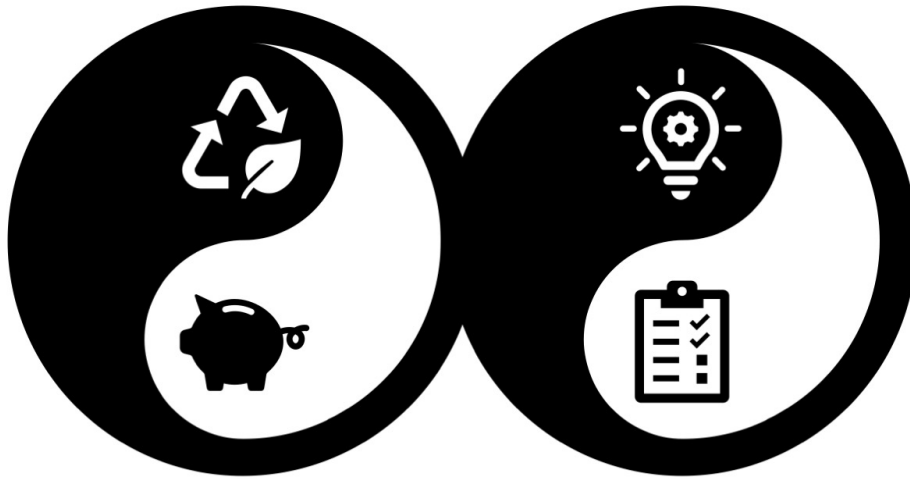




CHALMERS
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Managing Paradox in Sustainability Transition

A Case Study of a Swedish Contractor Firm
and Its Infrastructure Projects

Master's thesis in Design and Construction Project Management

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DEPARTMENT OF ARCHITECTURE AND CIVIL ENGINEERING
DIVISION OF CONSTRUCTION MANAGEMENT

CHALMERS UNIVERSITY OF TECHNOLOGY
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Cover:
Paradoxes between *market* logic and *sustainability* logic, between *project* logic and *innovation* logic, inspired by *yin yang* symbol of the eastern ancient thought Taoism.
Department of Architecture and Civil Engineering
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ABSTRACT

The construction sector in Sweden is engaging in a significant sustainability transition. In the process of changing and adapting, tensions among different actors become inevitable due to the contradictory nature of sustainability transition. Demands on new ways of thinking and practicing clash with the well-established and conventional ones. Competing demands from economic, environmental and social dimensions need to be considered simultaneously. This can lead to hinders if such tensions are not properly handled. The aim of the thesis is to investigate how a big Swedish contractor firm works with sustainable construction, with a focus on how three related infrastructure projects deal with the issue - reduction of climate impact of concrete constructions. Also, by adopting two closely linked theories - *paradox* theory and *institutional logics* theory, the author identifies and analyses tensions arising in the processes of decision-makings on sustainable objectives, in the levels of project and firm. *Paradox* theory provides a critical theoretical base for understanding, embracing and managing tensions, as it sees competing demands as contradictory yet interdependent elements and they are inherent in organizations. *Paradoxical* strategies focus on finding purposeful responses to tensions, living with and managing the continuous tensions rather than solving them. As a result, the main tensions that surface in the studied projects are created by 1) lack of contract, 2) lack of knowledge, and 3) lack of interconnection. By adopting the lens of *paradox* theory, the tensions are analysed and explained from an organizational paradox perspective, which are categorised of *organizing* paradox, *learning* paradox and *performing* paradox. Furthermore, *institutional logic* theory also offers an analytical base for explaining how environments frame and affect organizational goals and individual behaviours. The author thus studies the underlying logics behind the identified tensions. As an illustration, *market* logic clashes *sustainability* logic while confronting sustainable objectives, as different actors seek divergent organizational successes, resulting in a lack of commitment and a lack of integration in sustainability collaborations. Moreover, the established and conventional practice of project-as-an-island leads to inefficiency of knowledge transferring and organizational learning, hence relatively low ability to innovation. Finally, by embracing paradoxical tensions, the thesis suggests strategies and improvements for the contractor to manage such unsolvable tensions arising in the process of sustainability transition.

Keywords: paradox theory, tension, institutional logic theory, underlying logic, sustainability transition, construction sector, contractor

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Preface

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Gothenburg, May 2022

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Notation

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1 Introduction

This chapter will introduce the contextual background of the master thesis, and the aim and research questions of the study as well as its delimitations.

1.1 Background

Sustainability, circularity, life circle analysis, taxonomy and so on, these are successive keywords of sustainability development in its different periods. No matter it is in the global level that United Nations in 2015 set out a supremely ambitious and transformational vision for sustainable development (the 2030 Agenda), or it is in the European level that European Environment Agency (EEA) drew a conclusion in its five-yearly flagship report (SOER 2020), they all clearly demonstrate that the environmental challenges ahead require fundamental change in core societal systems. Not surprisingly, the construction sector belongs to these central systems. The newly popular concept of sustainability transition is about major shift in dominant practices, policies and ways of thinking, which will in turn demand new knowledge and long-term, integrated, global perspectives, since conventional approaches have made limited progress in resolving these grand challenges, according to EEA.

The Swedish society made a statement of becoming one of the first climate neutral countries in the world, according to Fossil Free Sweden, an organization started at the initiative of the Swedish Government in 2015 to increase the pace of climate transition and build strong fossil-free competitiveness for the Swedish industries (Fossil free Sweden, 2018). In the period 2017-2020, 22 Swedish business sectors have produced roadmaps to show opportunities, identify obstacles and provide proposals for sustainable solutions. The construction and civil engineering sector is one of the 22 sectors, as it accounts for about 20% of Sweden's climate emission, and its emission mainly comes from the manufacturing of construction materials and products (Fossil Free Sweden). Concrete, which is seen as the most used construction material in the world, is thus identified as considerably critical in sustainable construction. The roadmaps of the two closely linked industries (concrete industry and construction sector) illustrates the interdependent and successively increasing targets of climate transition (*Figure 1*): in the construction sector, 50% reduction in greenhouse gas emissions 2030, 75% 2040 and net zero 2045; accordingly, climate-neutral concrete should be available on the market 2030 and all concrete should be climate neutral 2045.

Concrete consists of aggregate, cement and water, large amounts of carbon dioxide are released during the production of cement, which accounts for about 90% of the climate impact of the material. However, it can be reduced by replacing parts of cement with alternative binders, such as fly ash and slag (by-products of other industrial processes). The definition of green concrete according to the Swedish Concrete initiative is concrete that contributes to at least 10% less carbon dioxide emissions than ordinary ones. The use of green concrete is thus considered as an effective measure to reduce climate emissions. Besides that, the roadmap also encourages the sector to lower the climate impact of transport of concrete, since transport plays a relatively important role in the total climate impact of a concrete construction. In other words, sustainability management should be based on a holistic and lifecycle perspective.

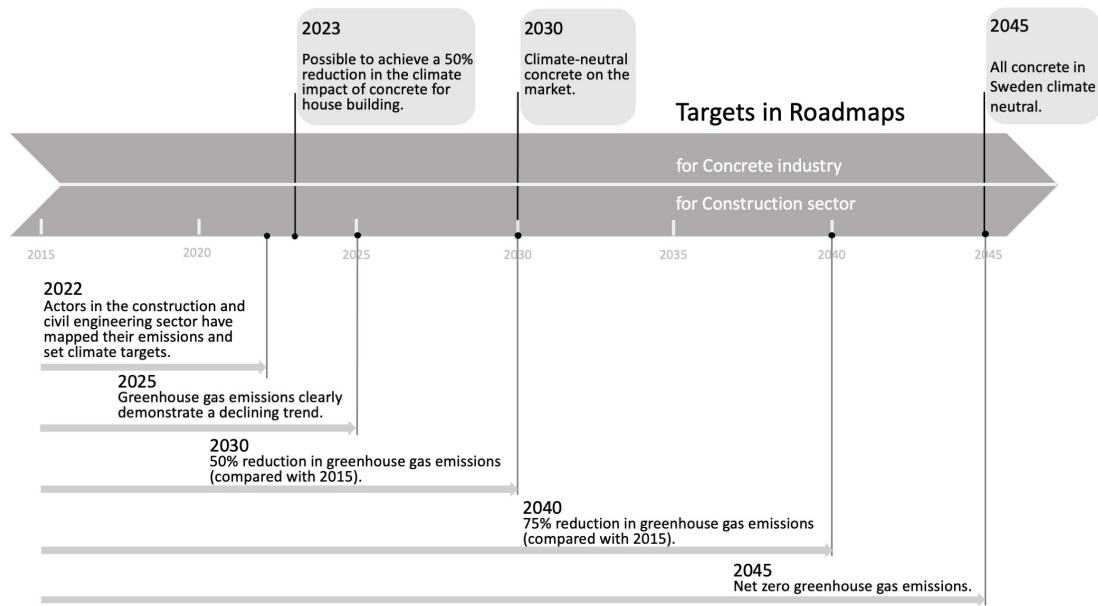


Figure 1 Targets in roadmaps for concrete industry and for construction sector

Summing up, there are some clear characteristics of the sustainability transition in Swedish construction sector: 1) The successive targets of the roadmaps will lead to constantly updating regulations from the Swedish authorities, thus more and more sustainable requirements will be made in procurements, and importantly, they should be based on a lifecycle perspective; 2) The sustainable construction of concrete is unavoidably a key issue, the usages of green concrete are seen to be an effective measure, plus taking transportation of the material into account; 3) The goal of sustainability transition is nevertheless to build strong competitiveness of Swedish industries by going climate neutral, which, in turn, demands innovation and embracing long-term, integrated and holistic ways of thinking. However, on the road of sustainability transition, conflicts and tensions become inevitable among different construction actors in the processes of changing and adapting. Scholars (Hanh et al., 2015; Sabine and Alderman, 2021) identify common and central tensions arising from such as temporality of objectives (i.e., short-term organizational goals vs. long-term sustainability-oriented goals), organizational barriers (i.e., personal vs. organizational sustainability), lack of institutional support (i.e., the need for change for sustainability vs. the well-established practice), and lack of knowledge (i.e. lacking education on sustainability). In the construction sector, the lack of institutional support and the lack of knowledge become even more salient. The rate of innovation in the sector is considered by many scholars to be relatively low compared to other sectors (Winch, 1998; Gann and Salter, 2000; Bygballe and Ingemansson, 2014). It will clash with the demand for fundamentally change in products and business models for more sustainability. As Hann et al. (2015) argue, "New ideas come at risk of institutional disapproval and loss of legitimacy while confronting the well-established and institutionalized practices" within the conservative sector.

Besides the tensions intensified by the sector-specific features, tensions between long-term and short-term, among economic, social and environmental dimensions can be generally strengthened by a traditional business case for sustainability - an environmental or social sustainable objective is adopted only when an economic one is also achieved (Hanh et al., 2015; Sabine and Alderman, 2021). Furthermore, as sustainability transition is a successive process and sustainable requirements and

regulations keep changing, general tensions between today and tomorrow, between routine and change cause competing demands for organizations and industries (Smith and Tracey, 2016), and construction firms are struggling with these contradictory and oppositional demands. Thus, it is highly relevant to adopt the lens of *paradox* theory to understand and manage the unavoidable tensions arising in the processes of sustainability transition. *Paradox* scholars see competing demands as inherent in organizations, that tensions persist over time and cannot be resolved, thus require ongoing, processual responses (Smith and Tracey, 2016). A *paradox* perspective can provide a critical insight and encourage acceptance to tensions. Decision-makers with a paradoxical mind-set tend to pursue different sustainability goals simultaneously without emphasizing one over another (Pinto, 2019; Hanh et al., 2015). Importantly, Smith and Tracey (2016) also argue that *institutional* theory and *paradox* theory together can contribute to a better understanding of the nature and responses to competing demands. *Institutional* theory suggests that all tensions are somehow institutionally derived and competing demands emerge from plurality of logics at the field or societal level (Smith and Tracey, 2016). Thus, together, *institutional* complexity and *paradox* theory can offer an analytical framework for understanding and managing the competing demands in sustainability transition.

1.2 Aim and research questions

The aim of the thesis is to investigate how a Swedish contractor works with sustainable construction in the background of a dramatical sustainability transition, what the challenges and possibilities are in the processes and among different actors. Especially, due to the importance of concrete in the construction sector and its enormous greenhouse gas emission, the thesis chooses to focus on how the studied projects deal with the reduction of climate impact of concrete constructions. Thus, by looking at sustainable management in both project and corporate levels, through the lenses of *paradox* theory and *institutional logic* theory, the research questions are:

1. *What are the tensions arising from managing sustainable constructions, in the case of the use of green concrete?*
2. *How can the theoretical framework help in understanding such tensions: how can paradox theory contribute to the identifications and characterisations of such tensions? and how can institutional logic theory reveal the underlying logics behind such tensions?*
3. *How can paradoxical strategies help managing such tensions?*

By answering to the research questions, the thesis contributes to sustainable construction literature on three points. First, it provides empirical evidence of tensions project-based organisations experience when dealing with competing objectives in sustainable objectives, as well as the sources of tensions in the levels of project and organization. Second, it provides critical perspectives in understanding and embracing the paradoxical tensions as embedded in organizations, that environments play an important role in deriving tensions. Third, it suggests possible strategies to contractors for managing such persistent tensions in sustainability transition.

1.3 Delimitation

The thesis is delimited as to solely address the tensions between two actors, the client and the contractor within the Swedish infrastructure sector. Moreover, the study focuses on environmental sustainability issues on concrete constructions thus not focusing specially on the economic or social aspects as an individual topic, nor other areas of constructions, such as asphalt pavement. Finally, the empirical material consists of one focus project and two supportive projects involving qualitative interviews with the contractor and the client.

1.4 Composition

This paper proceeds as follows. The next section is a literature review on *paradox* theory and *institutional logic* theory, as well as the two theories together applied in explaining and managing sustainability tensions. Then the research method is presented as an abductive approach to deal with the case research and theory development. After that, the studied cases will be introduced in a chronological and comparative manner, showing the decisions and the involved actors in the processes. The findings from the empirical materials will be presented and analyzed on different themes of *paradox* theory and then further discussed by using *institutional logic* theory, to understand the roles environments play in affecting and framing the paradoxical elements. Finally, some suggestions are provided to embrace paradoxical situations and conclusions are drawn.

2 Theory

This section aims for providing theoretical base of the thesis and presenting concepts used in the later analysis and discussions. Together, *paradox* theory and *institutional logic* theory create the analytical framework for analysing and explaining the nature and responses to tensions. The two theories complement each other, generating rich insights about competing demands and environmental complexity of a tension (Smith and Tracey, 2016). Hence, many sustainability management scholars (Sabine and Alderman, 2021; Hanh et al., 2015) adopt the two lenses together, offering critical ways of thinking to embrace and manage the competing demands for sustainable development, in the contexts of project and organization.

2.1 Paradox theory

Smith and Lewis (2011) state that organizing raises various tensions and they list out typical organizational tensions which have been well studied by scholars, such as collaboration vs. control, individual vs. collective, flexibility vs. efficiency, and profit vs. social responsibility. As organizational environments become more global, fast paced and competitive, these contradictory demands become more and more striking and persistent (Lewis, 2000). This, in turn, challenges leaders enormously as their responses to these tensions may decide the life-or-death of an organization (Quinn and Cameron, 1988; Smith and Tracey, 2016). *Paradox* theory offers a critical response to tensions, it highlights an exploration of how organizations can cope with competing demands simultaneously.

Paradox is defined as contradictory yet interrelated elements (dualities) that exist simultaneously and persist over time, which can be illustrated by the Taoist symbol of *yin yang* (Smith and Lewis, 2011). Historically, paradox is an age-old concept with its root in ancient teaching across both eastern and western thoughts, and it has been discussed in the late 1980s and motivated research in the field of organization and management, such as innovation, change and leadership (Smith and Lewis, 2011; Pinto, 2019). By adopting a lens of *paradox* theory in studying organizational tensions, tensions are seen as inherent within organizations. Due to the persistent nature of paradoxes, a *paradox* perspective stresses that long-term organizational sustainability requires purposeful and continuous responses to meet multiple and competing demands (Lewis, 2000).

After reviewing numerous *paradox* papers, Smith and Lewis (2011) categorize four types of organizational paradoxes - *belonging*, *learning*, *organizing*, and *performing*. They represent central activities and elements of organizations: *belonging* relates to identification, *learning* links with knowledge, *organizing* is about processes, and *performing* has to do with goals. Since the last three types of paradoxes are relevant for the analysis of the empirical material, the author decides to focus on them, namely, *learning* paradox, *organizing* paradox and *performing* paradox (Figure 2). Further, Smith and Lewis (2011) give an explicit illustration on which and how paradox arise in the process of organization creations: Leaders must decide for their organizations what they are going to do, how they are going to do it, and in what time horizon; Consequently, by defining what they are trying to do, goals and strategies are emphasized within organizations which creates *performing* tensions, such as socially oriented versus economically focused. By defining how they are going to operate,

organizing tensions are created and surfaces, for instance, between integration and differentiation, centralized and decentralized, flexible and controlling. Finally, by taking time horizon into account for the actions, *learning* tensions arise from paradoxes between today and tomorrow, between looking forward and looking backward.

Furthermore, Smith and Lewis (2011) also discuss more general nature of the three paradoxes as well as paradoxes at their interactions. Firstly, *learning* paradoxes arise when systems are changing and innovating, as it requires efforts in destroying and building upon the past to create the future. Meanwhile, *organizing* paradoxes surface when organizations create competing processes to achieve a wanted result, such as tensions between collaboration and competition, empowerment and direction, and routine and change. An example could be that manufacturing industry needs systems that facilitate both control and flexibility. Moreover, *performing* paradoxes stem from different actors seeking for divergent organizational successes which leads to conflicting strategies and competing goals. An example could be that the performance of corporate social responsibility depends on both financial and social goals. Furthermore, Smith and Lewis (2011) claim that tensions operate between as well as within these categories. An *organizing and performing* paradox arise within the interplay between process and outcome. A *learning and performing* paradox spur tensions between building capabilities for the future and ensuring today's success as the demands of the present differ from the needs for the future. An *organizing and learning* tension surface in organizational capabilities that seek focus and efficiency while also enabling innovation and flexibility. In response to external and internal stimuli, organizations are constantly shifting, learning, and changing. The demand for dynamic capabilities creates tensions in seeking to continuously renew and alter stable routines. Lastly, Smith and Lewis (2011) analyse that the features of paradoxical tensions can be salient or latent (unperceived or ignored). They argue that there are environmental forces that render latent tensions salient and experience by organizational actors. And they catalogue the environmental factors of plurality, change, and scarcity. Plurality indicates a multiplicity of views and goals, it can increase uncertainty and surfaces conflicting goals and inconsistent processes. Change stimulates new processes of sensemaking since actors might confront conflicting needs or situations. Lastly, scarcity has to do with resource limitations, including temporal, financial, or human resources, as resources allocation will create tensions between competing and interdependent options.

Despite an analytical explanation of the nature of paradoxical tensions, paradox theorists also provide strategies in how to response to paradox. The strategies differ between *acceptance* and *resolution*, and they have been adopted by other scholars for proposing strategies in dealing with tensions in the field of sustainable management, such as sustainable project management (Sabine and Alderman, 2021) and corporate sustainability (Hanh et al., 2015). The original proposal for strategic responses to paradoxes are by Poole and Van de Ven (1989). Firstly, *acceptance* strategy, in other word, living with paradox, keeping tensions separate and embracing their differences. It also encourages that actors shift their expectations for rationality and linearity to accept paradoxes as persistent and unsolvable (Smith and Lewis, 2011). Such strategies may be passive or proactive, "playing through" rather than confronting tensions, but *acceptance* also enable opening tensions for discussion to foster more creative considerations. In contrast, Poole and Van de Ven (1989) also suggest other strategies seeking *resolution*, which can be categorised into *separation* strategies (spatial

separation and temporal separation) and *synthesis* strategies. In this case, resolution does not mean to eliminate a tension. Rather, it indicates to find a way to meet competing demands or take divergent ideas into consideration simultaneously.

Nevertheless, many paradox scholars (i.e., Smith and Lewis, 2011; Pinto, 2019) debate that effectively responses to competing demands simultaneously has been associated with many positive effects in organization management, such as exceptional leadership capabilities, high-performing group, and better organizational performance. Thus, a dynamic balance can make use of the power of paradox to foster organizational sustainability through enabling learning and creativity, fostering flexibility and resilience, and unleashing human potential (Smith and Lewis, 2011). Paradoxical tensions have been explored as either inherent (existing within organizations and systems) or socially constructed. However, there are scholars (Smith and Lewis, 2011; Smith and Tracey, 2016) proposing that they are both, seeing that contradictory yet interdependent dualities are embedded in organizations and are brought into juxtaposition via environmental conditions. Hence, environments matter. The following section will bring in *institutional logic* theory into the scene and show the supportive role it plays in the explanation of how paradoxical tensions are socially constructed.

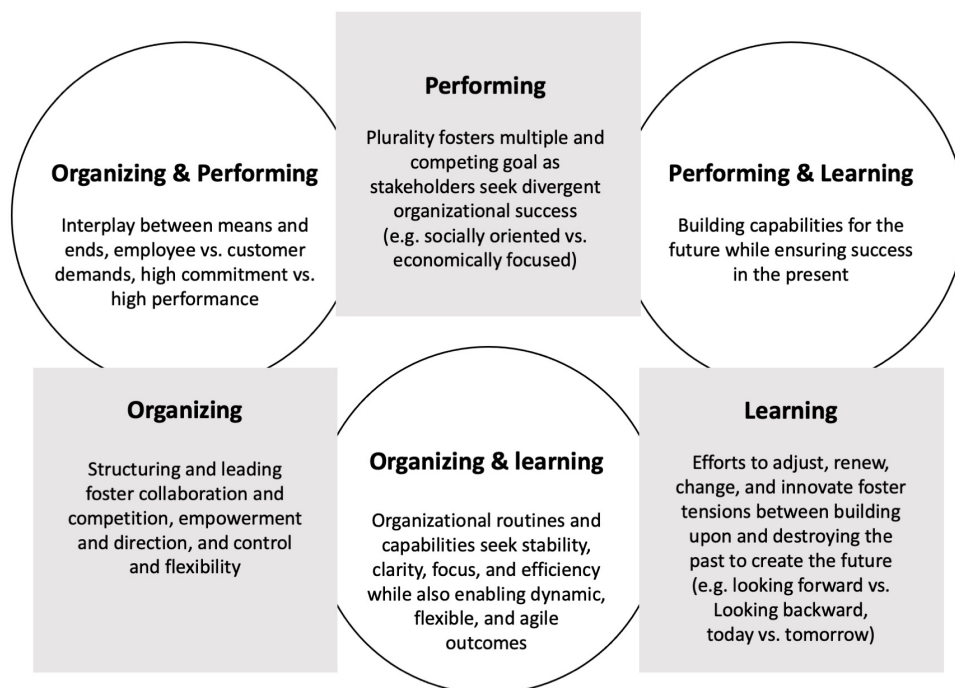


Figure 2 Categorization of organizational tensions (adapted from Smith and Lewis, 2011)

2.2 Institutional logic theory

Research in organization and management studies has increasingly adopted a lens of *institutional theory* by acknowledging that institutional logics condition behaviours, organizational goals, and decision-making within organizations (Durand and Thornton, 2018). Institutional scholars admit that organizations embed multiple institutional logics, and they explore responses to competing logics simultaneously (Kraatz & Block, 2008; Smith and Lewis, 2011). Thus, a social construction view presumes that

all tensions are somehow institutionally derived, and everything has to be grounded in broader field or societal processes (Smith and Lewis, 2011).

So, what are *institutional logics* and how do they function? According to Skelcher and Smith (2015), *institutional logics* are a concept developed within the wider field of *institutional* theory as a way of explaining the interactions between normative societal structures, organizational forms, and individual behaviours. And Friedland and Alford (1991) put it more practical and claim that *institutional logics* is a set of material practices and symbolic constructions that constitute organizing principles for institutions. *Institutional logics* function as “frame of reference” that relate to these principles, practice and symbols, helping actors make sense of their world and identities (Thornton et al., 2012). Smith and Tracey (2016) illustrate that organizations and their leaders follow expectations from these logics to gain legitimacy and cultivate necessary resources.

As *institutional logic* theory has tight connections with concepts such as “organization”, “institution”, “institutional theory”, some distinguishes must be made. To distinguish “institution” from “organization”, Greenwood et al. (2011) place the organization in larger institutional environments and value-sets, namely, institutions represent a broader field or societal contexts comparing to organizations. To distinguish “institutional logic” from “institution”, Johansen and Waldorff (2015) suggest that logics are more subtly powerful than institutions, as it is logics that guide institutions and social meaning, even though logics appear to be less tangible than the institution themselves, and logics are comprised of underlying practices and symbols.

By using a *paradox* perspective in seeing institutional logics, frictions between competing logics become salient, for instance, *market* logic vs. *sustainability* logic. The institutional logic of market is a classical one, it can be described as: the source of legitimacy is a company's share price, the basis of strategy is to increase profit and the basis of attention is on its market status (Thornton and Ocasio, 2008). Hence, the characteristics of *market* logic are prioritizing profit, creating competitive advantages, and reducing costs, which is often associated with negative effects on the environment and clashes with *sustainability* logic (Andersson and Buser, 2020). But how can *institutional logics* contribute to a *paradoxical* analysis? First, *institutional logics* enable *paradox* scholars to identify and discuss the deeper and taken-for-granted social layers behind tensions (Johansen and Waldorff, 2015).

Furthermore, Durand and Thornton (2018) also argue that when organizations confront conflicting instructions from multiple logics, actors tend to modify, resist, select and transform the available logics to legitimate the decision-making and the sense-making of their behaviours, and do not accept logics wholesale in. Friedland and Alford (1991) explain that it is because social situations and activities carry multiple meanings and motivations, and actors can draw on different institutional logics for their purposes as well as be driven by several logics. Logics are thus complex, competing and co-existing (Johansen and Waldorff, 2015). Competing logics provide actors with divergent references, which can be used to explicate how organizations find themselves in paradoxical situations where conflicting logics force them to act (Johansen and Waldorff, 2015). Besides that, Durand and Thornton (2018) also illuminate that one logic can constrain or moderate the effects of another, giving an example of how *religion* logic can influence *market* logic in the process of a corporate downsizing case

in Spain where religion has a strong root in the society. On the other hand, co-existing logics reflect an *acceptance* response of *paradoxical* strategies, namely, living with the competing logics. By adopting *separation* strategy, actors can move between logics depending on the time and organizational issues at hand (Johansen and Waldorff, 2015). Thus, the lens of *institutional logics* can reveal the interplay of multiple underlying logics behind the contradictory behaviours or decision-makings, it can show the micro-activity negotiations that take place in and between logic and actors, illustrating how logics work as a “toolbox” for actors in advocating their wishes and views in everyday organizational life (McPherson and Sauder, 2013).

Together, *paradox* theory and *institutional logic* theory create an analytical framework for the understanding and managing paradoxical tensions embedded in organizations. The coming section will present how this theoretical framework has been applied in the research of sustainable management, in the levels of project and corporate.

2.3 Manage tensions in sustainable development

In sustainability management literature which adopts *paradox* theory and *institutional logics*, there are two concepts which are highly relevant and can be applied in analysing the sustainability development in construction sector, namely, *corporate sustainability* (Hanh et al., 2015) and *sustainable project management* (Sabine and Alderman, 2021). The former one is from a broader level of a firm while the latter a project level, scholars working with these two concepts offer both empirical and theoretical material for identifying and explaining the paradoxical tensions while pursuing sustainability.

In the level of corporate, Bansal (2002) demonstrates that firms play a key role in sustainable development, since firms represent the productive resources of economy. This key role of business in turn has led to the advent of the concept of corporate sustainability, which is defined by Wilson (2003) that corporate sustainability “recognizes that corporate growth and profitability are important, [but] it also requires the corporation to pursue societal goals, specifically those relating to sustainable development—environmental protection, social justice and equity, and economic development”. Hence, corporate sustainability embraces the idea that firms confront multiple even contradictory demands. Hanh et al. (2015) explain the concept further: first, firms need to pursue different sustainability objectives with simultaneous integration of economic, environmental and social dimensions; second, firms should not fall into the trap of the mainstream corporate sustainability that the economic dimension is prioritised over the two other dimensions, that firms must benefit financially when they address environmental or societal issues; third, firms should accept tension in corporation sustainability because there are unavoidable situations where tensions exist, that environmental and social goals cannot be aligned with financial objectives. Lastly, Hanh et al. (2015) argue that there is a lack of consideration of tensions and conflicts in the current corporate sustainability management.

Hanh et al. (2015) then create a systematic framework for the analysis of tensions in corporate sustainability, identifying several typical tensions by adopting a lens of *paradox* theory as well as explaining characterisation of each tension through revealing the underlying logics. For example, one of the four identified tension is the tension between “Isomorphism and structural and technological change”, the definition of the tension is “Need for change for sustainability versus isomorphic pressures that stabilise

extant practices” and its underlying logic is “demands for fundamentally changed products and business models for more sustainability jar with well-established and institutionalised practices so that change comes at the risk of institutional disapproval and loss of legitimacy”. Besides identifying and characterizing tensions, Hanh et al. (2015) also provide strategic responses to tensions (*Figure 3*) by adopting the *paradoxical* strategies of Poole and Van de Ven (1989). As an illustration, responding to the above-mentioned tension, the *acceptance* strategy is “combine products and services based on well-established practices to maintain legitimacy with experimental practices to launch alternative offerings despite institutional disapproval”, and *separation* strategy is “Concentrate established business in markets where traditional institutional prevail while launching innovative solutions and novel business models in market segments where institutional change has already taken place” and finally the *synthesis* strategy is “Engage in institutional change and actively seek to shape institutional expectations in favour of more sustainable business practices”. Importantly, Hanh et al. (2015) set it as a goal for the creation of the framework is to “provide managers with a better understanding of tensions in corporate sustainability and enables them to embrace these tensions in their decision making.”

In the level of project, similar thoughts and methods to approach corporate sustainability can be seen in sustainable project management, as Sabine and Alderman (2021) base their research on similar *paradox* scholars and adopts the framework developed by Hanh et al. (2015) to identify and investigate the tensions project managers face when introducing sustainability considerations into the project context. Some obvious similarities and differences can be highlighted through comparison with the research Hanh et al. (2015) made in corporate sustainability. According to Sabine and Alderman (2021), the business case for sustainability, also described as a win-win paradigm by Hahn et al. (2010) is also evident in sustainable project management. Sabine and Alderman (2021) provide empirical material of how project manager response to the tensions arise by temporality of objectives (contradiction between the short-term nature of projects and the long-term focus of sustainability), organizational barriers (personal vs. project view of sustainability) and lack of control (in terms of power, knowledge and institutional support).

Besides the two common tensions (short-term vs. long-term; personal vs. organizational view of sustainability) identified by Hanh et al. (2015) in corporate sustainability and by Sabine and Alderman (2021) in sustainable project management, the tension caused by a lack of institutional support in sustainable project management is similar to the above-analysed tension in corporate sustainability “Isomorphism and structural and technological change”. According to Sabine and Alderman (2021), the tension arising from the lack of institutional support is identified as “project environment does not assist projects manager in pursuing sustainable goals”, and its underlying logic is “necessary shift needed to achieve sustainable objectives clashes with well-established institutional practices.” If comparing this with the one in corporate sustainability, demands for dramatical changes in the existing and conservative practice for more sustainability are clearly demonstrated in both of two studies. Moreover, the combination of *paradox* theory and *institutional logics* are well applied in the explanation of tensions in these sustainable management studies.

As the research of the thesis focus on the construction sector, the contexts of project and corporate become highly relevant. Since Gann and Salter (2000) declare that

construction sector is a project-oriented industry, it is important to understand the integration and differentiation between the semi-autonomous operating projects and the central business processes within the firm regarding construction innovation for the sake of sustainability transition. Thus, it is important to apply the theoretical framework created in this chapter, to identify tensions arise from sustainability transition in the levels of individual construction firm and its projects in the coming chapters.

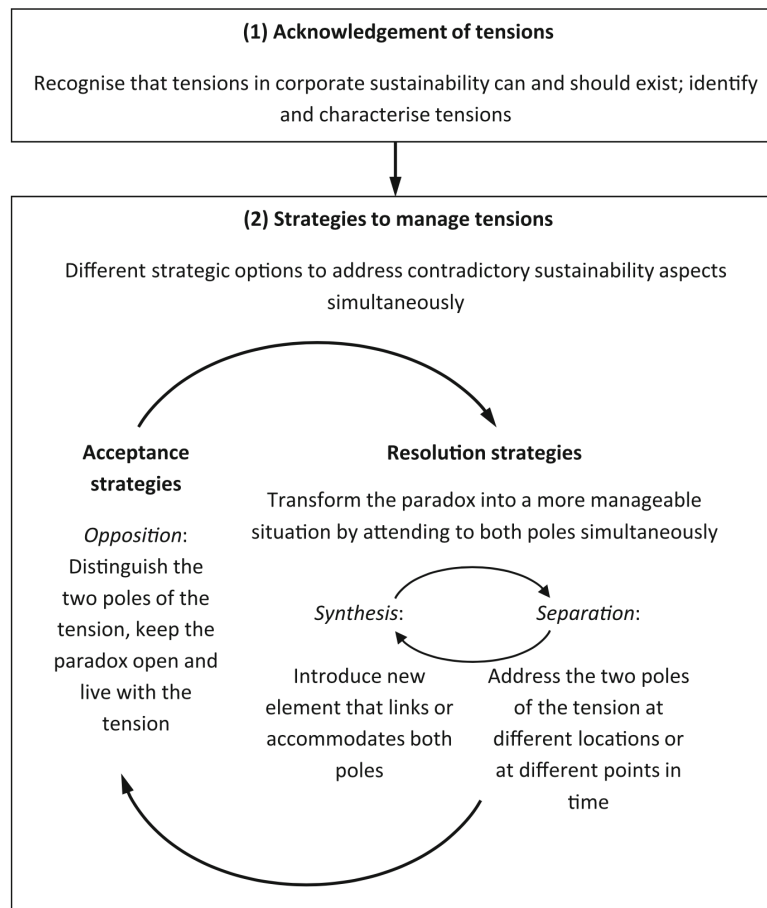


Figure 3 Adopting paradox strategies to acknowledge and manage tensions in corporate sustainability (Hanh et al., 2015)

3 Research Method

This chapter outlines the research method as adopting a qualitative methodology based on semi-structured interviews, meeting observations and document readings. The research approach turns to be an abductive process where theory development, empirical material collection and analysis evolve simultaneously.

3.1 Research approach and design

To investigate the tensions arising from sustainability transition, among different actors in construction sector and their respective responses, a qualitative research approach was adopted and based on semi-structured interviews with key persons from both client and contractor organizations. This approach provides opportunity to an in-depth exploration of the knowledge and experience held by individuals on the studied topics (Bryman and Bell, 2011). Besides, an abductive process (called by Dubois and Gadde as systematic combining) was conducted, since it facilitates a flexible and iterative process where the theoretical framework is developed alongside the collection and analysis of empirical data, so that the research questions and the analytical framework are accordingly reoriented when they are confronted with the successively increasing data collection from the empirical world (Dubois and Gadde, 2002). Dubois and Gadde (2002) further highlight one of the strengths of the process as an enabler for the study to continuous development by giving room for new perspectives and a deeper understanding of the subject. As Smith and Tracey (2016) debate that, researchers should develop more compelling insights of tensions by “view the world from the perspective of their informants, rather than assuming a set of tensions at the outset”.

Together with a qualitative method and an abductive process, a case study approach was chosen as to allow for detailed analysis of a particular case conditioned by its environmental context (Dubois and Gadde, 2002), as the research aims to investigate how the actors in construction sector response to tensions in the process of sustainability transition. Bryman and Bell (2011) argue that the use of case studies encourages a focus on a bounded situation or system and its complexity, hence the research questions that focus on what kinds of tensions arise in sustainable construction and how the involved actors response to them justifies this approach. Moreover, the data collection is limited to the projects that the contractor firm was involved in. The choice of having one focus project and two supportive projects was made since it allows not only to explore one bounded situation and its complexity, but also to compare and contrast the findings of the same subject among divergent projects (Bryman & Bell, 2011). There are reasons for the choice of the studied projects - the focus project was assigned by the contractor firm which the author collaborated with for this mater thesis, and the two supportive projects were selected by the author because they provide a contradictory and critical insights to the specific topic of green concrete while comparing with the findings from the focus project. Consequently, it contributes to a deeper and holistic analysis and understanding of the research questions.

3.2 Data collection

As mentioned above, the case study consists of a focus project (Project 1) and two supportive projects (Project 2 and Project 3) which are contracted with the same contractor firm. The data collection of the focus project is relatively detailed by

covering the entire phase of planning and design as well as part of the construction phase (since the construction is ongoing at the time of data collection), and it also considers the overall sustainable development through project coordination. While in Project 2 and Project 3, the data collection predominantly focuses on the specific research topic – the use of green concrete. Moreover, multiple sources of data collection is considered by scholars as to allow researcher to create a broader and a deeper insight of the case (Yin,1994), but also contribute to revealing aspects unknown to the researcher (Dubois and Gadde, 2002). This paper thus uses a multitude of data sources, such as semi-structured interviews, site visits, meeting observations, document readings and feedback discussions.

3.2.1 Interviews

A total 19 interviews with 9 interviewees were conducted, see Table 1. Interviews are held with both client and contractor representatives with a focus on the contractor firm as the thesis is to investigate what tensions arise and how the contractor firm responds to tensions and the contractual relationship between the client and the contractor is seen as essentially important. Besides that, the interviewees are chosen based on their roles in the projects as well as in the company. By doing this, it can ensure that multiple perspectives of the studied topics are gathered, and it also provides the possibility of comparison among the different projects and between the levels of project and firm. In the early stage of interview data collection, the guiding questions for each interview were specifically formulated based on the data collection from the previous interviews and the interviewee’s role, as to accumulate information and create a basic understanding of the projects and the firm. In the later stage, interview questions tended to be more general in terms of interviewee, namely, interviewees got more or less similar questions, but more specific in terms of content. Three interview guides, translated from Swedish, are attached in the section of Appendix. Finally, this process was undertaken within the time (from the middle of January to the end of May 2022) and resource constrain of the master thesis project. And most of the interviews were recorded with permission from the interviewees for the purpose of transcription, all interviews were held in Swedish and partly transcribed.

Table 1 Interviewees

Title	Organization	Project	Duration
Project Manager	STA	Project 1	1h
Site Manager 1	Contractor	Project 1	1h
Design Manager	Contractor	Project 1	1h
Site Manager 2	Contractor	Project 2, Project 3	1h30m
Regional Manager 1	Contractor	n/a	30m, 30m, 1h
Regional Manager 2	Contractor	n/a	1h
Operational Developer	Contractor	n/a	10 times 1h
Concrete Specialist 1	Contractor	n/a	1h
Concrete Specialist 2	Contractor	n/a	30m

3.2.2 Other data sources

Apart from interviews, empirical data are also gathered from varied sources. First, document readings cover business structure and processes from the contractor firm, such as organizational structures, sustainability strategies, annual sustainability report, environmental plan and procurement contract mall; and project-based documents such

as tendering proposal, meeting protocols in the planning and design phase, as well as in specific technical meeting of green concrete and in the lesson learned meeting, the green concrete receipt and EPD and so on. Secondly, the author conducted one site visit in Project 1 and two times in Project 3. During the site visit the author had the opportunities to start conversations with staffs on site without recordings, and experienced that the discussions were more open and direct than those in the later scheduled and recorded interviews. Third, the author participated in several meetings (have no direct connections with the studied projects) organized by the contractor firm, such a lesson learned meeting where a project team from both client and the contractor met and reflected upon a newly finished project, and two meetings on managing contractual conflict. Finally, the contractor provides a supervisor for the thesis research, with which the author had weekly discussion. The supervisor who works as operational developer in the company give feedback and provides further contacts for more interviews as well as relevant documents for the data collections.

3.3 Data analysis and trustworthiness

There are many ways in analysing qualitative data, this paper adopts the method of thematic analysis where the author can systematically search through data to detect themes and patterns (Alhojailan, 2012). Thematic analysis is a highly flexible method and facilitates the examination of the divergent perspectives of research participants and the illustration of similarities and differences, as well as the generation of unanticipated insights through coding and categorizing a rich and detailed amount of empirical data into themes (Alhojailan, 2012; Nowell et al., 2017). As mentioned earlier, the research process is an abductive approach. First, the collected empirical material was interpreted, preliminary analysed, and divided into three core thematic categories to make the data more manageable and structured. Second, an iterative process of matching theories and themes through direction and redirection between the theoretical framework and the empirical world, which resulted in the selections of *paradox* theory and *institutional* theory as the analytical framework for the study. Finally, the tailored-made recommendations are reached by matching the theoretical strategies with the empirical data analysis.

Furthermore, Bryman and Bell (2011) emphasize a researcher must evaluate the study's trustworthiness and authenticity. The author makes use of multiple data sources to ensure the quality of data. Later, the author had several meetings with two top managers of the contractor firm in order to present the empirical material collection and analysis as well as recommendations. The author got confirmative responses and positive feedbacks from the managers, which indicates the findings are relevant and trustworthy, and the recommendations are effective for the target audience. However, there is an unavoidable bias of being too close to the company, losing the distance of being critical.

3.4 Ethical aspects

As to ensure that the research has been conducted in an ethically correct manner, measures have been made mainly connected to the interviews. In the beginning of each interview, a short presentation of the study was made so that all participants were aware of the aim of the research. During the interviews, each interviewee was asked for permission to record for the purpose of transcription. All interviewees have voluntarily agreed to participate, and all material presented in the paper have been anonymized.

4 Case Description

In this chapter, the contractor firm and its projects will be introduced. The relevant issues and actors will be described in a chronological way in Project 1, whereas Project 2 and Project 3 are shortly presented, apart from a summarized comparison among the three projects on the common topic – the use of green concrete.

4.1 The contractor

Veidekke Infrastructure Sweden is the construction firm in the focus for the empirical material collection. The selected projects all have Veidekke Infrastructure Sweden as the main contractor and all of them are located within the division of Region West. Veidekke Infrastructure Sweden (will be called as ‘the contractor’ in the coming text) has the organizational structure of multidivisional form (*Figure 4*), basically grouped by geographical region and activity division, such as Concrete West. Since the studied projects have the common topic of green concrete, Concrete West within the regional division plays an important role in the understanding of the dynamic between semi-autonomous operations at the project level and central business processes at the firm level.

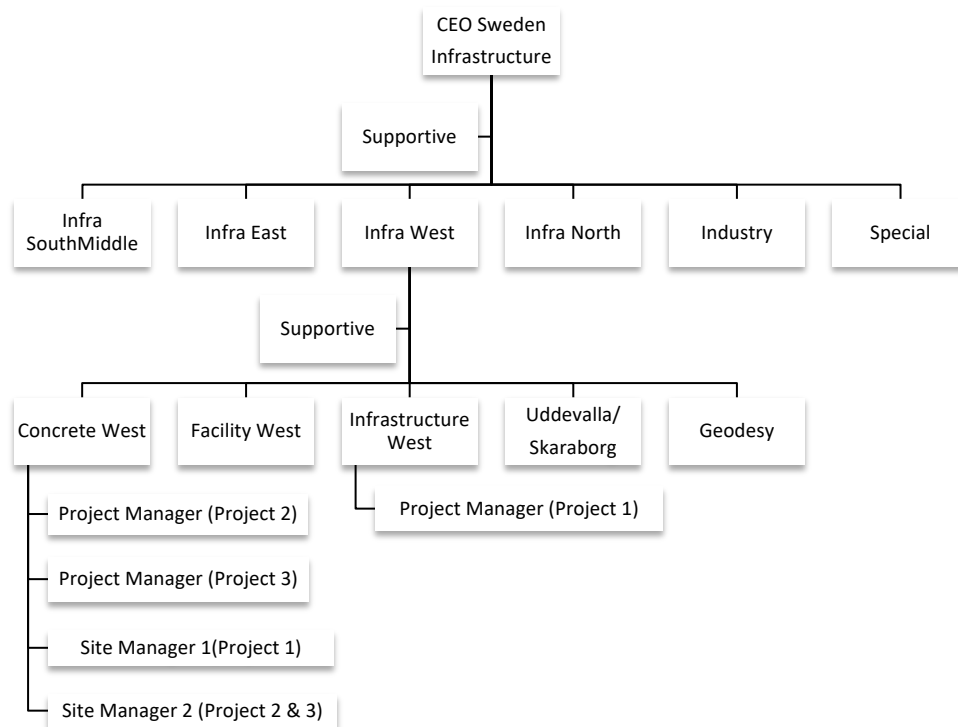


Figure 4 Multidivisional organization form of the contractor firm

Veidekke as the parent company was originally founded in Norway in the 1930s and expanded its civil engineering operation in Sweden around the beginning of 2000. Nowadays, Veidekke is seen as one of the biggest construction contractors in Scandinavia. Despite economic objectives, the company states that they take an active role in the sustainability transition, by “reduce our own emissions where we can, but also to use our competence and expertise to reduce the climate footprint of our clients and suppliers” “project by project” (Veidekke, 2022). The environmental goals are “halving greenhouse gas emissions across the value chain year on year to 2030” and

“becoming climate neutral by 2045”, which is in accordance with the Paris Agreement and the Swedish Roadmaps. Furthermore, innovation is also an important value for the company, as it sees projects as “arenas for innovation”, and “will invest selectively in innovation and solutions that support the green shift”. From the responds of the interviewees, they agree that there is a routine in the firm, called Lesson-learned meeting, summing up experiences from projects for the sake of continuous improvement and knowledge transferring as a key facilitator to innovation.

4.2 A focus project: 8 km highway with 7 bridges

Project 1 is the focus project for the empirical study of the thesis. It consists of nearly 8-kilometre highway and 7 bridges in the western parts of Sweden. It has been considered as a pilot project for Swedish Transport Administration (STA) to test the new contract form Early Contractor Involvement and the partnering collaboration. The contractor was procured by STA in 2016, the estimated cost for the project is 436 MSEK. Open-book accounting is in use to allow for full transparency of the project economy. The estimated handover of project is 2022, Figure 5 can give a holistic view of the project development and its sustainable management in a chronological manner with the involved actors and the decision-makings in each stage.

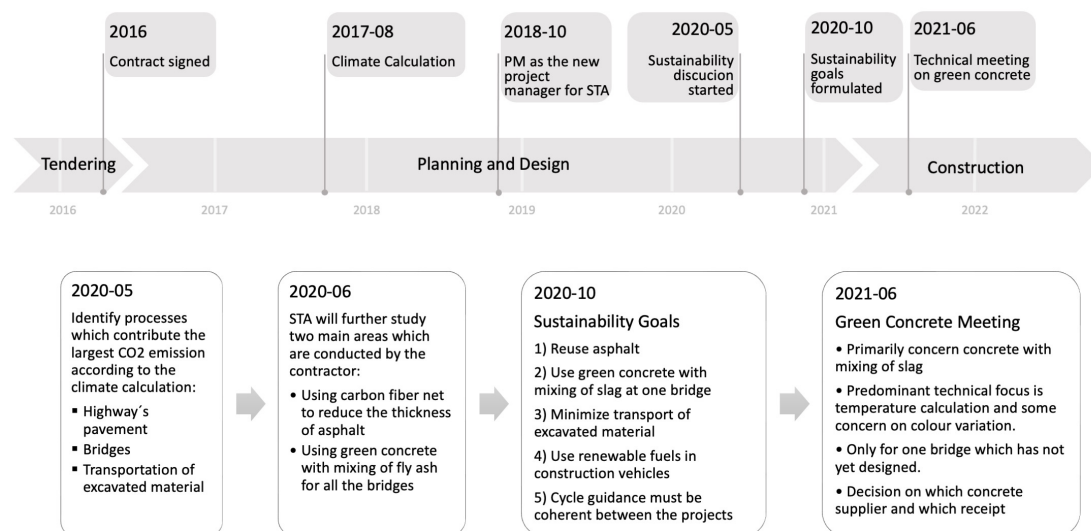


Figure 5 The Project development (above) and the sustainability management (down) of Project 1

Project 1 started the first phase of planning and design in 2016 which was led by a project manager from STA who then got retired in the end of 2018. Since there were not sustainability requirements written in the contract, little focus was put on sustainability issues, apart from that a climate calculation was conducted in August 2017. The new project manager (PM) from STA took over the project in October 2018 and has not started the discussion of sustainability in the project's planning and design meetings until May 2020, which is almost two years after the conduction of climate calculation. Nevertheless, at the end of the five-year-long planning and design phase, sustainability finally became a part of the planning work. It has been handled as following, basing on an aggregation of materials from both the project protocols (2016-2020) and the interviewees:

- In May 2020, the project team first started the discussion on sustainability, due to the unavoidable pressure from the sustainability transition that there are increasingly more and more sustainability concerns and requirements for construction projects. Hence, PM wanted to set sustainable goals in the project even though there were no clear requirements from STA for such an old-signed project. And it was recommended that the sustainable goals should be based on the climate calculation made in 2017, which indicates three aspects contributing the most emissions - pavements, bridges and transportation.
- In June 2020, STA considered to use concrete with mixing of fly ash in all the bridges and expressed the willingness that STA would like the contractor to investigate the possibility of using the new material. As PM stressed that *“It’s untried, a pretty untried method (...) there is no set of rules that you can count on.”* Besides that, the contractor also gave proposal of using carbon fibre net to reduce the thickness of asphalt. Due to the lack of experience of the new material from both the client and the contractor, STA rejected the proposal.
- In August 2020, after the investigation on green concrete, which was mainly conducted by Site Manager 1 (SM 1), the team members from the contractor without SM 1’s presence claimed that they have only little access to fly ash but more to slag products, that the option of mixing slag into concrete will result in a slightly higher cost. This investigation process, according to the interviews with both PM and SM 1, is mostly based on the information provided from the procured concrete supplier (Supplier A).
- In October 2020, the project team had a separate sustainability meeting and the result from the meeting was presented officially in the project protocol that there were some points they decided to work further. However, the sustainability work is based on “a voluntary agreement” as PM put it, which means that the client would like the project team to work with these identified sustainable aspects, and the client would pay for the hours and the material cost for sustainable investments, as Design Manager (DM) from the contractor defined the measurements *“when it does not cost that much money”*. For example, green steel for the reinforcement of concrete constructions is seen as too expensive by PM and thus is not taken into the scope of sustainable goals. Despite that, the voluntary agreement also means that it is not a contractual demand and has nothing to do with bonus or penalty. The client has the ultimate power to decide on what and how the sustainable construction should be, as PM expressed that *“I have not formulated anything myself so clearly, but we must work to reduce the environmental impact (...) in the environment plan that (the contractor) has produced, there is a 15% reduction in CO2. But it was not me who said it should be so.”* Thus, it is PM who eventually decided the following points as reasonable to continue in the construction phase:
 1. Reuse asphalt
 2. Use green concrete with mixing of slag at one bridge
 3. Minimize transport of excavated material
 4. Use renewable fuels in construction vehicles
 5. Cycle guidance must be coherent between the projects

In the first quarter of 2021, the second phase of construction was undertaken, which means SM 1 started to play an essential role in Project 1’s green concrete investigation and execution. A special technical meeting was led in June 2021, by the project team with the participations of one representative from Supplier A and an external concrete

consult. According to the meeting protocol, Supplier A presented the basic knowledge on green concrete, primarily on concrete with mixing of slag, little on another alternative - the mixing of fly ash. Then the predominant technical discussion on green concrete with mix of slag was how to make a reliable temperature calculation to limit cracks and the possible measurements in the production process. Besides that, concern on colour variation was mentioned. And they would test it for one bridge, which has not yet designed. Supplier A confirmed that they can deliver green concrete with mixing of slag, and the possible receipt of green concrete and its CO₂ reduction were presented. Nevertheless, in the interview conducted in January 2022, SM 1 were still in the process of investigation and expressed the lack of knowledge and experience on green concrete: *“The concrete is new, it is also new to the supplier, they may not have much experience in producing it.”*

Furthermore, SM 1 also explained a confusion about the sustainability goal: *“I think in a project like Project 1, we have a collaboration with STA, it is completely open to do environmental measures, as we can together with the client make decisions (...) I would like to see more from STA’s side to perhaps not only choose green concrete on a bridge, but perhaps more bridges, or other measures such as green reinforcement.”* and further criticized *“It’s pity that you do not have meetings in the beginning when you designed all the bridges(...) the issue should be led by those who are involved in the early stages.”* Interestingly, SM 1’s reflection is agreed by DM, who has been following the whole planning and design phase from the very beginning, arguing that *“It does not really matter what you do for choice, (rather,) it depends on how early it comes (into discussion). If we had chosen another bridge or the other bridges, we would have delayed the whole project. That was perhaps why they (STA) did not go in and change the other bridges, because we were already so long (in the process) and some bridges are completely ready in terms of construction design. (...) But if it had been decided earlier that we would use green concrete in all the bridges, we would have no problem with the cost issue.”*

Hence, the empirical material suggests that the late and short sustainability planning (only five months of the five-year-long phase) results in less space for sustainability development in the project regarding both budget and time. It is even more salient in the investigation and decision-making processes of green concrete. From the beginning, in June 2020 when STA expressed the willingness of using green concrete with mixing of fly ash in all of the seven bridges, it was a big gesture from the client’s side to engage in the reduction of climate impact. Then after two months, the team members from the contractor’s side came back with the findings indicating that there is a limitation of accessibility to fly ash but alternatively better to slag. Meanwhile, the construction design of the bridges was in the full speed of progressing since it was approaching the end of the planning and design phase. Under the multiply stresses of insecurity of material accessibility and technical uncertainty, as well as the time mismatching between the choice of construction material (the consideration of using green concrete) and the construction design of the bridges (the project processed as it was planned), the project team decided in October to only test using green concrete with slag in one of the seven bridges, which has not yet designed.

4.3 Two supportive projects: a bridge and a water tower

Project 2 is a supportive project for the empirical material collection on how the contractor works with sustainable construction in concrete. The project is to build a bridge for wildlife crossing, which is 32 meter wide with two 76-meter-long road tunnels over a highway and it is located in the western parts of Sweden. The construction has a steel upper part and a concrete substructure. The client is the same as in Project 1, STA and the contract form is turnkey. The project started the planning and design phase in August 2020 and was handed over in October 2021. The total cost of the project is 48 MSEK. Meanwhile, Project 2 is a relatively new project, concerning its project environment that a climate calculation was also made in the tendering phase, as it was considered as a large project according to STA, and there was a sustainability requirement on the contractor reducing the project's climate impact by 15 percent compared to the original calculation. The contractor solved it by using green concrete with mixing of fly ash and green steel reinforcement. Under the construction phase, Site Manager 2 (SM 2) was an essential figure in handling the green concrete delivered by the concrete supplier (Supplier B). The green concrete turned to have an unstable quality in air content which led to material waste and economic stress in the project.

Project 3 is another supportive project for the understanding of how the contractor handles green concrete in project management. The project is to build a new water tower located in a smaller town on the Swedish west coast. The project's client (Client B) is a company that is responsible for the provision of water and sewage services to two neighbour municipalities thus jointly owned by the two municipalities. The project uses the Swedish standard contract form turnkey and with a collaborative partnering agreement, and it is divided into two phases – a planning and design phase as well as a construction and handover phase. The first phase was undertaken in the beginning of 2019 and the second phase started in the first quarter of 2021 and plan to be finished in 2024. The project target cost was set to 249 MSEK at the end of phase 1. In the middle of 2018, the contractor joined the tendering with a clear proposal to use green concrete with slag. According to the tendering document, the contractor claimed that there are several technical advantages of using this green concrete, such as the workability of the concrete will be improved since it becomes denser, especially, the risk of temperature cracks can decrease. Besides that, the contractor also stated that concrete with slag also gets a lighter color than traditional one, since a lighter and even concrete color is one of the major aesthetic concerns of the architect. Finally, the contractor said that they could develop a project-adapted product that meets the set requirements through its concrete supplier. In the construction phase, SM 2 from Project 2 also works as site manager, and concrete supplier is the same as Project 2 - Supplier B. However, the option of using green concrete with slag was rejected by the project team. This is predominantly due to the unstable quality of the green concrete showed in Project 2, which, in turn, became a lesson learned by SM 2.

To sum up, there are similarities and differences among the three projects in the using of green concrete and the respective project environments which illustrated in Table 2. Firstly, both Project 1 and Project 2 have STA as client but different project managers within the institution, and there was no information exchange on the use of green concrete between the two project managers. Secondly, in the contractor's side, during the investigation of the possibilities of using green concrete, SM 1 had no idea that SM 2 was using or had used the new material in Project 2, even though both SM 1 and SM

2 belong to the same organization group – Concrete West. Noticeably, all these three projects had a simultaneous period of planning and construction, but information and knowledge are not shared across the projects. Thirdly, basing on the experience SM 2 got from Project 2, Project 3 decided not to use the same green concrete that Supplier B delivered to Project 2, instead, Project 3 chose to use the traditional concrete delivered by Supplier B. Fourthly, based on the information Supplier A provided, the team of Project 1 understood that there was lack of fly ash in the market and the temperature calculation was the central technical issue for the investigation in 2021, which turned to be that the concrete with slag has better temperature performance than the traditional one after the investigation. However, this technical issue has already been claimed in 2018 to be a technical advantage by the contractor in the tendering document of Project 2. Lastly, in Project 2, concrete with fly ash was used but its quality turned to be unstable, due to the big variation of air content. Thus, in the coming chapter, these findings will be analysed and discussed further by referring to the theoretical framework presented in Chapter 2.

Table 2 Green concrete issues among the three studied projects

	Project 1	Project 2	Project 3
Client	Client A (STA)	Client A(STA)	Client B
Site manager from the contractor	Site Manager 1	Site Manager 2	Site Manager 2
Concrete supplier	Supplier A	Supplier B	Supplier B
Duration of construction	2021-02 to 2022 (ongoing)	2021-01to 2021-10	2021-02 to 2024 (ongoing)
Is there a requirement from the client of using green concrete in tendering phase?	No	No, but there is a requirement on reduction of CO ² e emission	No, but there is a goal of being certificated
Did the contractor propose the using of green concrete to the client in tendering phase?	No	Yes	Yes
Stages of the using of green concrete in construction	Plan to use	Used	Decide not to use
Type of green concrete	Replace part of cement with slag	Replace part of cement with fly ash	n/a
Relevant technical issues of green concrete in the processes	Temperature crack	Air content, colour	Air content, colour
Is there any experience of green concrete in the project team?	No	No	Yes, Site manager 2

5 Discussion

In this chapter, the empirical material will be first analysed by adopting the lens of *paradox* theory, identifying what tensions arise in the studied projects. Then such tensions will be further discussed through the lens of *institutional logic* theory, revealing the underlying logics of organizational goals and individual behaviours under the tensions.

5.1 From a paradox theory perspective

By analysing the empirical data from a *paradox* perspective, three main tensions are identified, and they are created by the lack of contract, the lack of knowledge and the lack of interconnection in the processes of sustainable management and construction innovation. The tensions will then be analysed and explained through the theoretical base of *organisational paradox*.

5.1.1 Lack of contract

Smith and Tracey (2016) illustrate that there are studies depicting tensions between short-term and long-term, today and tomorrow, change and stability as inherent within organizations, and these tensions are more noticeable in the fields facing a fast paced development such as high-tech firms. However, such tensions are also present in the construction sector. Occasionally, after contracts are signed, planning and design phase of some big infrastructure projects can take several years. At the same time, the sector is introducing a dramatical sustainability transition, requirements and regulations on sustainability keep changing and updating, which creates an unstable project environment for those old-signed projects. Thus, one of the most obvious tensions identified from the empirical material arises from the lack of clear requirements on sustainability in the contract. The tensions surfacing between stability (old-signed contract) and change (new regulations) can be characterized as *organizing paradox*, which is illuminated by Smith and Lewis (2011) that, through defining how organizations are going to operate, *organizing* tensions arise when creating competing processes to achieve a desired outcome.

In Project 1, the tension between the old-signed contract and the constantly changing regulations becomes manifest. As it is introduced in the previous chapter, the contract of Project 1 is signed in 2016, which had no contractual requirements on the reduction of climate impact of the project. It was until the end of the five-year-long planning and designing phase, that sustainable issues started to be put on the table for discussion and planning by the second project manager (PM) from STA. PM illustrated the stress from the institution that keeps reminding them to work actively with sustainability and expressed the pressure of “*there are new things coming all the time, you have to take care of it*”. Consequently, without changing the old-signed contract (seeking for stability), PM was pushed by the project environment to find a way (coping with change) to push forward the sustainability development in Project 1. And the solution is “a voluntary agreement”, that the project’s sustainability goals have nothing to do with bonus or penalty, which are the fundamental mechanism for the client to take control of a project. However, the voluntary solution leads to another tension - *performing paradox*. Just as how *performing paradox* is defined by Smith and Lewis (2011), the client and the contractor are seeking divergent organizational goals in “a

voluntary agreement”. The client wants the project team to actively engage in achieving the extra sustainability goals beside the existing project objectives, without offering contractual and economic incitements to the contractor. Consequently, the team members from the contractor’s side do not change their pace and keep the same priority on the contracted project objectives. Thus, the lack of commitment and motivation on sustainability become a significant form of surfacing the *performing* paradox. As PM stated: “*The challenge is to get others interested in helping and finding ways for (resource and emission) savings*”.

Smith and Lewis (2011) emphasized that tension can become salient to actors through environmental conditions of scarcity, plurality and change. The tension arising from the lack of contract in Project 1 touches all these three factors: it starts with the *change* of sustainable demands, raising the pressure across varied time horizons (the old-signed contract vs. the new regulation); then it develops to a temporary solution (a voluntary agreement) which hopefully could deal with the embedded *scarcity* of projects – a limited time and budget; finally, it ends up to a *plurality* of divergent goals from different actors, which surface as the lack of commitment. In a similar vein, Wooten and Hoffman (2008) pointed out that “the fast pace of environmental change casts competing demands in flux and offers unclear prescriptions for organizational actors.” Thus, PM’s claim on the lack of power in seeking commitment is sharply opposed by the response from the Operative Director from the contractor: “*The client must make a demand!*”

5.1.2 Lack of knowledge

Another distinct tension identified among the studied projects is the lack of knowledge to the new material – green concrete. The team members from both the client and the contractor in Project 1 expressed explicitly that green concrete is so new that there is a lack of knowledge and experience in their respective organizations. PM from the client stressed: “*There was no experience. I have a specialist in the project from my organization (STA), she has no experience either. Then I try to ask around and find someone. We have not found anyone who has really worked with it in the organization.*” Similarly, SM1 from the contractor express a consistent situation: “*I do not know anyone in our group (Concrete West) who uses environmentally friendly concrete now*”. Seemingly, tension the new material leads to is from the *learning* paradox (Smith and Lewis, 2011), that sustainability transition demanding innovative knowledge clashes with the lack of practice and experience in the current way of building with concrete. As it is expressed from the project team, it seems that there is nothing to build upon from the past and the presence in order to implicate the new material.

Contradictorily, there are some projects going on from both the client’s and the contractor’s organizations, which are using and used green concrete for big infrastructure projects, see Figure 6. For instance, Project 2 which is a concrete bridge project was using the new material of concrete with mixing of fly ash, when Project 1 was searching for information and knowledge on green concrete (based on the meeting protocol 2021-06-03). Notice that, both Project 1 and Project 2 has STA as client but different project managers, both projects have the same contractor but different site managers – SM 1 and SM 2 respectively. Due to a lack of information exchange internally within both the corporate and the institution organizations, Project 1 had no idea that Project 2 was testing the new material. Therefore, the lack of knowledge is not

only due to the material is new but also due to the inefficiency in knowledge and information sharing. According to the interviewees, their ways of getting information of the new material was predominantly from the concrete suppliers they procured. The information flows can be described as a linear bottom-up model: from the procured supplier to the contractor then to the client within the project-based organizations. Obviously, there is a lack of a parallel exchange within the organizations or across the project organization boundaries (*Figure 6*). One of the obvious disadvantages of this model is that the information dependence on material supplier becomes a hinder to a holistic understanding of the new material. For instance, the project team in Project 1 understood the new technology in a way which is aligned to Supplier A's market situation. As Supplier A has few concrete products with mix of fly ash, the project team share the same opinion that there is a shortage of fly ash in the market. As it is noticed earlier, this is not the truth, since Project 2 has another concrete supplier - Supplier B, which has concrete products with mix of fly ash and delivers the new material for the construction of bridge. Therefore, the lack for knowledge is partly due to the lack of information and experience exchange, and the *learning* paradox can find its source from a processual paradox between the routine of a simplified linear bottom-up approach and the need of change to more complex and dynamic knowledge and information flows.

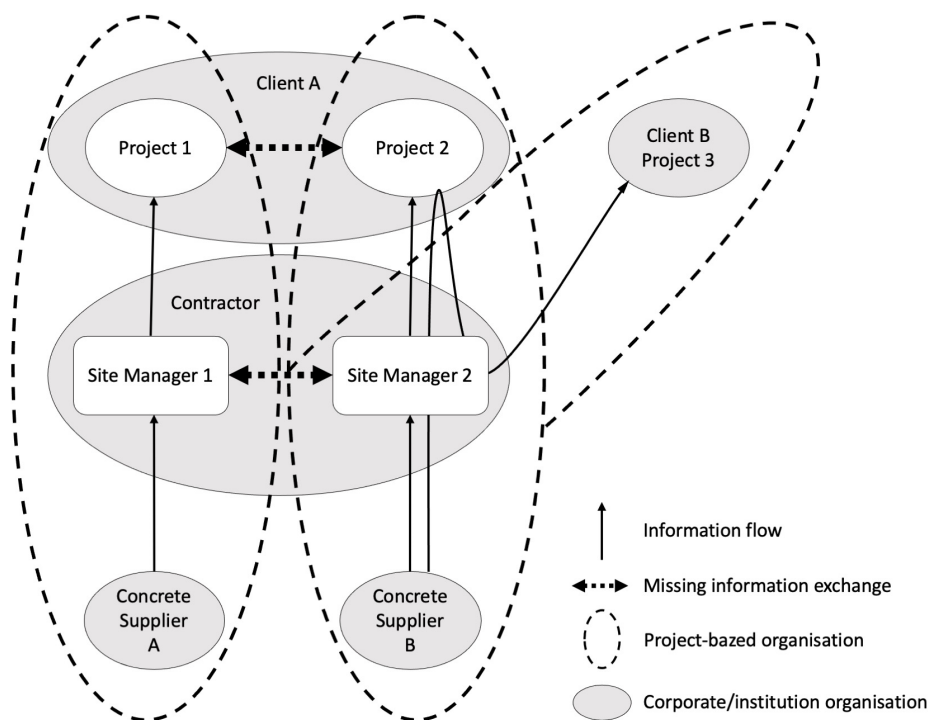


Figure 6 Information flows within the construction organizations

Furthermore, Project 3 comes into the discussion as it mirrors the importance of using the accumulated experience and knowledge of new material in the future or even parallel projects. Also, it demonstrates the limitations and downsides of the existing narrow ways to organizational learning of the contractor (*Figure 6*). Due to Project 3 shared the same site manager SM 2 and the same concrete supplier Supplier 2, the experience of the green concrete gathered from Project 2 became a crucial factor for Project 3 not using the same receipt of concrete for the construction of the water tower. This is mainly because the green concrete Supplier 2 delivered in Project 2 turned to

have a quality issue, as SM 2 explained: “*The material is not stable and we do not dare to take a risk with such a big amount of concrete in Project 3*” and “*It is so new, the supplier needs to make more test to come to the right receipt*”. However, lesson learned from Project 2 could not reach the project team of Project 1 due to the simplified and linear information and knowledge flows within the project organization boundaries. This model constrains the transferring and development of the knowledge and limits it within the same site manager, thus creates a hinder to an effective organizational learning. In other words, the *learning* tension of lacking knowledge is intensified by the *organizing* paradox between routine and change, that the well-established, simplified, and linear path of getting information and knowledge clashes with the need of a systematical, complex and dynamic way of knowledge management.

Hence, this finding provides a consistent empirical example for the statement made by *paradox* theorists Smith and Lewis (2011) that, tensions operate between as well as within the different types of categories, an *organizing and learning* tension surface in organizational capabilities that seek focus and efficiency in the current practice, while also enabling innovation and flexibility within the present way of doing things, for the sake of a future development. Thus, the demand for dynamic capabilities creates tensions in seeking to continuously renew the stable routines. There is another example showing how the contractor responses to this kind of *organizing and learning* tension, to see whether the organization is constantly learning and changing while confronting the external stimuli of sustainability transition. There is a central routine in the contractor firm that a lesson-learned-meeting will be held after a project is finished, with the participation of project team from both the client and contractor organizations, as well as some representatives from top managers of the firm. The main purpose is to constantly improve the contractor's processes and to use these experiences in new projects, namely, for a systematical organizational learning, which is also seen by the firm as an important facilitator to sustainable innovation. The author was invited to join one of these meetings, the project has not a direct connection with the above-mentioned ones. During the meeting (2022-03-22), there were many points which were discussed concretely. However, in *Quality and Environment*, the only focus was about quality improvements, few words on environment or sustainability. Moreover, the main construction of the project was on concrete, but the material was not mentioned regarding its innovative technique implication nor its environmental impact. The author's interpretation is that concrete might be treated as there was nothing new in its development regardless the dramatical technical innovation for the sake of sustainability, that the project team did their job as they usually do. In other word, there is no change in the well-established practice and routine, there is no lesson learned for sustainable innovation.

5.1.3 Lack of interconnection

The third tension is more of a latent nature, but it has a significant impact in the sustainability collaboration between the two actors. The tension becomes sensible when PM was asked to explain what Project 1 have done for the sustainability goals, see Figure 5. PM explained explicitly the first two and the last items in the list of the goals, namely, 1) Reusing asphalt, 2) Use green concrete with mixing of slag at one bridge and 5) Cycle guidance must be coherent between the projects. However, when PM came to the third and the fourth items – 3) Minimize transport of excavated material and 4) Use renewable fuels in construction vehicles, PM simply claimed that: “*It's actually*

the contractor's thing because it costs them money to drive around material, so they want as little transport as possible. I would say that we have not been so focused on that. No." and *"I do not really know how much renewable fuel the contractor has (used). No."*

The author's observation is that the lack of interest on the cooperative partner's work directly indicates a lack of interconnection between the collaborative partners, which surfaces the latent tension between integration and differentiation. Organizations are inclined to apply the well-established "management by objectives" (Drucker, 1954; Odiorne, 1965) and each actor tends to focus on its own organizational objectives and operate separately. Thus, *organizing* tension arise from the lack of coordination on sustainability from a holistic perspective, that each actor acts individually within its organizational boundary. However, the processual paradox between integration and differentiation also leads to *performing* tension, that the separate actors overlook the common goal and neglect the contribution of the collaborative partners, which results in a fragmented situation of sustainability management. As Smith and Lewis (2011) underline that tensions operate between the categories of paradoxes, an *organizing and performing* paradox can arise within the interplay between process and outcome. The responses of PM illustrate manifestly that the client separated transportation from STA's focus on sustainability, as a result, PM did not follow up the contribution of transportation in the sustainable goals. This thus evidences the lack of integration regarding the project sustainable management of Project 1. Nevertheless, Ansari et al. (2013) provide an effective response to a similar situation and explain when tensions emerge among divergent actors in trying to address climate change issue, it is critical to differentiate and appreciate the contributions of different actors, as well as simultaneously developing "an overarching, integrative frame that helps actors recognize their interconnections with one another".

By adopting a *paradox* perspective to identify and analyse the tensions from the studied projects is the first part of the discussion. In the following part, the author will adopt the lens of *institutional logic* theory to further discuss the underlying logics of the opposite poles of tensions.

5.2 From an institutional logic perspective

As Smith and Tracey (2016) demonstrate that *institutional theory* can offer important insights for *paradox* scholar by seeing that all tensions are somehow institutionally derived, namely, environments play roles. Thus, the three paradoxical tensions will be explained by identifying and discussing the deeper and taken-for-granted social layers under such tensions, revealing those embedded and multiple logics organizations and individuals use in everyday life (Johansen and Waldorff, 2015). However, *institutional* scholars also argue that social situations and activities carry manifold meanings and motivations, and actors can refer to divergent logics for their purposes as well as be driven by various logics, thus, logics can be complex and co-existing, and there is no one-to-one relationship between an organization and the meanings and incitements carried by the practices associated with it (Friedland and Alford, 1991; Johansen and Waldorff, 2015).

5.2.1 Is a voluntary agreement solving problems?

According to Chapter 5.1, *organizing* paradox between stability and change becomes salient in Project 1, arising from the clash between the old-signed contract and the constantly updating regulations on sustainability. In the problem solving, PM did not make a change in the contract and the project team agreed upon a voluntary agreement, which leads to a *performing* tension surfacing as the lack of commitment and incitement on sustainability. As many *institutional* theory scholars (Johansen and Waldorff, 2015; Durand and Thornton, 2018; Andersson and Buser, 2021) claim that organizational goals and individual behaviors are framed and affected by the socially constructed assumptions, values and rules, the identification and discussion of underlying institutional logics can provide critical insights on understanding the *organizing and performing* tension across different levels: the constantly changing regulations (system/social structures), the voluntary solution (project's organizational forms) and the lack of engagement (individual behaviors) (Skelcher and Smith, 2015). Furthermore, since logics can be complex, co-existing or even competing in practical organizational life, institutional logics can function as frame of reference (relate to these principles, practice and symbols) helping actors make sense of their world and identities (Thornton et al., 2012). Thus, *market* logic (Thornton and Ocasio, 2008) and *sustainability* logic (inspired by *Circular Economy* logic of Andersson and Buser, 2021) are adopted as two competing logics for discussing how the identified tension in Project 1 is grounded in the institutional complex, how the competing logics provide actors with divergent references and actors use the logics as "toolbox" in advocating their wishes and views, and how organizations find themselves in paradoxical situations where the contradictory logics force them to act (Johansen and Waldorff, 2015).

From the client's perspective, PM has the role of representative for STA in Project 1, which can be interpreted as a symbol for societal value as well as a guard for project's success, and the former are framed by the institutional logic of *sustainability* and the latter by *market* logics. By referring to the wish of reducing climate emissions which is built on *sustainability* logic, PM wants the project team to actively search for resource efficient solutions, since STA is a public institution and represents the value of societal benefits and the project should align to the guidelines and policies of STA. However, the decision-making of "a voluntary agreement" indicates that the achievement of sustainable goals depends on individual belief, rather than a hard mechanism such as bonus or penalty. In contrast, an infrastructure construction project has its inherent business context, *market* logic which characterized by prioritizing profit and reducing costs of time and money is embedded in a project-based organization. By referring to the willing of minimizing cost, which is built on *market* logic, PM needs to monitor the economic activities which have to do with the contractor. Thus, the voluntary agreement fulfills both of the two purposes. The former can be identified in the narrow and short-term scope of sustainability - "*when it does not cost that much money*" as Design Manager from the contractor defined it. And the latter can be recognized in the defensive response from PM when being asked to explain why not making a contractual demand on sustainability and PM argued: "*They (the contractor) think it's easier if someone says that you should do this, and you don't need to think of anything together then. Because if the client decided, then they can say "yes, it costs this much". It's so like.*" Summing up, the voluntary agreement is a way for PM to simultaneously handle the competing demands between short-term and long-term, stability and change, the old-signed contract and the new regulations, in other words, to cope with the co-existing of *sustainability* and *market* logics. As it is presented in Chapter 2.1.3, Johansen and

Waldorff (2015) state that individuals tend to choose among possible elements of different logics in their sensemaking of daily life, and PM does resist, select and transform the available logics when confronting the sustainability objectives. This statement is also supported by the empirical struggles from the contractor.

In a traditional *market* logic, contractors play a role of mission executioner. If clients have not a will or if the will is not stated in the contract, sustainability is not contractors' business. However, the current sustainability transition challenges this well-established logic through the constantly updating sustainability regulations and puts pressure on construction companies to pursue corporate sustainability. According to the contractor, its environmental goals are "halving greenhouse gas emissions across the value chain year on year to 2030" and "becoming climate neutral by 2045". Thus, the corporate's sustainability goals and guidelines become the institutional logic for the contractor engaging into the voluntary agreement. Interestingly, the different degrees of engagement in sustainability among the key persons show the characteristic of that actors consciously select and resist different logics for the sake of their wishes and views (Johansen and Waldorff, 2015). In Project 1, those who were engaged in the early stages and had more direct contact with the client show more acceptance to the voluntary agreement and vice versa. For instance, Design Manager was involved as early as the project started the planning and design phase in 2016, thus shared a similar interpretation of the voluntary goals as PM: "*We sought to set a soft goal, which means that it does not link to penalty or bonus*", but with a comment which reflects the underlying *market* logic that sustainability goal should start with making a contractual demand: "*Because (if) you (the client) set the sustainability goals yourself and take it with you in the contracts, then it automatically becomes that both consultants and contractors get to look at it more.*" Meanwhile, Site Manager 1 who has not directly involved in the planning and design phase and expressed a confusion to the voluntary goal, since SM insist that the partnering contractual relationship between the client and the contractor should give a voice to the contractor in the decision-making on sustainability goals, rather than the client deciding everything solely. SM 1 argue: "*I think in a project like Project 1, we have a collaboration with STA, it is completely open to do environmental measures, as we can together with the client make decisions (...) I would like to see more from STA's side to perhaps not only choose green concrete on a bridge, but perhaps more bridges, or other measures such as green reinforcement.*" Finally, the interviewees who oversee the corporate sustainable strategies, such as Operative Developer and Regional Manager 1, shared a consistent opinion that sustainability should start by clients making clear commands in the contract.

Nevertheless, PM is aware of the clash between the two logics "*The client is important because if the client does not make any demands on sustainability, then suppliers probably do not do much.*" and further expressed the challenge: "*I cannot think of any better solution.*" It seems that the voluntary agreement is not solving problem, Dodd and Favaro (2006) illustrate lively: "If we chase two rabbits, both will escape".

5.2.2 Is a project an isolated island?

Sustainability transition of the construction sector plays an important role as innovation driver for the development and implement of sustainable technologies. Meanwhile, the empirical study suggests that the usage of green concrete for the reduction of climate impact of the infrastructure projects surfaces both *learning* and *organizing* paradoxes

within the construction organizations. *Learning* paradox arises evidently from the lack of knowledge and experience of the new material. However, as resonated in Chapter 5.1.2, it is more crucial to understand and manage the processual paradox identified as the inefficiency of information sharing and knowledge transferring within organizations. As institutional scholars argue that institutional logics condition organizational behaviours (Durand and Thornton, 2018) and logics are comprised of underlying practices and symbols (Johansen and Waldorff, 2015), the *organizing* paradox of inefficiency of knowledge management in the studied projects can seek for the source from the established practice within project-based organizations, namely, projects tend to operate as isolated islands. Engwall (2003) criticises that contemporary thinking on project management is grounded in a lonely project perspective and condemns the treatment of projects as “well-defined, solitary units, detached from both history and context”. Hence, the author adopts “*project logic*” as a logic to describe the underlying practices of project as an isolated island, which frames and constrains the behaviours of project-based organizations. This self-defined logic is inspired by the institutional scholars Johansen and Waldorff (2015) when they clarify that there are studies employing a more pragmatic approach to defining logics, despite the above-mentioned well-established *market* logic. For instance, two logics defined by scholars as to describe tensions between a “Business-like health care” logic and a “Medical professionalism” logic (Johansen and Waldorff, 2015).

To protest against *project logic*, Engwall (2003) calls for a new way of seeing project work, which takes into account historical traces over successive projects and cross-section comparisons over parallel projects, so that the isolated operations at project level are bridged to the central routine activities of a firm. In a similar vein, Winch (1998) proposes two critical flows in the management of construction innovation through linking projects to its parent firm, see Figure 7. One of the two key innovation dynamics is the top-down adoption and implication flow; another is the bottom-up problem-solving and learning flow. In the empirical projects, the latter flow shows to be disconnected between the project and the firm levels, namely, experience and knowledge on green concrete accumulated in Project 2 was not learned by the contractor organization as a firm and thus cannot generate further benefit to Project 1, which is also identified and visualized by the missed horizontal exchange across projects in Figure 6. Furthermore, Winch (1998) highlights that the capacity of the firm to learn is of the predominant importance for its ability to innovate on projects. Thus, “*innovation logic*” is adopted by the author to illustrate the legitimated academical assumption that organizational learning is a vital foundation for construction innovation, according to Winch’s innovation dynamics.

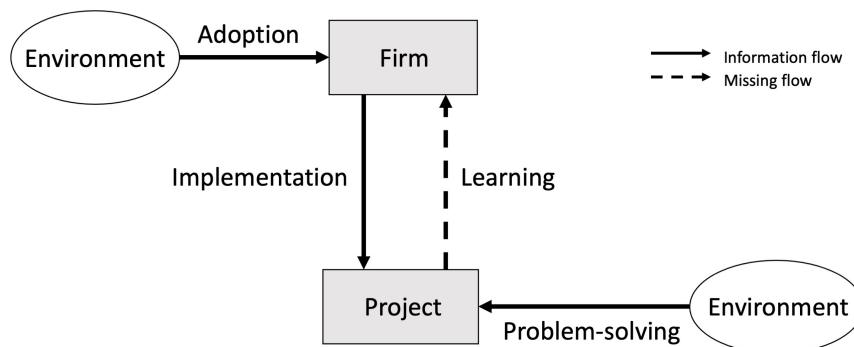


Figure 7 The model of construction innovation processes for the contractor’s organization (adapted from Winch, 1998)

After the explanation of the two self-defined logics - *project* logic and *innovation* logic, they will be applied into formulating an institutional explanation on why information and knowledge are not efficiently transferred within the construction firm and its consequence as a hinder to sustainability transition. By referring to *project* logic, each of the studied projects functions as a lonely island, especially evident in the separate and enclosed information and knowledge flows (*Figure 6*). Consequently, information and knowledge were stopped being shared or generating further benefit across project boundaries. Since the popular notion of projects as solid units is the larger institutional environment that guides project management in construction sector, it hinders an effective organizational learning, which according to *innovation* logic, is fundamental deterrent for construction innovation. Therefore, the clash between the two logics results in construction firms' relatively low ability to innovation for the sake of sustainability transition. Thus, projects should not operate as isolated islands.

5.2.3 Is transportation the contractor's business?

As it is analyzed in Chapter 5.1.3, the client in Project 1 states that transportation is the contractor's business, which surfaces the latent tension between integration and differentiation in sustainability collaboration. The question to discuss further here is why transportation becomes the contractor's business. Again, as *market* logic is described by scholars (Lee and Lounsbury, 2015; Andersson and Buser, 2020) as being attentive to economic pressure, prioritize profit, create competitive advantages, and reduce cost, all these characteristics can be identified thus used to explain the logic behind the phenomenon of transportation as the contractor's business.

The contractor cares about transportation since it has economic incitement to reduce transportation distance and this motivation starts as early as from the tendering phase. Especially in some infrastructure projects, the volume of transportation tends to play a predominant role in cost estimations, and a better optimization of transportation will lead to more competitive advantages for the contractor to win the contract. Even during the construction phase, the minimization of transportation links directly to the reduction of cost regarding time and budget, which increases profit. This understanding is shared by Regional Manager 1 of the contractor. Based on a long experience in the sector, Regional Manager 1 claimed that transportation might contribute to the biggest emission, more than the use of concrete, so that the use of green concrete might just make a modest impact if comparing to the effect of reducing transportation distance. Obviously, the underlying logic for the contractor to emphasize the importance of transportation is that transportation is a perfect case for resolving the competing demands between *market* and *sustainable* logics, that the reduction of transportation will help the contractor to achieve two goals simultaneously - the economic and the environmental sustainability. As many sustainability scholars (Sabini and Alderman, 2021; Hahn et al., 2010) point out, the well-established business case for sustainability is that the sustainable objective is emphasized only when an economic one is also achieved, namely, a win-win paradigm. Consequently, from the perspective of the client, transportation automatically become the contractor's business after the contract is signed and the target budget is set, as if the client has nothing to do with transportation anymore. As a result, the contribution made by the contractor in optimizing transportation is neglected by the leader (PM) in sustainable management of Project 1.

The underlying logic of *market* helps the sensemaking of the separation between the client and the contractor on the issue of transportation, however, as Andersson and Buser (2020) explicitly argue that the value creation of sustainability is through interdependencies. *Sustainability* logic will help the recognition of the importance of interconnection among actors, and the consequence of not keeping a holistic picture in sustainability collaboration. For example, the reduction of transportation distance and the use of green concrete can be a pair of competing demands, yet they are interdependent because using green concrete can lead to a longer distance of transportation, or the choice of procuring a close-by concrete supplier can result in less accessibility to green concrete. Thus, to make a sustainable decision cannot simply depend on gut-feeling, rather, factual analyses from a holistic perspective need to be conducted through climate calculations of different alternatives, providing factual ground to make right decisions. Therefore, the differentiation between transportation (the contractor's business) and green concrete (the client's business) without a holistic view and an integrative analyze can endanger the trustworthiness of the decision-makings from the separate actors on sustainability. When Andersson and Buser (2020) compared the economic systems between the circular economy model and the established one in waste management, they found that in the sustainable model, value is created through interdependencies of the involved actors, whereas in the latter, value is created inside the individual organizations. Hence, to make a sustainable decision, transportation should not only be contractor's business. Decisions and contributions of clients and contractors are interdependent thus should be interconnected and integrated.

Table 3 Characteristics of the four institutional logics (adapted from Andersson and Buser, 2020; Winch, 1998; Engwall, 2003)

Institutional logics Characteristics	<i>Market logic</i>	<i>Sustainability logic</i>	<i>Project logic</i>	<i>Innovation logic</i>
<i>Assumptions</i>	Profit and competition oriented	Reduction of environmental impact oriented	Project as a solitary unit detached from history and context	Organizational learning is the base for innovation
<i>Values</i>	Financial reward, private	Social benefits, public	Project successes, project-based team	Capacity of innovation, corporate organization
<i>Practices</i>	Well-established	Not stabilized, partly to be defined	Long tradition	Stabilized but in need of improvement
<i>Control mechanism</i>	Regulation, contract	Social duty, certification, reputation	Client-centralized contractual relationship	Corporate's central routines and strategies
<i>Temporality</i>	Short-term	Long-term	Project lifetime	Long-term
<i>Source of legitimacy</i>	Profit, efficiency, competitiveness	Climate emission, holistic, backed by scientific evidence	Normalized practices, Profit, efficiency	New ideas, sustainable solutions, competitiveness.
<i>Economic system</i>	Value created inside organization	Value through interdependencies	Value creation within project team orientated	Value through exchange within organization
<i>Bases of strategy</i>	Focus on core activities	Contribute to society	Focus on core activities	Contribute to innovation and competitiveness
<i>Bases of mission</i>	Company and customer value	Societal value	Project goal	Competitiveness and sustainability
<i>Based of attention</i>	Market status	Reduction of climate emission, sustainable resource management	Achievement of project mission on time within budget	Organizational learning

To conclude, the analysis of the empirical material suggests that institutional logics behind organizational goals and individual behaviours are not only passive take-for-granted assumptions, but also can be active choice of actors, as they change their references to logics depending on contexts. This finding offers empirical material for the statement of “institutional logics reveals and theorizes the micro-activity negotiations that take place in and between logic and actors and help us understand the complexity of logics as they play out in everyday organizational life” (Johansen and Waldorff, 2015).

Furthermore, Table 3 illustrates a comparative summary of the two pairs of competing logics used in the discussion of the identified tensions (*market* logic vs. *sustainability* logic; *project* logic vs. *innovation* logic). One of the most manifest characteristics of the four compared logics are that *project* logic finds its source in *market* logic as construction firms are seen as project-driven corporate organizations, *project* logic is basically one type of *market* logic and adjusted to fit the special context of construction projects. Moreover, *sustainability* and *innovation* logics stay very close to each other and share many likenesses mainly because sustainability transition demands major shift in the current conservative practices and requires new ways of thinking and doing things, which, in turn, calls for innovation. Despite that, *innovation* logic also shares a few similarities with *market* logic in terms of “source of legitimacy” that both have “competitiveness”, as seeking construction innovation from a corporate perspective usually aims at increasing its organizational competitiveness in the market. This shows a consistent vision from the Swedish Roadmaps (2018) for the construction sector that, the main goal of thinking new and being climate neutral is to build up the competitiveness of the Swedish industries. Overall, the identified institutional logics are connected, competing and co-existing in the complex system of construction sector.

6 Recommendation

After the tensions are identified and explained with the lenses of *paradox* theory and *institutional logic* theory, this section will present the possible strategies (*separation* and *synthesis* strategies) to embrace the paradoxes and manage these unsolvable tensions. Recommendations are both from a strategical perspective and some practical improvement based on the contractor's ongoing operations.

6.1 An open contract

Although Project 1 is a unique project in terms of its contractual form – Early Contractor Involvement and the long duration in the planning and design phase, the *organizing* paradox between old-signed contract and new regulations are not unique, since a changing environment has become an everyday for organizations and projects, as the sector is aiming at a faster transition to sustainability. There is a need to find a strategy, based on this unique case to reflect on a general situation where contract can find the balance between flexibility and rigidity, so that sustainability can be better handled in facing paradoxes between today and tomorrow, stability and change, long-term and short-term, and voluntary and contractual.

Nevertheless, there is possibility in the contractual form of a voluntary agreement. By adopting a *separation* strategy, the contractor can apply it in the area where there is a promising opportunity for learning and practicing within specific areas, for instance, green concrete, where the contractor can make use of a voluntary goal, together with the client, creating knowledge and collaboration for sustainable innovation. As Regional Manager 2 concluded in the end of the feedback meeting as mentioned in Chapter 3.3: “*Sustainability is on the way to be a competitive issue*”, a voluntary collaboration can provide a flexible condition for the competence development to the coming sustainability-orientated market.

For a *synthesis* strategy, a possible suggestion is to put a time aspect in the contract, so that the pressure of today and tomorrow is considered in the early phase, which helps creating a paradoxical mind-set for project teams and it would “facilitate development of more creative solutions and long-term alignment between business goals and societal needs” (Pinto, 2019). As project develops and the project environment changes, an open contract together with a paradoxical cognitive frame of decision-makers (Pinto, 2019) would lead to a balanced and holistic model in managing contractual relationships.

6.2 A systematic way to organizational learning

The tension caused by a new technology and surfaced as limited information and knowledge is more an *organizing* paradox than a *learning* one. As it was discussed in Chapter 5.2.2, the *organizing* paradox seeks for an institutional explanation that *project* logic clashes with *innovation* logic, which creates a hinder to organizational learning and innovation. There is a need to find a way to capture the problem-solving or lesson-learning from projects as it is identified as a disconnection between project and firm levels in the contractor's innovation flows. As a *separation* strategy, it will be to encourage experience sharing internally within the involved team members and expand it to some strategical experts or top managers, as it has been applied now in the lesson-learned meetings by the contractor's organization after a project is finished. It is the

first step to organizational learning, basing on the construction innovation model proposed by Winch (1998), the bottom-up flow of gathering knowledge and experience from projects to the parent firm (*Figure 7*).

Furthermore, *synthesis* strategies will demand a systematic knowledge sharing across the project boundaries. If referring to the innovation dynamics of Winch (1998), another flow of top-down from firm to project (*Figure 7*) is a good illustration. As it is demonstrated in the empirical material, there is an urgency to accelerate communication among projects especially there is a keen need of knowing a new material or technology which has not been used so widely. A suggestion can be that themes such as green concrete with mix of fly ash, could be identified as key themes for lesson-learned-meetings, so that project team which needs to search for experience and knowledge on it can, through an easy and effective process, get in touch with the information. Thus, a systematical theme identification and categorizing in the bottom-up flow can create effectiveness to the successive flow of the top-down, from the collective knowledge and experience library to the adoption and implication of the accumulated knowledge and experience in future projects. Staffs who work with *Quality and Environment* should be active in identifying and categorizing key topics in lesson-learned-meetings from projects. Moreover, there is also a need to have sustainability strategically as an individual topic in lesson-learned-meeting's agenda, which can function as a reminding to the project team to reflect on their contribution in environmental sustainability when the project is done. Consequently, sustainability awareness can be successively increase through all projects. Iteratively, staffs who work with *Quality and Environment* should again be actively in following up what has been done and learned in projects and use this material as bridges to connect new and old projects.

Hopefully, the lessons learned can be alive in the organization and continue to generate benefit to the coming projects. Otherwise, experience and knowledge risk to be graved in the system after being written down and uploaded.

6.3 A holistic perspective in collaboration

The latent tension on whether transportation is only the contractor's business trigger a reflection on the lack of interconnection in the sustainable collaboration in Project 1. As it was discussed in Chapter 5.2.3, sustainability needs to be built upon a mutual interest and interdependency, a sustainable decision-making needs a coordination of different actor and divergent factors. A holistic perspective is important for integration when different actors focus on its own goals and neglect contributions from other actors or show less interest when there is a need for collaboration.

A *separation* strategy to the contractor will be that to visualize and underline the contribution which have been done in optimizing of transportation. Make use of climate calculation tools to compare the different alternatives and show the process and result, so that it becomes part of the discussion in project sustainability management as well as an important part of the project's achievement on the reduction of climate emission.

A *synthesis* strategy will be to make sure the decision on transportation is not only about reduction of distance, but an important parameter to take into consideration when making a sustainable decision, both economic and environmental sustainability. Furthermore, the contractor also needs to show its interest in sustainable collaboration

when clients have their own focus and goals in sustainability and seeking for engagement and commitment. By doing so, a holistic perspective can help the differentiation among actors building up an integrative connection, since it is through interdependency that the value creation of sustainability is created, then we are on the right way to sustainability transition.

7 Conclusion

In the light of the Swedish construction sector engaging in a dramatical sustainability transition, the thesis investigates how the studied contractor works with sustainable construction, with a focus on the usage of green concrete to reduce the climate impact of constructions. By using the theoretical framework - a combination of *paradox* theory and *institutional logic* theory, three tensions arising from the processes of sustainability management are identified in the case study. Firstly, tensions arise from the lack of clear requirements on sustainability in the contract. They are identified as *organizing* tension between stability (the old-signed contract) and change (the constantly updated regulations); and *performing* tension as the client and the contractor are seeking divergent organizational goals in the voluntary agreement. Secondly, tensions emerge from the lack of knowledge of the new material (green concrete). They are identified as *learning* tension between today (current way of building with concrete) and tomorrow (demanding new knowledge for innovative material); and as *organizing* tension between routine (the simple and lineal model of knowledge management) and change (the need of a complex and dynamic one). Lastly, tensions surface from the lack of interconnection in sustainability collaboration between the client and the contractor. They are identified as an *organizing and performing* tension between differentiation (the transportation is the contractor's business) and integration (the need of a holistic coordination and an interconnective collaboration).

Furthermore, institutional logics reveal the take-for-granted assumptions so as to understand how environments frame and constrain organizational goals and individual behaviours under the identified tensions. Two pairs of competing logics are identified and discussed in the analysis of the empirical tensions. *Market* logic clashes *sustainability* logic while confronting sustainable objectives, as the client and the contractor seek divergent organizational successes and focus on separate goals, resulting in tensions arising from the lack of commitment and the lack of integration in sustainability collaboration. Moreover, *project* logic and *innovation* logic are two self-defined logics. The adoption of these logics in analysing the *learning and organizing* tension reveals that the established and conventional practice of project-as-an-island leads to the inefficiency of knowledge transferring and organizational learning, hence relatively low ability to construction innovation. Meanwhile, these analyses also suggest that actors not just accept institutional logics passively or unconsciously, they also resist, select and transform logics for their own purposes, using logics as tools to advocate their wishes and views.

Finally, recommendations are made by using *paradoxical* strategies. It starts by *acceptance* strategy, encouraging decision-makers to embrace paradoxical situations. Then followed by *separation* and *synthesis* strategies, providing approaches for the contractor to cope with competing or contradictory demands simultaneously. The strategies and improvements the author recommends for the identified tensions can be summarized as:

- Seeking an open contract that can find the balance between flexibility and rigidity, so that sustainability can be better handled in facing paradoxes between today and tomorrow, stability and change, long-term and short-term, and voluntary and contractual;
- A systematic way to organizational learning and improvements in the current lesson-learned routine;

- Keeping a holistic perspective in sustainability collaboration and decision-making, so that contributions are not neglected, right decisions can be made, and then we might on the right way to sustainability transition.

8 Appendices

8.1 Interview guide for Project Manager (PM) from STA

Introduction

1. Introduce myself/research focus/ interview format
2. Provide information (Background, purpose, use of data, anonymity.)
3. Ask for permission to record the interview
4. Obtain general information about interviewee

Generical questions

- What does sustainability mean to you?
- Do you identify with any active engagement by STA in sustainability?
- What is STA doing for sustainability?
- How do STA communicate about it?
- As a project manager in STA, have you ever been involved in discussions/ decisions/ projects over the sustainability topic?

Project specific questions

- Since the contract of the project was signed in 2016, during the project's planning and design process, there were many changes in the requirements and regulations from STA in order to reduce the greenhouse gas emissions. In what circumstances did sustainability topic become an active part in the planning and design process?
 - Are there any specific requirements and regulations which trigger the sustainability considerations in the project? If yes, what are they?
 - Are you obligated to follow the new regulations in sustainability after the contract was signed? If not, what is the motivation for sustainability practice as a client?
 - What are the challenges?
- Because it was written in the meeting document that the consultant recommended that sustainability goals should be managed at the same time as the construction design phase. They even suggested the following method to lead the process:
 - First, in May 2020, identify processes which contribute the largest CO2 emission, which are: pavement, bridges, transportation of excavated material. And using climate calculation tools to formulate the goal of sustainability.
 - Then, study further two alternatives:
 - *Using carbon fiber network to reduce the amount of asphalt* : In June 2020, this proposal came. According to the project team members, it is a material which has been used in Sweden and it works. However, it is not very common, and sometimes the clients approve it and sometimes not.
 - Can you describe the process of decision-making from your perspective? Any special considerations? (Such as conflicts between the willingness of doing greener construction and

the demand of existing regulations or uncertainty of the new material?)

- *Using fly ash in all the bridges*: in September 2020, STA had this idea, and the contractor came with the possibility of mixing slag in concrete.
- Finally, in October 2020, after an extra sustainability meeting, the project team decided to focus on several areas:
 - Reuse of asphalt
 - Mixing slag in concrete at least one bridge
 - Minimization of transports when handling soil with invasive species
 - Use of renewable fuels in work vehicles
 - Cycle guidance must be coherent between the projects

Among the above mentioned, what have been implicated in the project? What are planned to be implemented?

- How was the collaboration among the client, the consultant, and the contractor in terms of communication and decision-making processes in reducing CO2 emission?
 - In the case of deciding using slag in only one bridge
 - Have you considered different options: green reinforced steel, green concrete, two or more bridges?
 - How do you find information and who do you and your team turn to when you need to make decision on the use of green concrete?
 - In the case of deciding not using carbon fiber net in pavements
- Since this project is a pilot project for STA in terms of applying ECI contract form in a highway project.
 - What do you think the early integration, or even partnering collaboration, create any impact in the sustainable and innovative development in the project?

Looking at the future

-
- According to the academic and practitioner literature, there is a growing link between sustainability and project management. Do you share this vision?
 - Do you believe that project management as a profession has a critical role in the sustainability topic?
 - Buying into the idea of the need for the integration of sustainability and project management, how much influence do you think a project manager has in bring sustainability into a project (compared with clients, contractors, consulting designers, and so forth)?
 - Does a gap exist between the literature (importance of sustainability in project management) and reality (what is carried out in practice)? How can this gap be filled?

Ending

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5. Thanks for the participation and ask for permission to follow-up questions.

8.2 Interview guide for Site Manager 2 (SM 2) from the contractor

Introduction

1. Introduce myself/research focus/ interview format
2. Provide information (Background, purpose, use of data, anonymity.)
3. Ask for permission to record the interview
4. Obtain general information about interviewee

Project specific questions: (with focus on green concrete)

1. Project 2

- Project's different processes
 - Was the use of green concrete a demand from STA in the project description? if not, where and when came up the idea of using green concrete?
 - How was green concrete issue planned in the planning and design phase?
 - How was green concrete issue handled in the Construction phase?
 - What kinds of experience you got from trying the new material in the construction phase? Challenge?
 - Did you use the same concrete everywhere for the whole construction?
- Knowledge flow
 - How and where to get the information on green concrete?
 - within concrete group (institutional organization)
 - among different projects (project-based organization)
 - outside the contractor's organization boundary, such as client, supplier, branch forum
 - Knowledge sharing
 - Is it important to share? or if you see each project as an island, this is the project, we do this thing, and then next one, and nobody asks.
 - Where to share within the contractor's organization?
 - What kinds of information you want to share?
 - For the next project, if you want to try new way or not.

2. Project 3

- Project's different processes
 - Was the use of green concrete a demand from the client in the project description? if not, where and when came up the idea of using green concrete?
 - How was green concrete issue planned in the planning and design phase?
 - How was concrete issue handled in the construction phase?
 - Did you use the same concrete everywhere for the whole construction?
 - the decisions-making process of not using green concrete

- Decision-making flow
 - who are involved in decision making?
 - who can influence the decision-making process?
 - who has the power to make decision?
 - Special process of decision-making?
 - Your role as site manager in the decision-making process
- Knowledge flow
 - How and where to get information?
 - within concrete group (institutional organization)
 - among different projects (project-based organization)
 - outside the contractor's organization boundary, such as client, supplier, branch forum

8.3 Interview guide for Regional Manager 2 from the contractor

- How do you interpretate if the client says that the sustainability work is “*a voluntary agreement*”?
 - How would you react in this situation?
 - What do you see as challenges and opportunities?
- How do you interpretate if the project manager of the client says: “*It's really the contractor's thing because it costs them money to drive things around, so they want as little transport as possible. I would say that we have not focused so much on just that, No.* ”
- About organizational learning
 - What do you think of the information and experience exchange on green concrete among the three projects?
 - If the concrete supplier plays the role of information source in the project, how do you handle the limitation of this way?
- What do you consider if the client says, “*Now I know, it was not so expensive nor troublesome to use green concrete. Then I can make demands on it from the beginning in my next project*”?
- What are Region West's tools for meeting the new requirement on reducing climate emissions in the new projects?

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