier to evaluate. Also interviewee I highlights the difficulties with following up on innovation or different kind of ideas due to the fact that they are not applicable from project to project. Interviewee A argues that the mathematic formula is probably not existing here, someone need to have opinions about how we evaluate innovation.

Interviewee B argues that evaluation happens in some projects but quite rarely. One reason might be because it never happens that a project ends just like that, but the time is long and many tend to start on working on new projects and then it just not happening.

*"We are quite bad at follow-up and evaluating projects" (Interviewee B)*

*"An evaluation is never taking place after something is built. After investigation the project disappears to a contractor and then the actual outcome is unknown for us, unless we did a big mistake" (Interviewee B)*

Interviewee A suggest an idea that to measure the operational costs during the life cycle and then compare it to historical known values. And if then money is saved due to this innovation the contractor or consultant can receive an incentive/bonus a few years after, when the results of the project are known. For example, maybe it is not needed to change coating as often. Say that this innovation saved 100 million SEK, maybe then the consultant or entrepreneur that come up with the innovation will get a percentage of this back. The respondent state that this model can be more concrete. Interviewee B argues that if this would be possible it has a lot to do with which type of project it is and its complexity or if it could be possible to compare only one part of the project.

### 4.2.4 Summary of chapter 4.2

*Chapter 4.2 have presented the empirical findings from the ten interviews with the external companies and figure (4.4.2) summarizes the chapter. The aim of chapter 4.2.2 was to provide information to answer the first and second sub-questions: what factors that can support the innovation process and second to act as a barrier. Chapter 4.2.3 aims to answer the third sub-question: How can innovation be evaluated in projects?*

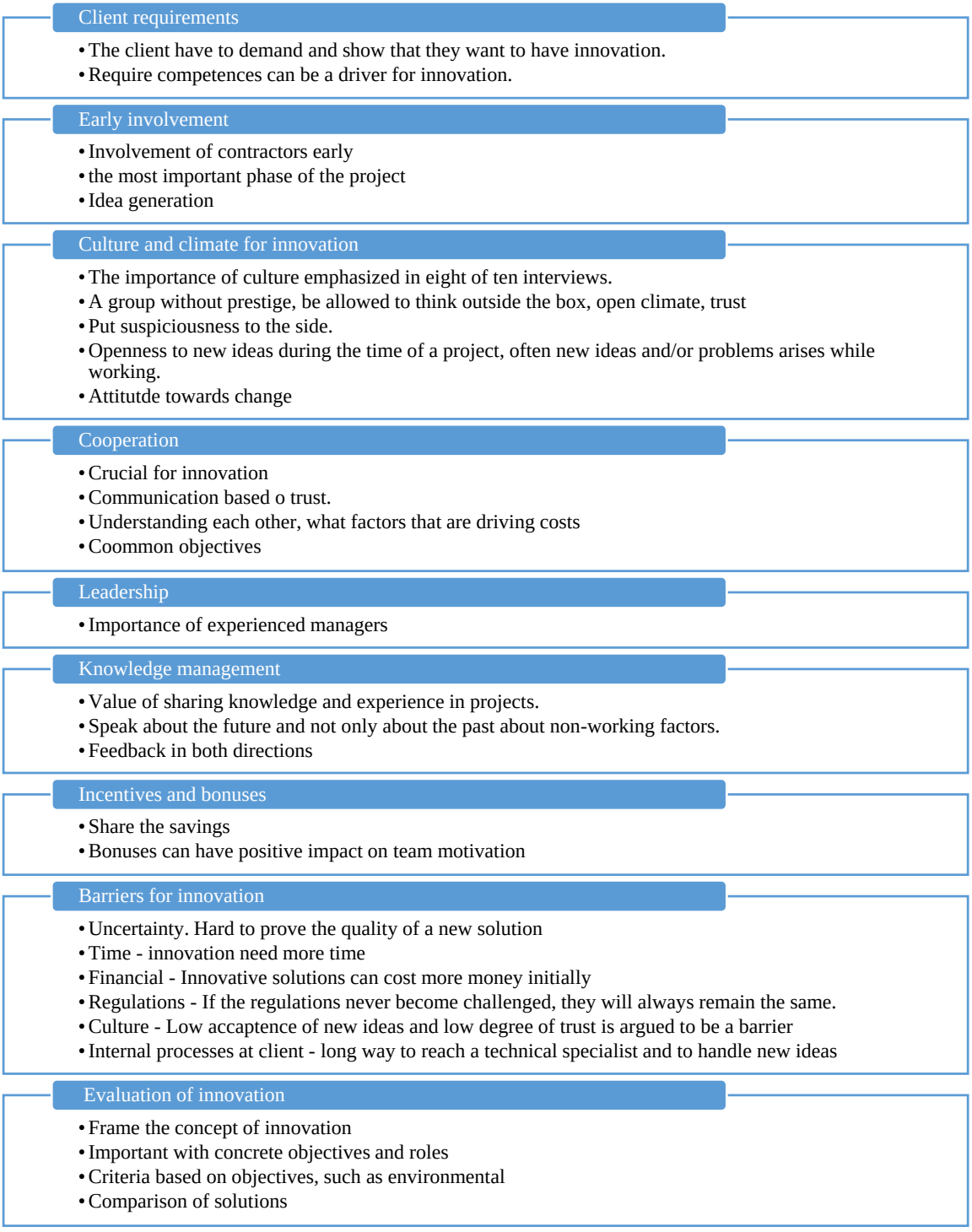


*Figure 4.2.4 - Summary external interviews*

## 4.3 WORKSHOP PROJECT MANAGERS TRAFIKVERKET

*Seven project managers within Trafikverket participated in a one-hour long workshop. The length of one hour was due to time limitations. The purpose was to gain an internal view about the question whether how innovations can be enhanced during the time of a project. Based on the external interviews it was found that there were hard to have new ideas evaluated during the time of a project. As suggested by Gambatese and Hallowell (2011), the simplest form of innovation can be a positive change after the implementation of a new idea. With this background, the questions whether how Trafikverket as the client can enhance new ideas during a project as well as how these ideas can be evaluated was asked. The main findings from the workshop will be presented below.*

### 4.3.1 Time

Time is argued to be a main factor and that it is important to create time in an early phase of the project with the purpose of investigating best possible ideas. The internal processes to evaluate an idea are very long and therefore is the time aspect crucial. Furthermore, it is argued that a tight time plan just increases the likelihood for the supplier to get a penalty if they would be innovative during the project.

### 4.3.2 Regulations

There are many regulations, especially in the railway. It is suggested that it is important to sometimes take steps outside the regulations and see opportunities to make innovations happen. As mentioned, the railway is argued to be very strict and hard to test new things, mostly due to safety reasons. There is no railway somewhere in which new things can be tested. It is also argued that in the fixed price contracts the least possible is received and it is questioned whether new solutions can be found in fixed price projects

### 4.3.3 Early phase

It can be seen as crucial too early in the process communicate about money and how to handle changes within the project which also can send signals to the suppliers. Money, forms and how changes can occur are important to discuss. Furthermore, it is argued that no one will bring an innovative idea without getting paid for it and the client need to be aware of that the initial phase might be more expensive and that it can become less expensive in the long run. It is emphasized that it is important to not only focus on time and money. The possibility to bring together the best team and not only focus on the lowest price is also crucial, however, this is more due to the procurement mode.

### 4.3.4 Early phase – idea

It is argued to be important to take time with the purpose to find better solutions such as through an idea generation. To have these kind of idea generations is argued to not be done in any bigger extent today even though it might happen. The perception is rather different among the project managers about how clear Trafikverket as the client is in this question and when they invite to it. When a supplier got the contract they normally plan and start work. However, this kind of idea generation phase is suggested to be very important to enhance the possibility for new ideas and innovations. Another aspect mentioned is to point out where there can be degrees of freedom, meaning where there are possible to find new ideas and solutions in the project.

### 4.3.5 How to handle new ideas

It is discussed whether who should receive new solutions due to the fact that today there are many steps before a new idea can be approved. The question whether how to evaluate the ideas are also raised due to the fact that what is innovative is often subjective. The degrees of freedom are one important factor and also the commission to take decisions as a project manager. Furthermore, it is also stated that it is important as a client to have a desire to receive new ideas and want to make changes. New ideas are received from time to time but time and pressure might make it hard to pursue with them.

#### *4.3.5.1 Internal processes*

It is argued that the internal processes and attitude needs to be changed. The main argument in the workshop was that the internal process does not support innovation to happen, instead it is a big barrier. Today, there are many instances internally to pass before an idea can get approved. One of the project managers provides the example of the easiness to see the barriers if a new idea is suggested in a project. This is due to the long processes and the time it takes to find the right people to have an idea approved. Based upon this, it is suggested to be easier to say no, especially if there is a tight time plan to manage as well. Also due to the time plan, one project manager argues that if it would affect the time plan, then a "no" would be the first answer due to strict times in the railways. However, it also worth to mention differences if it is railways or roads. The regulations and times are much stricter in railways. It is also discussed about the consequences and the possible wins of doing something different and the safety reasons is emphasized. It is argued that too much time cannot be spent searching for the right individuals.

The internal attitude is also discussed among the participants and the importance to reward internally. It is discussed to be the opposite today; it is a struggle to proceed in the process. A culture which can open up for more innovation and change the perception of a new idea from a "no" to a "yes".

#### *4.3.5.2 A group of people to support the evaluation of new ideas*

It is suggested by the participants that a group of people might be put together in order to work as a support for project managers when these new ideas arrive. This kind of group could shorter the process and a decision can be reached faster within the project. Also to know where to go to find the right individuals. Furthermore, it is also suggested that a forum which brings up the good examples to the organization could be of value to increase the awareness internally.

### 4.3.6 Summary of chapter 4.3

*Figure (4.3.6) summarizes the most important findings from chapter 4.3. It provides understanding for answering the first and second sub-question: What factors that can support the innovation process and second, be a barrier for innovation.*

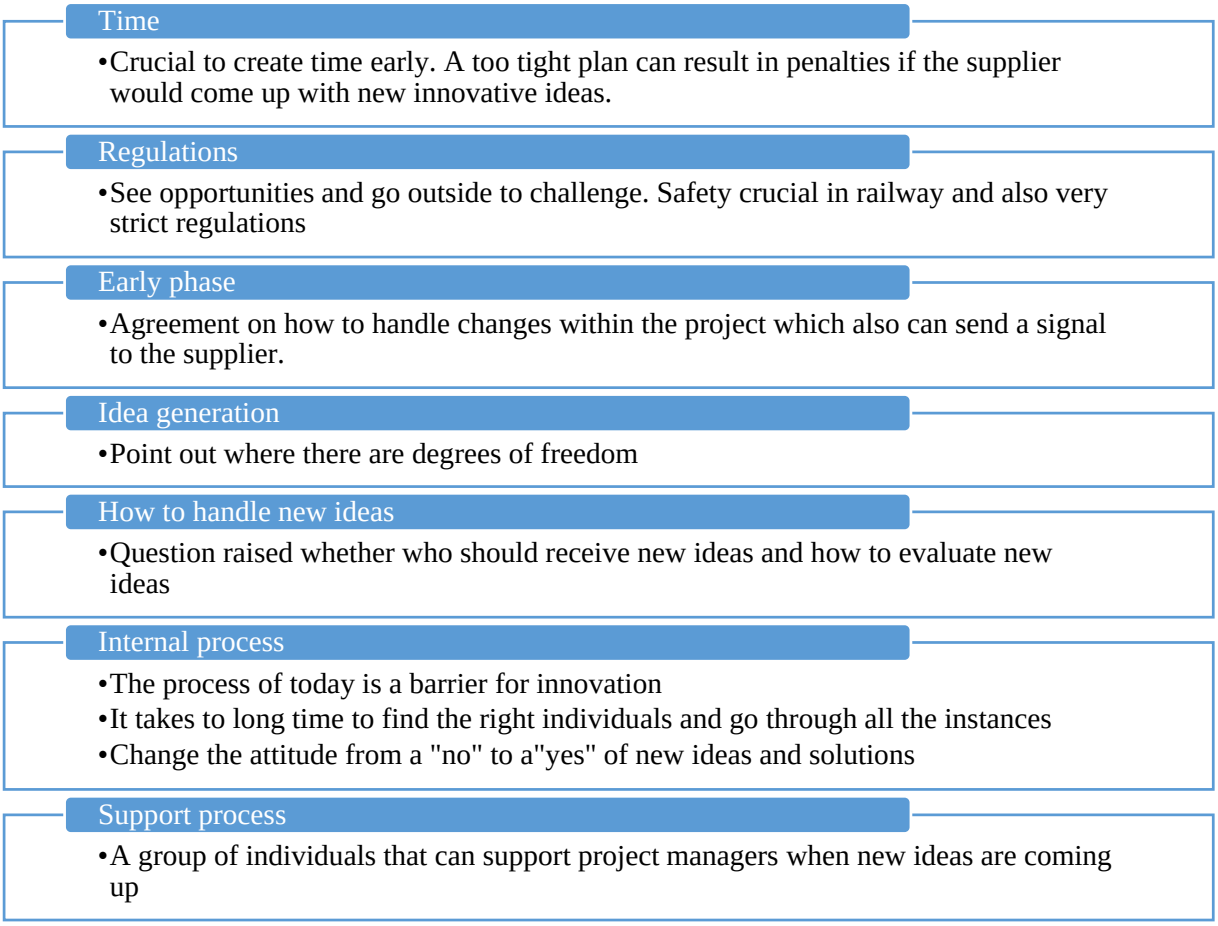


*Figure 4.3.6 - Summary workshop*

# 5 ANALYSIS

*In this chapter will the findings from the literature as well as the empirical data be analysed. The analysis will create the foundation for answering the research questions in chapter 6. Chapter 5.4 summarizes the analysis in a model to get an overview about the findings.*

## 5.1 DEFINITION OF INNOVATION

Innovation is argued by several interviewees to be hard to define and that the word innovation is misused. In earlier literature, there are several definitions of innovation. One of the most accepted definition in the construction industry seems to be the definition of Slaughter, (1998, p.1*); "Innovation 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".* Among the interviews it suggested that these incremental improvements are obvious to consider. One of the interviewees argued that if you are not innovative as an advisor, then you are not a good advisor and that other clients just assume that they are innovative. According to one of the interviewees, it is mostly often about to find the smartest solution for the project. In project X it was highlighted by the project manager that an optimized projecting might be more valuable than an innovation. According to Gambatese & Hallowell (2011) is the simplest form of innovation the implementation of a new idea. Based on this, one can argue that innovation in this context refer to finding new ideas which can improve the process or outcome of a project.

## 5.2 FACTORS TO ENHANCE THE INNOVATION PROCESS

*The structure of chapter 5.2 will build upon the framework for the innovation process (figure 2.2) created by Ozorhon et al. (2014). Based upon the findings, the identified factors will be grouped into the different components; drivers, inputs, barriers and enablers. Chapter 5.4 summarizes the chapter.*

### 5.2.1 Drivers for innovation

*Drivers represent the main reasons for innovation (Ozorhon et al. 2015) and can be of different types due to the project context. The project scope and the demand for innovation by the client has been identified as the key drivers in this paper.*

#### *5.2.1.1 Project specific factors and innovation opportunity*

As mentioned by Russel et al (2006), the type of the project determines whether innovation is of value. One interviewee emphasizes that as a consultant, it is crucial to have respect for the client and their requirements. As argued, if time is the most important factor, then it is not respectful to start generating other ideas about how the project should be performed. However, one can also raise the question of when innovation is needed. Russel et al (2006) argues that the complexity and size of the project can determine whether innovations are suitable, which also can be seen in project X. This project is very complex with several cross points of other infrastructure which led to differences in the estimate of cost with 500 million SEK. The project manager argues that it was crucial to start to investigate and aim to find the most optimal solution in the project. However, the question of how other projects can create a more systematic process of working towards more innovative solutions is important to raise.

According to the project manager of "project X", he has not experienced any similar project in relation to differences in estimated costs. However, innovation can occur in any project but not necessarily because of the system as suggested by Dougherty & Hardy (1996). Then one can argue that the foundation could be to create a system around the actual project process that supports innovation in projects. Then it can be assumed that innovations can be implemented in a project even though it wasn't the objective from the very beginning.

#### *5.2.1.2 Client Requirements*

The client plays a crucial role in terms of innovation in construction (Briscoe et al. 2004; Brandon and Lu, 2008; Loosermore, 2015; Ozorhon, 2013). A common argument from the interviewees where that it has to be a willingness from the client to make innovation happen. One of the respondents emphasizes that Trafikverket today does not show at all that they want to buy innovation or creativity. With these both statements from literature and the empirical findings it can be argued that there is a gap there. Dodgson et al (2014) state that very few organizations can innovate without collaborating and Ozorhon (2013) argues that construction innovation is co-created in a multiparty environment.

*"Alone it is hard to be innovative, the client must want to have it" (Interviewee A)*

However, as mentioned before, innovation is not suitable in every project but when it is, then it should be a willingness from the client to shape the project differently than normally. It is suggested by one interviewee that there has to be some kind of policy instruments internally within Trafikverket so that the top management and those who are working out in the projects are on the same level. These findings suggest that in many projects, there is a barrier of a non-willingness of a new idea or innovation. However, it is also worth to mention that this has its explanations such as time constraints and long processes which will be described in the chapter of barrier (5.2.4) for innovations.

Furthermore, it is also suggested that Trafikverket has the control because they could ask the consultants and contractors for any kind of competence and they would get it. This can also be argued to a great driver to ask for innovation and new solutions in different projects. Kulatunga et al. (2011) also suggest the demand from the client is a big driver and Brandon and Lu (2008) suggest that the client shapes factors such as leadership, culture and financial incentives. With this in mind, it can be argued that the client plays a crucial role for innovation and that there are several factors that influences the opportunity and ability to enhance innovations during the time of a contract.

### 5.2.2 Inputs

*Inputs to the innovation process refers to the resources, strategies and tools (Ozorhon et al. 2014). The author of this paper would also like to emphasize that these factors also are related to the factors presented as enablers in chapter 5.2.3. The early phase, idea generation, a system for how to handle new ideas and incentives has been identified as important inputs in this paper.*

#### *5.2.2.1 Early phase & involvement*

The early stage has been emphasized as very important in project X, among the external interviewees and as well in the workshop to enhance innovation. The project manager of project X argues that the early stage can have rather big impact to relatively small cost in comparison to a later phase of the project. The involvement of suppliers in an early stage can according to Briscoe et al. (2004) increase the likelihood for innovation. Furthermore, as suggested among a few interviewees and of Briscoe et al. (2004); a mutual understanding about the project objectives is crucial which can increase the trust in a project. One can argue that early involvement can be crucial for an understanding of project objectives and criteria for how to evaluate potential upcoming ideas during the project. It was suggested in the workshop that it is important that the client early, or in the specifications, send a signal to the supplier of where there might be potential for innovations. Furthermore, an early agreement on how to handle upcoming ideas during the project can be seen as crucial.

Including the contractors in an early phase has been found to have positive impact (Meng & Humphreys, 2015) and is argued among the contractor interviewees to be crucial for innovation. One interviewee argues that sometimes the contractor has more knowledge about the most financially beneficial solution which also is supported by Meng & Humphreys, (2015). Also due to the long process (see chapter 5.2.4) the early phase can be important to investigate possible solutions and to bring different knowledge to the design process.

#### *5.2.2.2 Idea generation*

Idea generation can be crucial for construction innovation (Gambatese & Hallowell, 2011). The findings from the interviews and workshop indicates that this happens rarely today. However, the potential value of it is also emphasized to come up with new ideas. Dodgson et al. (2014) suggests that ideas for innovation often requires different sources. Based upon this argument, the importance of involving different suppliers with various knowledge to generate ideas for the project can be crucial for innovation. Furthermore, the cost of an idea generation can be relatively small (Adams et al. 2006) and can have a big impact in the end as argued by the project manager of project X.

#### *5.2.2.3 Idea evaluation early and during the project*

It is suggested that it can be difficult to go into a project and say that you will find several new solutions. However, these new ideas or solutions can occur during the project while working. Furthermore, it is also suggested that a working model for how to handle new ideas in a project would be valuable. According to one of the interviewees, this kind of model does not exist today. As mentioned earlier, the simplest form of innovation is the implementation of a new idea (Gambatese & Hallowell, 2011). Based upon this, one can argue that in order to enhance innovation during the time of a contract, it is crucial to have a systematic of how to handle and evaluate new ideas in different stages of the project.

Cooper (2008) introduced the stage-gate model (figure 2.2.5) which can be seen as an adjustable blueprint for the development phase. The model includes several stages and on each stage a decision is needed whether to proceed or leave the idea (Cooper, 2008). The importance of understanding each other goals has been highlighted in this paper as well as the

importance of an agreement on how to handle changes during the project. How to handle changes is emphasized in the workshop to be important to establish in an early phase.

Based on upon this information, one can argue that the gates should include a pre-set of criteria for the idea based upon the project objectives. When a new idea arrives during the project, then there is a working model on how to evaluate and proceed with the idea based upon the stage-gate process. One interviewee suggests that the evaluation or implementation of a new idea can be run in parallel with the original plan of execution.

#### *5.2.2.4 Reward schemes / incentives*

*Two different types of financial incentives have been proposed. First, if the project becomes cheaper, then the savings can be shared. Second, incentives to encourage the project team through an innovation bonus.*

##### 5.2.2.4.1 Share the savings

According to Bresnen & Marshall (2000) can incentives in construction projects be an important way to collaborate in the short term and build trust in the long term. The construction companies discuss whether how the savings can be shared between the client and the contractor when something smart is found. The sharing among the partners based is also suggested by Pesämaa et al. (2009) that suggests that it should be dependent on the total cost. It is argued by one interviewee that if you come up with a new solution, then there is no incentive to receive one million for that. Instead, the incentive should be based upon the activities that is specified in the project specification that can reduce the cost and still keep the value for the client and contractor.

##### 5.2.2.4.2 Incentives

There is a positive attitude towards incentives among the interviewees and with one argument that it can increase the motivation and encourage to think outside the box. This is identified by Kadefors & Badenfelt (2009) that suggests that incentives can improve the motivation of the project team. The concept of innovation bonuses is emphasized to be good and one interviewee explained that that the gesture is much more important than the money. The concept of being rewarded when something good is performed versus being punished with extra fees is discussed in relation to the willingness of bring an innovative idea into the project. However, it is also mentioned by Kadefors & Badenfelt (2009) that a reward behaviour also can include a risk due to the project objectives.

Kadefors & Badenfelt (2009) suggests that the right underlying reason behind the symbolic role of incentives can refer to trust, collaboration and intrinsic motivation. With this strategy of incentives and bonuses, it is suggested by one interviewee that Trafikverket can save more money in the long run. Pesämaa et al. (2009) suggests that in order to enhance the team work and collaboration, the incentives should be based upon the performance of the team. Simplicity without too much of administration is also emphasized by one interviewee in terms of evaluating and rewarding with incentives.

The difficulties with innovation and how to measure it is argued among the interviewees and it can be questioned whether what is innovative. However, Kadefors & Badenfelt (2009) suggests that incentives can relate to process generators on organizational processes. Communication

processes can be generated through performance assessment and in which the knowledge can be exchanged. The knowledge exchange part is explained more in the chapter (5.2.3.4) of knowledge management.

### 5.2.3 Enablers

*Enablers can support the process to overcome or minimize the barriers for innovation in the project (Ozorhon et al. 2015). As mentioned in the introduction to 5.2.2, the input factors can be seen as connected to the enablers presented in this chapter as well.*

#### *5.2.3.1 Culture and climate for innovation*

Creating a culture for innovation is one of the most important factors for innovation and this has been highlighted in literature (Phillips, 2014; Dodgson et al. 2008; Ahmed, 1998; Ozorhon, 2013; Ozorhon et al. 2015). A culture and climate that can foster innovation is also highlighted by most of the interviewees and it can be concluded that creating a culture and climate is crucial for innovation and development within a project. Culture is also described as a key factor in project X and the project manager argued that the leadership is important to foster this. One can also argue that creating a culture for innovation that can be difficult when there are tight deadlines and other factors which might create pressure in a project. As also argued by interviewee D; "*you can´t create the culture within the project specifications, you do it when the project starts and when you start to interact with each other".*

An open climate where project members can bring ideas without being judged is argued among respondents to be a key factor. In project X, the project manager also emphasizes the importance of considering all ideas and let everyone speak. According to Blayse & Manley (2004) is it crucial that individuals within a project can question how things are working without fear of penalty in order to create an open climate. As argued by one interviewee, nine ideas might be bad, but if these are not encouraged the tenth good idea will not be found.

Blayse & Manley (2004) also suggests that an important factor to create an innovation culture within a project is a better understanding about each other´s goals and an openness to new ideas. One interviewee argued that the client has its goals, they have their goals but it is better to create common goals and works towards them for the best possible project. This can be crucial to create a good culture and trust within the project. If the different parties in a project might have different goals, then conflicts can arise easier which also is emphasized of one interviewee. It is also emphasized that it is devastating when you come up with new ideas and every time will hear: no that is not possible. This statement is also supported by one project manager within Trafikverket during the workshop. It was argued that there is so long way to handle the new idea and it is easier to say no from the beginning due to a very strict time plan. One can argue that this does not enhance innovations during the time of a contract and can be seen as a barrier to overcome. Further, according to Ahmed (1998), a culture where it is possible for the organizational members to strive for innovation is crucial.

Schein (1992) cited in Phillips (2014) identified three levels of culture and in which the first level refers to basic underlying assumptions which includes unconscious taken for granted beliefs and values. When presenting a new idea. There are among some of the interviews stated that there can be a suspiciousness that a consultant/contractor want to do something different

just because they want to earn more money. It is suggested that with this discussion innovation will not move forward and the willingness of bringing new ideas or innovations will stop. This is supported by Phillips (2014) who state that if an innovation will be accepted or rejected is shaped to a large extent by the organizational culture. It is also discussed in the workshop that it is important to improve the internal culture to enhance innovation. Communicating good examples of innovative projects is argued to be one starting factor in order to raise the awareness internally.

It is also important to emphasize that many of the projects might have limited budgets and with a time pressure. Therefore, one can argue that the culture and openness between the different parties is crucial to understand each other and not just taking things for granted. As one of the interviewee's state: "*it is as important for us to build up the trust towards Trafikverket as it is for them to build trust for us, it is a collaboration".*

#### *5.2.3.2 Cooperation*

Cooperation is emphasized among several respondents to be important for innovation. It is suggested by one interviewee that the collaboration can be more important than any incentive or bonus. Dodgson (2014) argues that very few organizations can innovate without collaborating in some form. Consultants, contractors, clients and other potential participants in a project have co-developing roles in the innovation process (Ozorhon, 2013). One of the interviewees has the feeling that the consultants, contractors and the client has each become more specialized in its role and it might lack of knowledge among the different parties.

According to Mention (2011) can cooperation be seen as innovation stimulus by bringing together complementary knowledge that can reduce the uncertainty in the innovation process. This could lower the cost, risk and increase the pace of reaching the goals (Schilling, 2013). Communication, trust, openness and a mutual understanding are mentioned among the interviewees as import factors for the cooperation. It is suggested that when there have been projects with a fixed price, then the communication stops from the client and that can be seen as the opposite to generate innovation. A co-developing role from the client can be of importance for innovation (Ozorhon, 2013) and to which extent should be based upon the type and objectives of the project. It is also argued by one interviewee that the supplier and client are not on two different sides, everyone benefits of a good collaboration.

#### *5.2.3.3 Project champions*

Experienced managers that can take the role as an innovation champion is of great importance to enhance innovation (Russel et al. 2006; Shilling, 2013; Ozorhon et al. 2015; Gambatese & Hallowell 2011). The experience of the project manager is argued among several of the interviewees to be important and it is argued that the more experience, the faster process. However, as explained in chapter 5.2.4.5, there are long ways to reach a decision and without the right connections it can take long time in an already tight time plan. Shilling (2013) define a project champion as a senior member that have the authority to fight for a project. It is suggested that without technical background and experience it might be hard to explain to higher management when someone raises critique. Based upon this one can argue that it is

important to have experienced project managers in complex projects where innovation can occur.

Furthermore, one idea suggested in the workshop was to put together a group of individuals that can support the project managers in project where new ideas occur. This group could then act as "champions" when needed and improve the easiness for the project manager, in both speed and to evaluate a higher number of feasible ideas.

#### *5.2.3.4 Knowledge management*

The management of knowledge within a project can be a crucial aspect for innovation (Kamara et al. 2002). It is suggested by one interviewee that it is way too common to go through a project and don't follow up and exchange knowledge and experience during the project. If it is done after a too long time, no one will remember what has been done. It is also suggested by Riberio (2009) that the project performance can be improved by communication, sharing of insights, experience and knowledge. One interviewee state the whole industry is rather bad at following up and evaluating a project. Furthermore, it is suggested that it can get better since Trafikverket have started more with a turnkey approach where the consultants and contractors are working closer to each other. It is also discussed whether where the responsibility for these things should be, however, that might be dependent on which type of contract there is.

In project X, this phase is highlighted as important and especially the fact to have meetings with the purpose of only discussing the projecting. The number of involved people in these meetings should not be limited according to the project manager. This is in phase with Ozorhon (2014) that argues that the sharing of knowledge is crucial for innovation and to communicate it to everyone in the project team.

*"Talk the individual who are drilling in the ground, what is he doing, what can be improved and try to work there and start talking to the people who executes. Not only to the consultant and professor, even though everyone is needed" (Interviewee G)*

Another interviewee also emphasizes the importance of speaking about the future in these projects and not only about the problems in the past but what can be improved for the upcoming stages of the project. This in line with Ribeiro (2009) that argues that knowledge generated by individuals is crucial in order for improvements to happen. It is also suggested by one interviewee that to implement this kind of meetings it might be needed with pressure from top management in both organizations. Further, as suggested by another interviewee, it is important to have active feedback, follow up on the goals and work active with these questions which then can improve project performance as also suggested by Ribeiro (2009).

### 5.2.4 Barriers for innovation

*A barrier is defined by Ozorhon et al (2015) as a problem or challenge in the innovation process. This study has identified five barriers for innovation which is widely argued among the respondents. These are time, money, culture, regulations and internal processes of the client.*

#### *5.2.4.1 Time*

Ozorhon (2015) identified time pressure as a barrier for innovation and that is confirmed by all interviews in this study. However, a few of the interviewees state that a time pressure can result in innovation in their own process, but not in the end product. This is also in line with Russel et al (2006) that suggested that time can be both a driver or barrier due to the delivery phase of the project. However, in order for innovation to be possible it is argued that an extended time frame is needed which also is highlighted as a crucial factor in project X. This is also emphasized in the workshop with project managers from Trafikverket that discussed the importance of creating time in an early phase. If innovation is of value in the project, then it is argued that it has to take some longer time initially to earn time and save money in a later stage. According to Russel et al. (2006) is it important to identify the constraints that can be challenged and moved.

#### *5.2.4.2 Financial*

There are often low margins for the suppliers and innovation can as mentioned in previous chapter, be expected to initially take more time. Therefore, it can also be expected to cost more money in the early stage. However, it is also experienced that the client believes that the supplier presents new ideas just because they want to earn more money. It is suggested that this suspiciousness will not result in a desire from the consultant/contractor to be more innovative. Furthermore, in project X, the project manager argues that it was crucial to in an early stage to add hours and spend more money to find the best solution for the project. One can then argue that in order to enhance innovation during the time of a contract, there has to be focus on the total value in the end of the project and not only focus on the initial cost. Furthermore, as argued by one interviewee, the cheapest solution is not always the most financial for the project. However, there are also uncertainties connected to innovation (Tao et al. 2010) and the project objectives (Freeman and Soete, 1997, refered in Davies, 2014, p. 625) which can make it difficult for the client.

#### *5.2.4.3 Culture*

Culture have been discussed earlier as an important factor for innovation. Just as important it is, it is also a big barrier on the other hand. The innovation un-friendly culture with low acceptance for new ideas are also considered to be a barrier for innovation which also is suggested by Ozorhon (2015). It is argued that it is way too common that the client says no with the argument that the other way is how it normally is done. It is argued by one interviewee that it is to common that the client says no with the argument that the other way is how it normally is done. It is discussed among a few respondents that when they are coming with new ideas, the ideas are often rejected without trying.

#### *5.2.4.4 Regulations*

Due to factors such as third man and safety there are a lot of regulations for infrastructure projects and especially in the railway in which time at the railway has to be booked 1-2 years in advance. This also implies strict time constraints to not disturb the traffic and the surrounding environment. These regulations are argued to be barriers for innovation and new solutions. However, according to Russel et al. (2006), it is important to identify the constraints in which can be challenged. This is also emphasized by one of the respondents who asks the question

whether how the regulations can be updated if they never are challenged and are remaining the same. However, safety is also concerned with understanding among the interviewees, but it should be areas where more efficient solutions can be performed.

#### *5.2.4.5 Internal processes at the client (Trafikverket)*

Client requirements have earlier been analysed as an important factor for new ideas and innovation. However, there are a majority of the respondents that argues that there is a big barrier in the internal processes of the client. This is also emphasized among the workshop participants and one can say that this can be connected to the other four barriers presented here; time, money, regulations and culture. If there are new ideas during a project, the process of today is very long to get a new idea approved. There are many instances to pass and argued among the project managers in this study that it is difficult to find and reach out to the desired people such as technical specialists. With this in mind there was stated by one project manager that it is easier to say no when a new idea is suggested in a project due to a tight time plan. If the answer no without the evaluation a new idea, the willingness of bringing new and different ideas might decrease.

Furthermore, it is discussed about what incentives there are from the client and the project manager to bring in a new idea. This can often involve higher risk and an uncertain outcome and this can be a very complicated situation as a project manager to handle, which also is expressed in the workshop. Support processes and clarity can be crucial in order to handle new ideas in a faster way.

## 5.3 EVALUATION OF INNOVATION

The management of innovation performance is a complicated task (Jansen et al. 2011; Ozorhon et al. 2015). Among the interviews it is also argued that innovation is a wide term and can be defined differently among different companies. The difficulties of following up and measure innovation is highlighted among the interviewees. Ozorhon (2013) state that in order to determine the innovation performance of a firm, the measurement is important.

Both Slaughter (2000) and Ozorhon (2013) suggest that it is important to evaluate the project based on expectations, outcomes and that the innovation should be evaluated based on the innovation criteria. This is also emphasized by one of the interviewees that argues that it is crucial to set up concrete understandable objectives which the people in the project can work towards. Davila et al. (2006) and Janssen et al. (2011) state that output metrics can be an implementation of an innovation. However, it is also suggested that if the objective is to come up with a new innovation, it can be very hard to determine whether what is an innovation. The construction industry is most about incremental innovations (Loosermore, 2015) and a new solution can be defined as an innovation if it is new to the organization (Slaughter, 1998). Based on this, one can argue that it is crucial to identify innovation criteria which then can communicated as an objective in the project.

Slaughter (2000) argues that the criteria should be updated based on the experience with the innovation. It is stated by one interviewee that if the client is serious with for example environment and sustainable solutions, then it is crucial to find criteria which is important for

building for example a more energy-efficient road. This method for measurement is also suggested by Ozorhon (2013) that suggest that if innovation is connected to environment, then the criteria for measurement should be factors such as waste or energy consumption. Russel et al. (2006) mentions that there are a wide variety of stakeholders within infrastructure projects and metrics such as safety, durability and environmental impact should be considered. In project X there were also criteria such as less impact on traffic, production time, cost, groundwater impact and socioeconomic value considered.

One idea among one of the interviewees related to durability was to measure the actual outcome of the project after a few years. If then money was saved in comparison to historical values due to a new innovative solution, then the savings can be shared between the client and consultant/contractor. In their case study of U.K construction firms, Ozorhon et al. (2014) showed that one project compared the actual change in order to evaluate innovation. However, this is also argued to be hard due to the uniqueness of each project as well as the complexity of the project. It is suggested by one interviewee that if this would be possible, then it might be a part of the project which is comparable for the innovation. According to Smith (2009) are technical measurements seldom valuable across product. Then can the question also be asked about how accurate the data can be if comparing one part of another project and moreover question whether if data is available. If then there are an incentive connected it will be a subjective evaluation of how and what to compare. Also the uniqueness of each project is argued to make it hard to follow up on innovation.

Due to the difficulties of evaluating the actual innovation, it has also been suggested that it might be better to focus on the process. One interviewee argues that innovation should more about the cooperation to create the opportunity for innovation in a project. To discuss the objectives in an early stage has been emphasized and then work together towards innovative solutions. According to Janssen et al. (2011) should innovation metrics be part of an innovation management framework to identify key success factors within the innovation process. It is suggested that the performance drivers within the input, process, and output should be analysed to find relationships among the different performance measures. To stimulate continuous learning, these drivers should be revised regularly (Janssen et al. 2011; Slaughter, 2000). Based on the literature review, table 2.3.4 summarizes potential drivers and criteria for evaluating the innovation performance.

## 5.4 SUMMARY OF ANALYSIS

Figure 5.4 summarizes the findings from chapter this chapter. It builds upon figure 2.2 (Ozorhon et al. 2014) with the difference with an additional box: evaluation. The different factors are categorized into the different components; drivers, inputs, barriers, enablers and how to evaluate innovation.

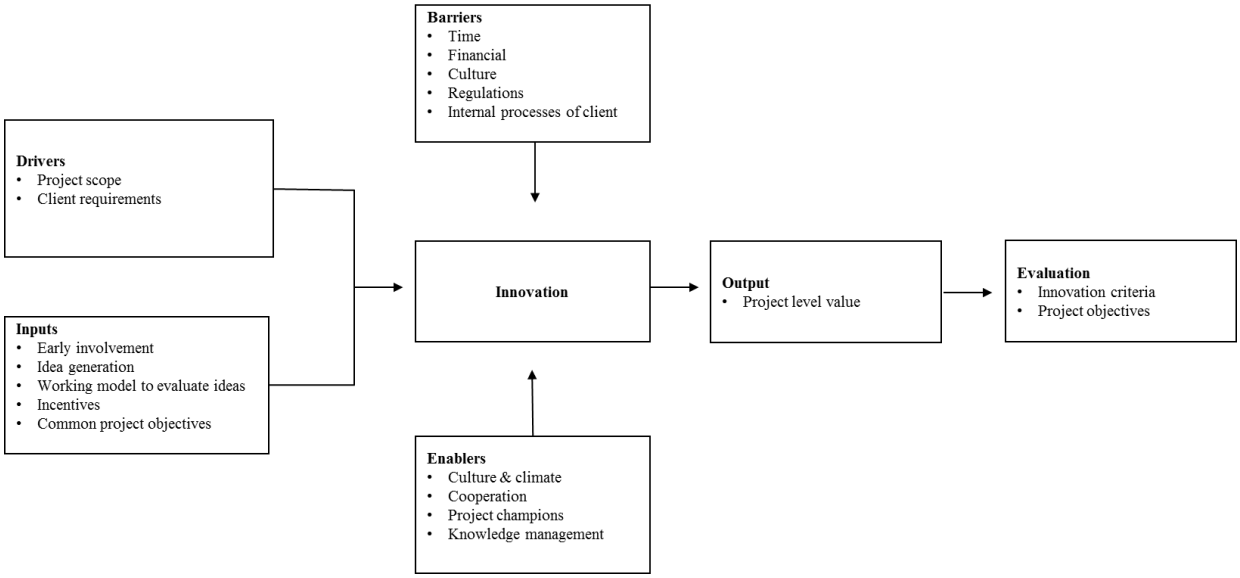


*Figure 5.4 - Summary of analysis*

# 6 CONCLUSION

*This chapter will conclude the paper and answer the research questions provided in chapter 1.3.1. First, the three sub-questions will be answered in chapter 6.1–6.3. The main question whether how Trafikverket as the client can enhance innovation during the time of a contract will be answered in chapter 6.4. Chapter 6.5 gives recommendations and chapter 6.6 suggestions for future research.*

## 6.1 WHAT FACTORS CAN SUPPORT THE INNOVATION PROCESS IN CONSTRUCTION PROJECTS?

As suggested by Ozorhon (2013), Cooper (2008) and Dodgson (2008), a systematic process for innovation activities can be beneficial in a project. Considering the findings of this paper, several factors have been identified which can support the innovation process in projects. However, it is important to mention that these have not been tested. To visualize the factors that can support the innovation process in a project, with Trafikverket as the client, figure 6.1 was created.

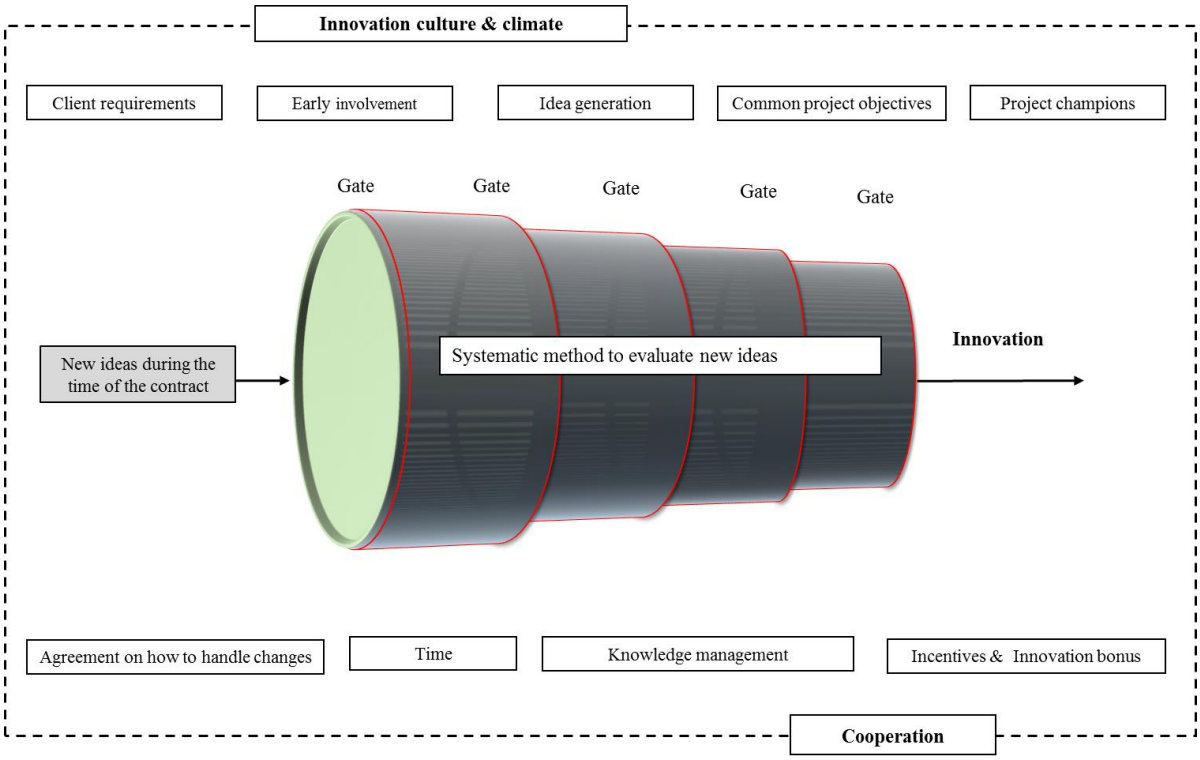


*Figure 6.1 – Enhancing innovation during the time of a contract – made by author*

The dashed line surrounding the model emphasizes the importance of an innovation-friendly culture and cooperation in the project to enhance innovation. The white boxes inside the dashed line show factors which can be important to support the innovation process. The funnel with edges in the middle is inspired by the stage-gate model (Cooper, 2008) and aims to illustrate the importance of a systematic method to evaluate new ideas.

**New ideas and systematic method to evaluate the ideas**

Innovation in the simplest form is the implementation of a new idea (Gambatese & Hallowell, 2011). In the construction industry, innovation is mostly about incremental improvements

(Loosermore, 2015). To enhance innovation during the time of a contract, one can argue that the evaluation and implementation of new ideas are fundamental. It is argued that it can be hard to go into a project with the objective to find new solutions which can often arise while working. Furthermore, according to the findings of this study, there are today no method to evaluate new ideas, however, it is argued to be needed. Therefore, the author of this paper would recommend to further investigate in how to use a model, such as the stage-gate. This will be further examined in the chapter of recommendations.

**Client requirements**

The client plays a very important role to enhance innovation during the time of a contract. It implies that there is a willingness from the client organization to innovation. According to Brandon & Lu (2008) does the client shape factors such as culture and leadership in a project. It is emphasized that the client today does not show that they want innovation and it is very difficult to be innovative alone which is also emphasized by Dodgson (2014) and Ozorhon (2013). This implies that the cooperation to reach innovation can be stopped already by a non-willingness of innovation. Cooperation among different organizations is considered to be crucial for innovation (Dodgson, 2014). Based upon this, one can argue that a change in the requirements from the client can be crucial to enhance innovation during the time of a contract. As suggested by one interviewee, the client can ask for any competence which can be seen as a big driver for innovation.

**Culture, cooperation and incentives**

A culture and open climate for innovation have been emphasized among the respondents as well as in literature (Dodgson et al. 2008; Phillips, 2014; Ozorhon, 2013). A culture where the project team are encouraged to bring up new ideas can be crucial to enhance innovation during the time of a contract. Furthermore, cooperation can according to Mention (2011) be seen as an innovation stimulus. According to the interviewees, factors such as communication, trust, openness and a mutual understanding are important for the cooperation. Furthermore, according to Ozorhon (2013) can a co-developing role from the client be very important for innovation. One way to improve the cooperation can be to include incentives (Bresenen & Marshall, 2000). It can be concluded that the concept of incentives and innovation bonuses is valued among most of the interviewees and it can be a source for motivation as also suggested by Kadefors & Badenfelt (2009). To illustrate the importance of an innovation-friendly culture and cooperation, these factors are surrounding figure 6.1. One can argue that culture and cooperation can affect the rest of the factors while working in a project.

**Common objectives & how to handle changes**

To create this culture where ideas can be fostered and systematically managed (Dodgson et al. 2008), one can argue that it is crucial to have common objectives among the different involved parties in the project. The importance of common goals has been emphasized in earlier literature (Blayse and Manley, 2006; Russel et al. 2006) as well as by interviewees. However, it is suggested that sometimes there are different goals among the client and supplier. To reach the best possible result of a project and possible innovations, one can argue that a mutual understanding about each other´s or to have common objectives can be crucial. The question whether how innovation and development can take place without common goals can be raised.

Furthermore, the importance of common objectives can also be crucial regarding the evaluation of upcoming ideas in the project. If there is a mutual understanding about on what criteria a new idea will be evaluated on, then one can argue that the opportunity for creating an innovation-friendly culture can increase. It is also suggested that it is crucial to have an agreement on how to handle potential changes during the project, such as evaluation and implementation of a new idea.

**Early involvement, idea generation & time**

A better understanding about the project objectives can be improved by early involvement (Briscoe et al. 2004). The importance of the early stage is also emphasized among all the respondents and it is argued that the different parties have different knowledge which is valuable for the best possible outcome of a project. According to (Briscoe et al. 2004) can the early involvement of the suppliers increase the opportunity for innovation. Further, idea generation is considered to happen rarely today and is according to Gambatese & Hallowell (2011) crucial for construction innovation. This can be argued to be important in an early stage of the project, involving different suppliers, e.g. consultants and contractors. Further, the time aspect has been argued to be crucial for innovation and the importance of creating time in an early phase of a project.

**Project champions**

Project champions who can fight for the innovation have been emphasised in literature (Russel et al. 2006; Shilling, 2013; Ozorhon et al. 2015; Gambatese & Hallowell 2011) as well as among the interviewees. Among the interviewees, the experience of the project manager has been highlighted as crucial when it comes to innovation. One interviewee state that it is as important for the client as the supplier to put together an organization that meets the demands for the project. It can be concluded that experienced managers that can act as project champions can be crucial for innovation during the time of a contract.

**Knowledge management**

Knowledge management within a project can be crucial for innovation (Kamara et al. 2002) and according to one of the interviewees the whole industry is rather bad at it. In project X it is emphasized as a crucial factor and to use those meetings to only speak about the project and possible solutions. This can generate valuable knowledge both within the current project but also to future projects.

## 6.2 WHAT ARE THE BARRIERS FOR INNOVATION?

One can argue that to enhance innovation during the time of a contract, it can be crucial to know the barriers for innovation. This paper has identified five barriers for innovation; time, financial, culture, regulations and the internal processes in the client organization. Ahmed (1998) suggest that it is important to create an environment in which innovations can occur and according to Ozorhon (2013) can a project be beneficial with a more systematic management of innovation activities. Based on these arguments it can then be concluded that a system around these barriers is needed to simplify the process and enhance the probability for innovation during the time of a contract.

**Time**
Time is crucial for innovation and today there often no room for it in the projects that often have very tight time plans. Moreover, if any new idea is found in the project, it can be expected to take longer time. It was discussed in the workshop if more time could be created in an early stage of the project to make room for innovation. As also the case in project X, more time was created in an early stage to find the best possible solution for the project.

**Financial**
The financial aspect is also important to mention. Innovation can be expected to cost and take more time initially as showed in project X. However, the financial aspect is very important for both the client and the supplier, and can create an uncertainty for innovation. Uncertainty can also be connected to an unknown outcome for a new solution. It is suggested among a few interviewees that the client sometimes can become suspiciousness that the supplier just want to earn more money when presenting a new idea. Based upon this, one can argue that is crucial to aim for a culture in which a trust and mutual understanding among the parties can be established.

**Culture**
Culture is another factor that can be seen as a barrier for innovation. Gambatese & Hallowell (2011) suggest that innovation in the simplest form is an implementation of a new idea. However, several interviewees mention that suggestions for new ideas are often rejected by the client, even though they might have potential to save money and/or improve quality. To create an innovation-friendly culture that can foster new ideas from a systematic process can be a challenge (Dodgson, 2008). However, one can argue that this is connected to the internal process, which will be further explained below.

**Regulations**
There are many regulations which has been emphasized to be a big barrier for innovation. The regulations are important for safety reasons but it has also been argued as important to challenge the regulations where it is applicable which also is suggested by Russel et al. (2006). The importance of experienced project managers from the client has been emphasized in order to have the capability to fight for an idea.

**Internal processes**
The most significant barrier for innovation during projects seems to be the internal processes in Trafikverket. This is argued by most of the external companies as well as in the workshop. It is stated that there are a too long process and too many instances to pass to reach a decision when a new idea is presented during a project. This implies that it is much easier to say no to a new idea with the time as one aspect. Within the workshop with the project managers this was emphasized as a problem. Furthermore, it is argued by several interviewees that the experience of the project manager from the client is crucial and that the project managers might have little incentive to try something new if there is a risk involved. Furthermore, one can say that innovation often brings uncertainty (Tao et al. 2010) which then can lead to an increased risk in the project. However, according to Mention (2011) can the uncertainty be reduced by bringing together complementary knowledge in a cooperation. With this argument one can say

that it is crucial to bring in complementary knowledge in this process when a project manager receives a new idea or suggestion for solution in a project.

In the workshop with the project managers it was suggested that the internal process need to be significantly improved to enhance innovation in projects. As it is today, it takes time and is hard to reach out to the right people such as technical specialists. To improve this, it is suggested to put together a group of people that can support the project managers in these questions.

## 6.3 HOW CAN INNOVATION IN PROJECTS BE EVALUATED?

Evaluating innovation and manage the innovation performance is argued to be complex (Janssen et al. 2011; Ozorhon et al. 2015). This complexity is also emphasized by several interviewees. At first, it is important to define the concept of innovation and factors of interest for evaluation. The construction sector differs among other industries in measuring innovation (Loosermore, 2015). Davila et al. (2006) suggested that an innovation measurement system designed in the wrong way can do more harm than good. Because every project is unique and the complexity of measuring innovation, reaching an objective evaluation can be difficult, however, it can be possible. Ozorhon (2013) state that it is important to evaluate innovation based on innovation criteria for the specific project.

As suggested both in the literature and by one interviewee, the innovation criteria should be based upon measurable factors such as energy waste, if environment is an important factor in the project. In the case study made by Ozorhon et al. (2014), this kind of measurement was showed to be possible. However, it can also be argued that the ability of measuring this, requires high competence within the specific area of innovation. Also durability can be a factor of interest and it is suggested by one respondent to measure the outcome after a fixed number of years due to the cost of maintenance.

Considering the discussion above, one can argue that in order to evaluate innovation in an objective way, the evaluation should be based upon the innovation criteria. However, as also mentioned can this be seen as a very complex task (Janssen et al. 2011; Ozorhon et al. 2015). Therefore, one can discuss the purpose of evaluating the outcome of innovation.

However, it has also been suggested that the process might be more important to manage and then create the possibility for innovation in projects. Due to the complexity of evaluating innovation, it might be more important to manage the process and to create opportunity for innovation. As showed in the previous question, several factors have been introduced to enhance innovation during the time of a contract. One suggestion for future research could be how these factors can be measured to manage the process in a better way.

## 6.4 HOW CAN TRAFIKVERKET AS THE CLIENT ENHANCE INNOVATION DURING THE TIME OF A CONTRACT?

Several factors (figure 6.1) have been identified in this study which can have a positive impact on innovation. However, as mentioned in 6.2, to enhance innovation during the time of a contract, it is crucial to lower the barriers to innovation. Today, there seem to be a difficult and time consuming process in order to get an idea evaluated. Innovation in the simplest form

is the implementation of a new idea (Gambatese & Hallowell). If then there is a low acceptance for new ideas in projects, it can be argued to be crucial to improve the process of managing new ideas in order to enhance innovation. If this process can be improved, and Trafikverket as the client encourage the process and demand innovation in a higher extent, then more innovations can be achieved. Moreover, the cooperation and creating the innovation-friendly culture in the projects as well as clear communication about project objectives can be seen as crucial.

Further, evaluation of innovation has been argued to be a complex task. As suggested, the process might be more important to manage to create opportunities for innovation. However, more research is suggested in order to create a good tool for evaluating the different components of the innovation process.

## 6.5 RECOMMENDATIONS

To stimulate innovation during the time of the contract, the author of this paper argue that it is important to investigate how the internal process regarding evaluating new ideas can be improved. Today, it seems like the process is time-consuming and according to the project managers, it can be hard to find the right people to have a new idea evaluated. The innovation-friendly culture is an important factor for innovation which has been emphasized by most of the interviewed companies as well as in the literature (Phillips, 2014; Dodgson et al. 2008; Ahmed, 1998; Ozorhon, 2013; Ozorhon et al. 2015). One can argue that in order to stimulate innovation, the innovation-friendly culture is crucial where the project team can bring up new ideas which have a potential value. According to the findings in this paper, it seems like many ideas are rejected before even evaluated. This might imply that new solutions and innovations that have a potential to save money, time and improve quality, not are considered in several projects. The author of this paper would argue that this barrier is fundamental to lower, in order to stimulate more innovation during the time of the contract.

It is emphasized among the project managers in the workshop that some kind of support process are important. The time plans are mostly often tight and it is argued that you don't have time searching for the right people and wait to have the idea approved through all the instances. One idea suggested in the workshop is to have some kind of group that can support in questions regarding new ideas or innovation. This group could support the project managers when new ideas arise in a project and make the initial process of evaluating an idea easier and faster. How a group like this could look like is recommend to further examine to improve the process and then increase the probability for innovation and development. However, building upon the idea of creating a group that can support the process of new ideas.

As mentioned in the conclusion of this paper, a systematic process for innovation can be beneficial in a project (Ozorhon, 2013; Cooper, 2008). This implies that the ability to receive and evaluate potential valuable solutions is crucial to stimulate innovation during the time of a contract. Further, the stage-gate model was introduced as a suggestion for a systematic method to evaluate ideas. However, it is crucial to decide who will take the decisions of whether to proceed or leave an idea. An idea of the author is whether it is possible to develop a working model based upon this method to evaluate upcoming ideas in projects. Moreover, this should

be communicated at an early stage as well as have an agreement on how to handle potential changes during the project.

Furthermore, Trafikverket, in the role as the client, plays a crucial role to stimulate to innovation during the time of a contract. The importance of the role of the client in the innovation process has been showed in several scholars (Gambatese & Hallowell, 2011; Brandon & Lu, 2008; Kulatunga et al. 2011; Loosermore, 2015; Ozorhon, 2013; Briscoe et al. 2004). It is suggested that the client affects factors such as culture and leadership. However, the findings from the external interviews show that the client doesn't want innovation in several projects. This can be in line with the internal processes as explained earlier. It is also suggested that it is hard to be innovative alone and the client has to want it. Therefore, to stimulate innovation, it can be argued to be crucial to improving the internal processes as well as to demand innovation. Thereafter, create possibilities for innovation together with the supplier.

To create the possibility for innovation it can also be argued that the internal awareness is crucial. Besides the internal processes, the internal culture was also discussed in the workshop with the project managers. To create awareness and get more people on-board when it comes to questions regarding innovation, it is argued that the attitude needs to be improved. However, it is suggested that it is important to spread the awareness of good examples in the organization, through a forum or similar. Furthermore, among some external interviews, it is suggested that the project managers have small incentives to try something new, especially since they have the responsibility and can get the blame. This can also be seen as crucial to further investigate in Trafikverket. In one of the case studies in Ozorhon et al. (2014), a reward scheme with the "innovator of the month" was introduced with the purpose to reward individuals with great contributions. Maybe a similar approach could be of value to raise the internal awareness?

## 6.6 SUGGESTION FOR FUTURE RESEARCH

Most of the theory of innovation are on a firm level and not as much research is conducted on a project-level. It is a need for more research to improve the understanding of what factors that have a significant impact on innovation on a project-level. This study has proposed several factors that can be important to enhance innovation, however, they have not been tested and it would be interesting to further research and to further improve the understanding about this process. Moreover, it would be interesting to research whether how the practical aspects of the innovation process can be measured and thus managed in a better way.

Second, knowledge management has in earlier literature been identified as important for innovation. However, based on the findings in this paper, it is suggested that it is not done to any big extent today. It would be interesting to research on how the management of knowledge can be improved, both within projects in progress but also for future projects.

Third, several barriers have been detected in this research and also in earlier literature. However, one crucial aspect to stimulate innovation is to understand how these barriers can be overcome. One barrier identified in this study was the internal processes of the client. A suggestion for future research could be how a support group of people can improve the processes of evaluating and implementing ideas at the client organization.

Fourth, the purpose of this paper was to investigate how innovation can be enhanced during the time of a contract with Trafikverket as the client. It would be interesting to further investigate on how a systematic model can be developed to evaluate upcoming ideas during the time of a contract.

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# 8 APPENDIX

*Appendix 8.1 and 8.2 contains the overall questions for the interviews. However, in the interview guideline the researcher of the paper had several "follow-up" questions due to the answers. All the interviews were performed in Swedish and the questions have thereby become translated to English in this paper.*

## 8.1 INTERVIEW QUESTIONS CASE STUDY

1. Can you first briefly tell me who you are and your role at Trafikverket?
2. Can you tell me about the background to the focus of innovation in this project?
3. Can you explain important components in the process for this project?
4. Can you tell me about how the evaluation worked in the project?
5. Can you tell me about the cooperation with the supplier?
6. How did you decide the incentives?
7. What was the biggest challenges in this project?
8. Finally, something you would like to add?

## 8.2 INTERVIEW QUESTIONS EXTERNAL COMPANIES

1. Can you first tell me briefly who you are and your role at company XXX?
2. How do you define innovation?
3. Can you describe important components for a good process of innovation between the client and projector/contractor?
4. What is important in the evaluation?
5. How is the opportunity to be innovative with Trafikverket as the client?
6. How do you collaborate with other companies in order to innovate?
7. What is your attitude toward incentives regarding innovation?
8. What do you think about ownership and the rights of use for new solutions and innovation?
9. Finally, something you would like to add?