

The changed production environment

A qualitative study of industry consequences derived from the changed division of labour

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**Department of Construction management
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Cover: Thesis established model of the typical construction project, illustrating the relationships subject to the covered theory.

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Abstract

The project based environment of the construction industry stipulates a unique environment that is determined by a set of local circumstances, involving a lot of people that are organized into many different business entities throughout the various stages of the construction; all coordinated in means of time and space. There is thus an inherent complexity and fragmentation to the construction industry since projects are fundamentally unique and dynamic. During the last couple of years, these characteristics have been reinforced by an increased utilization of subcontractors within the industry, founded in a rapid growth of start-up companies and specialized construction activities. Concurrently, the major construction companies have increased their share of white collar workers in order to cope with developments at industry level, indicating that the division of labour brought on by main contractors in projects has been changed in relation to previous compositions. It is therefore necessary to analyze and evaluate what impacts the new division of labour have on the production in order to understand the adaptations and developments needed.

The aim of this thesis is, through the perspective of Skanska Sverige AB, to examine how the division of labour has changed in the production, what consequences this change have spawned within the site environment and how the division of labour will change in the future. This was achieved by combining a qualitative study approach through a literature study and first hand data from interviews with a quantitative approach by gathering raw data from industry actors. The findings show that the share and number of subcontractors has increased in the production while the share and number of blue collar workers has decreased. In turn the number of white collar workers has increased in order to manage projects in greater absence of own construction workers. The consequences of this change is an even more complex and fragmented production environment where managers face challenges in coordinating as well as monitoring and controlling activities to an increased extent than previously. How the division of labour will change in the future is not definitive, but as the development indicates to continue, a point of concern is when the number of own construction workers gets too few in numbers in order to perform any major activities and produce any value even though they are considered quintessential to the production.

Table of content

Abstract	V
List of Figures.....	8IX
List of Tables.....	X
1. Introduction.....	10
1.1 Background.....	10
1.1.1 Development of the industry	2
1.2 Aim.....	5
1.3 Research questions.....	5
1.4 Thesis disposition	6
2. Theory.....	7
2.1 Outsourcing	7
2.2 Advantages and risks of outsourcing.....	8
2.3 Loosely and tightly coupled systems.....	190
2.4 The production environment as a tightly coupled system.....	12
2.5 Transaction cost economics	12
2.6 Analytic model of the project based environment	16
2.6.1 Roles of the production	18
3. Method.....	21
3.1 Research methodology.....	21
3.2 Collection of data	21
3.2.1 Interviewees	22
3.2.2 Statistics.....	23
4. Empirical inquiry.....	25
4.1 Skanska Sverige AB.....	25
4.2 Business strategy and development	26
4.2.1 Construction workers	28
4.2.2 Core business.....	29
4.3 On-site coordination.....	31
4.3.1 Efficiency and value of the morning sessions.....	33
4.3.2 Engaging subcontractors	34
4.3.3 Short term activities and momentary visits	34
4.4 Development of subcontractors.....	35
4.4.1 Evaluation of subcontractors	37

4.5 Changed roles	38
4.6 International activity on-site	39
4.6.1 Langue barriers.....	39
5. Analysis.....	41
5.1 Development of production division of labour	41
5.2 Consequences of changed division of labour.....	44
5.3 Future division of labour	48
6. Conclusion	51
7. References.....	53
8. Appendices	57

List of Figures

- 1. The share of white collar workers in the major Swedish construction companies over the period 2005-2017 2
- 2. The national net sales of the construction industry divided by standard industrial classification (SNI) 3
- 3. Proportion of the industry workforce in the smaller companies, i.e. companies with fewer than 50 employees over the period 2003-2017 4
- 4. An illustration of a typical construction project in the scale of above 400 million SEK over 2-5 years. The different link type showcasing what concept the relationship is subjected to 16
- 5. Relationship between the Swedish construction stream by revenue and the number of construction workers 41
- 6. Development of the typical construction project model 42
- 7. Relationship between the revenue of the Swedish development and construction stream 43
- 8. The new model of the typical construction project including what concepts and theories the relationships are subject to 45
- 9. Illustration of the new ownership of activities among subcontractors and internal construction workers 46

List of Tables

1. List of participatory interviewees by position and business entity 23
2. The number of subcontractors' workers in comparison to the number of own blue collar workers on site 27
3. Revenue of the Swedish construction stream in comparison to the number of construction workers 27

1. Introduction

This chapter introduces the background of the thesis while dealing largely with the complex and fragmented characteristics of the construction industry. Furthermore, the recent developments within the four major construction companies in Sweden are described along with several commercial and structural changes at industry-level depicting its current state. Lastly, the aim and research questions are outlined together with the thesis disposition.

1.1 Background

The composing of a structure in the project based environment of the construction industry stipulates a unique environment and a set of local circumstances where various processed raw materials, from wildly different locations, are assembled or further processed into a single product. The division of labour consists of coexisting specialized units beholden to different business entities, coordinated in means of time and space over various stages of the construction. Thus, there is an inherent complexity to the construction industry as projects are fundamentally dynamic and unique.

Dubois and Gadde (2002) suggest that the industry is characterized by complexity factors stemmed from industry specific uncertainties and interdependencies, and subsequently inefficacy of operations by four causes: (1) management is unfamiliar with the local environment; (2) lack of complete specifications; (3) low uniformity of materials, work and parties; and (4) the unpredictability of the environment. Gidado (1996) sources this complexity to two perspectives; first, the operative and technological perspective i.e. the engineering and executing difficulties imposed by the project environment. Secondly, the managerial perspective, which involves planning, coordination and the creation of a workflow from the different scattered activities. The latter perspective manifests as the related difficulties of coordinating, controlling and monitoring from start to finish which increase with the number of actors as the interactions multiply exponentially.

However, the two perspectives aren't mutually exclusive; they are rather codependent as an increase of one complexity perspective justifies the increase of the other. Today's industry with increased technology and advanced machinery subsequently also requires specialized labour to utilize it. Consequently, multiple authors argue that the industry is heavily fragmented (Mirawati et.al, 2015), (Dubois and Gadde, 2002), (Koskela, 2000), (Nawi et.al,

2014), often citing the complexity, heterogeneity of demand, local character of the market, and the inherent short term market-based relationships.

1.1.1 Development of the industry

According to Akyol (2016) the 21th century’s commercial development of the construction industry has furthered the narrative of a more fragmented and complex industry. The current state of the industry is derived from multiple factors; as a result of heavy utilization of subcontractors there is subsequent increasing need for coordination and collaboration. Concurrently, the new way of operating increases documentation, administrative and monitoring activities funded in the interest to continuously evaluate the business relationships in order to secure quality. Furthermore, due to successively increasing requirements within the industry the necessity of capabilities within primarily sustainable environmental, working environmental, IT, health and safety areas have consequently increased. The continuous introduction of building information modeling within the industry has also increased the IT-modeling and IT-coordination required not only by the main contractor and client but also subcontractors and blue collar workers alike. As the ongoing refinement of the client’s role has characterized the relationship between the contractor and the client with collaboration, the client’s technical expertise has decreased while the main contractors have increased both their technical and management capabilities as customer understanding, design and planning capabilities.

Subsequently, there is an increased demand for white collar activities as manifested in the increased capacity of the industry’s largest companies; PEAB, Skanska, NCC and JM made available figures.

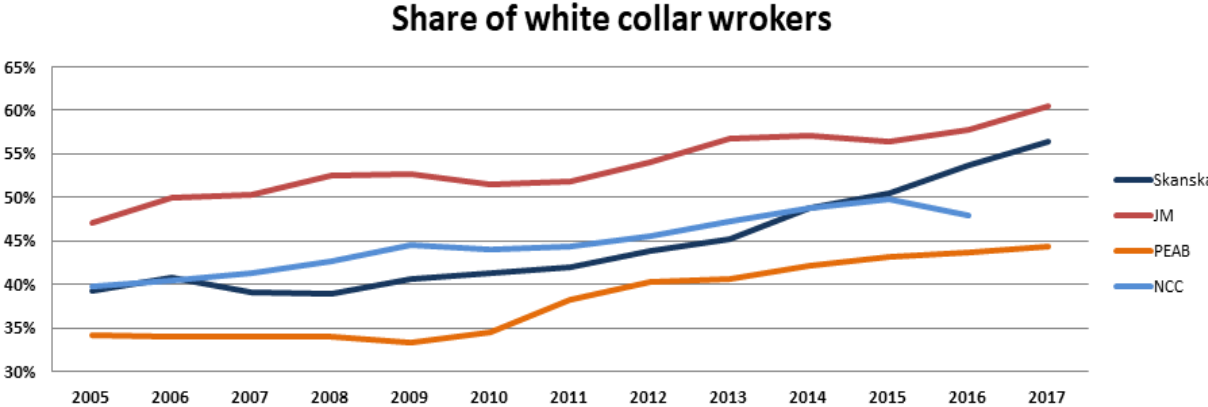


Figure 1, The share of white collar workers in the major Swedish construction companies over the period 2005-2017.

During the seven-years-period 2010-2017 Skanska increased its share of white collar workers with 17.3 % while collectively the companies increased on average 12.3 %, see figure 1. However, the change is not only as a result of increased white collar workers, the number of blue collar workers continuously decreased during the period in all companies. The development can be attributed to multiple factors; Akyol (2016) suggests that the continuous technological development and higher utilization of prefabricated elements is a contributing factor as surrounding activities are often performed by subcontractors. Furthermore, after the financial downturns of the mid-90s the construction companies avoid employing more blue collar workers than what is possible to continuously employ for a long period of time, concurrently, a high proportion of white collar workers allows for necessary control and steering of economy and time i.e. quality and exaction in production.

These changes at company level have also manifested at industry level, with an increasingly fragmented industry the market has become progressively heterogeneous. The industry is characterized by a comparatively high renewal rate i.e. the proportion of start-ups in relation to existing company stock, with the majority of new companies being categorized as specialized construction companies. Statistics Sweden (SCB) considers this category as companies performing activities that require specialized knowledge or equipment and foremost performed by subcontractors.

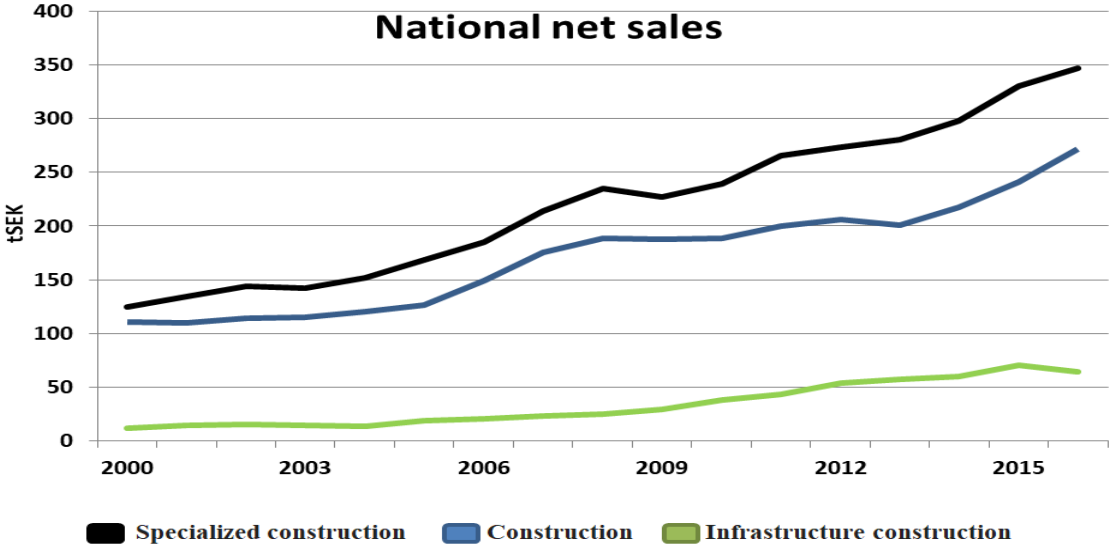


Figure 2, The national net sales of the construction industry divided by standard industrial classification (SNI).

The net sales of the industry during the 21st century, as in figure 2, depict a strong correlation between specialized construction and general construction net sales. However, the gap between the categories has increased indicating that specialized activities are performed with higher frequency i.e. the industry is progressively getting more complex and that subcontractors are more widely utilized. This, however, is not definitive as to depict the division of labour within the production.

Concurrently the portion of the workforce in regards to company size has steadily shifted as the smaller companies also are responsible for a greater portion of the industry's net sales. According to Statistics Sweden companies with 49 or fewer employees constitutes 99.5 % of the current market landscape as of 2017 and employ 66 % of the workforce, which from 2003 is a sustainable increase from 61%. Largest comparable incase in regards to the major companies was the micro-companies i.e. the companies with fewer than 10 employees. Individually all company sizes increased their portion of the workforce in relation to the major companies i.e. companies with more than 250 employees depicted in figure 3.

Proportion of the industry workfoce in small companies

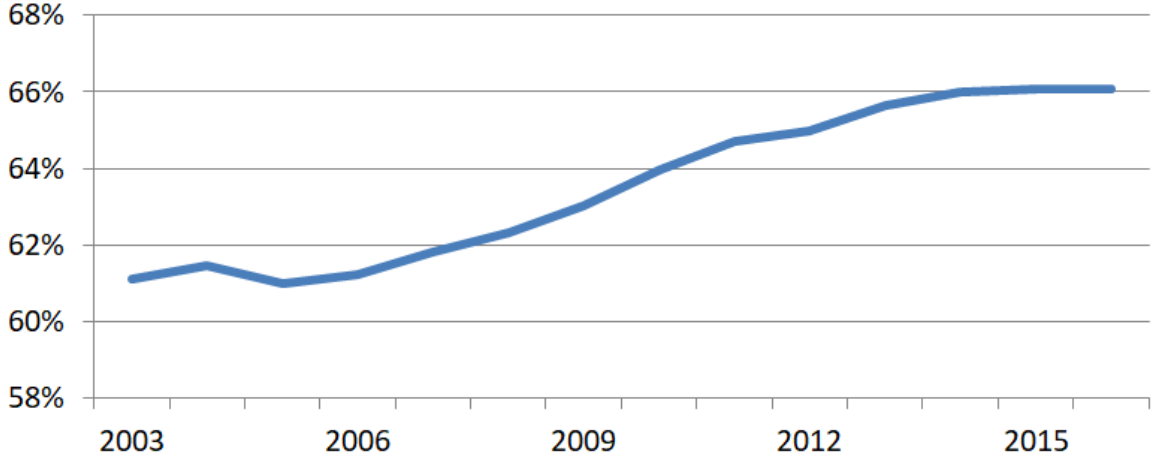


Figure 3, Proportion of the industry workforce in the smaller companies, i.e. companies with fewer than 50 employees over the period 2003-2017

Moreover, the presence of foreign labour and companies has increased on the Swedish market as the perception has shifted. Swedish businesses are no longer perceived to provide a significantly superior service (Akyol, 2016). As the foreign companies are able to compete with lower wages and not abiding Swedish collective agreements, foreign companies within the construction industry during the period 2006-2017 has increased from 242 to 508 which is more than any other Swedish industry (Tillväxtanalys, 2018).

These changes at company and industry level have brought on a changing production environment in the industry with a different division of labour than previously. With a further fragmented and complex production the site management faces challenges in collaborating, controlling and monitoring the production flow in the new environment. It is therefore necessary to analyze and evaluate the impact that the new division of labour has on the production site to understand the adaptation and development needed.

1.2 Aim

The aim of the thesis is to provide construction companies basis for decision-making in the choice of division of labour within their production. Specifically, the thesis aim to depicting and evaluate the previous and current state of the division of labour. In addition, it aims to identify the future division and its potential disadvantages.

To achieve this aim, the thesis will examine through the perspective of Skanska Sverige AB as a contractor how the changes on market and organizational level have affected the division of labour in the production stage and subsequently what consequences it has spawned within the site environment. Thereafter, by utilizing the empirical data gathered evaluate the potential future division of labour.

1.3 Research questions

Derived from the purpose, the quintessential questions this thesis aim to answer are accordingly:

- RQ1: How has the division of labour changed within the production?
- RQ2: What are the challenges derived from the change?
- RQ3: How will the future division of labour look like?

1.4 Thesis disposition

In chapter 1 the background and problem statement of the thesis are introduced while dealing with characteristics and developments of the construction industry. Included as part of this chapter is additionally the aim and research questions of the study.

In chapter 2 the literature study of the thesis is presented, composing of the selected concepts which are combined into a theoretical model of the production environment. These include outsourcing, coupled systems theory and transaction cost economics.

In chapter 3 the applied research methodology to conduct the thesis and fulfill its aim is introduced along with the approach towards data collection and the selection of participatory roles and business entities.

In chapter 4 the data collected from interviews and inquired statistics are presented. Included in the chapter is an introduction to the examined company along with the processed topics business strategy and development, on-site coordination, development of subcontractors, changed roles and international activity on-site.

In chapter 5 the empirical inquiry is analyzed in relation to the selected theoretical concepts and model of the production introduced in chapter 2. The structure and content of this chapter is presented in accordance to the research questions found in chapter 1.4.

In chapter 6 the conclusions of this thesis are presented to answer the research questions derived by the aim in chapter 1.

2. Theory

This chapter presents the literature study that has been performed and aims to provide the reader with a theoretical background to the investigation of this thesis. In the following subheadings the selected concepts are introduced and shape the theoretical framework that will be used to analyze the empirical inquiry. These include outsourcing, transaction cost economics and coupled systems theory, which are finally combined into a generalized model of the production environment along with the two main actors of interest; the main contractor and its subcontractors, to illustrate how the selected theoretical concepts act within the field of investigation.

2.1 Outsourcing

The concept of outsourcing began to emerge from the mid 1900's as a result of an attempt to broaden corporate bases and utilize further advantages of economies of scale through the focus on diversification. Up until that point, including most of the 20th century, the typical business model had been a large integrated company that could own, manage and directly control all of its assets. Many organizations subsequently began to suffer from a lack of mobility due to the strain that the expansion had put on the management structures of the firm, while simultaneously trying to compete at a global scale. To increase flexibility several large-sized companies started to develop new strategies that aimed to focus more on their core business. This transformation included deciding on which processes and activities that should be considered core and left performed in-house and which should be outsourced to external suppliers, also known as the "make or buy" decision (SCRC 2006).

Since then, the concept of outsourcing has been described in various yet similar ways, whereby one definition is *"the strategic use of external resources to perform activities traditionally managed by internal staff"* (Griffiths 1999, p. 1). It can therefore be argued that subcontracting, which is often referred to as the practice of bringing in external companies to perform specific parts of a project that cannot be managed internally, is not the exact same as outsourcing, since certain activities among some of today's construction firms may have never been part of internal blue collar employment. However, the line between outsourcing and subcontracting is often viewed as non-distinct, and several hold that the latter simply can be interpreted as a common form of outsourcing (Bichescu, et al. 2009). As

both concepts provide identical implications for the customer organization, it can be used to help describe why companies choose to contract out proportions of construction work to external subcontractors, likewise the difficulties and risks that arise while engaging in the practice.

2.2 Advantages and risks of outsourcing

When outsourcing was formally identified as a business strategy in 1989, one of the primary reasonings behind its use was, and still is, to decrease costs by converting fixed overheads into variable costs and to avoid major investments tied to the modernization of in-house functions (Mullin 1996). Subcontracting brings similar economic benefits by allowing contractors to have a higher degree of variable expenses which can be more efficiently adjusted to market swings in supply and demand, thus increasing the financial flexibility of the company. What is missing internally for each project can subsequently be procured by subcontractors without jeopardizing the employment of internal blue collar workers to equal extents (Power, et al. 2006). Furthermore, the contracting of external providers unlocks access to specialized knowledge and skills, up-to-date procedures and technological advances in practices, which provides an opportunity to improve quality of work and competitive edge in the areas where the company is lacking internally (Burkholder 2006). Meanwhile, the customer organization can focus more in-house resources on the development of core competencies and functions as well as strategy-related issues (Bragg 2006). Thus, while outsourcing is primarily cost-reduction oriented, the concept of using external companies to perform specific activities additionally includes strategic considerations, in which focus lies on performing value-adding activities in-house where the core competencies can be utilized in a more efficient way.

While there are several advantageous reasons to outsource certain activities in organizations, it also has a number of risks that need to be considered. Firstly, there is the concern of losing control of operations that previously have been part of in-house performance. According to Axelrod (2004) this originates from the customers organization's suspicion that the external provider simply does not have the same level of commitment to meet contractual requirements compared to internal groups. Secondly, it is argued that there are fundamental differences in motivation, goals and attitudes between internal staff

and employees of external providers which might affect the quality of relationship and project outcomes. Additionally, the absence of other insiders and subscribers to goals, missions and culture of the customer organization may further this perspective. Although this effect is a similar issue with subcontracting, the contractor and provider typically work in a close relationship throughout the project, meaning that the hiring party normally can remain in reasonable control over the process. Likewise, the formalities embodied in contractual arrangements may partially reduce the lack of commitment among subcontractor firms. Still, it is the providing company as performer that remains in direct control over the quality of outcome in the work undertaken (Axelrod 2004).

Then there is the issue of viability among external providers, where the prospect of failure is perhaps one of the worst considered scenarios for customer organizations engaging in the practice. This is of special importance for construction contractors due to the sequential nature in which a lot of work is organized, where the initiation of one activity is dependent on the completion of the prior. Failure among subcontractors can subsequently harm the entire production chain and result in costly delays if not acted upon quickly. It is argued by Bragg (2006) that the only way to reduce this risk is to follow a clear, structured approach to minimize the chance of being subject to failure and to reduce the impact if such a failure does occur. The customer organization should therefore carefully investigate the external providers before they are selected and awarded a contract. By additionally controlling the transition, their subsequent activities and preparing a responsive plan in case of failure, the risk can be mitigated (Bragg 2016).

A likely scenario as a result of engaging in outsourcing practices is also that the provider keeps meeting most if not all of the customer's requirements, but only that, with limited to no considerations for customization and enhancement of activities. Seeking improvements in specific parts of project delivery systems may additionally not be a primary need in early customer-supplier relationships. These situations however change over time, both for the external provider and the customer organization, which needs to be renegotiated if not addressed in the original contract. Doing so will derive both implicit and explicit costs for the customer depending on the degree to which new requirements diverge from the contractual agreement, and can even reach to the point where the service needs to be transferred to a different provider or back to an in-house operation (Axelrod 2004).

Last but not least is the issue of knowledge maintenance. The more functions and roles that the customer organization chooses to contract out to external providers, the more difficult it is going to be for internal staff to support these if they ever are to be moved back in-house. In order to maintain a solid bargaining position and retain critical staff, Axelrod (2004) suggests that the latter must be kept up-to-date by means of internal education and training programs or through knowledge transfer from an external partner. While the costs of maintaining knowledgeable employees can be considerable long-term, the consequences of not doing so include loss of negotiating power, difficulty in moving to alternative providers or back in-house, and being totally dependent on a third party. Likewise, if internal staff and management retain limited knowledge and competence within the activities undertaken by their external providers, the ability to remain in control and tightly govern the work as a customer organization may be partly hampered (Axelrod 2004).

2.3 Loosely and tightly coupled systems

The notion of loosely and tightly coupled systems was originally suggested by Weick (1976) and further developed by Orton and Weick (1990), with a foundation in systems theory and the idea that organizations consist of multiple interdependent elements that in one way or another, are coupled together. According to Orton and Weick (1990), these couplings describe various ways in which people and work are linked together, and can occur in a number of different dimensions. These can include connections among ideas, individuals, subunits and organizations, as well as between hierarchical levels, organizations and environments, activities, intentions and actions (Dubois and Gadde 2002).

The corresponding degree to which couplings like these are linked together is described by Glassman (1973) on the basis of variables which two units such as events, elements and systems share. If two units have few variables in common, or if the variables they share are weak in relation to other variables influencing the two, they are relatively independent of each other and subsequently loosely coupled. In Weick (1976), couplings are treated in terms of 'tightness' and 'looseness' and similarly determined by their interdependence and interrelationship. Consequently, both tightly and loosely coupled systems can be described by the degree to which changes in one part of the system, can affect and lead to changes in another. The stronger such interdependence is within a system, the tighter the couplings are

going to be bound together as mutually reliant parts. This creates a greater need for coordination in tightly coupled systems since the impacts of disturbance within one part will have greater, often characterized as immediate, constant or significant effects, on the others and is thus less resistant to unexpected problems originating from each individual part of the system (Weick 1976).

Loose couplings are characterized by Weick (1976) as events that are responsive, but that they also preserve their own identity and some evidence of their physical or logical separateness. In contrast to tight couplings, these connections are typically circumscribed, infrequent and weak in mutual affects, unimportant or slow to respond. To some extent loose couplings are thus also tied together, but are far less interdependent, and the effects on other parts due to disturbances within one either tend to be negligible, occasional, indirect or eventual. However, loose couplings also carry connotations of impermanence, dissolvability and tacitness, all of which are potentially crucial properties to the 'glue' that holds organizations together (Weick 1976).

It is further argued that loosely coupled systems possess several advantages over tightly coupled systems. First, they allow for proportions of an organization to persist by lowering the probability of having to respond to each unfavorable change in the environment that occurs. Second, they may be better systems for localized adaptations due to the ability of each individual element to adjust and modify a local unique contingency without affecting the whole system. Third, they provide a sensitive sensing mechanism by preserving many independent elements and consequently 'know' their environments better in comparison to tightly coupled systems with fewer externally constrained, independent elements. Fourth, they can retain a greater number of mutations and novel solutions that would be the case with a tightly coupled system by preserving the identity, uniqueness and separateness of each element. Fifth, if there is a breakdown in one portion of the system, this breakdown is sealed off and does not affect other portions of the organization. Sixth, they leave more room available for self-determination by the actors compared to tightly coupled systems where discretion is limited. Last, loosely coupled systems are relatively inexpensive to run because it requires less effort to coordinate people and work. The main difference is, however, that the work flow in a loosely coupled system is designed to be flexible so that the

different parts of the system can keep functioning in the absence of others should they encounter disturbances from unexpected problems (Weick 1976).

2.4 The production environment as a tightly coupled system

Cox and Goodman (1956) describe the execution of construction projects as a complex undertaking which requires the services from a multitude of people that are organized into many different sorts of business entities. These, in turn, are increasingly focusing their efforts and specializing into more specific segments of the construction process as means of obtaining comparative advantage over their competitors. Depending on a number of factors, including resource availability and market supply, the main contractor will subsequently decide upon what activities to perform with eventual in-house labor and what segments should be contracted to external subcontractors. Thus, the composition of participant firms constitutes a temporary division of labor that is tailored to fit the unique circumstances under which projects operate (Bankvall 2011).

Furthermore, the sequential organization of construction activities gives rise to a rigid sequence of work which has to be executed in accordance to time while ensuring that agreed upon quality is maintained. Since the initiation of multiple activities is dependent on the completion of others, disruption or change in one specialist's work flow may subsequently affect the duration of others and harm the entire production plan, thus requiring the joint effort of all the firms involved (Dubois and Gadde 2012). Owing to these above mentioned characteristics of activity linking in construction, there are apparent interdependencies between the activities that are carried out on site and the people that they concern, which calls for extensive coordination among participant firms. From this point of view, there is a clear correlation between the production environment, particularly the way construction work is organized, and Weick's definition of a tightly coupled system.

2.5 Transaction cost economics

Transaction Cost Economics (TCE) is a theoretical field used to rationalize the make-or-buy decision among organizations as means of obtaining competitive advantage over their competitors. The theory sets its foundation in the assumption that transferring activities externally through market exchange brings about multiple transaction costs that would not be the case with vertical integration and continued in-house performance (Williamson

2008). It is therefore argued that if the internalization costs exceed the prevailing market price together with the transaction costs induced by the external provider, then rational firms will choose to outsource these activities (Miller et al., 2000). Main contractors are thus not only subject to production costs, but also substantial transaction costs which arise when large proportions of construction work is contracted to external subcontractor firms.

The typical association of transaction costs in construction is tied to the management of purchasing subcontractor services and materials. Subsequently most researchers confine themselves to the procurement-phase costs of preparing specifications, evaluating tendering documents and engaging in negotiations, while few choose to focus on the post-contract transaction costs that occur during the actual construction phase (Hughes et al. 2006). According to Guo, Li et al. (2016) these transaction costs emerge from administering the execution of contractual agreements and include costs for monitoring and controlling subcontractors and their activities, engaging in conflict resolutions and renegotiating contractual changes. Rahman and Kumaraswamy (2002) further add costs for acquiring and processing information, organizational costs and costs associated with inefficient production behavior.

A study conducted by Whittington (2008) finds through six case studies that post-contract transaction costs at an average reached as much as 11 % of the total contract value for both design-bid-build and design-build project delivery systems, whereas pre-contract transaction costs only reached as much as 2.4 %. The subsequent conclusion was that post-contract transaction costs may be much higher than the transaction costs that occur during the procurement phase, which have been supported by several other authors (Turner 2001; Hughes et al. 2006; Lingard et al. 1998). It is however argued that transaction costs in the construction industry need further research due to a lack of standard definitions and overall consensus as to what they include (Hughes et al. 2016). Thus, the numbers provided by Whittington (2008) merely serve as an indicator for the magnitude of transaction costs in construction, which makes monitoring of price behaviors over the entire transaction process important to identify new potential sources.

Eriksson (2007) argues that increased project complexity and uncertainty has developed to be viewed as two primary reasons for high transaction costs in the construction industry.

Shifting focus from competition to more collaborative measurements is subsequently argued to hold great potential in reducing transaction costs for main contractors engaging in subcontracting practices. This process involves transforming current market transactions to be characterized by more relation-specific investments, knowledge sharing, flexibility and integration, which are facilitated by long-term cooperative relationships. Huimin et al. (2015) describe these benefits through the frequency of transactions, representing the number of times a transaction is repeated over time with the same partner. TCE ultimately suggests that a higher frequency of transactions will generate lower transaction costs if managed to be sustained over a longer period of time. By subsequently working repeatedly with the same subcontractors that have functioned well in the past, the quality and strength of relationships can be increased over time and successively diminish the transaction costs tied to the inherent uncertainties of new customer-supplier relations.

Kadefors (2004) claims that the frequent use of traditional design-bid-build contracts over the years has spawned a general lack of trust between main contractors and subcontractors which is partly to blame for projects experiencing higher transaction costs than others. In turn, negative attitudes and opportunistic behaviors are told to be more common among today's subcontractor firms, thus hampering relational efficiency and giving rise to unnecessary transaction costs for the main contractor. Kadefors (2004) subsequently argues that the construction industry is in need of a cultural change, since TCE is largely a behavioral theory where economic self-interest is viewed as one of the main drivers of transaction costs. Similar to that of Eriksson (2007), Kadefors concludes that collaboration is the key to accelerating the process of reducing transaction costs in the construction industry.

In relation to this, there are several features of partnering contracts that seem to possess potential in reducing the time frame, mainly through directly experiencing the mutual benefits of collaboration. Among those features are increased incentives to cooperate, tentatively through lengthening relationships or increasing the importance of reputation and co-operative skills in relation to price in subcontractor procurements. Furthermore, the use of collaborative workshops and meetings with focus on team building, joint goal and obstacle formulations and collective planning is perceived to generate more trust and collaborative behaviors among participant subcontractors. In turn, opportunistic behavior is decreased, meaning that strategies become more focused on cooperation rather than

defection. It also reduces the need for strict inspection routines and other monitoring and controlling procedures, which in turn decreases transaction costs (Eriksson 2007).

Given the importance of collaboration and relationship management, the efficiency of project management practiced by the main contractor plays an additional important role in the extent to which transaction costs will occur. Humin, et al. (2005) suggests that this efficiency can be measured based on five different qualities. First, by the extent to which leadership tunes team performance and inspires co-operative action and achievement of project objectives. Second, by the extent to which decision-making reduces the amount of time spent on unexpected problems, minimizes disagreements and assists keeping a project on schedule and within budget. Third, by the extent to which communication creates awareness of decisions and minimizes room for uncertainty in terms of individual responsibilities and goals. Fourth, by the extent to which conflict management resolves disputes and claims without wasting extensive valuable resources. Finally, the last quality concerns itself with the extent to which technical competency possessed by the project manager promotes quick decisions, fluent operations, few reworks and smooth communication among participant subcontractor firms. Humin, et al. (2015) subsequently concludes that if the role as project manager can be undertaken proficiently enough with regards to these qualities through stages of planning, coordination and monitoring and controlling, the transaction costs can be reduced.

2.6 Analytic model of the project based environment

These previous stated theories, concepts and terms coexist in an interrelated relationship in the project based environment of the industry. A typical project can be illustrated as in figure 4, where: (1) the blue dotted line is the confinement of the project while the squares outside the project limit represent the companies involved in the project i.e. the contractor (2) and subcontractors (3). While the roles may differ in purpose and name depending on what standard contractual agreement is being utilized the project illustration remains in the same custom. The project site is the focal point of the production, where companies collaborate and organize in order accomplish the activities ultimately resulting in the finished product.

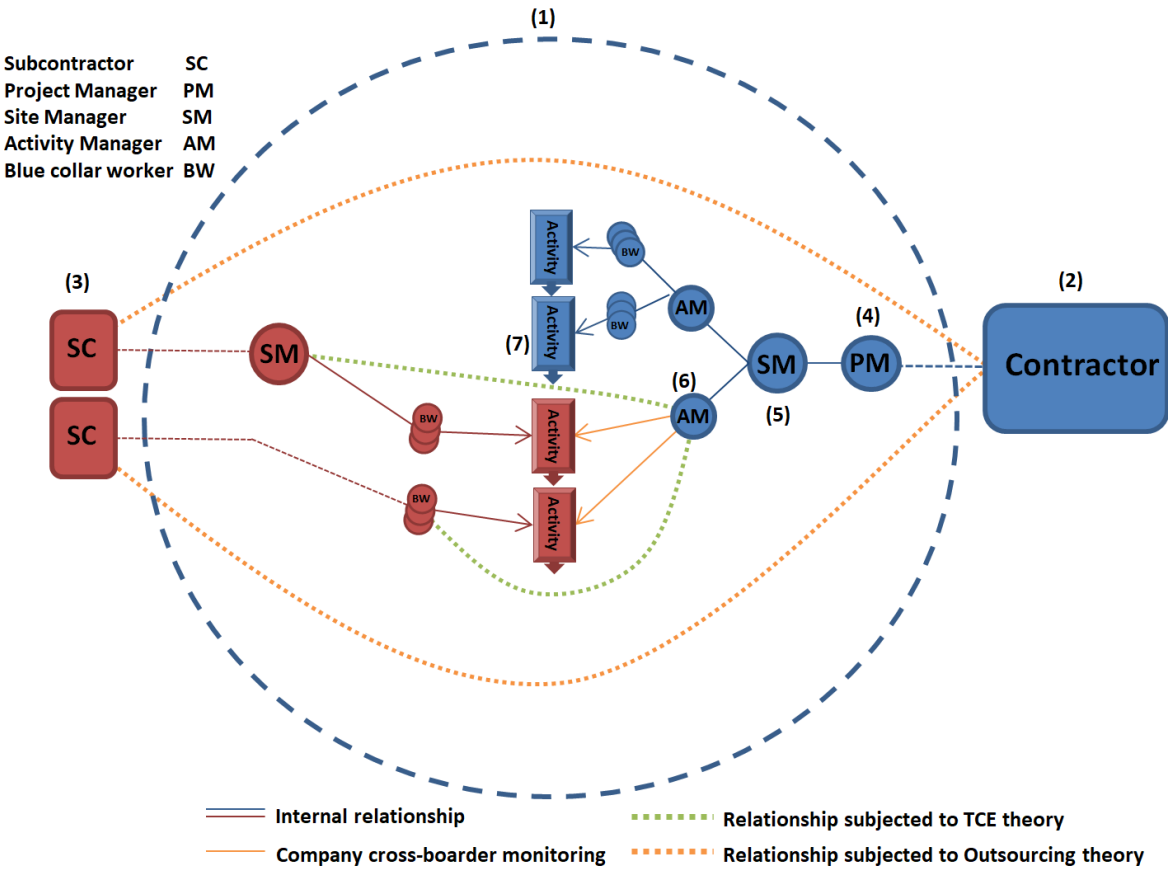


Figure 4, An illustration of a typical construction project in the scale of above 400 million SEK over 2-5 years. The different link type showcasing what concept or theory the relationship is subjected to.

The project manager (4) serves as an extension of the contractor company; reporting and organizing resources, as the site managers of the subcontractors (5) serve as the link between the project and their respective company as well as leading activities on site. The

site managers of the contractor meanwhile concentrate on planning and organizing activities whereas the activity managers (6) either lead the separate activities through the contractor's blue collar worker or monitor and control the subcontractor's blue collar workers.

The activities (7) in different colors indicate ownership, red signifying that the activity has been procured by a subcontractor while blue signifies that the activity is carried out by the contractor itself. The activities are connected and confounded in a network, spanning all the activities that make up the project. The order of which the activities are completed is predetermined as the start of one activity is dependent on the completion of another, thus the network can be divided into chains containing a specific order of activities. The connection between activities in the chains, as described by the coupling system concept, can either be characterized as tight or loose couplings. Whether the couplings are tight or loose affect the sensitivity of the chain for disruption which is further propagated by the activities not being completely internal processes for a company but a collaboration of multiple business entities with separate abilities to handle change.

The cost of transactions, i.e. TCE do not only occur externally to the project bubble (1) between the business entities directly as part of the procurement phase, but also within the project as a result of the problem resolutions, monitoring and controlling by the contractor's site management; the latter part being greater in magnitude according to Whittington (2008). As indicated by the green dotted lines there is multiple relationships within the project subjected to costs that can be attributed to the transaction between two business entities, often in tandem with outsourcing as the concepts are closely related. Such transaction costs are thus not only limited to the contractor-subcontractor relationship but also present in the subcontractor-subcontractor relationship as coordinating in means of time, space and availability is required on the confined project site.

Outsourcing in this illustration refers to an activity that previously, traditionally over other projects, has been a blue active, i.e. an activity that the contractor performs by itself, but now is red i.e. procured by a subcontractor. A substantial amount of recurring activities have never been conducted internally by the major Swedish contractors, activities as e.g. electrical and system work whereas the outsourcing theory do not fully apply as it is not outsourcing by definition. However, recurring activities the contractors continuously sell to

subcontractors even though they possess the knowledge to perform them adhere to outsourcing theory e.g. demolition, assembly and safety installation work. By outsourcing (8) the previous internal relationship between manager and blue collar worker has been replaced by a cross-business entity relationship (9) subjected to transaction costs, changed communication and responsiveness. While the contractor, by outsourcing, transfers the risk of the activity to the subcontractor, the contractor consequently also sells the opportunity of improvement i.e. the possibility of substantially reducing cost of the process through innovation or different resources utilization.

2.6.1 Roles of the production

The role of an activity manager in the production stage is to manage the resources and administrative duties of the appointed activities, subsequently leading, facilitating and instructing either blue collar workers or subcontractors in their daily activities. The manager often holds responsibility over different physical areas of the construction site or particular network of activities ordering material and accruing resources in advance of the construction.

The team or discipline manager acts as a spokesperson or representative of the discipline or subset of the discipline propagating progress, obstacles, working environment and safety concerns to the site management, partaking in site management meetings. The role is often combined with other roles as working environment manager, or for the subcontractors, site manager.

The project manager role on the other hand is not only adherent to the production but extends to prior and following stages, participating in planning, developing and executing the project. During the production stage the project manager is heavily orientated towards financial steering, customer relation, project planning and reporting; but the role also entails managing staff, distributing resources and creating benchmarks. However, the project manager title is not always present in every project as on minor projects the responsibilities are absorbed by the site manager.

Lastly, the site manager oversees the production, coordinating and supervising similar to the activity manager; however inspecting, monitoring and enforcing procedures to a greater

extent. The site manager is often active in the major operations on site assessing and minimizing risk while handling administrative duties e.g. preparing site reports, procedures and contractual disputes. Besides the activity managers, the site manager serves as a contact person for the subcontractors on site and to a certain degree participates in the procurement of subcontractors.

3. Method

This chapter introduces the research methodology applied to conduct the thesis and fulfill its aim. Included as part of the chapter, is also the approach used towards collection of data and the selection of participatory roles and business entities.

3.1 Research methodology

The thesis concerns itself with the multiple and different actors involved in the production environment throughout the construction stage, their perspectives, industry knowledge and experiences. Moreover, the data were collected at an aggregated level in order to depict the current state of the production site environment through a grander holistic perspective. Consequently, the thesis combines a qualitative study approach through a literature study and first hand data from interviews with a quantitative approach by gathering raw data from multiple industry actors. Thereto, a rigid theoretical basis is utilized to support the first-hand knowledge and statistics collected as primary data from the interviews to depict the circumstances brought on by the change in division of labour within the production.

While there exist broader understanding for the consequences of the change within the production stage, both for the authors and within the industry, there is a lack of a complete image. Inherently, there remains a need to explore the current state to further the understanding of opportunities, as well as, obstacles. Through an exploratory research approach, the thesis therefore aims to generate a better understanding for the effects and consequences, and not to offer any final solutions to existing problems. The focus is rather concerned with providing a possible direction for adaptation and development regarding the difficulties surrounding the change and its consequences for the production environment.

3.2 Collection of data

While this thesis is associated with Skanska the focal point is the production environment i.e. the holistic and aggregated perspective with all the present actors. Skanska's production merely serves as the point of departure, subsequently, the interviewees and data stem from a wide range of actors and business entities, all linked to the production.

3.2.1 Interviewees

The interviewees were selected based on participatory interest and resource availability with primary scope in the western region of Sweden. Managerial positions were sought after such as supervisors, site managers and project leaders. In addition, multiple blue collar workers were interviewed to capture the eternity of the production and subsequently not to acquire a skewed perspective. Finally, several positions outside the construction site context but still with connection to the production were aimed at in order to identify possible relationships and relevant developments from alternative standpoints. All participatory interviewees by position and business entity can be found in table 1.

The interviews were conducted face-to-face at the project site or the companies home office, however, a small sample size of the interviews were conducted through conference calls due to availability problems, nonetheless, face-to-face interview were sought after. Furthermore, the interviews were semi-structured by premade questionnaires, all available in appendix. These were however continuously developed during the study and adapted to the interviewees as well as the direction of the thesis. While they were semi-structured the interviewees were allowed to elaborate and advance the dialogue in means of time and relevance during the 50-70 minutes interview sessions.

The interviewees answered questions in terms of experience, position and time. They do not necessarily support the conclusions of the study or that what has been stated during the interview depict the organization's public standing or intention.

Name	Position	Business entity
A	Project manager	Skanska
B	Project manager	Skanska
C	Site manager	Skanska
D	Site manager	Skanska
E	Site manager	Skanska
F	Site manager	Skanska
G	Site manager	Skanska

H	Activity manager	Skanska
I	Activity manager	Skanska
J	Activity manager	Skanska
K	Activity manager	Skanska
L	Construction worker	Skanska
M	Construction worker	Skanska
N	Purchaser	Skanska
O	Purchaser	Skanska
P	Purchaser	Skanska
Q	Project manager	NCC
R	Site manager	Assemblin
S	Site manager	Assemblin
T	Site manager	BS Construction
U	Site manager	Wästbygg
V	Construction worker	Wästbygg
W	Purchaser - Client	Gothenburg Municipality
X	Purchaser - Client	Gothenburg Municipality
Y	Sales Manager - Client	Real estate developer

Table 1, List of participatory interviewees by position and business entity.

3.2.2 Statistics

The quantitative data were collected at both industry and company level for the four major construction companies in Sweden; PEAB, Skanska, NCC and JM. All presented statistics at industry level were gathered from Statistics Sweden (SBC) and the Swedish Agency for Growth Policy Analysis (Tillväxtanalys) which are two government agencies with the aim to produce, analyze and evaluate official statistics regarding Sweden. For these sources a number of selections had to be made in order to identify the targeted industrial activities.

In 2007, the standard of industrial classification, SNI, used to define the activities was altered resulting in different outcomes for the corresponding inputs made post and prior to the change. The currently applied SNI for the construction industry is divided into construction,

specialized construction and infrastructure construction, see figure 2, all of which were classified under the same industrial activity prior to 2007. Subsequently, years after the change depicts the present SNI composing of the three industrial activities, whereas years prior were made available by summarizing subcategories and thereafter distributing them in accordance to the new classifications. Although the approach resulted in slight differences for the years prior to the change in relation to the existing SNI, they were considered limited as the aim is to illustrate trends for the industry as a whole rather than yearly variations.

The statistics at company level were collected by combining publicly available information from the major construction companies including yearly financial reports as well as interim reports and by contacting associated positions within the organizations due to absence or inconsistency of information during the sought after time period. Similarly, all the statistics concerning the division of labour in construction projects for Skanska were received by internal positions due to the inherent shortage of public information at production level.

4. Empirical inquiry

This chapter presents the data collected from interviews and inquired quantitative data. The first subchapter the examined company is introduced with the aim to provide a deeper understanding and insight to the content presented in succeeding chapters. Topics included are business strategy and development, on-site coordination, development of subcontractors, changed roles and international activity on-site. The applied statistics of this thesis can be located in subchapter 4.2 and aims to support previous qualitative data or to establish additional information.

4.1 Skanska Sverige AB

Skanska Sweden AB is one of the leading construction and project development companies nationally with headquarter situated in Stockholm. Today, Skanska has approximately 9100 employees and operations in three major business streams, i.e. construction, residential development and commercial property development. In 2017, Skanska was ranked the second largest construction company by revenue in Sweden with net sales of SEK 23 billion while having the most international activity amongst the major Swedish construction companies. Through the business strategy “*profit with purpose*”, lasting until 2020, the company intends to establish itself by retaining the largest profit margin within the construction industry and simultaneously leading the national market in size. This is to be achieved by combining continuous efforts toward increased profitability and extended value creation for the society; viewed as two interlinked elements with mutually strengthening benefits (Skanska 2017).

The business structure is divided into multiple departments that are spread across the different business streams and linked to the company-wide support functions. All of the business departments, including housing, infrastructure, industrial solutions amongst others contribute with unique efforts that in different ways are linked to the construction, i.e. the physical production where the focus of the thesis is concentrated. The departments are in turn further divided into numerous regions reflecting the geographical markets of the country. Each region comprises of districts characterized largely by autonomy, operating by company interest, goals and requirements. Thus, while Skanska as a whole can be interpreted as one complete unit, the company can also be recognized locally within the

districts as separate and independent companies. With access to various support functions made available by the organization, these district units are provided with the resources necessary to conduct their operations. In the construction business stream, the assignments undertaken by these units range from some of the largest projects on the Swedish market to a great number of minor local projects (Skanska 2018).

Fundamental to Skanska's operations are four core values, acting as guidelines for the company direction. These include care for life, concerning the health and well-being of coworkers with focus on improving both the physical and psychological environment. Secondly, to act ethically and transparently regarding to the actions of coworkers, and to never accept any deviations from the established code of conduct. Thirdly, being better together, refers to the way of practicing while moving forward, collaborating between coworkers, partners and customers. Lastly, commitment to customers is the drive towards more enduring and sustainable partnerships with present and future customer relations. These values are together considered key to the company success and constitute the core upon which ongoing efforts and strategies such as the business plan are built (Skanska 2018).

4.2 Business strategy and development

The project based environment of the industry present subsequent difficulties in measuring the division of labour within the production, every project is unique and require therefore a unique division of labour. Likewise the shift of the major companies, Skanska included, to focus their resources on the medium and large projects, disregarding the smaller projects have profound effect on the division of labour as the smaller project utilizes a large share of own construction workers. Consequently, due to the shift in focus it is difficult to separate the change in division of labour adherent to the larger development and proclaim an indicator of the move towards the business strategy of construction management.

Furthermore, the numbers of subcontractors in relation to the numbers of own construction workers in the project on an aggregated level, while a viable indicator, isn't definitive as subcontractors inherent short based presence on site obscure the accurate division of labour change. According company collected data the share in the numbers of subcontractors workers have increased from 55% to 70% during the period 2010-2018, see table 2.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Subcontractors workers	6511	7292	9000	9566	9711	9843	9643	8717	8717
Construction workers	11 764	12 912	14 719	15 056	14 258	14 268	13 755	12 617	12 482

Table 2, The number of subcontractors' workers in comparison to the number of own blue collar workers on site.

However, during the period 2007-2009 Skanska's own construction workers were 33% of the people registered on site while they performed 77% of the hours registered. An absolute majority of subcontractors are not procured to be present on site during the whole project; their presence can vary from weeks, days, hours or be reoccurring short periods of time during the project's life time.

While an increased share of subcontractors and number of white collar workers is indicated, the share of own blue collar workers subsequently must have decreased as indicated by table 3. The construction stream revenue have increased from SEK 22 billion to SEK 35 billion while the number of construction workers decreased from 5938 to 3765 during the same period of 2005-2018 with a peak of construction workers of 7002 in 2008. Thus, during 2005 each construction worker was equivalent to SEK 3.7 million revenue while during 2018 SEK 9.3 million, a substantial increase.

Year	2005	2007	2009	2011	2013	2014	2016	2018
Revenue MSEK	22141	27389	25004	27014	29637	29565	31736	35490
Construction workers	5938	6609	5520	5620	5490	4547	4112	3765

Table 3, Revenue of the Swedish construction stream in comparison to the number of construction workers.

However, the significant decline of own blue collar workers cannot be fully contributed to the development as Skanska gone through a period of reorganization following the financial downturn of 2008 by terminating presence in location's where profitability was lacking. These outposts, or local offices e.g. Sundsvall are typically contacting most employees categorized

as blue collar workers. Subsequently, by terminating several offices the number and share of blue collar are affected the most.

4.2.1 Construction workers

The internal baseline refers to the presumed number of construction works that can be continuously employed over a long period of time regardless of the economy. Naturally, in tandem with the state of the economy the number of construction workers fluctuates in the projects. During periods with high projects intensity own construction workers are not in sufficient numbers and therefore subcontractors are procured, while during down turns with lesser projects intensity the own construction workers are able to be responsible for a larger portion of the construction. The practice of a baseline is widely utilized in the industry due to numerous reasons as it is a marketable strategy, construction with own construction workers, and it stabilizes the companies over long periods of time. By continuously hiring and terminating construction workers in tandem with the projects intensity the advantages of retaining own construction workers are mitigated and made obsolete.

An absolute majority of project and site managers identify own construction workers as quintessential resources in order to monitor, control and otherwise manage the production site. As a group they not only facilitate site management with information regarding safety, logistics and procedure failures but are a vital extension of the site management, incorporating and pushing company practices and values as to create appropriate working environment. Furthermore, while subcontractors can, depending on the nature of contract, to limited extent be micro managed own construction workers are considerably more flexible and can be instantaneously allocated to different activities in order to serve the schedule or events on site. However, construction workers experiences that due to an increase of subcontractors which widely varies in quality output many of the activities become redoing of faulty or quality lacking subcontractor activities even though it is in their contractual obligation to complete them with sufficient quality. While managers acknowledges these circumstances efforts are typically directed so not to make the own construction workers some complementary team tasked with what are not covered by the subcontractor contacts.

Since the project intensity is geographically heterogeneous the baseline varies nationally and is independently set by each district who also determines the hiring need. The construction workers are largely an immobile group, employed at projects within the district. While allocation of construction workers to surrounding districts is possible during low project intensity to secure full utilization of the resources it is not preferred as it is the function of the baseline to avoid such circumstances. The baseline is thus determined and changed regularly depending on the project intensity within the district, both historically and within the foreseeable future.

Historically subcontractors have always been procured to perform the specialized activities such as electrical, ventilation and control engineering work while the baseline is concerned with activities that require less specialized input such as structural, concrete and interior work. However, with diminishing baseline compared to the project intensity a majority of the participating site manager experience that the own construction workers are too few in numbers to perform all of these subset of activities, especially the larger within the desired time frame. Subsequently subcontractors are procured i.e. the activity is outsourced due to insufficient internal resources. Seldom are activities outsourced on the bases of lower cost subcontractors, more commonly is the availability of resources i.e. own construction workers, as the deciding factor but also the prevalence of the relationship and earlier experience with the subcontractor.

4.2.2 Core business

Skanska Sweden AB defines their core business as developing, constructing and maintaining the societal physical environment i.e. a holistic commitment, partaking in the construction process, pre- and postproduction. It's further specified as constructing and renovating housing, commercial houses and infrastructure. Half of the management subjects interviewed offered a description in agreement with the official proclamation of the company core business, mostly justified through an historical context as pronounced by site manger X:

"[The core business] has always been the [production, to construct with own people, and it still is]"

Veteran site and activity managers depict a production environment where own construction workers are managed as always although in fewer numbers and in greater

presence of subcontractors. The two groups not necessarily or always encroaching on each other's core activities but coexist parallel to each other in the production site. The same manager subjects proclaim a desire to retain or develop the base line, as a diminishing baseline is experienced or recognized, in order to uphold core business i.e. physical construction. In some cases, the experience or opinion of physical construction as the core business remain even though the subjects represented current projects completely absents of own construction worker, relaying fully on subcontractor with the purpose of carrying out the physical construction. Subsequently, some projects outsource the core business; however, this is contributed by the managers to unfrequently high project intensity and suboptimal circumstances with difficulties in accruing a sufficient base line.

Another established perception of the core business in production is the construction management perspective i.e. the core business in not the physical construction but the management of the production, subsequently to coordinate the different entities in order to complete the product. A minority of the remaining half of the interviewed subjects holds this perception and consequently finds that own construction workers are not anymore, as of the current development of the market, quintessential to the core business of the contractor company. Commonly it is asserted that there is no major difference in quality output between own construction workers and subcontractors while company policies are enforced without obstacles regardless. The view entails that subcontractors has subsequently evolved to a current state in which there is little to none operational disadvantages of contracting rather than hiring. Furthermore, without own construction workers from the managerial perspective there is no subsequent need to invest efforts in to continuously employing them, which is taught of as being a considerable factor in what projects to tender. Not unanimously, although frequently express by managers adhering to this perspective taught of own construction workers as demanding and requiring more managerial efforts than subcontractors presiding and post activities. There is an inherent simplicity to procuring subcontractors as the main activity and subsequent surrounding actives are levitated of contractor to a certain extent.

Observationally, the perspective of physical construction as the core business of the contractor company is substantially more frequent in geographical areas outside the urban markets while the construction management perspective is more pronounced in the urban

areas. Concurrently, manager outside the urban areas express advantages in homogeneous sized small project whereby a small number of construction workers are able to be responsible for large portion of the production without subcontractors; while manager in the city markets are adherent to another set of time scales and project size fluctuations. Managers outside the urban areas furthermore do not express the same difficulties in hiring new construction workers.

Lastly, there is additional existing perception of core business although not centralized around construction workers or subcontractors and expressed by a minority of managers is the soft value perspective. The defined focal point is the soft value created in the production i.e. not strictly the economical or quality value but the value of e.g. safety, working environment, social sustainability and wellbeing of the entities involved.

“[The core business] has during recent years developed towards added value creation in the production, destined for internal as well as external coworkers, rather than merely viewing it as a means of delivering a finished product in accordance to time, budget and quality”

Subsequently, Skanska as a contractor is neither specialized in the physical construction nor the management of the production but their core business is the added soft value from a holistic commitment to the production, incorporating both elements. Own construction workers and managers are thus vital in the value creation process serving as an extension and supplier of the company policies and procedures that constitute the frame work of the production. Consequently, the end value of the production is greater than the finished product and satisfied client. The attributes of the soft value as the core business is further claimed by manger adhering to the perspective as particular attractive to public clients as their value system is perceived different from the private clients. However, it is claimed that also private client are increasingly valuing these aspect and that it is a valid marketable strategy with the current state of the market and in the future.

4.3 On-site coordination

The increased procurement of subcontractor firms has successively increased the need for some form of coordination meeting where participant firms can gather and discuss the challenges of day-to-day operations at the construction site. This, in turn, have partly resulted in the introduction of morning meetings, which are typically held by a site or activity

manager at the site office every day before each participant firm initiate their work on site. The concept itself is relatively new, and began to be implemented during 2012 and 2013 as part of the strategic safety and collaboration efforts. Over the last couple of years, the success of the morning meetings has spread and contributed to a standardized practice across the industry as a whole.

The morning sessions can be organized in different ways with regards to content and structure depending on the person in charge and current stage of the project. Normally there is a primary focus on the safety of the construction site, where general instructions and eventual activities that will be carried out during the day is announced in order to create awareness of possible risks among the participant construction workers. Over time, the content may subsequently shift as the project enters stages of less critical operations. Furthermore, each participatory discipline is usually processed through a questionnaire template which systematically aims to answer a set of questions with regard to their schedules and activities on site. These typically include: (1) what the team did the day before; (2) how the schedule for the day is organized; and (3) if there are any obstacles between the different firms or in the tasks that will be carried out during the day. The content and adherence to prepared templates however differ between projects and over the district borders, and is partly governed by the individual preference depending on the person managing the sessions. In case there are problems that need to be solved, a follow-up meeting is held together with the concerned construction firms and their corresponding personnel after the morning session is completed.

These types of coordination meetings can additionally differ in size and structure depending on the project scope and space available. There is a general interest to involve as many people as possible during the sessions, including own and subcontractor personnel, since the distributed information is regarded advantageous for all parties sharing the construction site. With such an approach, the company can ensure that the announcement of critical operations is received by all the employees of each business entity. However, in correlation with increased project size, there are difficulties in terms of time and space required for these kinds of daily sessions. Therefore, multiple meetings in parallel sequences may be necessary at different locations in order to cover all the segments in the current work-flow of the project. If the meetings are divided accordingly, a greater need for coordination

between the different disciplines is thus created and requires the accountable persons to conduct further dialogues on behalf of their corresponding groups to capture eventual obstacles among the activities that are carried out on site.

An existing solution is therefore to manage the meetings based on a partial or full attendance of team managers only, who thereafter passes on the information to the parties they represent on the construction site. This line of communication however functions with variable satisfaction. The distribution of information thus tends to be unreliable and the control over what information that is received by the subcontractor personnel and what is lost throughout the chain is removed. Subsequently, there is a risk that inaccurate or limited information regarding the announcement of safety procedures and critical operations is distributed to the construction site, which leads to additional time that is consumed on repeating instructions. All respondents employed by Skanska therefore prefer to involve as many as possible simultaneously, but can at the same time easily become too extensive if the whole construction site is to be included. For projects of larger scope there is thus a greater need for controlling the time frame and efficiency of the morning sessions.

4.3.1 Efficiency and value of the morning sessions

The content and structure of the morning meetings have over time been improved and more standardized which in turn has contributed to sessions of higher efficiency. However, while the meetings have internally been considered a success, disadvantages arise when there is a lack of attendance and limited adherence to questionnaire templates and preparation among participant firms. The time required to process each discipline can thus easily exceed the desirable time frame if there is limited control with regards to content and time. Subsequently, there are also divided opinions about the importance of the morning sessions.

Despite the occasional lack of efficiency, the morning meetings are internally considered to play an important role for the coordination, collaboration and foremost the safety on the construction site. The consequences of insufficient attending are apparent and can result in time consuming conflicts and dangerous risk exposures at the construction site. Subcontractors arriving at scattered occasions do not possess the same awareness of what is happening on site with regard to safety and ongoing activities. The morning sessions thus remove substantial and additional work that is introduced by having to process each

subcontractor firm at a time as they arrive at the construction site. While subcontractors are contractually obligated to attend the morning meeting sessions, there is no direct consequence of not attending. Simultaneously, there is no interest in turning the contractual breach into a conflict before the concerned personnel. Limited attendance is thus rather solved momentarily by project for each subcontractor firm by contacting the employees on site or through their corresponding management depending on the importance of the matter.

4.3.2 Engaging subcontractors

In line with the development of morning meetings the interest to attend among subcontractor firms has successively increased since its introduction. Six out of eleven respondents find the attendance on the morning sessions to be satisfying, whereas five out of eleven find it sufficient but with room for improvements. There are still difficulties to create ideal morning sessions, partly since the attendance is largely governed by the individual preference and vary between firms, but also because subcontractor personnel often categorize under different agreements in regards to work hours. The gathering of participatory firms to a common time and place is thus hampered and result in scattered arrivals throughout the day.

Larger subcontractor firms that work jointly with the contractors have increased their attendance the most since the introduction of the morning sessions. There is a continuous difficulty to engage the smaller subcontractors who are only scheduled for a shorter period of time as well as inexperienced subcontractors in regards to company practices. Firms that execute significantly smaller activities on the construction site are consequently considered to disregard the morning meetings to greater extent. However, even the minor subcontractors have successively increased their interest in the morning sessions as their inherent value is realized.

4.3.3 Short term activities and momentary visits

During economic advantageous times the occurrence of longer subcontractor chains becomes more frequent as there is an increased shortage of resources among subcontractors. The resources are subsequently split between projects to a greater extent as the project intensity increases. Due to unforeseen events, resources are aggressively

allocated to the given projects in order to fulfill the different contractual agreements. While the allocation of activities to other construction firms should be reported to the site management, the line of communication can be lacking during time periods of high employment. As a result there is limited awareness of what subcontractor firms the on-site employees are adherent to when they arrive, likewise what activities they are scheduled to perform. A substantial risk can be derived from firms that are only scheduled for a short period of time or momentary minor activity at the construction site. There is thus limited time to identify the arrivals of new firms and subsequently process them in the introduction and safety instructions before they complete their activities on site. As with subcontractors further down the chain there is a significant difficulty of controlling the safety and quality as they can largely be unknown. The quality of performed activities thus tend to decrease in correlation with the length of the subcontractor chain, which can turn into special significance if the firm is part of a rigid sequence of construction activities that is more sensitive to quality fluctuations and adherence to time schedules.

Subcontractors that are several steps away from the original contract are additionally found to place less interest in collaboration and attendance during the morning sessions. The information that is processed with the initial subcontractor firm at the start-up meeting regarding these aspects is subsequently lost in correlation with the number of steps in the subcontractor chain. When longer chains occur, the subcontractor firms are considered to be less aware about the requirements that are demanded in relation to the applied practices and safety procedures stipulated in the original contract. Consequently the site management, to fulfill their responsibility, spends resources in order to extend the information of the morning session as well as safety practices to the absent subcontractors which often are a time consuming endeavor.

4.4 Development of subcontractors

The subcontractors have over the years developed greater interest in collaboration and organizational capability which can be derived from several ongoing changes at industry level. Partly, an increased use of partnering contracts has spawned a new set of attitudes and behaviors where project completion is achieved through efforts strengthened by the mutual benefits of cooperation. Recurrent business entities with previous experience of the

partnering setting are thus found to place a greater interest in the collaboration on site and involvement throughout production stages of coordination, time scheduling and economic planning. The collaborative capability has in turn been gaining importance for the selection of subcontractors, which have called for adaptation within the industry. Thus, while there is contractually a larger emphasis on collaboration, the value of team based efforts is additionally gaining realization to an increasing extent as it is heading towards a more standardized company practice. The common interest to cooperate between the different parties involved have subsequently increased, where focus centers around co-existing efforts towards a mutual goal rather than proceeding as an individual entity.

The fulfilment of contractual requirements with regards to quality and safety has successively improved, but can still vary depending on the subcontractor firm and participatory employees on the project. Recurring business entities are increasingly considered aware of the requirements that are demanded in the contracts, likewise the different practices that are applied. The ongoing safety efforts that initially received a lot of resistance among subcontractor firms as basic safety equipment have over time settled and gained acceptance across the industry. While common safety practices additionally are gaining traction among subcontractors the interest to support established procedures is becoming more apparent. Subsequently the establishment of requirements is not only tied to the main contractor, as several subcontractors often set their own demands and even develop different safety precautions with regards to their operations. This behavior however varies wildly and is often only displayed by larger established subcontractors, although immensely valued towards future relationship and projects. There are still difficulties getting new and usually smaller construction firms to follow applied procedures and full utilization of safety equipment which causes time consuming enforcements from the site management.

Beyond the controlling of quality and time the subcontractors are frequently provided with the freedom to independently execute their scheduled activities. During prolonged or recurring relationships, an improved communication between the main contractor and participatory subcontractors has contributed to an increased understanding and subsequently independency among subcontractors. Through increased familiarity of company practices, recurring business entities are thus in less need of the activity

management apart from potential introductory briefings and ongoing morning sessions. Furthermore, there is a tendency to procure more holistic subcontractors that are not only concerned with one single activity, but rather come as a package deal. A majority of the site managers suggest that this stems from an increased utilization of prefabrication whereby subcontractors are not only procured for the production of the prefabricated elements but also the assembly on the construction site. By additionally removing associated risk many large work packages are thus allocated to external business entities rather than internal construction workers employed by the main contractor. The extensiveness in terms of complexity and size of these activities subsequently require own coordination, which eases the activity managers' work load on site. Subcontractors are additionally realizing that there is a greater need for managing their own personnel on site in order to secure a certain level of quality. Moreover, the administrative requirements introduced by their organizations are successively increasing, which strengthens the need for support functions since the managerial roles can utilize less time towards the construction sites. Consequently, the number of external coordinators in ongoing projects has increased slightly as a whole.

4.4.1 Evaluation of subcontractors

The evaluation of subcontractors takes shape in different ways and to variable extents across the districts. There is thus not always a concrete occasion dedicated towards the gathering of information to discuss the performance of subcontractors. Instead, concerns from personnel are commonly brought up individually to the site management when the quality is perceived lacking, resulting in fragmented inputs throughout the project's lifetime. The evaluation is thereby infrequent and is not utilized further after the completion of ongoing activities. Valuable information to the subcontractor selection can subsequently be lost and contribute to repeated decision making during the procurement phase. In turn, the same subcontractors that have possessed lacking quality is unhindered in the next procurement, thus frequently returning to the production. The participatory construction workers of the examined company consequently find that their ability to affect the decisions based on previous experience of subcontractor firms is limited.

The feedback between the production environment and the purchasing department is thus occasionally lacking due to limited internal communication within and between ongoing

projects. However, while the importance of relationship based procurement is considered essential in order to avoid further costs, it can also have negative effects if restricted to a smaller number of firms. By procuring the same subcontractor extensively among the districts, the contractual obligations are met by spreading resources between a successively larger amount of projects. When reaching a point of internal resource shortage, the subcontractor obligations can instead be fulfilled by hiring or procuring another firm of which the performance is relatively unknown to the main contractor. Subsequently, turning out potentially less efficient despite the usual benefits of long-term partnerships.

4.5 Changed roles

The roles of project, site and activity managers have been characterized by an increased amount of administrative duties as a result of strengthened quality, environmental and safety requirements within the organization. The requirements imply a greater focus on documentation of ongoing efforts which have to be gradually controlled against a set of goals throughout the construction process. All participatory project and site managers employed by the examined company consequently find that their roles over time have developed to involve less of the practical aspects that are included in the day-to-day operations on the construction site. This, in turn, has increased the need for support functions in the production environment since the concerned roles, especially the site manager, can utilize less time towards the management of site related activities on a daily basis.

Similar developments have been identified in the role of activity managers, who beyond the regular assignments have to focus on documentation and adherence to various checklists to ensure that the practice and ongoing activities in the production is maintained in accordance to the requirements. The role has subsequently been expanded to a point where both practical and administrative assignments are part of the daily workload to an increasing extent. Furthermore, an increased procurement of subcontractor firms has strengthened the need for monitoring and controlling activities on the construction site. Projects with limited internal construction workers thus have a greater need for more activity managers on site in order to cope with the additional workload that is introduced by managing the activities of a larger number of subcontractors.

4.6 International activity on-site

The increased participation of foreign construction workers and firms has spawned a wider range of different cultures in the production. These partly include differences in risk acceptance, which can result in time consuming conflicts upon confrontation and high risk exposures on site. Beyond safety, there are additionally alternate perceptions on the importance of coordination and gathered sessions, occasionally hampering the distribution of information and collaborative efforts aimed towards all the parties involved. Furthermore, the preferred structure of communication between the subcontractors and main contractor can be shaped significantly different ways. Some personnel display high interest in the activity management on site and consequently collaborative attitude towards the main contractor, whereas others convey a preference for their corresponding managers to constitute the main line of communication between the two parties. Cultures can thus govern how the communication is structured and subsequently how the handling of subcontractors on the construction site is approached by the site management.

These types of differences are however not only tied to foreign personnel, since they are inherent in all business entities as part of their individual cultures. When clashes between involved parties occur, there is a greater need for additional resources, often in terms of activity managers on the construction site. A better understanding for cultural differences is subsequently considered to be an important element in order to improve the management of subcontractor firms during the construction process.

4.6.1 Langue barriers

The distribution of information becomes a difficult challenge when there are limited abilities to communicate in a common language. Although the attendance of at least one English speaking person is a common part of the contractual agreement, the requirement can be fulfilled to variable degrees among subcontractors. The elected spokesperson, which typically involves a manager acting as representative of the subcontractor personnel, may in turn be bound to attend several other projects. A spokesperson is thus in many situations a momentary availability on the construction site, which hampers the ability to communicate fluently regarding eventual safety precautions or practical issues that need to be solved.

There is however a mutual interest to create an understanding between the parties involved in order to proceed as efficiently as possible.

The language becomes an additional complication for the management of morning sessions. When the firms have a spokesperson on site, the sessions are either summarized or held completely in English, whereby the content is passed on to the subcontractor personnel by their attending representatives. With limited common language, the knowledge of what information that is received and how much is passed on to the subcontractor personnel is subsequently reduced. The resulting language barrier between the site management and participatory employees consequently diminishes the value of attending, which is also displayed among subcontractors when there are difficulties in creating a mutual understanding. An existing solution, especially for larger projects where disciplines have their own project management located at the site office, is for subcontractors to arrange separate morning sessions. With the attendance of an activity manager, the content can be translated through a spokesperson which thereafter is distributed between the different groups by arranging an additional coordinative session with all the responsible meeting managers.

The largest difficulties are considered to occur when the first subcontractor in the chain hires personnel or procures another firm with foreign language lacking ability to communicate optimally. The communication consequently suffers and can result in high risk exposures on the construction site if the subcontractor is accounting for the execution of a critical operation. When the lacking communication causes risk beyond the acceptable limit, it can subsequently lead to the replacement of subcontractor firm if there is limited understanding for the safety precautions involved. Business entities that constitute repeated contract relationships are however considered to fulfill the requirement of having a spokesperson fluently in English on site. Thus, problems regarding safety, quality and collaboration are usually a result of limited understanding rather than a low interest of participating or lack of competency among subcontractors.

5. Analysis

The following chapter presents the analysis of the empirical inquiry in relation to the selected theoretical concepts and analytic model of the project based environment. The content and structure of this chapter is organized in accordance to the research questions found in chapter 1.

5.1 Development of production division of labour

While the revenue for the construction business stream of Skanska increased during the period 2005-2018 with over 60%, indicating company growth, the number of construction workers decreased with 40%. During the financial downturn of 2008, the company reported peak construction worker, employing more than 7000 while in 2018 the base line had reduced to 3765 construction workers. As indicated by figure 5, the relationship between the construction stream revenue is negatively correlated with the number of construction workers.

Development of Revenue and Blue collar workers

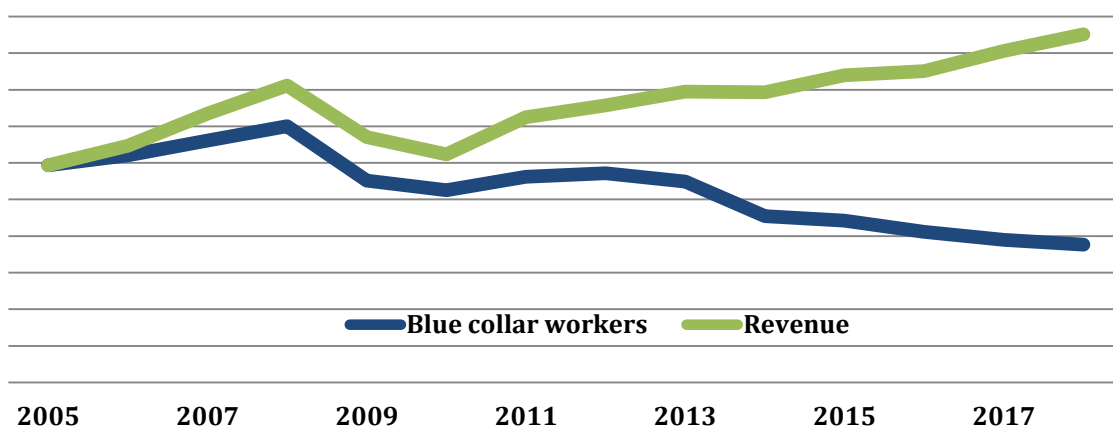


Figure 5, Relationship between the revenue of the Swedish construction stream and the number of blue collar workers.

The diminishing number of construction workers rather than stagnation can be explained by the termination or sales of departments containing substantial amounts of employees categorized as blue collar workers. No company strategy of reducing the number of construction workers exists or existed, as indicated by the qualitative data a majority of the managers are inclined or content with retaining own construction workers, describing them as quintessential to the business. However, as the revenue increased the number of blue

collar workers has not aggressively followed, instead the ensued gap between the number of construction workers and the work hours required have been resolved through procurement of subcontractors.

Despite the fact that the number of construction workers in the production have not actively decreased, many of the managers in the inquiry perceive it to be decreasing. The logical reflection is rather that the share of own construction workers decrease in the production, while the share and number of subcontractors heavily increases as to compensate for the business growth. Although, the persistent baseline may be divided among more projects and thus the number of construction workers decreased locally in the projects since it is divided among the production sites. The baseline is however limited to a few numbers of projects as to have sufficient enough groups of own construction workers able to perform full scale activities without support, subsequently why at high project intensity some projects are completely absent of blue collar workers from the contractor.

Furthermore, due to the inherent momentary characteristic of subcontractor activities in projects, i.e. a subcontractor complete their activity and move on to the next project, the number of entities and sheer number of people can be concluded to be increased heavily in the production illustrated by figure 6.

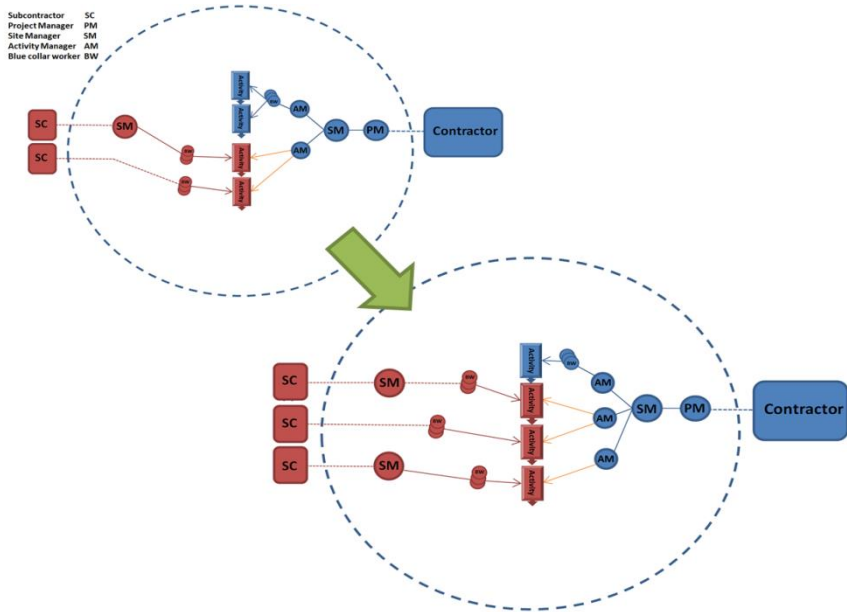


Figure 6, Development of the typical construction project model.

Consequently, the model of typical project introduced in earlier in the thesis has evolved. Greater share of the activities are performed by a larger number of subcontractors, while the share of contractor construction worker has contracted. Concurrently the numbers of activity managers and project engineers have increased to meet the new requirements; administrative duties, monitoring and controlling.

Moreover, the complexity of the production is advanced as more entities and employees are limited within the same space and time. Adding an additional entity to the production exponentially generates required interactions. By utilizing a higher share of subcontractors the inherent short-term based market relationship that characterizes the industry is reinforced as e.g. (Mirawati et.al, 2015), (Dubois and Gadde, 2002), (Koskela, 2000), (Nawi et.al, 2014) cite as one of the factors contributing to the fragmented industry.

While the share of own construction workers decreased for the contractor, the number of white collar workers increased as indicated by the inquiry. Managers attest to amounting administrative workload and an increase of monitoring and controlling in production brought on largely by the new division of labour concerning subcontractors. In order to meet the new requirement the number of white collar workers increased in Skanska from 3829 in 2005 to 5345 in 2018 i.e. a 40% increase, consequently 1.5 white collar worker for every blue collar worker. However, as the numbers reflect Skanska Sverige AB and not solely the construction revenue stream the count is fluctuated by the strong increase of the project development business stream see figure 7.

Relations between business stream

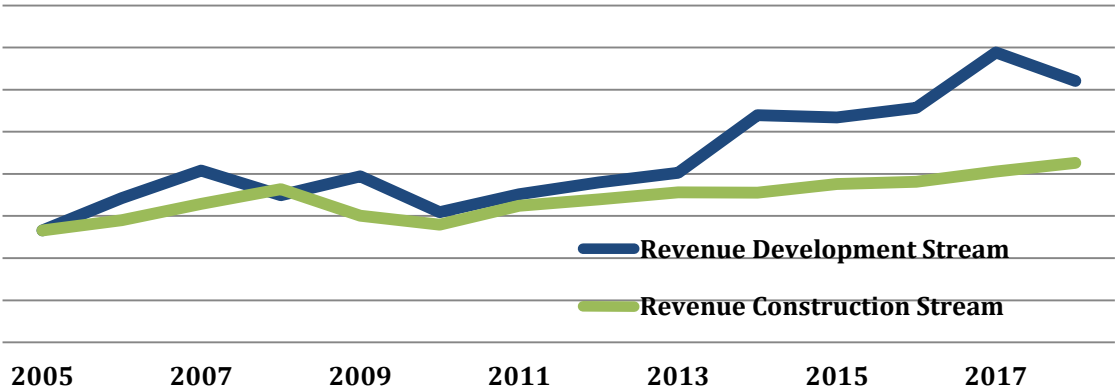


Figure 7, Relationship between the Swedish development and construction stream by revenue.

While indicated by the failure of construction workers numbers to follow the revenue, concurrently with the increase of white collar workers and subcontractors the contractor is not actively advancing towards the construction management business model i.e. managing the construction process absent of own construction workers the development is, however, passive since the growth of revenue is compensated with subcontractors. The greater business model change is rather the project development stream, not only pronounced in Skanska but all major Swedish construction companies. While the construction stream since 2005 increased from SEK 22 to 35 billion, the collective project development stream, both housing and commercial development, more than doubled from SEK 5.3 to 12.4 billion whereas the latter enjoy a typical 10 % margin rather than 3%. Subsequently, the development in figure 1 of the share of white and blue collar workers in the major companies can be concluded not solely caused by the minor increase of white collar workers in production compared to the project development department which also is only consistent of white collar workers.....

5.2 Consequences of changed division of labour

Since the number of business entities and subsequently people involved in the production environment has increased, the need for coordination has been substantially reinforced by the main contractor in order to steer commitments towards the common goal of ongoing projects. As illustrated by figure 8, each added subcontractor quickly gives rise to a new set of interdependencies which require extensive coordination at different levels in the chain while simultaneously affecting the inherent roles of the production.

On the main contractor side of the figure, site and project managers are increasingly aiming their efforts to the management of new subcontractor relationships while finding less time to utilize towards the physical construction. Instead, greater emphasis is put on protecting contractual borderlines while ensuring that the production environment is equipped with the prerequisites necessary in order for a larger number of business entities to conduct their operations. Concurrently, the activity managers are assuming more workload in the production while dealing with a larger amount of people in the daily duties on-site.

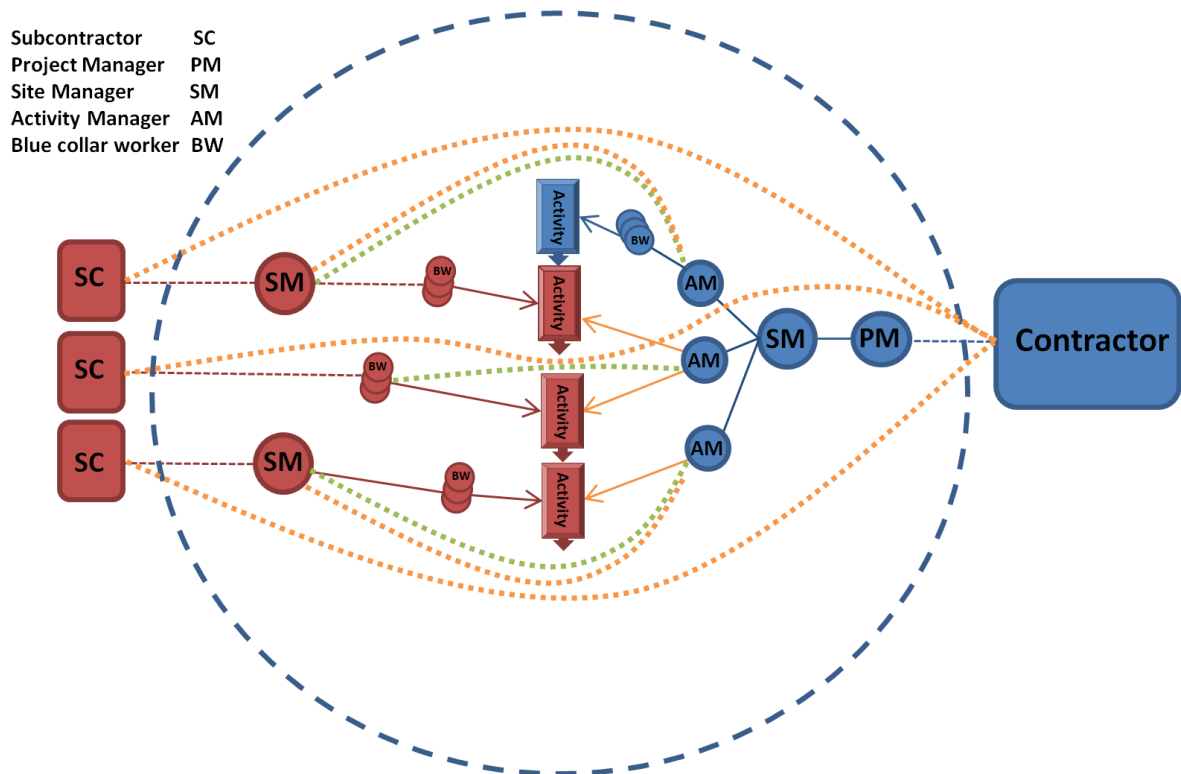


Figure 8, The new model of the typical construction project including what concepts and theories the relationships are subjected to.

The coordination required by activity managers is as displayed by the figure not only tied to external construction workers performing the activities, but also to participatory site managers, which as established by the inquiry are more frequently present during the production while acting as coordinator for the subcontractor firms. Subsequently, an additional line of communication subject to conflicting views and misunderstandings is introduced between the main contractor and subcontractor in the site environment. Concerned activity managers must therefore adapt the collaboration between external coordinators and construction workers to an increased extent while ensuring that both parties are in mutual understanding with the main contractor before entering the execution of planned activities.

As also illustrated by the lines between activity managers and site managers (red), the relationship is not only subject to outsourcing theory, but TCE. Since the contract agreements utilized by the examined company merely concern the execution of scheduled activities, associated materials have to be continuously purchased by internal staff so that they are made available in the correct quantity at the right time during the production. In shortage of stock, new purchases have to be organized with the site manager so that the

belonging in-house resources can be utilized by the subcontractor. The added time and cost caused by the transaction subsequently categorizes as a transaction cost as part of administering the contractual execution defined by Huimin et al (2015), and can be expected to increase as larger shares of the construction are outsourced to external business entities.

While many of the participatory subcontractors additionally claim to have assumed larger responsibilities in the production over the years, the required collaboration is no longer tied solely to the main contractor, but rather increasingly to all the business entities involved. Consequently, the subcontractors must to a greater extent than before be aware of each other's activities and coordinate between them in order to avoid further clashes in the production. Similarly, activity managers have to capture the holistic progression of ongoing activities by collaborating more internally as the number of subcontractors in the production increases. In reality the coordination is thus not only required in parallel as indicated by the lines of the model, but also vertically which furthers the complexity of the environment as the number of entities and people during the production grows.

The number of interactions required in order to reach the bottom of the chain, i.e. the physical construction, has subsequently increased due to the greater amount of people involved within the site environment. As illustrated by figure 9, the new ownership of activities is now increasingly characterized by subcontractors (red) while the number of internally managed activities (blue) has decreased compared to the introductory model. In turn, the need monitoring and controlling of subcontractor activities has been notably reinforced in order to secure the quality of projects in shortage of own construction workers. As the amount of business entities and people required throughout the production stage continues to increase, the importance of such administration is not only enhanced as described by TCE theory, but additionally more difficult to control due to the high share of short-term activities and momentary stays on the construction site.

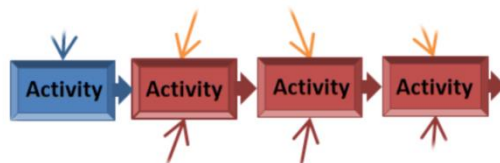


Figure 9, Illustration of the new ownership of activities among subcontractors and internal construction workers.

The fragmented characteristics of the construction industry can thus also be found within the production since many entities are merely involved during a short period of time while a relatively small amount of people is associated with the same firm. Owing to the subsequent flow of subcontractor personnel during the production new potential sources of variation are constantly being added to the site environment, i.e. in a tightly coupled system that is already sensitive towards fluctuations due to the various interdependencies between activities and people. Due to the greater number of interactions required in order to reach the bottom of the chain, see figure 8, the likelihood of failure along the way has additionally increased since multiple dependent relationships have been added to the production.

Subsequently, the current remains of the internal baseline constitute an important role in the production by retaining properties of loose couplings in a system that is otherwise characterized by very strong interdependencies. Unlike subcontractors, own construction workers act in accordance to what Weick (1976) defines as independent elements within a coupled system, consequently knowing their environment better in comparison to external business entities that are distant from company practices, goals and cultures. As explained by loosely coupled theory, these properties are not only important for the system's ability to make localized adaptations in favor of the construction, but they also preserve many sensing mechanisms for potentially harmful production behaviors within the site environment. Consequently, by adding subcontractors, the system is quickly introduced to new uncertainties which need extensive coordinative attention in order to protect the inherent interdependencies on the construction site.

As derivable from the current development of subcontractor procurement, the site environment is gaining increasingly complex and fragmented as the number of business entities and people involved during the production grows. Concurrently, the number of relationships subject to outsourcing and TCE theory is also rapidly increasing while collectively being greater in magnitude than before; calling for extended consideration as the development continues to advance. To counteract the impact of the theories increased efforts need to be aimed towards developing systematic practice in the production so that the complexity generated by unique circumstances of projects can be reduced. Subsequently allowing for further sources of variation to be identified and removed while ensuring more

steady production flow. As claimed by coupled systems theory, there are additional benefits to gain by adhering increasingly to a rigid and continuous evaluation of subcontractors so that more elements of loose couplings can be incorporated into the production. By working recurrently with the same subcontractors while reducing the amount of transactions, the predictability and reliability of the environment can thereby be successively increased.

5.3 Future division of labour

The inquiry establishes a progressive and continuous development of the industry's production and the business models of the major companies. Continued advancement in the same direction would entail a production dominated of subcontractors managed by the contractor until a stage wherein own construction workers are too few in number in order to perform any major activities and subsequently lack valuable function. The numbers of projects absent of own construction worker would increase hence the value created largely depend on the local circumstances and quality of the procured subcontractors, consequently diminishing brand value as the core business is outsourced. Concurrently the construction business stream at Skanska, often associated as the core business of major construction companies, were as of 2018 surpassed in operating profit by the project development stream establishing president in the industry.

Subsequently Skanska stands at a crossroad; either the development towards construction management's business model is continued with recognized consequences and advantages or the baseline is expanded to previous or optimal proportion. The inquiry depicts a current production where managers retain conflicting perceptions of the core business centralized around the share of own construction workers. Historically Skanska diverged from the other major companies by establishing themselves as the contractor associated with safety and robust company policies e.g. introducing the four-piece safety gear requirement and the safety morning sessions. However with mounting share of subcontractors in the production managers attest to difficulties enforcing company policies and overall quality, likewise the added soft value which the own construction workers are a vital resource in the efforts of maintaining and developing . Private and public clients alike testify to an increasing interest for soft value or surrounding value i.e. more than the finished product e.g. appropriate working environment, safety and sustainability.

By ignoring the development Skanska is limiting the future range of clients and thus promoting an increasing share of white collar workers on a company basis as the project development business stream only is indicated to grow. However, in the production the continuous increase of subcontractor indicate collectively with the inquiry a slight increase of white collar workers in order to meet the demand, while the baseline will remain in the same numbers but divided between more projects. The perception of a diminishing baseline will therefore persist.

In conclusion Skanska's and likewise the other major construction companies' current business strategies need to adjust in order to retain own construction workers which managers in production define as quintessential for maintaining the expect quality and values. As the major construction companies converges towards the same standing, competing for the same market there is however ample opportunity to diverge and create distinguishing business strategy while retaining own construction workers.

6. Conclusion

Concluded from the quantitative inquiry and supported by the semi-structured interviews the division of labour has gone through a substantial development, both on production and company level. The production has been subjected to significant increase in share and number of subcontractors, which partly have prompted an increase of white collar workers from the contractor companies. Concurrently, the share of blue collar workers has decreased, however, not necessarily in numbers on company level but they are split among more projects. Consequently in the average project the numbers of blue collar workers have also decreases in the production. There is a combined multitude of factors contributing to the development, among them contractor disregarding the smaller projects, more specialized, technical and administrative requirements, border use of prefabrication and risk management from the contractor.

As for the consequences of the changed division of labour the production has gained increasingly complex and fragmented due to the greater amount of business entities and people involved in the average project. Managers consequently face challenges in coordinating as well as monitoring and controlling of subcontractor activities to an increased extent than before in order to secure the quality of projects in shortage of own construction workers. Concurrently, the magnitude of outsourcing and transaction cost economics theory has evolved which calls for extended consideration while moving forward. To counteract their impact there is a need for more systematic practice in the production and adhering increasingly to a continuous evaluation of subcontractors so that the number of transactions can be reduced to a set of ideal subcontractors for long-term and sustainable relationships. Subsequently, the complexity generated by unique circumstances of projects can be decreased while incorporating further sources of reliability into the production environment.

Regarding the future division of labour the thesis fails to acquire a definitive result, nonetheless, if the development continues, which is indicated, there will be a further increase of subcontractors, minimal increase of white collar workers and a continued diminishing share of blue collar worker, split among more projects in the production. The point of concern, however, is when the contractor's own blue collar workers are too few in numbers to have any major value, unable to perform any major activities on site.

Consequently, the quality will be determined by the local subcontractor's quality and enforcement of company policies, appropriate working environment and safety may suffer. Moreover, Skanska's own brand value is thereby indicated to weaken as the company has through the years established itself as leading safety and social sustainability actor.

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8. Appendices

Questionnaires

Five separate questionnaires were used in performing the interviews of the thesis. While most departure from one primary questionnaire, each were adapted and continuously developed to better fit the current roles that were being interviewed. Some roles were also combined into one as these were able to provide identical answers in relation to the questions asked. These questionnaires are presented below.

Note that some of the questionnaires are intended for both external business entities and the examined company. For those that include both, the questions intended specifically for Skanska are marked with <company> at the end.

A. Project and site manager questionnaire

General

1. Please tell us briefly about the company and yourself, how long have you been employed and what kind of projects have you worked in?
2. What does your current role as project/site manager imply and have you noticed any changes during your stay?

Core business and division of labour

1. From your point of view, what would you say is the core business of the company, and do you think that this has changed during the last couple of years?
2. Is there an interest to lead all disciplines by means of project management, and do you think that the company has the competence necessary for this? <company>
3. What are the core activities provided internally in the production, and do you perceive that these have changed over time?
4. Would you consider the utilization of subcontractors to be greater today compared to before, if so, why do you think that is?
5. Yearly financial reports show that the share of white collar workers is increasing in the major construction companies, what do you think is the reason behind this development? <company>
6. Do you believe that the share of white and blue collar workers has changed in the production, if so, what are the reasons behind it?
7. Has the share of subcontractors in relation to own construction workers changed in the production? <company>
 - a. Would you say that the participation of foreign subcontractors has increased?
8. Do you think that subcontractors have developed in any way that could have affected the division of labour, for instance:
 - a. Has there been a change in organization, e.g. internal coordination on site?



- b. Has the demand for support functions in the production changed?
9. What is the optimum balance between subcontractors and internal construction workers in the production, and how does the company act to achieve this during the procurement phase? <company>

Production challenges

1. What are the advantages/disadvantages of procuring subcontractors? <company>
2. What are the consequences of increased subcontractor procurement for the production environment? <company>
3. How is the evaluation of subcontractors organized? <company>
4. What value do internal construction workers produce in contrast to subcontractors, how necessary would you say that they are? <company>
5. How does the company actively work to collaborate with the participatory business entities during the construction process?
6. How does the participation of a site manager affect the relationship with the main contractor on site, and how does this differ from only having construction workers?
7. Has there been an increase in administrative requirements for white collar roles, if so, what are the consequences of this change?
8. What are the major obstacles/challenges in achieving a sustainable collaboration?
 - a. Safety
 - b. Communication
 - a. Coordination/morning sessions
 - b. Degree of independency/dependency
 - c. Cultural differences
9. Have you noticed any limitations in the way subcontractors are managed that could be changed in order to improve the collaboration?
10. Do you perceive that there is a lack of competency or interest to collaborate and engage in the coordination that is taking place in the production <company>?
 - a. Have subcontractors improved in this regard?
11. Would you consider that the applied quality and safety requirements are being fulfilled by subcontractors <company>?
 - a. How does this vary with the number of stages in the subcontractor chain?
 - b. What is your general experience of subcontractor chains?
12. How would you rate the attendance on morning sessions <company>?
 - a. Very satisfying
 - b. Satisfying
 - c. Can be improved
13. How do you think that the division of labour in projects will continue to develop in the future, and what implications would that bring?



CHALMERS

B. Activity manager questionnaire

General

1. Please tell us briefly about the company and yourself, how long have you been employed and what kind of projects have you worked in?
2. What does your current role as activity manager imply and have you noticed any changes during your stay?

Core business and division of labour

1. Based on your experience of the production, what would you say is the core business of the company?
2. What kinds of activities are usually performed internally, and do you think that these have changed over time?
3. Have you noticed an increase of subcontractors in the projects during your employment?
4. Would you say that internal construction workers have decreased, stayed at an even level, or increased in the production?
5. Is it more common today that subcontractors have site managers acting as own coordination on site, if so, what are the reasons behind this need?

Production challenges

1. How are subcontractor relationships managed in the production on a daily basis?
2. What are the advantages of working with internal construction workers?
3. What are the challenges of supervising construction with external business entities?
4. How is the coordination on site affected by an increased amount of companies and people involved during the construction process?
5. To what extent would you say that monitoring and controlling is required for externally performed activities, and how does this differ from internal personnel?
6. Is there an interest to control subcontractors in means of time and quality, or are they preferably provided with the space to independently perform their activities?
7. Do you think that projects with larger share of subcontractors require further activity managers on the construction site?
8. How are the morning sessions managed, and what are the difficulties involved?
9. How does the participation of external coordinators affect the management of subcontractors in the production?
10. How would you rate the attendance on morning sessions?
 - a. Very satisfying
 - b. Satisfying
 - c. Can be improved



CHALMERS

C. Construction worker questionnaire

General

1. Please tell us briefly about the company and yourself, how long have you been employed and what kind of projects have you worked in?

Core business and division of labour

1. What are the typical activities provided by your company in the production, have these changed in any way during your stay?
2. Have you noticed any increase or decrease in the number of internal construction workers present in projects so far?
3. The construction industry shows multiple signs of increased subcontractor activity, is that something that has been noticeable throughout your employment?
4. Do you perceive that the production is increasingly characterized by more employees from many different companies, rather than these being associated with a few?

Production challenges

1. What would you say are the major challenges in the production?
2. What are the consequences of increased amount of companies and people involved during the construction process?
3. How is the communication and collaboration organized between internal personnel and those of external business entities on site, and to what extent does this occur?
4. How would you describe the collaboration with Skanska, is there anything in particular that could be changed in order to improve the relationship?
5. How important are the morning sessions for the collaboration on site, what kind of value do they generate for the participatory business entities?
6. What is your general experience of subcontractors in the production? <company>
7. Do you perceive that internal construction workers are sometimes subject to re- and complementary work due to lacking quality among subcontractors? <company>
8. Do you feel that construction workers are sufficiently involved in the evaluation of subcontractors? <company>
9. Do you ever experience that the same subcontractors that have possessed lacking quality in the past are returning to the sites? <company>
10. Based on direct experience of subcontractors, would you say that you have the ability to affect the decision making regarding the choice of firm? <company>



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D. Purchaser questionnaire

General

1. Please tell us briefly about the company and yourself, how long have you been employed and what kind of projects have you worked in?
2. What does your current role as purchaser imply and have you noticed any changes during the last couple of years?

Procurement

1. What factors are generally sought after when procuring subcontractors?
2. How would you describe that the weighing of lowest price and relationship based procurement is managed?
3. Do you think that there is enough supply of subcontractors in order to procure as intended or are the choices rather limited to a fewer number of relationships?
 - a. How is the ability to select subcontractors affected by upturns and downturns in the national economy?
4. Based on experience of subcontractor supply, have you noticed an increase in specialized activities?
 - a. Is there an interest to divide segments of the construction into smaller parts or rather to procure subcontractors that provide larger package deals?
5. How is the evaluation system organized and to what degree is it utilized during the procurement phase?
6. Do you find that the current evaluation system provides enough support for the decision making?
7. How would you rate the feedback between the production and purchasing department regarding the evaluation of subcontractor relationships?
8. Would you say that there is sufficient knowledge feedback between projects in the nation regarding the performance of subcontractor firms?

E. Client questionnaire

General

1. Please tell us briefly about the company and yourself, how long have you been employed and what kind of projects have you worked in?
2. What does your current role imply and have you noticed any changes during the last couple of years?

Market strategies

1. How is the awarding system organized and what kind of contractors does your organization normally collaborate with?
2. What qualities are sought after in a contractor when awarding contracts?
3. How would you say that contractors differentiate in today's construction industry?
4. Would you say that there is larger interest for any particular market strategy?
5. What are the most important factors surrounding the finished product? e.g.
 - a. Time
 - b. Budget
 - c. Quality
6. Are there any values of the production other than delivering a finished product that makes a difference for your organization? e.g.
 - a. Working environment
 - b. Safety
 - c. Sustainability
7. The major construction companies are showing signs of increased subcontractor procurement, what is your take on this development and does it have any further implications for your organization as a client?
8. Do you think that there is market value to be found for contractors by retaining internal construction workers?
9. Similarly, do you think that there is a lot to gain by pursuing a construction management structure instead?