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A Swedish contractor's view on incentives for environmental classified construction

Master's thesis in Design and Construction Project Management

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Department of Architecture and Civil Engineering
Division of Construction Management
CHALMERS UNIVERSITY OF TECHNOLOGY
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SKF one roof, LEED building of the year 2016
Contractor: SERNEKE

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Abstract

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Sustainable construction has become increasingly important to consider for all stakeholders in the industry, but also for many users. As a result, more and more environmentally certified buildings and districts are demanded. Many companies see competitive advantages in being associated with sustainable construction and see financial gains while improving environmental work in society.

The purpose of this report is to investigate the driving forces and barriers that exist for entrepreneurs in the industry. The essay will also examine which collaboration and construction methods are best suited for success with environmental certification projects. The report is based on a literature study and a qualitative interview study.

Economy and time are represented as the main drivers and barriers. It can be added that there is generally a consensus among respondents about an entrepreneur's view of environmental certifications. It is more advantageous to certify a commercial property where users can profile themselves in promoting environmental work. Large companies demand environmentally certified buildings more than private individuals do. It can also be determined that the quality of the detailed design is more important and has a greater impact than the type of construction applied.

Keywords: Drivers, Barrier, Environmental Certification, Environmental Databases, Contract forms.

Sammanfattning

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Hållbart byggande blivit allt viktigare att ta hänsyn till dels för alla branschaktörer men också för många brukare. Som en följd av detta efterfrågas det mer och mer miljöcertifierade byggnader och stadsdelar. Många företag ser konkurrensfördelar i att förknippas med hållbart byggande samtidigt som de ser finansiella vinningar samtidigt som de kan förbättra miljöarbetet i samhället.

Syftet med denna uppsats är att undersöka vilka drivkrafter och barriärer som finns för entreprenörer inom branschen. Uppsatsen skall också undersöka vilka samarbets- och entreprenadformer som är bäst lämpade för att lyckas med miljöcertifieringsprojekt. Rapporten baseras på en litteraturstudie och en kvalitativ intervjustudie.

Ekonomi och tid är representerat som de största drivkrafterna och barriärerna. Det kan tilläggas att det generellt finns en samstämmighet hos respondenterna kring en entreprenörs syn på miljöcertifieringar. Det är fördelaktigare att certifiera en kommersiell fastighet då brukarna kan profilera sig med att främja miljöarbete. Stora företag efterfrågar miljöcertifierade byggnader mer än vad privatpersoner gör. Det kan också fastställas att detaljprojekterings kvalitité är viktigare och har större inverkan än vilken entreprenadform som tillämpas.

Nyckelord: Drivkraft, Barriär, Miljöcertifiering, Miljödatabaser, Kontraktsformer.

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1 Introduction

This report is a master thesis at the masters program Design and Construction Project Management within the department of Architecture and Civil Engineering at Chalmers University of Technology. The following sections will clarify the background and purpose of the report as well as the limitations.

1.1 Background

The Swedish construction industry is a resource intensive industry which is often called “The 40%-sector” which historically has produced a large part of society's energy consumption. With the high level of sustainability goals in society, major responsibility lies with the builders and clients who are active in the industry. In Sweden there are already relatively strict requirements from Boverkets Byggregler (BBR) and it is often the client who demands a certain environmental classification rating on the building. The client might have incentives ranging from a trademark with social responsibility or a good working environment for the user to economic benefits such as higher market value and lower operating costs. The contractor wants to provide the customer with a good quality of the building and at the same time keep costs down to get good profitability and create value for the shareholders. With many different environmental classification systems, contractual forms and procurement processes, the industry can be experienced as snugly. Therefore, there is a need to unite and to find effective forms of cooperation in order not to lose efficiency in sustainable construction projects.

1.2 Purpose

This report aims at investigating what incentives and barriers that exist for a contractor in the Swedish construction industry to produce environmental classification buildings. Furthermore, the work is also aimed at investigating whether various types of contractual forms affect the possibilities to produce environmental classification buildings.

1.3 Limitations

The report will focus exclusively on the Swedish market, however, some of the literature study will be based on international research that is comparable to a Swedish context and the purpose of the report. The empirical part of the report will only treat a specific contractor, Serneke Bygg AB. The opinions of the contractor will be examined through a series of interviews. The result of the report will not fully represent an entire sector, but nonetheless give some light to what the situation in the industry is like.

1.4 Research questions

- What are the different incentives and barriers for a Contractor to build environmentally-rated buildings?
- Which building types are best suited for environmental rating? What is the demand?
- Does the contractual form affect the environmental rating in a construction project?

1.5 Potential Conflicts of interest

Both authors have an employment at Serneke Bygg AB.

1.6 Contribution to the research area

This report has mainly contributed to the research in terms of the contractor's view on environmental classification systems and how the incentives and barriers are affecting a contractor. The report also identifies fields within the research area that are objects to future research.

1.7 Method

This report has its base in a literature study on environmental classification systems and contract forms to get the necessary background knowledge, see table 1 below. In cooperation with the Health and Safety department at Serneke statistics on environmental classified projects from the company was gathered and suitable persons from these projects were contacted for interviews. In total ten interviews were conducted with 10 persons from 9 different projects. The analysis and discussion are based on the literature study together with the empirical findings. In order to provide an ethical approach all interviewees had the opportunity to voluntarily contribute or not. Questions was sent out a week in advance to let the interviewee prepare. All interviewees were granted anonymity.

Literature study	Empirics/interviews	Reflections, analysis and discussion
<p>Aims to:</p> <ul style="list-style-type: none"> • Give an understanding of how the construction industry addresses environmental classification systems. • Present earlier research in the field of drivers and barriers related to the field of study. • Identify pros and cons between the different methods. 	<p>Aims to:</p> <ul style="list-style-type: none"> • Give a picture of how the respondents and the company is working within the field of study. • Investigate what the industry sees as the main drivers and barriers. • Generate a basis for the analysis. 	<p>Aims to:</p> <ul style="list-style-type: none"> • Target similarities and differences between the literature and the empirics. • Understand what improvements needs to take place • Propose further research.

Table 1 - Method of report

The empirical study is qualitative and will be further described in chapter 3.3 “Method of empirics”.

2 Theory; Sustainability and construction

The classical definition of sustainability from the Brundtland report reads:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."
(Brundtland, 1987).

The quote is now widely known and adopted in sustainability contexts. It is however a very broad definition and not very specific in terms of how to achieve a sustainable development. Another common sustainability concept is the triple bottom line approach that considers sustainability from three perspectives: environmental, economic and social. The economy within the industry has a great impact, Yılmaz & Bakış (2015) argues that the construction industry is not efficient from an economical view due to inadequate competition, with large contracts sums and low profitability margins. From a social viewpoint it fills an important role as it provides many job opportunities and housing for people. Thus, buildings are necessary for civilization, yet they contribute to environmental problems during the construction, operation and destruction. They consume energy and natural resources, and contributes to pollution of the air and water. Green buildings are the result of environmental policies being implemented within the industry to lower the negative effects on the climate that it contributes to. According to Bahaudin, et al. (2013) green buildings are meant to reduce energy consumption and usage of natural resources and thereby reduce impact on human health and the environment. This require improvements in all stages, i.e. design, construction, operation and maintenance, by using green energy sources, improving workers productivity and managing waste and pollution.

According to O'Mara (2012) a high-performance green building can be described as a design that lead to lower energy use, reduced CO₂ emissions and increased future value to the stakeholders. Yet O'Mara (2012) see that advanced designs require a high degree of integration between many disciplines e.g. architect, structure, installations. Yılmaz & Bakış (2015) stresses the holistic approach that sustainable construction require. All stages of the building life cycle should be involved, from raw material to production, usage, destruction and waste management. The benefits cover all three aspects of the triple bottom line approach (people, profit and planet). As the value of green buildings on the real estate market increase, construction companies need to invest in research and development and start to implement new technologies that are sustainable to be able to compete on a global market in the future.

2.1.1 The project based construction industry in Sweden

Construction companies in Sweden are mainly working in a project based form and the projects are regarded as temporary by their nature (Gluch, 2009). Project-based organization is not just a common form of organization in the construction industry. However, most organizations in the construction industry are not purely project oriented. They often consist of a project-based matrix organization that houses both a permanent structure, a hierarchical organization based on functions, customer oriented or based on geographical location. The projects may also have a temporary structure adapted to the specific project (Gluch, 2009).

Gluch (2009) emphasizes that to build constitutes a difficult task of assembling a fragmented set of sub-tasks. Furthermore, she stresses that a huge challenge in construction projects is therefore to coordinate activities, people time. As construction projects evolves over time, the organization of a construction project is dynamic where individuals enter and leave the project at different times. Kadefors (1995) claim that, besides its temporality, the construction project organization is characterized with a decentralized decision culture. A challenge for project-based organizations is therefore to coordinate permanent organizational structures, such as management systems, with the temporary project organizations and activities within the framework of the projects. According to

Gluch (2009), coordination between the permanent organization and the project organization can be associated with certain problems, in terms of organizational learning, as well as to manage innovations and new technologies in projects. According to Gargovic & Ouahchi (2006), knowledge within a project-based organization must be captured and managed before the temporary organization is resolved so that knowledge is not lost.

2.2 Incentives and barriers for green buildings

As the construction industry is energy intense and accounts for about 40 percent of the total energy use in the world, it is important to consider sustainable practices in order to reduce the impact on the world's limited resources. O'Mara (2012) argues that there is a big potential for improving processes and thereby reducing the impact on the climate and at the same time improve the business performance. Investment in green buildings can lead to financial benefits due to, for example, tenant attraction and higher rental rates. As a company, it can be of value to own or operate in a green building to showcase social corporate responsibility. It is a way to attract and retain employees and at the same time reduce operating costs and energy usage (O'Mara, 2012)

2.2.1 Construction costs versus operations and maintenance costs

Tam, Hao & Zeng (2012) studied the financial and social factors that affect the construction of green buildings. Their results show that the industry believe that green buildings can improve the environment and social values for the occupants. Yet, there is a general perception that the production costs are higher in green buildings than in general projects due to higher material costs and more expensive features. From the survey of financial factors, one can see that most people in the industry answered that the usage of energy efficient systems will increase the initial building cost to some extent (Tam, et al., 2012). Furthermore, many view a green design as being more time consuming and that it will increase the design costs and affect the construction cost due to the cost of installing green features. Further Hydes and Creech (2000) propose that solutions for sustainable buildings are limited since clients are concerned about higher risks based on the lack of experience and unfamiliar techniques. The clients also worry about additional testing and inspections as well as support from both manufacturers and contractors.

Yilmaz & Bakış (2015) claims construction costs are undoubtedly higher in green buildings by 5 -10 percent but on the other hand they will amortize themselves in 1 -15 years as the operation costs are lower. According to von Paumgartten (2003) there are many financial benefits of green buildings, stretching from reduced energy consumption to higher occupant productivity. It is claimed that by building with LEED standard 250 percent of the upfront costs can be saved over a 40-year life cycle (von Paumgartten, 2003). Further it's shown that an extra 5 percent of construction costs due to investments in energy efficient features can result in a 10 percent reduction of operating cost during the building's life cycle. The latter costs are substantially higher resulting in huge long-term savings. All at the same time, with an end product that has a better performance, higher market value and lower environmental impact.

On the other hand, several studies also show that energy effective buildings do not cause significant increases in investment costs (Häkkinen and Belloni, 2011). Though Bordass (2000) states that economical life-cycle thinking is often ignored by those who pay upfront since they do not receive the long-term benefits or because those benefits are rapidly discounted. It is also emphasized that cost consultants risk overestimating the capital costs of energy-efficient measures while they at the same time underestimating the future cost savings. Unfamiliarity with designers and contractors of sustainable building methods may also cause a perception of higher costs for environmental classifications (Hydes and Creech, 2000).

2.2.2 Other incentives and barriers

Besides the measurable factors such as high property value, low energy consumption and thermal comfort, building green demonstrates a good image of responsibility in the eyes of different stakeholders e.g. clients, investors, the public etcetera. O'Mara (2012) also emphasize that the return on investment is higher in new construction and existing houses in green building compared to regular construction. It is also stated that green buildings have positive effects on capital- and operational expenses. Von Paumgartten (2003) argue that companies that have taken an environmental friendly approach has won financial benefits and that this can be reflected on the market for green buildings. The market for green buildings has matured and is not only niched towards ultra-environmentalists but is now supplying owners and operators of all kinds. Von Paumgartten (2003) mean that owners and occupants are now starting to see the benefits of green buildings from a business perspective and not just from the environmental perspective. Furthermore, as green buildings often offer, for instance, better daylighting and air quality for the employees than traditional buildings, the improved working environment in turn lead to higher productivity. It also reduces sick time and improves the working place occupancy. Von Paumgartten (2003) claims that one can see an increasing productivity from workers that get to operate in a green building which alone contributes to financial savings which are larger than savings from the lower operating costs.

Tam, Hao & Zeng (2012) mean that the limited implementation of green buildings is due to incomplete integration in and between projects. Decentralized management makes knowledge transferring difficult and the lack of clear design goals and comprehensive standards in green buildings make actors conservative. If the time and funding was not as limited more cost efficient and buildable green designs could be developed. The holistic approach that involves integration and collaboration is emphasized by most researchers. O'Mara (2012) makes a claim to that the best solution require the right expertise in different areas e.g. architect, systems engineer etcetera during the design phase and to consider the building lifecycle and the triple bottom line. Von Paumgartten (2003) mean that contractors and clients that wish to build green can implement different new technologies etcetera but need to integrate people and processes for successful projects and end products and address a new model for design. Tam, et al. (2012) proposes that the government should take more initiatives for implementation of green buildings and develop a set of guidelines that reduces the uncertainty in the industry. There could be mandatory requirements on certain building types starting with commercial buildings that leads the way of gradually classifying all buildings.

2.2.2.1 Drivers and Barriers

Pitt, Tucker, Riley and Longden (2009) aimed at identifying what factors that best promote or prevent sustainable practices in the United Kingdom. A list of key drivers and barriers was made based on a review of the literature. These key factors were then ranked by importance by interviewing professionals from the industry (see table 2).

Rank	Drivers	Barriers
1	Financial incentives	Affordability
2	Building regulations	Lack of client demand
3	Client awareness	Lack of client awareness

4	Client demand	Lack of business case understanding
5	Planning policy	Lack of proven alternative technologies
6	Taxes/levies	Building regulations
7	Investment	Planning policy
8	Other	Other
9	Labelling/measurement	Labelling/measurement

Table 2 - Drivers and Barriers ranked by importance.

Based on their observed rankings Pitt, et al. (2009) points to that financial incentives and building regulations are the most important drivers for sustainable construction as these will increase the demand from different stakeholders. Here, the client is seen as the principal stakeholder who determines what sustainable functions to have in a building. The authors suggest that the clients should be educated on the benefits of sustainability issues. Looking at the most important barriers, affordability, lack of client demand and lack of client awareness are in the top. Again, this is related to the perception of higher costs in sustainable construction and that clients should be educated on the benefits. Pitt, et al. (2009) argues that different stakeholders can influence the implementation of sustainable practices and that architects and designers plays an important role, since they participate in early stages. Investors has a more limited role as well as contractors. It is emphasized that in order to promote the business case for sustainable construction and to use financial incentives and penalties to increase the implementation, the industry should come together to bridge the gap between the demand and supply side so that the awareness increases and a wider environmental consideration is achieved.

Häkkinen and Belloni (2011) also emphasize the development of clients' awareness of the benefits of sustainable buildings, along with the adoption and development of new methods and sustainable building tools. Designers has a great impact of promoting sustainable construction, especially regarding their ability to offer new concepts and services.

Bordass (2000) states that pioneering of sustainable buildings in the UK have been mainly done by owner-occupiers who are less limited by market standards. Owner-occupiers have a higher desire to own sustainable buildings than ordinary investors, since the investment horizon might be longer. Market-related issues and corporate policies might also be drivers for sustainable buildings. Häkkinen and Belloni (2011) mean that sustainable buildings can become more relevant and important for companies if they are dedicated to corporate social responsibility. They argue that a company that focus on corporate social responsibility are likely to consider the features of a green building as valuable and be ready to pay a higher price. The authors stresses that companies who take environmental responsibility into account as a competitive advantage introduce a client demand on the market for green buildings.

As seen in table 2, the financial aspects have the greatest impact on both the driver- and barrier side. Furthermore, it is emphasized by several researchers that with understanding of future long-term

savings many clients can be convinced to build sustainable. Also, stakeholders such as architects and legislators can influence clients to see the benefits of sustainable building.

2.3 Environmental classification systems

There are several different classification systems, with a wide range from energy consumption in buildings to whole neighborhood areas total impact on the environment. In this section the most common classification systems in Sweden will be described, examined and compared.

2.3.1 Sweden Green Building Council, (SGBC)

The Swedish Green Building Council (Sweden Green Building Council, 2018a) is a non-profit association consisting of over 300 members consisting of companies and organizations in the Swedish construction and real estate sector. Local authorities, county councils and other public actors are also members. SGBC is a member of the World Green Building Council World Organization since October 2011. SGBC handles and manages most of the classification systems in Sweden, or has adapted the systems to the Swedish market.

2.3.2 LEED

Leadership in Energy and Environmental Design (LEED) is the most common environmental classification rating system according to SGBC. It is now broadly accepted as a standard for all types of buildings and was originally developed by U.S. Green Building Council, LEED in Sweden is adapted to Swedish conditions by the Sweden Green Building Council (Sweden Green Building Council, 2018b). LEED can be adapted to all types of buildings by developing different versions from the base version. LEED can be used in both the design and operation stages as well as for existing buildings.

LEED is a framework for assessing buildings and their performance and demonstrate how well they meet sustainability goals. The standards of LEED are meant to cover all aspects of the development, construction and management process and all of them are from the first version New Construction. Today, LEED contains the following standards for building assessment:

- New Construction
- Existing Buildings: Operations & Maintenance (EBOM)
- Commercial Interiors
- Core & Shell
- School
- Retail
- Healthcare
- Homes
- Neighborhood Development

LEED assesses a project in seven areas. Each assessment area consists of many different criteria that must be met in the project to obtain a certification. These criterions are called credits and each individual credit can give at least 1 point. The categories and examples of what they estimate are presented in table 3.

Category	Subdivision
Sustainable Sites (SS)	Choice of land
	Alternative means of transportation
	Storm water management
	Reduce heating islands
Water Efficiency (WE)	Water use
	Water recycling and reuse
	Sewage
Energy and Atmosphere (EA)	Optimized energy use
	Refrigerants
	Renewable energy
	Energy-efficient building systems and measurement
	Green agreement
Materials and Resources (MR)	Waste
	Origin Responsibility
	Recycling of materials
	Recycled content
Indoor Environmental Quality (IEQ)	Indoor Environment Quality
	Air Quality
	Thermal comfort
	Daylight and views
	Low emission material
	Lighting control
Regional priority points	Geographical priorities - extra points for energy and water
Innovation and Design	Exemplary performance - perform better than LEED requires.
	Innovation
	Hire LEED Accredited Professional

Table 3 - Categories in LEED

For housing, there are two additional categories which are "Places and Focal Points" as well as "Awareness and Education". Places and Focal Points considers hubs, local and public transport. Awareness and Education is a category where assessment is executed with the regards to education for awareness raising among people living and staying in LEED-certified buildings.

2.3.2.1 Pros and Cons with LEED

Since LEED originates from the American standards it structured after their norms, laws and agreements with USGBCs members (Edenborgh, 2011). This contributes to several translation problems, some pure mathematical because the system prescribes the use of US measurement systems, but problems also arise on other points. In LEED, everything refers to ASHREA's standard, which is the United States equivalent to Swedish BBR. This also causes major problems and duplication because no direct translation or comparison is available.

An advantage with LEED is that it is an international environmental classification system that is well-known and widely spread across the world. This means that LEED is often demanded by clients (Edenborgh, 2011). LEED is also a comprehensive system that considers a few different environmental

aspects besides from the construction qualities, which can increase the credibility of good environmental work. Certified buildings also get a good comparability as the same rules apply no matter where in the world the building is constructed.

The system takes a triple bottom line approach and considers sustainability in forms of economic, environmental and social factors. It also considers the full building process from concept to design, production and usage. The last part is something that is not yet implemented in most rating systems which only considers the operation and maintenance part. Bahaudin, et al. (2013) claim that even if these criteria have the greatest importance in a current building, the construction phase will have the highest intensity of environmental impacts.

2.3.3 BREEAM

Building Research Establishment Environmental Assessment Method (BREEAM) is an environmental certification system from UK, developed and administered by the Building Research Establishment (BRE) (Sweden Green Building Council, 2018c). BREEAM is one of the oldest environmental certification systems, and the system has been used to certify over 500,000 buildings. BREEAM has been in revised versions since 1990 and is the most widely distributed by the international systems in Europe.

BREEAM-SE is the Swedish version of the classification system which makes it possible to certify buildings according to Swedish rules and standards, while working on an internationally recognized method (Sweden Green Building Council, 2018c). BREEAM-SE is used to certify newly built buildings. Furthermore, it is used for the building's environmental performance and is assessed in a number of different areas. The projects are for example assessed based on the energy use of the building, the indoor climate and water and waste management. In the assessment the system also considers the project management, the choice of building materials, the location of the building in relation to public communications and the pollution that the building causes. Lastly, innovation for technical solutions are also considered and graded.

For each assessed area, a total score is aggregated and evaluated (Sweden Green Building Council, 2018c). The project needs to achieve at least 30 percent of the maximum score to get a classification level. The different levels are Pass, Good, Very Good, Excellent and Outstanding. In order to achieve the highest grade. Outstanding, it will require 85 percent of the maximum score.

2.3.3.1 Pros and Cons with BREEAM

An advantage with BREEAM is that it is an internationally recognized environmental classification system (Sweden Green Building Council, 2017). BREEAM is the environmental classification system that has the most certified buildings in the world. BREEAM is a comprehensive system that considers many different environmental aspects which increase the credibility of good environmental work (Edenborgh, 2011).

Since BREEAM is developed in the UK it initially had some translation problems which still might be present (Edenborgh, 2011). Thus, in contrast to LEED, BREEAM has the advantage that the international version has a checklist specifying which Swedish standards can be used for certification. Both Swedish and European standards can be used as reference at most points.

2.3.4 GreenBuilding Program, GBP

The GreenBuilding Program (GBP) was initiated and introduced by the European Commission in 2004 (Heincke & Olsson, 2012). The program's purpose is to implement cost-effective energy efficiency measures and increase the use of renewable energy (European Commission, 2018). The program certifies local buildings in three different categories; new production, rebuilding and existing building.

The certification systems are an ungraded system where pass or fail are the only outcomes. According to Heincke & Olsson (2012) a thumb of rule within the system is to be 25 percent better than the minimum-requirements of the laws of each country. This rule of thumb can be applied to new production, rebuilding and existing buildings.

2.3.4.1 Pros and Cons with Green Building Program

Since GBP does not define what is required to be energy-efficient it is up to the contractor or developer. This method will reduce the energy consumption by 25 percent in comparison with BBR when the building is in use but it will not define any requirements on the building materials put in to the building and therefore does not consider the life cycle perspective.

2.3.5 Miljöbyggnad

Miljöbyggnad is a Swedish certification system, which is based on Swedish regulations and construction practices (Sweden Green Building Council, 2018d). Miljöbyggnad defines how well the building is performing in terms of energy, indoor environment and materials. The system can be used for new production, rebuilding and existing buildings. The certification system is divided into four different certification levels; Graded, Bronze, Silver and Gold.

The system’s main focus lies on the four following areas; Energy, Indoor climate, Building materials and Specific environmental requirements (only for buildings with water and sewage systems) (Heincke & Olsson, 2012). All areas have further aspects such as energy efficiency, indoor air quality, documentation of building materials etc. The areas are then divided into indicators with more detailed commitments (see table 4 below).

The final certification level for the building is determined based on the lowest grade achieved in the areas which are determined through the aspects which depends on the indicators, see table 4 below.

By meeting the Swedish standards according to BBR a project fulfills the classification standard “Bronze”. The lowest grade in the area of indicators defines the constructions final grade.

Indicator	Aspect	Area	Building
Energy usage	Energy usage	Energy	Certification level
Heating power requirements	Power requirement		
Solar heat load			
Energy type	Energy type	Indoor climate	
Acoustic environment	Acoustic environment		
Radon	Air quality		
Ventilation standard			
Nitrogen oxide			
Moisture safety	Moisture		
Thermal climate winter	Thermal climate		
Thermal climate summer			
Daylight	Daylight		
Legionella	Legionella		
Documentation of building materials	Documentation of building materials	Material	

Phasing out of hazardous substances	Phasing out of hazardous substances		
Decontamination of hazardous substances	Decontamination of hazardous substances		

Table 4 - Indicators of Miljöbyggnad (Swegon Air Academy, 2017)

2.3.5.1 Pros and Cons with Miljöbyggnad

Since Miljöbyggnad is developed in Sweden according to Swedish laws and regulations it is fairly easy to certify a Swedish project (Wallentin, 2014). Miljöbyggnad Bronze is equal to the Swedish building standard BBR which also makes a project easy to certify. Furthermore, is not an internationally recognized system is not internationally known. This leads to a narrow use for buildings only in Sweden. Another disadvantage is that it only covers four areas within buildings and does for example not consider whole neighborhoods.

2.3.6 Svanen

Svanen was founded with the aim to help Swedish consumers to choose environmentally friendly products and has evolved into review the life cycle perspective of a building (Svanen.se 2018). This means a holistic approach to the entire construction process, the building and its use and management. Building materials and chemical products are assessed. The building must live up to tough demands on low energy consumption. Svanen also sets requirements that stimulates the use of renewable energy and green innovations. Checks are made before the house is approved. Svanen certifies small houses, multi-family houses, pre-school and school buildings. Extensions and refurbishments can also be Svanen certified (Svanen.se 2018).

2.3.6.1 Pros and Cons with Svanen

As a consumer there are many advantages to live in a Svanen project, such as the climate impact being reduced due to the holistic approach through the entire construction process and in the use of the building (Skanska Bostad, 2017). The indoor climate as well as the energy consumption is better which also is an advantage for the consumer. Since Svanen is a national system it is not recognized internationally which can be considered as an advantage according to Wallentin (2014).

2.3.7 Comparison between the environmental classification systems

Wallentin (2014) argues that the four environmental rating systems (Breeam, Leed, Miljöbyggnad and Green building) all focus on different areas which makes it difficult to make a clear comparison between them. Breeam and Leed are more alike and therefore comparable. The fact that they all are derived from different national settings is also something that must be considered as they build on different regulations and might be more or less advantageous depending on what type of project is being built as well as who the owner and client are.

In common for Breeam, Leed and Miljöbyggnad is that they all aim at providing a better connection to the local surroundings and indoor climate with as low environmental impact as possible (Wallentin, 2014). They all include energy, environment and indoor climate. The most basic difference is the rating system itself and the grading scale. Breeam has five levels (pass, good, very good, excellent and outstanding). Leed has four (certified, silver, gold and platinum). Both are built on a point system while Miljöbyggnad has four grades (klassad, brons, silver and gold) and require that a majority of the different areas has fulfilled the grade that is given. The different rating areas can be viewed in table 5 below.

<u>BREEAM</u>	<u>LEED</u>	<u>Miljöbyggnad</u>
Energy	Energy and atmosphere	Energy
Health and indoor climate	Indoor climate quality	Indoor climate
Material	Material and resources	Material
Transportation	Innovation/design	Special environmental requirements
Water	Water efficiency	
Management	sustainable site choice	
Waste	Regional priority	
Ground and ecology		
Emissions		
Innovation		

Table 5 - Comparison of rating systems

What separates the systems is in where their focus lies (Wallentin, 2014). Leed focuses more on indoor climate and Breeam focuses more on environmental impact. Jakubova & Millander (2012) conclude in their comparison of the different systems that Breeam and Leed values sustainable energy sources, waste management, purchases and material choices. In these systems, the building and its resources are a part of a cycle. Miljöbyggnad does not consider waste management or emissions and Green building is only considering energy consumption.

According to Jakubova & Millander (2012) all the systems can further be fitted into national contexts in different ways. Miljöbyggnad is an all Swedish system that builds on the regulations from BBR. It is therefore easy to understand and use in the Swedish context but is harder to applicate internationally. Breeam is a UK based system and Leed is US based, both can be translated into Swedish context but Breeam allows for better adaption to laws and regulations. Leed require US standards to be fulfilled no matter what climate or regulations the current country has. Wallentin (2014) concludes that Leed is mostly chosen by multinational companies that want the same classification on all their buildings regardless of location.

Wallentin's (2014) survey, mainly answered by clients and consultants, showed that many are positive towards the usage of environmental rating systems as it can be of good guidance if are looking to make an effort in environmental responsibility when building a house. However, many respondents mean that it is expensive to certify a building. This is something that must change if the number of certified buildings shall increase. If more clients are to choose a rating system for their buildings the costs for documentation decrease. The demand is higher for environmental rating systems if they are easy to understand and apply, but at the same time the utility associated with using them also must be sufficiently high. Therefore, many in the survey believe that systems like Green Building that only focus on energy consumption are too narrow to compete with the other systems. Miljöbyggnad is somewhere in between. It is not a narrow system but neither a system covering all possible aspects. The system is well known in the Swedish sector and considers much of the sustainability issues yet it focuses more on the indoor climate than the other aspects and might need to broaden the scope a bit to better compete with Breeam and Leed.

Looking at environmental sustainability, Miljöbyggnad is not as good as Breeam and Leed as the latter systems cover more aspects e.g. waste management and ground disposal (Jakubova & Millander, 2012). In economic terms Breeam and Leed are also more expensive and require more administration from the project organization. On the other hand, they often contribute to lower operational costs.

Wallentin's (2014) opinion is that it is hard to say that one system is better than another as they focus on different areas which implies that a building can have a high grade according to one system but not in the others. Which system that is chosen depends what the company wants to achieve with the building and if an international or national context is more important. Jakubova & Millander (2012) state that the choice of environmental rating system must be preceded by a decision on what the purpose with the classification is and what level of environmental work that is to be carried out. A smaller organization might not have enough funds to choose more extensive classifications that Breeam and Leed constitute. In these cases, Miljöbyggnad will be a better choice, given that the building is in Sweden.

2.4 Contract forms

Boswell & Walker (2004) mean that sustainable practices are anticipated to become more widespread in the construction industry and this will affect the procurement. They further stress the importance of strategies, policies and initiatives which are needed in order to enhance the procurement process for sustainable buildings. However, there are yet some significant concerns that are hindering the progress. Boswell & Walker (2004) claim that the total project cost is a factor that is largely affected by sustainability questions. As it includes both the first construction cost and the later life cycle costs one should not be too quick about saving money during the construction if this result in much higher operation and maintenance costs. Thus, it is important to consider operation management and construction early and keep all costs in mind during the tendering process. Sustainability issues should be considered in the beginning of the design as decisions that are made early have more impact on the configuration of the building systems than those that are made later. Varnäs, Balfors & Faith-Ell (2009) have studied the current practices and issues with green procurement in construction contracts within a Swedish context. The result shows that clients consider environmental issues and that contracts include environmental requirements. However, it is less common to include environmental criteria during the tendering process.

As there is a difference between projects depending on contract type and tendering process, there are different issues to consider which affect the sustainability. In the Swedish sector contracts are regulated by the institution "Byggnadets Kontraktskommitté" (BKK) (Byggnadets Kontraktskommitté, 2017). The regulations are different depending on which actors that are affected and which contract type that is being used. In general, there is one set of regulations for design and build (ABT06) and one for design-bid-build (AB04). The contracts are legally binding and states who is accountable for different parts in the contract.

2.4.1 Design-bid-build

In this contract form the client is responsible for the design and the contractor is responsible for the execution according to the design documents. When the design is complete, one or several contractors are procured under competition based on price and quality aspects. It is common that one main contractor has the full responsibility towards the client and that this contractor in turn has additional contracts with subcontractors that are specializing in different types of work. The quality of the design documents is of great importance in this contract form as alterations and additional work will lead to increased costs for the client if something is wrong in the documents (BKK, 2013). It is essential to get all the stakeholders integrated from the beginning to develop the scope before specifications are made.

Sustainability should be implemented during the planning stage where feasibility is evaluated from both economic and technical standpoints (Boswell & Walker, 2004). Quality management should be adopted before choosing selection criteria in the tendering to ensure good quality of goods and services. The contract is essential for the project quality which is directly related to the documents that are agreed on by the different stakeholders. Thus, sustainability criteria should be considered during the specification stage of the procurement process (Boswell & Walker, 2004). The client is then looking for the most advantageous offer, where life cycle costs and quality are optimized to meet the requirements. When everything is specified a call for tenders is made to look for the best value for money.

2.4.2 Design and build

When the contractor is responsible for both the design and execution of construction the contract form is called design and build. The client will describe what functions the design shall have to varying extent and the procures a contractor to finish the design and project. The contractor thus has freedom to choose different solutions as long as he fulfills the required functions from the client's description (Nordstrand, 2008).

The contract type design-build is now accounting for approximately 50 percent of construction contracts used in projects around the world (Boswell & Walker, 2004). It is outgrowing DBB design as it is faster and lead to less costs alterations and additional work. The contractor is participating in the design which leads to more innovative solutions and frees the client of responsibility. The higher degree of integration between building systems and project organization is facilitating for sustainable solutions. Some of the advantages with early contractor involvement is awareness of what the client needs and possibility to contribute with knowledge during the design and thereby choose solutions that results in a product with good quality and price. The risk is that not every solution is considered and that the contractor makes choices after his ability rather than the client's need (Ashworth, 2012). Varnäs, Balfors & Faith-Ell (2009) argue that the results from their study indicate that when a design and build contract is used there is less use of environmental preferences in the procurement stage as the design is carried out after the procurement.

2.4.3 New contract forms and cooperation

The two contract forms described above are standard in the Swedish construction industry. Other contract forms are being implemented in the international context but has not yet been customized to fit with the Swedish regulations (Boswell & Walker, 2004). A contractor can also do a project completely in-house. The company will then have a client organization or project development group which acquire land and plan for construction. This project form gives good conditions for profitability (Fernström, 2003).

As clients seek more single-point responsibility and an end to adversarial partnerships, there is a growing interest for new procurement procedures (Boswell & Walker, 2004). Furthermore, the approach of competitive tendering and construction contracts to build relationships within a project is questioned as it often leads to conflicts and inefficiency. Therefore, other types of contracts are sought that are more rewarding, demanding and require mutual interdependence. Methods, like partnering that are based on delivery outcome with incentives of shared risk and reward are being tested (Fernström, 2007). Partnering is a cooperation form that can be included in the contract and serves to reduce risk and enhance trust between the actors by avoiding sub optimization. The method is best used when a comprehensive design process is necessary or when the cooperation can continue over time where repetition and experience feedback can be effectively utilized (Fernström, 2007).

2.5 Procurement procedures

A procurement process involves finding the best contractor for the job from a technical and economical point of view (Nordstrand & Révai, 2002). From the contractor's view, it is important to consider the competence of the client, as this will affect the workload in the project. If there is lack of understanding between the parties' complications can easily arise. The conditions for cooperation are dependent on how early in the design that the client chooses to procure a contractor. The contractor often wants to enter early in the process in order to create more efficient solutions as so to save time and money. Thus, the contractor must first evaluate which of the available contracts to consider before making calculations or leaving bids.

The process is different depending on if it is a private or a public client (Oberlender, 2000). In the latter case, one must follow the law governing public procurement. This law covers several sectors with the purpose to create competition which in turn leads to more efficiency. Boswell & Walker (2004) claims that it is common to define both basic options and additional options with higher sustainability standards. When evaluating the bids, the client can then choose which offer that best meets the needs according to the award criterions in the tendering documents. These include time, cost, quality, ingenuity and environmental effects. The offer that has best value for money and meets all requirements in the bid package will be selected for the contract. It is possible to use a weighted selection approach that considers the award criteria in different aspects such as qualifications, resources, experience etcetera where sustainability aspects can be included. Depending on the risk, price should be approximately 80 % of the tender and other aspects 20 %.

Boswell & Walker (2004) describes different ways to choose a designer or a builder. Quality based selection (QBS) is a two-envelope appointment system that selects contractor in two steps. First commercial and technical appreciation is evaluated and then in the second step the price will be considered. If the leading bid is under budget it will get the contract and if the top bids are close, the contract will go to the lowest price. QBS is supposedly allowing for factorization of life cycle costs, finding a qualified supplier and testing of quality and price of different design-build proposals before selection. However, if QBS is to be used effectively commitments and benefits stated in the first envelope should be contractual with a margin of profit as an incentive. The method is further not covering selection of subcontractors which can be bought by the main contractor without tendering.

2.5.1 Green procurement

Pressure from shareholders and NGO's is according to Varnäs, Balfors & Faith-Ell (2009) an important factor for the implementation of environmental evaluation criteria in procurements. Private companies are seldom considering environmental aspects in the procurement even if this clearly could be beneficial from a business perspective (Varnäs, et al., 2009). In addition, it is hard for clients to evaluate environmental impact of construction materials in the procurement with the current criteria and therefore it is suggested to implement a new set of criteria. Boswell & Walker (2004) mean that sustainability could be boosted if the procurement procedure could target selected technologies, innovative solutions and performance based building. The latter has a simple concept that builds on terms that the client and the users understand. All building activities are based on the building's performance during its operation rather than on how it is to be constructed. The advantage lies in extended objectives that goes beyond cost, time and quality and include sustainability performance. This mean that suppliers can be more innovative and find cost-efficient solutions that fulfil the sustainability objectives.

Varnäs, Balfors & Faith-Ell (2009) states that the reasons for the limited application of environmental procurement preferences from the clients are due to fear of introducing limitations, bureaucracy and extra costs to the project. Sometimes soft evaluation criteria such as the environmental ones, are minimized to not risk as many appeals after the procurement process. Also, the lack of knowledge

within the field is a factor for not applying the environmental preferences as it can be hard to formulate these to be specific and measurable enough. The survey results indicate that the most common evaluation criteria are waste disposal during construction, harmful substances, working environment and the contractor's environmental management. Driving factors were committed management and procedures from the client (Varnäs, Balfors & Faith-Ell, 2009). The criteria can also function as a way of showing high ambitions which can be motivational during construction work and attract tenders. Furthermore, the organizational culture, environmental policy, goals and strategy of the company are largely affecting the incentives for green procurement.

3 Empirics

The main part of the empirical study is based on interviews with people within the company Serneke Bygg with relevant roles to the topic. For deeper understanding of the topic, interviews has been carried out. The methodology of the interviews was semi-structured in order to get comparable data from the interviewees into the upcoming analysis. The questions in the empirical part i.e. the interviews were based on the theoretical framework. The main content of the questions regards the “Incentives” and the “Barriers” of a contractor to produce and construct environmental classified buildings. The interviews also related to topics of; “Economy” and how the process of certifying green buildings are affected by barriers and incentives, “Stakeholders influence” such as how the general public views companies with a green building certification approach, “Contractual forms” and how different forms of cooperation affects the success-rate of green buildings. A small part of the empirics also relates to procurement methods and how it impacts the process.

3.1 Serneke

Serneke is a contractor active in the construction, project development and property management sectors (Serneke, 2018). The company was founded in 2002 by Ola Serneke and has been one of Sweden's fastest growing companies in recent years. As of the annual financial report of 2017 Serneke has a turnover of 5,6 billion SEK. The future projects in their order stock is worth more than 7 billion SEK. Serneke focuses mainly on projects in the largest conurbations but are also active in nearby cities that are considered attractive according to the company.

3.1.1 Serneke Projects

Between 2013 and 2017, approximately 18 of 80 projects executed by Serneke had or will have an environmental classification rating. However, this number is to some extent uncertain as the certification process sometimes can last for as long as two years after the project is completed. For 2018 there are at least 6 more projects in the order stock is planned to have an environmental classification according to Serneke (2018).

Projects with an Environmental Classification System, 2013-2017

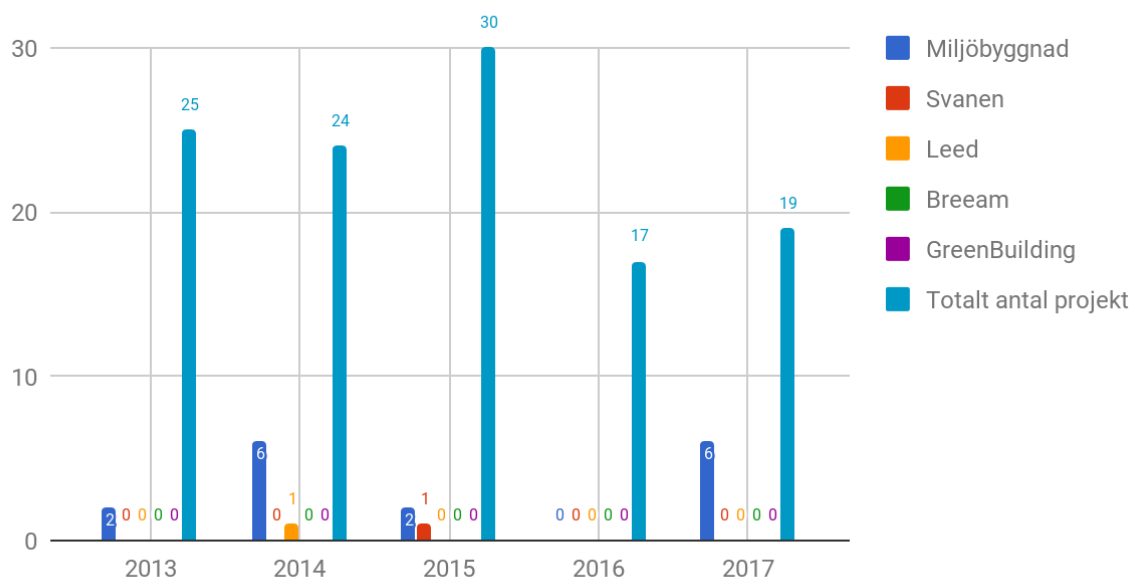


Table 6 - Certified projects of Serneke (Serneke, 2018)

As can be seen in table 6 Miljöbyggnad is the most common system followed by Leed and GreenBuilding. This is in line with the in large construction market (SGBC, 2018). Also, there are examples of projects with the standards fulfilling the requirements, but without the costly classification process in the order stock.

Serneke's environmental work in projects is not only defined through environmental classification systems. According to Serneke Bygg, when doing a project with an environmental classification, a logbook of used products and materials is usually required (Nordström, 2017). This logbook logs products and compare them with environmental databases, such databases are Basta, SundaHus and Byggvarubedömningen. However, a project without an environmental classification system can still use an environmental database. Serneke Bygg states that more than half of the Serneke's projects has requirements from their client to log materials and products through these databases (Nordström, 2017).

3.2 Method of empirics

The interviews were carried out in a semi-structured way, according to the methodology of qualitative interviews by Bryman and Bell (2014). They provided knowledge and defined how the company within the industry related to the topic. One advantage with the open questions lets the interviewee talk freely but the structure lets the questioner to steer the answers in a way, in order to receive relatively comparable data between the interviews.

All interviews were held face-to-face in to give all the interviews the same preconditions. An interview guide (see appendix 1) was produced in order to ensure that all interviewees were asked the same questions, in the same wording, with the variations of a semi-structured interview. The interviews were then divided into chapters with follow-up questions according to the interview guide. This was done for the data collection to be comparable as well as to give all interviewers similar prerequisites and interpretation of the main issue. The interviewer was also given the opportunity to highlight what was considered important in the context of the interview. Another reason for this was to understand the interviewees explanations around the questions where they were allowed to develop their reflections and reasoning. It also gave the respondent the opportunity to express their own perspectives and thoughts.

At the beginning of each interview, an introduction of the purpose was given to the respondent. This was mainly done for the respondent to collect its thoughts around the topic. Also, prior to each interview the respondent received a preparation document in order to cogitate around the questions. After the interviews a questionnaire was filled in to ensure that all data from each interview could be analyzed retrospectively. All interviews were recorded digitally with the approval of the respondent. All above arrangements were also considered with ethical consideration. The interviews were also noted during the interview. An advantage with the recording and noting was that they complement each other as well as to ensure that nothing important from the interview was omitted.

3.2.1 Interviewees

In cooperation with the Health, Safety, Environment & Quality (HSEQ) department at Serneke, statistics regarding number of environmental classified construction projects in the history of the company was gathered. Key persons in different positions within these projects was contacted for interviews. The interviewees had positions as environmental coordinators, production superintendents, Engineering, Procurement, and Construction (EPC) Engineers, production site manager, project managers and division managers. Many of the respondents had a history at Serneke, while some had experiences from other industries or other companies within the industry. In total nine

interviews were conducted with 10 persons from different projects. The interviewees ranged from 26 years of age to 57 years. The interviews took approximately 60 minutes. All interviews were handled with privacy and was therefore anonymized. The interviewees experiences from environmental classification systems and databases are summarized in table 7 below.

Interview no.	Working title	Worked with classification systems and environmental databases
1	Construction Manager A	Miljöbyggnad, Sundahus and Byggvarubedömningen
3	Construction Manager B	Miljöbyggnad, Sundahus, Byggvarubedömningen, Svanen
6	Construction Manager C	Miljöbyggnad
5	Project Manager A	LEED, Green Building, Byggvarubedömningen
7	Project Manager B	Svanen, Sundahus
9	Project Manager C	Miljöbyggnad
7	Site Manager	Svanen, Sundahus
8	Design Manager	BREEAM
4	EPC Engineer	Miljöbyggnad, Byggvarubedömningen
2	Environmental Coordinator	Miljöbyggnad, LEED Sundahus, Byggvarubedömningen

Table 7 - List over interviewees

3.3 Compilation of the respondents' statements

In general, all respondents saw positive contributions of environmental classification systems such as "a better building", "good for the environment", "better daylighting" and "lower energy consumption". However, a few mean that the certificate cost more than it should as the rating systems also want to make profit and consultants are expensive. A few also argued that there is no need for environmental classifications.

The Construction Manager A claimed that it is mostly in the detailed design phase that one can see the difference between a project with environmental classifications and a project without rating. During the production phase the difference is less clear as there is quite much administration and documentation regardless nowadays. The Construction Manager B meant that for clients who are going to own the building for a long time and cannot use the certificate as marketing and justify a higher rent, it would be better to skip the certificate and instead require harder regulations (BBR+) and thereby get a higher quality on their building to a lower cost.

3.3.1 Incentives

In summary the interviewees expressed that incentives for the client and the contractor can be environmental policies, marketing value/branding and PR. A few argued that it depends on what type of project it is, i.e. housing or commercial and who the client is. In general, private property developers are less interested in a certificate, they often want to have a cheap and easy process and sell the building quickly according to Construction Manager B. Whereas a public client is more likely to certify a housing project. This is sometimes also a municipal requirement, the Construction Manager stated that all public housing projects in Stockholm should be rated according to Miljöbyggnad silver and consume maximum 55 kwh/m² and year.

A general opinion was that the market controls the demand. It is important to separate the housing market from the commercial market as the total market consists of clients' contractors, buyers and tenants. In the housing market, demand is primarily driven by environmental-profiling entrepreneurs rather than end-users. In the commercial market, the end user has a greater impact, which has led the clients to demand certified buildings. A general view was also that demand has increased dramatically over the last 5 years. Many interviewees considered it important for contractors to keep up with the development on the market.

3.3.1.1 Environmental and social responsibilities

Regarding responsibilities and sustainability policies most interviewees was of the opinion that this is of course something that you want to do in some way, yet the certificate is not always the best way to do this. In Sweden the lowest acceptable level in the BBR regulations is still rather high compared to other countries. So, for the contractor the main incentive is that there is a demand for it, i.e. the client requests a rated building. On the other hand, one aspect is that certification has become popular in certain types of projects and if you as a contractor do not take on this kind of projects you will lose in reputation.

"The industry is moving more and more towards sustainability and it is important to show that you take environmental responsibility. If you do not hang with the progression you will lose in reputation. For instance, a contractor that does not have the capacity to build houses rated according to Miljöbyggnad will not be able to compete with the others on the market and a client that choose not to certify houses will get worse reputation."

- Environmental Coordinator

This was also emphasized by Construction Manager B who said that:

"If you are going to be in the next generation of contractors you need to be on the frontlines with new technologies, BIM and environmental rating."

Regarding social responsibilities such as a better indoor climate there was a mixed response. A few interviewees claimed a certificate would have a positive impact as this is a part of Leed, Breeam, Miljöbyggnad and Svanen to some extent. Furthermore, the documentation of what materials that are used is good to have in the maintenance phase. However, there was also arguments that we already produce buildings with good indoor climate without the certification and that the client need to choose a very high level on the rating to actually get a difference from the standard regulations.

3.3.1.2 Operating Costs

Looking at energy consumption and operating costs, the overall answer was that a rating can improve the performance but that it depends on how difficult level in the certificate you choose. The Construction Manager A stated that there is a break-even point when the higher investment cost will no longer pay off that you must consider.

“There is a line where it is not worth the money to put in more insulation or make the building denser because it will not pay back for 50 years and in the end, it is about money. That is how we think when designing the building. It is in the interest for both the client and the contractor to leave a building for the next generation that is good for the future and the environment, but it is not necessarily our highest priority when calculating on a bid. In the end we are a company that should generate profit.” - Construction Manager A

It might also depend on what type of building it is and who is going to use it. The Environmental Coordinator stated that:

“If it is a residential house, I think you save more money on lower operating costs compared to an office space building. On the other hand, I think more and more companies are requesting rated buildings and that employees are requesting it from their employer. Especially for big international companies it is important to maintain a good reputation.”

3.3.1.3 Financial Incentives

The interviewees emphasized that there is money in terms of turnover and profit in certified projects. If that is the case it might be due to the fact that the construction sum is higher or that certified projects are associated with poor support from the client and therefore more alterations and additional work. However, many interviewees said that there is a built-in risk in building with high demands from the client. If the contractor can handle the risk as well as being well-informed and experienced in the field, the interviewees confirmed that profit is increased. However, the Environmental Coordinator said that it is difficult to say if profitability increases. As the market demands certified buildings, competition increases and over time certified buildings become a standard that is the basic prerequisite for a functioning market. The Construction Manager B also said that the biggest opportunity for increased profitability is the competitive advantages a successful certified project brings, as well as a strengthened brand due to experience.

The general perception of market value was that it would increase with a certificate. Construction Manager A argued that this is a result of having a third-party organization that examines and approves the building. The majority assumed that the market value becomes higher as the yield should increase with lower operating costs. However, there were uncertainties in the answers as the majority of the interviewees represent the entrepreneurial side and not the client side. Both Construction Manager B and Project Manager B was critical of the need for certification systems. They meant that a good client can get good operating costs without using a certification system and thus save money. Again, this depends on what type of building it is and what type of activities that will take place in it.

There were also different opinions about whether the income can be increased. If one can communicate the advantages with a classified building to tenants you should be able to claim a higher rent. However, when building housing projects, it might not be requested by the market and the consumers. A few of the interviewees pondered the issue and told that many of the certification systems are not enough well-known among consumers. The EPC Engineer meant that during a construction boom and when there is a housing shortage, there are other factors that affect the choice of housing and its properties.

The EPC Engineer stated:

“In this case it was a residential building for elderly people and then I do not think you see it that way. You might do in normal residential buildings, but then since the housing shortage is rather high I do not know how much you consider this. In office buildings I think it is more the location that matters the most.”

The Construction Manager C claimed that the apartments became more expensive but it is hard to say if tenants are willing to pay more, even though we are quite environmentally aware in Sweden and buy ecological products etcetera. Here, the Svanen brand has the advantage that it is widely known with the people, according to the Construction Manager C.

The Project Manager A with a lot of experience from working with LEED did not believe that the consumer wants to pay more for it. The Svanen certification rather leads to a strengthened brand for the owner than a significant price raise. The Project Manager A further argued that it is mainly big international property owners that enjoy the advantages of environmental rating, mostly on commercial buildings. He referred to LEED buildings and that global companies can say that all their buildings around the world has the same high environmental friendly standard. However, in a Swedish context he meant that public clients could be more effective and choose higher energy requirements and so on without choosing to classify their buildings.

During the interviews the majority expressed the belief that the increased cost for certifying will be amortized over time. However, there were many who did not really know the exact calculation, but many agreed on that there is a break even for the investments. The Construction Manager B said that the client considers the break even in the investment calculation. The Design Manager meant that the highest return rate on investments are the energy-efficient systems, which lead to cheaper operating costs. However, he did not believe that the full range of environmental certification will pay back.

3.3.1.4 Stakeholders Influence

There are many stakeholders in a project, each of these has got their own incentives with different possibilities of impact depending on project type.

The majority of the respondents claimed that the client has the most overall influence, especially since the client represents the demand from the market and many times also is to be considered as the investor in a project. The client has the opportunity to control the entire chain from pre- design, further demands in the tendering process to construction and to facility management.

A few of the respondents reflected around the impact from external investors. The Construction Manager C with experiences from Miljöbyggnad reasoned around whether some international private equity companies might request classifications in order to minimize risk and also if the property value might be increased. The potential classification might attract more property renters which can lead to a higher rent. He also reflected around if a decreased energy consumption together with the classification leads to a higher value and therefore lower investment costs in percentage

The Project Manager A with LEED experiences mentioned that many technical consultants has been lobbying for environmental classification systems with the ulterior motive to be more requested, i.e. sell more services. The interviewee also stated that property owners has been lobbying for classifications, maybe with the motive to increase the value of their properties.

In a potential case where a contractor becomes an expert at a certain classification system, it opens for greater impact where the contractor can use his "know how" to influence the client and make profit. The Construction Manager C emphasized that this is what partnering is about and that in those cases the contractor actually can do considerable impact. Project Manager A also stated that some contractors early on have been lobbying for certain classification systems. It is thus possible to affect the market if you have enough knowledge and resources.

Politicians and municipal officials are stakeholders with a great potential impact. In extension they control the laws and rules and are also big landowners and advocate to many municipal clients. These

stakeholders have for example determined a regulatory framework in Stockholm and Gothenburg where sold building rights need to fulfill a certain classification or certain key operation costs.

The certification organizations also has a great interest in successful certifications and also a potential impact. For example, The Site Manager and Project Manager B claimed that the certification organization Svanen had lobbied to the client to use their certification system. The Project Manager A with international experiences highlighted that the certification organs gain profit when environmental classifications are wider used and therefore also are a stakeholder with impact

3.3.2 Barriers

When asked about what barriers there might be in choosing a certification, all respondents at least mentioned that the cost is higher. The fact that the rating process itself cost relatively much money seem to be something that many see as a barrier. A few meant that it is an unnecessary cost as the building can be just as good without the certificate. The experienced Construction Manager C argued that it might be unreasonable costly but that this is probably not a barrier at least for public clients, if so it affects private clients more, those who wants to make money fast. The all over answer was that the cost will go to the client in the end but that you need to be aware of the costs as a contractor when calculating the bid. Thus, if you have the competence to build a “green building” without the rating system, you can save money.

“It is the money, let us say that you are a contractor who is going to build an office building that you are going to operate for 50 years, in this case you might not see the point in rating it. You can build a super dense, well insulated house with environmental friendly materials but there is no point in having someone else classifying it from their criteria unless you can use this in your marketing and get money in return that way.”

- Construction Manager A

Think of an in-house project where you can choose whatever systems you like, as long as you fulfill the BBR requirements, then you can avoid a lot of extra costs that you would have with a rating and still build a “good” house. However, if the client requests a rated building and as a contractor you have good internal competence around this rating system you can make or save money in the project. If the demand is right, the end users of the building will pay for the rating.

“Many of today’s clients have the requirements of Miljöbyggnad as a backbone in the project but not necessarily with any ambition of applying for a certificate. We have the criteria for the silver level but if we notice that by any reason it would become hard to reach these without an unreasonably high investment that’s a good argument to skip it. This is especially usual in a partnering contract with a well versed public client.”

- Construction Manager B

3.3.2.1 Resource demanding processes

All interviewees agreed on that a classified project is more time consuming. There are a lot of details to consider. You need to be aware of what it actually includes both in the design phase and the construction phase. The Design Manager explained that as a contractor, one is aware of that the process is different and that it becomes iterative since many instances needs to cooperate. He emphasized that as one has to start analyzing the client’s needs and requests and see what is possible with the requested rating system. Then one can start designing but one need to stop and evaluate at several stages. Typically, the contractor hires consultants to help with different tasks during the design.

“Within the design phase it feels like most people are on track, it has become quite standard with rated buildings. However, it can probably be perceived as harder with all the extra documentation

and so on. Especially if you have not worked with product databases before, it can seem hard to do research of what products that are allowed to use before buying them.” - Environmental Coordinator

The EPC Engineer emphasized the importance of having enough time in order to succeed with a certification. In many projects the lack of time might be a barrier to success.

“The greatest barrier I would say is the lack of time. As you want to start building as fast as possible, often before all documents are complete. This makes it very hard to succeed with a certificate.” - EPC Engineer

The Construction Manager C argued that it is important that a contractor can come in during the early design phase and look at buildability. If not, there is a risk that the documents do not give the right opportunities to succeed with the certification. Another risk depending on the documents are the time factor as well. One need to be aware of what one need to do during the construction phase to succeed. Depending on the project size and certification level one might have to put in extra resources that support the management on site with administration and documentation.

3.3.2.2 Uncertain Demands

When asked about the demand for certified buildings, the overall answer again was that it depends on the building type and who the end user is. A few were more positive and argued that there is an adequate demand if you do the marketing right and showcase the advantages that the certification brings. Others stated that most residents do not have a certification as requirement to buy or rent an apartment. A factor could be housing shortage, that we are experiencing. However, if one look at commercial buildings the demand could be higher as the certified buildings can be a part of a company's branding.

3.3.2.3 Knowledge Gaps

Several interviewees emphasized that a common barrier can be lack of knowledge. The tender documents can be rather complex and both the client as well as the contractor are not always fully aware of what these implies. This is different between clients of course, some have very good knowledge but some are not fully aware of what they actually are requesting. The Design Manager expressed it as one client in a project had an idea that they could pretty much build what they wanted and then pay some extra money to get a certification. The Design Manager emphasized that this was not the case, and he clarified the knowledge gap. Further he argued that clients with less knowledge who does not provide good tender documents will lead to expensive projects. This, together with many other factors, depends on the early design specifications. The risk as a contractor is that one does not calculate with all the extra costs that comes with the certification e.g. more hours and more expensive materials etcetera. The Construction Manager B emphasized that there is a knowledge gap between actors on the market. He emphasized that clients with good knowledge rather chooses not to certify the building and instead putting the money on making a better building, without certification. He also meant that some clients with less knowledge rather certifies a building but with a higher cost.

3.3.2.4 Stakeholders influence

There are many stakeholders with different possibilities of impacting depending on type of project. Some stakeholders can represent barriers in the environmental classification work, which are described in the following paragraph.

Depending on which contractual form the client demands he can also influence the participation during the detailed design phase. The interviewees emphasized the importance that the client is dedicated and committed as well as knowledgeable. Either with own competence or through an

external design manager. The respondents were of the opinion that the degree of engagement from the client are of significant importance when it comes to the final cost and the success of the project. In cases where the client does not pay attention to these factors, the success rate of classified projects might be affected and can therefore be seen as a barrier.

The design team has also a great impact on the degree of success. Both the EPC Engineer and Project Manager A emphasized that they set the framework for the future construction, mainly through the decisions regarding installation solutions and choice of products.

The Construction Manager B and Project Manager A stated that an investor probably doesn't value a classification, he should rather value a property with better qualities and operating costs. The Project Manager A stated that:

"The building itself doesn't know if it has a classification or not"

The Project Manager A said that the actual classification isn't the cause for better operating costs. It is rather the method and material choices that leads to better qualities of the building. Thus, Investors who doesn't value the classification can be considered as obstacles in the classification work.

Other barriers were brought up by the interviewees but they were not viewed as significant. Two Construction Managers emphasized that lack of resources could lead to a higher risk both in the tendering stage but also in the construction phase.

"A contractor can choose not to calculate on a Breeam project due to lack of resources and instead go for an easier project that does not require the same resources. A hard environmental class might need an extra full-time employment which in the end cost an extra million SEK. If you can manage the rating with less resources than you have calculated for you make a profit but this is also an extra risk." - Construction Manager A

Project Manager C also emphasized that the entrepreneur might see risks in classified projects and could therefore prioritize easier projects.

3.3.3 Regulation

Regarding harder regulations or certification requirements from the government the interviewees expressed different views. Some were positive towards the idea of certification on all new commercial buildings, while others meant that the industry can self-regulate and does not need an extra push. To begin with the current minimum BBR regulations equals miljöbyggnad bronze and are not very different from "good" levels in the international systems. Therefore, a few argued that harder regulations on all buildings would not be reasonable since it would become more expensive to build and to live in these buildings. In addition, as the Environmental Coordinator emphasized, the municipalities do have their own environmental programs, e.g. if you buy land in Gothenburg you have to follow the guidelines in their program "environmentally sound construction" if you are going to build a residential house. The program guidelines are covering seven areas:

1. Persistence
2. Health - Indoor Climate
3. Environmental Impact
4. Resource Management
5. Noise Protection
6. Energy Conservation
7. Moisture Protection

Each has control values which are to be documented and reported to the city building office and the property office (Göteborgs Fastighetskontor, 2010). In this context it is clear that one has to choose a high level in the certification to get a better building. Both the Construction Manager B and the Project Manager A argued that if one is a skilled client one can save money by ignoring the certificate and instead specify harder requirements for energy conservation, energy sources, moisture, products etcetera.

“Choose BBR+ or BBR ++ and let the permits officer examine this, the only difference for them is that they also get an energy and daylight calculation together with a product database.” - Construction Manager B

The experienced Construction Manager C explained that Stockholm city already has requirements for all public new produced residential houses that they have to fulfill Miljöbyggnad silver and also cannot consume more than 55 kwh/ m² each year.

The Design Manager stated that it would benefit the industry if there was only one system that everybody had to comply with. He meant that this would increase the knowledge in the sector and that this would benefit the market and the end users. However, to make the minimum BBR regulations harder so that they are more like Miljöbyggnad silver rather than bronze would not decrease the construction costs but increase these even more.

3.3.4 Economy

The majority agree that certification entails increased costs, both in terms of design, but also when it comes to production. Thus, there was different opinions about how much the economic impact are. The majority of the interviewees said the design phase are more expensive since there is more coordination required between the instances as well as more external consultants involved depending on knowledge needs. Furthermore, the majority emphasized of the importance of putting a lot of resources in the design phase in order to succeed with the project's objective, which also explains higher costs. Thus, the Design Manager stated that the methodology in the design phase is more effective since a certification demands a certain approach.

“It is more time consuming and the detailed design is harder, as well as leading to more expensive products. It is important to consider this and calculate with more resources instead of overload the site management.” - Design Manager

The majority also disclosed that production methods and materials entails higher production costs. The production also requires more resources, as much time is put on administrative work, for example documentation with checklists etc. A risk brought up by the experienced Site Manager was that certain products, which must fit in the requirements of the databases or the classification, might be in short supply on the market and might lead to higher costs. He also told of an inertia of product suppliers to certify their products due to higher costs. The Construction Manager C claimed that the suppliers can affect the outcome of a certification and also the price of products as they do not always have products that live up to the requirements, e.g. windows with adequate U-values.

3.3.5 The rating systems

Since Miljöbyggnad is developed and adapted for the Swedish market it is preferred by many of the respondents in Sweden. Miljöbyggnad is mainly preferred since it leaves a degree of flexibility within the ratings. Construction Manager B stated that the degree of flexibility was optimal for the Swedish market where different regional areas had different conditions. The same argument regarding the flexibility was brought forward by Construction Manager A, but emphasizing the contractor's flexibility in choosing the easiest and most profitable solutions, but with the condition that the project stayed in

the predetermined classification rating. This was also brought up in the first interview by the Construction Manager as a potential disadvantage for the general public since it made projects with the same classification unequal and difficult to compare.

The general view on the international systems, BREEAM and LEED, was that they weren't customized enough for the general Swedish market. They originate from countries with big differences in environmental conditions (such as climate) as well as in regulations. The Environmental Coordinator stated that it is vital that the rating system is adapted for the market where it shall be valid/used.

The Environmental Coordinator also stated that the international systems can be of great use when it comes to international actors wanting to get a grip on many markets but with one standard or system. The companies SKF and Skanska was brought up by many interviewees as examples of companies who had all their regional headquarters certified with LEED. Many argued that this was attractive for many potential and current clients as well as many other stakeholders. The Construction Manager A and Project Manager A talked about the potential value for international private equity companies in terms of minimizing the risk of their investment by only owning internationally recognized and certified buildings.

“International certification systems are a good choice if one what to market in an international context, depending on the size of project etc.” - Environmental Coordinator

Many brought up BREEAM and BREEAM Communities as good examples of systems observing neighborhoods and not only the buildings within the area. In terms of taking responsibility for the bigger community. The Environmental Coordinator stated that it is vital to not only see environmental classifications on a small-scale level, but to see synergies between buildings and take advantage on the collaboration between future projects. A few of the interviewees also talked about sustainable city development and many of them mentioned “CityLab” by SGBC as a future commonly used Swedish system.

The Design Manager who only had worked with BREEAM in the pre- design phase but without any successful classification argued that the way of thinking within BREEAM developed the project in to a better project. Mainly in terms of the working environment at the construction site, but also regarding rainwater storages and the projects long-distance heating and cooling system.

During the interview with Project Manager A, it was emphasized that it is worth paying attention to that the certification organizations works for profit. Accordingly, it is in their interest that the certification goals are achievable in order to ensure that many projects get certified while at the same time ensuring an expected quality level.

“The certification organizations have a great influence and a great interest. They are profitable and therefore want many certifications. For example, South Africa “they saw between the fingers” since they didn’t want the project to fail and to discourage other builders to build Leed buildings. They earn no money to deny...” - Project Manager A

In the end, the classification rating system has to be chosen with regards to the type of project, regional area as well as who the client and users are. This was especially emphasized by the Environmental Coordinator, but also by many others, on the topic of which of the classification systems that was preferred.

A few were dubious if it is really needed with certification systems. A good solution with clear guidelines might be to require higher standards in BBR or similar.

3.3.5.1 The rating databases

Many of the classification systems are associated with product databases. Many of the interviewees has worked in multiple product databases with the general opinion are that they are similar to their purpose. Depending on who is paying for the database and which role the interviewee has, different databases are preferred. When the contractor pays for the database Byggvarubedömningen is proposed while Sundahus is desired when the client pays. Sundahus is also preferred by the contractor's production personal due to good user friendliness and content.

The Site Manager and Project Manager B described a problematic situation when Svanen renewed its database. In connection with the remake, the contractor, together with the suppliers, had to renew the database and pay for the work. This was a reason for preferring the other databases but also an obstacle in general for the databases who are dependent on the interaction from the suppliers and contractors.

3.3.6 Contract Forms

Many of the respondents stated that when the contractual form is DBB the client can usually expect more change and additional work in terms of work regarding the classification. This is quite common for DBB projects in general and the environmental classification work is not an exception. The Environmental Coordinator argued that if the client has a good knowledge and also are willing to take a greater risk DBB could be a successful contractual form. This argument was substantiated by the Project Manager A with experience from working with LEED who was of the opinion that DBB is preferred if the client has good knowledge and taken all aspects into account. The experienced Construction Manager C was of the opinion that DBB is a great contract form if the contractor has to opportunity to give input in the design phase regarding the future constructability. Further he was of the opinion that the clients more frequently requested input and feedback from contractors nowadays in phase-based cooperation.

"A DBB is a good choice if the client has done a well-executed detailed design, if not there is a greater risk of additional costs" - Environmental Coordinator

Since all of the respondents represented the entrepreneur side, many still advocated DB contracts. An argument stated by the Environmental Coordinator, but which also was stated by the majority, was that with more control over the detailed design, the project also had a better success rate. The Stockholm based Construction Manager C stated that with the uncertainty regarding the client's representatives' competence it is less risk for the contractor to own and control the design phase. The Design Manager stressed a risk in a DB, where the client could have done a poor pre- design where at the same time the contractor wants to build cheap and with a good profit. In projects like this, the success rate for the classification might not be good.

Partnering was also a proposed form of cooperation since both the aim and the spirit in the project are mutual. The Environmental Coordinator emphasized that when partnering is applied all parties can provide knowledge from their perspectives as well as from their experiences. Many of the respondents highlighted that the impact on the rating system in fact was more dependent on the client, tender documents and the detailed design than on the contractual forms. If the client has a good knowledge of the classification system and is aware of what is requested in the tender documents, then the actual contractual form doesn't impact the classification nor its success rate. Many also argued that the framework and the goals are dependent on early involvement and a well-executed design phase. Thus, the Construction Manager B as well as interviewed Design Manager emphasized that the contractual form had a considerable impact when it came to more challenging projects. In these challenging and complex projects collaboration and partnering are of great importance in order to achieve the goals.

The Project Manager B also emphasized the importance of partnering when it comes to the ability to influence prerequisites. The EPC Engineer spoke in terms of early involvement from the future user by letting them influence the design in order to produce better buildings.

“Partnering is always good choice, but a DB is also to prefer. It depends on who are involved, the contract form has actually a small-scale impact. In complex projects where systems are difficult to describe sufficiently clearly in the tender documents, partnering provides better prerequisites” - Construction Manager B

3.3.7 Procurement

The clients usually put high demands on the contractor’s experiences in the tendering phase. The client usually demands resumes from key persons as well as reference projects. Many of the interviewees was of the opinion that during a booming construction market as of today, the clients don’t put enough demands on previously experiences. A few on the interviewees couldn’t tell any differences regarding the client’s assessments depending on economic cyclically (booming market). The Environmental Coordinator was of the opinion that the municipal clients should put even higher demands on previously successful collaborations between the client and the contractor rather than on the actual contract sum. The Site Manager believed the client has to consider the regional market before demanding too much of the contractors, the lack of experiences might affect the number of bids submitted in smaller regions.

There was a recurrent opinion that there is a difference between municipal and private clients. The public actors are governed by the Swedish Public Procurement Act and therefore more interested in collecting and assessing references. The private actors’ values previously successful mutual projects ahead of references.

3.3.7.1 The Tendering Process

All interviewees were asked a question regarding the tendering process and if it has to change due to the fact that classified projects are more common nowadays. The majority of the interviewees thought that the process shouldn’t change while some others underlined the need to consider the expenditure of time since there are more things to pay attention to. Another opinion regarding the tender process came from Project Manager B where he emphasized that a contractor sometimes is a bit too fast in the tendering process, which leads to soaring unexpected costs. They meant that these experiences are important to take into account regarding the future knowledge transfer.

All respondents talked about making a risk assessment during the calculation phase in order to assess the relation between internal and external resources as well as understanding the clients’ needs. The Construction Manager B talked about the importance of the gut feeling, which is based on previous experiences. Both in terms of evaluation the tendering documents but also in order to estimate the resource requirement for the project. It is thus a challenge to estimate the need from external consultants as well as dedicated internal resources for the administrative tasks related to the classification. The LEED experienced Project Manager A was of the opinion that the contractor doesn’t usually consider calculating an extra internal resource. He together with the Construction Manager A meant that it is difficult to win the project if the contractor has calculated in all the costs together with a risk supplement. The Design Manager stressed the importance of being prepared for higher material prices.

“I don’t think a contractor choose to add on extra resources in the calculation phase, it depends on how well the design is done. If there are very incoherent tendering documents, a contractor may have to put in an extra resource that connects everything.” - Project Manager A

4 Analysis and Discussion

This chapter aims to compare the previous research with our findings from the empirical study.

4.1 Incentives

The interviewees expressed that incentives for the client and the contractor can be environmental policies, marketing value/branding and PR. This is in line with what the previous research says as it is emphasized that corporate policies certainly can be drivers for sustainable buildings and that end users who take environmental responsibility into account as a competitive advantage introduce a client demand (Häkkinen and Belloni, 2011).

It is further stated in previous research that the industry believe that green buildings can improve the environment and social values for the occupants as green buildings often offer, for instance, better daylighting and air quality for the employees than traditional buildings, the improved working environment in turn lead to higher productivity (Bahaudin, et al., 2013). It also reduces sick time and improves the working place occupancy. Here it is important to consider what is meant with a “green building”. As our results showed, it does not necessarily equal an environmental rated building as you can build a house that is just as “green” without the certificate.

Regarding responsibilities and sustainability policies most interviewees had the opinion that this is of course something that you want to do in some way, yet the certificate is not always the best way to do this. In Sweden the lowest acceptable level in the BBR regulations is still rather high compared to other countries. So, for the contractor the main incentive is that there is a demand for it, i.e. that the client requests a rated building. Regarding social responsibilities such as a better indoor climate there was a mixed response. Some interviewees claimed a certificate would have a positive impact as this is a part of Leed, Breeam, Miljöbyggnad and Svanen to some extent. Furthermore, the documentation of what materials that are used is good to have in the maintenance phase. However, there was also arguments that Sweden already produces buildings with good indoor climate without the certification and that the client need to choose a very high level on the rating to actually get a difference from the standard regulations. Looking at energy consumption and operating costs, again the overall answer was that a rating can improve the performance but that it depends on how hard level in the certificate you choose.

The previous research by von Paumgartten (2003) also says that investment in “*green buildings*” can lead to financial benefits as e.g. higher market value, more tenant attraction and increased rental rates. Comparing this with the empirics, the general perception was also that the market value should increase with a certificate. This could be a result of having a third-party organization that approves the building. Furthermore, there was some different opinions about whether the rental rates can be increased. If it can be communicated about the advantages with a classified building to tenants one should be able to claim a higher rent. However, when doing residential projects, a certificate might not be requested by the end users. A few of the interviewees pondered the issue and tells that many of the certification systems are not enough well-known for the consumers. There were uncertainties in the answers as the interviewees represent the contractor side and not the client side. When asked about the demand for certified buildings, the overall answer again was that it depends on the building type and who the end user is. A few argued that it is probably most big international property owners that can enjoy the advantages of an environmental rating, mostly on commercial buildings. There was also some who were more positive towards housing projects and argued that there is an adequate demand if you do the marketing right and showcase the advantages that the certification brings. However, most believed that residents do not have a certification as requirement when choosing an apartment. A factor could be the current housing shortage on the Swedish market stated by EPC Engineer.

4.2 Barriers

When asked about what barriers that hinders a certification, all respondents mentioned that the cost as being one. A few claimed that it is an unnecessary cost as the building can be just as good without the certificate. Thus, if you have the competence to build a “green building” without the rating system, you could save money. The certificate might be unreasonable costly according to the interviewees; however, this probably affects private clients who wants to make fast money more than public landlords. This is also brought up in the theory chapter as it is stated that economical life-cycle thinking is often ignored by those who pay upfront since they do not receive the long-term benefits or because those benefits are rapidly discounted (Yılmaz & Bakış, 2015). Owner-occupiers have a higher desire to own sustainable buildings than ordinary investors, since the investment horizon might be longer (Bordass, 2000).

The majority of interviewees also expressed that higher production costs are incurred due to more expensive production methods and materials. The production furthermore requires more resources in terms of more administrative work. All interviewees confirmed Wallentin’s (2014) research that a classified project is in general more time consuming. There are a lot of details to be aware of in the design and what these actually implies during the construction phase. The cost will go to the client in the end, but a contractor needs to be aware of these when calculating the bid. Depending on the project size and certification level, extra resources should be there to support the management on site with administration and documentation. A majority of the interviewees confirmed what Varnäs, Balfors & Faith-Ell (2009) also stated, that a common barrier is lack of knowledge. The tender documents can be rather complex and both the client as well as the contractor are not always fully aware of what these actually implies.

The previous research by Pitt, et al. (2009) has found, the most important barriers, affordability, lack of client demand and lack of client awareness are in the top. Here, the client is seen as the principal stakeholder who determines what sustainable functions to have in a building. The client has the opportunity to control the entire chain from pre- design, further demands in the tendering process to construction and to facility management. The interviewees emphasized the importance that the client is dedicated and committed as well as knowledgeable. The degree of engagement from the client is of significant importance when it comes to the final cost and the success of the project. In cases where the client does not pay attention to these factors, the success rate might be affected and can therefore be seen as a barrier. According to Hydes and Creech (2000) solutions for sustainable buildings are limited since clients are concerned about higher risks based on the lack of experience and unfamiliar techniques. This is something that the interviewees argued can be true for some minor clients but in the big picture most clients have enough experience today to not see this as a barrier.

In addition, our result point to that the design phase is more expensive since more coordination is required between the instances and that more external consultants often are involved. Pitt, et al. (2009) points to that designers plays an important role, since they participate in early stages when many decisions are made. Contractors has a more limited role when it comes to the decision of if a building should be rated. However, the empirics confirm that it is important that a contractor can come in during the early design phase and look at buildability. If not, there is a risk that the documents do not give the right opportunities to succeed with the certification. The holistic approach that involves integration and collaboration is emphasized by Yılmaz & Bakış (2015) and in the empirics. Contractors and clients that wish to build green and certify buildings need to integrate people and processes for successful projects and end products.

4.3 Economy

The research by Yılmaz & Bakış (2015) says that the return on investment is higher and that there are positive effects on capital- and operational expenses in green building compared to regular

construction. Even if construction costs are higher in green buildings by 5 -10 percent studies show that they will amortize themselves in 1 -15 years as the operation costs are lower. Observations has been made where an extra 5 percent of construction costs due to investments in energy efficient features can result in a 10 percent reduction of operating cost during the building's life cycle (Yılmaz & Bakış, 2015). Our results showed that some believe that the increased cost for a certificate will be amortized over time. The interviewees agreed on that there is a break even for when the investments pay off but they were not certain enough to talk about any numbers here. Several interviewees pointed to that the highest return on investments should be on energy-efficient building systems, which lead to cheaper operating costs. However, from a pure financial perspective the full range of criteria in an environmental certification will probably not pay back.

The results showed that from a contractor view it is hard to say if the profitability increases when building a rated house compared to a non-rated house. The contract sum is in general higher but there is also an increased risk. If the contractor has good knowledge within the certification system they can most likely handle the risk and make business on these kinds of projects as they can calculate with a certain amount of time but use less and in that way, earn money.

4.4 Regulations

According to the research by Pitt, et al. (2009), building regulations are identified as important drivers for supporting sustainable construction by professionals in the industry in UK. From the interviews there were incoherent responses. Mainly depending on which role and experience each interviewee had. Some argued for stricter regulations, such as "BBR+" and "BBR++", in order to reduce the amount of certification programs. One interviewee argued that it would be better if there was only one system on the Swedish market as this would lead to increased knowledge since all stakeholders then only would have one system to comply to. Thus, it could maybe discourage international stakeholders with a knowledge disadvantage. Some of the interviewees brought up that several municipals already demand higher performance than what the current regulations does. These interviewees argued for increased client knowledge rather than stricter regulations, which might lead to higher demand of responsibility on the client. A risk with more responsibility put on the client could be a potential knowledge gap, since the client might not have the ability to manage higher knowledge compared to a certification system. The same interviewees talked about the benefits which clients with high demands could take advantage of. The theoretical chapter and the interviews don't examine the topic of whether stricter regulations are to prefer or not.

4.5 Classifications systems

The empirics and the information given by Sweden Green Building Council (2018d) identified that Miljöbyggnad is the most commonly used system on the Swedish market since it is adapted to the Swedish regulations, but also since it leaves a degree of variation. This is also identified by Wallentin (2014) where the connection to the Swedish regulations is seen as an important advantage which makes it fairly easy to certify a project.

The research by Wallentin (2014) states that internationally recognized systems are good alternatives for international stakeholders, which is also emphasized in the interviews. Furthermore, it is claimed that the international systems often are more expensive as well as more resource demanding but contributed to lower operation costs. This was neither confirmed or denied in the interviews. Some meant that the international systems are not customized enough for the Swedish market, this can be seen in both the literature as well as empirics. This can lead to that Swedish clients might not use the international systems since they aren't adapted to the Swedish market.

The research by Wallentin (2014) states that the certification systems all focuses on different areas which makes it difficult to make them comparable. The fact that the systems focuses on different areas

was not clearly identified in the empirics. This could have been due to the fact that the interviewees represented the contractor side and the literature research was based on interviews with clients and consultants (Wallentin, 2014). Some of the respondents meant that there are too many systems on the market, handling the same requirements.

There are many aspects to consider when choosing a classification system e.g. who the owner is, who the end user is and what requirements they have. The owner and users might not be as long term as the building itself. The research by Jakubova & Millander (2012) means that the choice of classification system must be preceded by a decision on what the purpose is and the level of environmental work that will be carried out. This was confirmed in the empirics as the interviewees stated that the choice of system depends on the client's demand.

Furthermore, it was emphasized in both previous research by Wallentin (2014) and as our results show, if more clients demand and choose a rating system for their buildings, the cost would decrease due to the demand driven market. The reflections upon lower costs for all cost items due to greater demand is explained by the fact that higher demand will drive the market of demand and supply to a new established standard.

4.6 Contract forms and procurement

It was found in the empirics that the contract form mainly regulates who is responsible for the detailed design and that this does not necessarily affect the project or the rating as long as everyone involved does their part. However, both the previous research by Boswell & Walker (2004) and the empirics stressed the importance of considering and designing for sustainability at an early stage of the project. Further it was highlighted that the knowledge from the detailed designer is related to the project's risk and therefore contractual form. The project risk relates to the success rate of the project for all involved. Also, it was described by the interviewees as an important factor by the contractor, when choosing what project to get involved in. Some meant that a contractor might choose not to get involved in a project depending on who performed the design, since it can lead to unnecessary extra workload and future discussions. The research by Nordstrand & Révai (2002) states that a contractor needs to consider the competence of the client, since it will affect the workload of the contractor in the project.

Many of the interviewees advocated early contractor engagement in order to be able to contribute with their expertise, i.e. to build. This is in line with previous research, which has shown that there are advantages with early contractor engagement as the higher degree of integration between design and production gives a better result (Boswell & Walker, 2004). Both DB and DBB allows early engagement, yet the majority of the interviewees advocated DB contracts since it gives the contractor more control. If the client is doing all the design, the contractor cannot be certain that it is actually buildable. The interviewees further stressed that DBB contracts usually are associated with more alterations and additional work, depending on the clients detailed design. Thus, when the client has environmental preferences and does a lot in the detailed design, it is of great importance that he has the knowledge and experience that is required.

In order to reduce risk and enhance trust both the previous research and the empirics showed that partnering is a good form of cooperation (Fernström, 2003). He further claims that partnering is of best use when the project requires an extra comprehensive design or when the parties has a cooperation that continues over time and several projects. The empirics confirmed that this is applicable on projects with an environmental classification.

In the procurement process it is possible for the client to use a weighted selection approach that considers the award criteria in different aspects such as qualifications, resources, experience etcetera

where sustainability aspects can be included. The previous research has indicated that that private clients are less likely to consider environmental aspects here due to fear of introducing limitations, bureaucracy and extra costs to the project (Varnäs, Balfors & Faith-Ell, 2009). However, the interviewees rather emphasized that the tendering process nowadays always considers a weighted selection approach and promotes previously experiences, both in terms of environmental aspects but also in terms of time and economy. Some interviewees promoted the selection approach since it by nature regulates the market, in terms of competition.

The previous research by Boswell & Walker (2004) emphasizes new procurement procedures where the client can request selected technologies and more innovative solutions. This was however not emphasized in the empirics as the majority of the interviewees thought that the process shouldn't change. This is again the contractor view and not the client's.

Furthermore, a few of the interviewees underlined the need to consider the expenditure of time since there are more things to pay attention to in environmental rated projects. There is a built-in risk in tendering since the contractor sometimes can't put in enough resources in the tendering process. This can lead to soaring unexpected costs.

4.7 Project based organization

The previous research states that since the construction industry are project based with temporary organizations, with the task of assembling a set of sub-tasks (Kadefors, 1995). It means that the knowledge transfer can be challenging in the industry. The interviews confirmed this claim and identifies that knowledge transfer can be an issue. Knowledge transfer in terms of certification and workload can be challenging for the project organization previous research by Gluch (2009) states that coordination between the permanent organization and the project organization can be associated with problems when it comes to organizational learning. The majority of the interviewees argued for the need of support from internal groups within the organization in order to maintain and always be updated on the latest regulations within the certification systems. It can therefore be confirmed that the empirics and the previous research emphasized the same subjects in terms of project-based organizations and knowledge transfer.

5 Main conclusions

This chapter aims to answer the research questions and to present additional conclusions.

5.1 What are the different incentives and barriers for a Contractor to build environmentally-rated buildings?

Based on our findings incentives for the contractor can be environmental policies, marketing value/branding and PR as some certified projects easily can be showcased as a part of an environmental friendly profiling for the company. However, we can further conclude that the main incentive for a contractor to do projects with environmental classification is that there is a demand for it, i.e. that the client requests a rated building.

Our results suggest that the cost is higher in rated projects. The fact that the rating process itself cost relatively much money might be a barrier, at least in minor projects where the marketing value does not pay back. This is something that mainly should affect the client. On the other hand, the production cost is also higher as well as the design cost, this is due to the more resource demanding nature of rated projects which might be a barrier for the contractor depending on their in-house resources and what knowledge and experience they have. Furthermore, we see that a common barrier is lack of knowledge. Both client and contractor are not always fully aware of what the certification process implies. If one or more parties does not have sufficient knowledge the project will most likely go over budget if it is even possible to succeed with the intended rating.

5.2 Which building types are best suited for environmental rating? What is the demand?

Regarding the demand for certified buildings, the conclusion is that it depends on the building type and who the end user is. The perception is that different sorts of clients has different agendas with a rating. Most likely it is major international property owners that operates commercial buildings that has the highest demand for buildings that are rated according to LEED or BREEAM. A Swedish public landlord would instead probably choose Miljöbyggnad which fits better with the national regulations or Svanen which is more well known around the end users. A private client who want to make fast money will probably not value a rating high and is likely to skip the process.

5.3 Does the contractual form affect the environmental rating in a construction project?

Both the previous research and our results advocates for early contractor engagement together with the design team in order get a better result in the production. The interviews clearly emphasize the importance of a well-executed detailed design, while at the same time preferring different contractual forms, with an advantage to DB. The reason why DB was more favorable in the empirics depended on the increased control for the contractor and therefore a reduced risk. A conclusion is therefore that the contract form doesn't really affect the success rate of the project, it rather depends on how well the design is executed. It can also be concluded that partnering is a favorable form of cooperation, especially in more complex projects where integration between all involved parties are a prerequisite.

5.4 Additional conclusions

Another conclusion is that the client is the principal stakeholder with the main incentive to classify a building. The client has a very important role and the interviews confirmed the importance of dedication and knowledge from the client in order to succeed with the project.

The designer also has an important role, since they participate in early stages when many decisions are made. The role of the contractor regarding environmental classification is mainly to look at the

buildability and see if the suggested design is possible to carry out. Thus, an important conclusion is that integration of the different actors in the early design phase is key to succeed with an environmental classification.

The previous research points to many advantages that green buildings offer for the environment and the occupants. However, it can be concluded from our results that green buildings do not require an environmental rating. Furthermore, our results show that the relatively hard Swedish regulations makes the difference between certified projects and non-certified projects less substantial than what the international research claims. The certification can be an unnecessary cost, provided that the certificate in itself does not bring about any more value as the building can be just as good without the certificate. Thus, if you have the competence to build a “green building” without the rating system, you can save money.

From the international stakeholders’ perspective, it can be concluded that the international systems are more beneficial in terms of recognition. However, it can also be concluded that the international systems sometimes are not fully adjusted for the Swedish market. This is a reason for Swedish clients to prefer the Swedish systems.

On the topic of systems’ adjustments to local markets an argument can be made for that every project has its own conditions which therefore makes it difficult to make them comparable in a global context. The client and the contractor have different objectives in different projects and in different times, which proves a uniqueness for every project. Every project needs to be evaluated for its conditions and its objectives in order to commit to an environmental system.

Our findings show that knowledge transfer is key for contractors that do projects with environmental rating. An effective system for knowledge transfer leads to a strengthened organization and savings in consultant hours. Thus, a successful contractor should have support functions securing and maintaining a high level of knowledge within different fields e.g. environmental classification systems.

5.5 Future research

As our results showed, some of the interviewees believe that the increased cost for a certificate will be amortized over time. The interviewees agreed on that there is a break even for when the investments pay off, but they were not certain enough to talk about any numbers here. Several interviewees pointed to that the highest return on investments should be on energy-efficient building systems, which lead to cheaper operating costs. However, from a pure financial perspective the full range of criteria in an environmental certification will probably not pay back. A future research topic could therefore focus on the break-even-point for certified buildings and which features that pay back.

The previous research states that the return on investment is higher in green building compared to regular construction for the client. The interviews gave an inexplicit picture whether the return on investment was higher or not, where some said that an environmental certification will probably not pay back in full. A factor to the indefinite picture might be that the interviews mainly observed the contractors view. Since there are contradictions between the previous research and the interviews we recommend future research within the field of higher return on investment in relation to environmental rating. To the topic it would also be interesting to research whether the profitability increases for the contractor or not, since the results from the interviews didn’t give a clear picture regarding the profitability. It was clear that the contract sum was higher, but with a greater risk. The future research could therefore also consider risk adjusted profitability for both the client and the contractor.

The previous research also says that investment in “green buildings” can lead to financial benefits as e.g. higher market value, more tenant attraction and increased rental rates. However, the interviewees expressed an uncertainty whether private end users are willing to pay more when buying or renting a flat in a certified building. Since the market is constantly evolving and since there might be a gap between the supply and demand for the end users on the housing market for certified buildings, we recommend further research within the field. Thus, future research should also explore future buyers’ knowledge and expectations on certified buildings.

In the procurement process Boswell & Walker (2004) emphasized a weighted selection approach, but that private clients are less likely to consider environmental aspects. This was opposed in our results, stating that all clients nowadays are considering a weighted selection. Boswell & Walker (2004) also emphasized new procurement procedures in order to be able to request selected technologies and more innovative solutions. Since the contractor didn’t emphasize new procurement procedures we recommend future research that thoroughly investigate if and how new procurement procedures would affect a contractor’s tender and how this could benefit the process of environmental rating.

Finally, in order to gain a more comprehensive picture of incentives and barriers for environmental rating within the entire construction sector, representatives from both sides should be interviewed (contractor and client), perhaps also representatives from the rating organizations and consultants.

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7 Appendix

1. Interview guide - A Swedish contractor's view on incentives for environmental classified construction

Presentation of us and the background of the report, purpose and research question.

- What are the different incentives for an entrepreneur to build environmentally-rated buildings? How does Serneke look at environmental classification and what drives the company do to build such projects?
 - Which type of contract form is best suited for environmental classification? (Also form of cooperation)
 - How can H&S support the work of the projects? Does Serneke need to increase the expertise within the department?
 - Need more in-house resources? (a lot of money goes to consultants today)
-

Who is the respondent?

-Age, title, previous work, education, time at Serneke?

Experience from environmentally classified projects

- Current / previous projects?
 - Which classification system?
 - What was positive?
 - What was negative?
-

What incentives are there for choosing an environmental classification of a building?

(Respondent's perception of incentive for an entrepreneur / client)

- Show that you take environmental responsibility?
 - (Brand)
- Social responsibility?
 - (Better indoor climate)
- Lower operating costs?
 - (Is energy consumption generally lower in a classified building compared to one that meets only BBR?)
- Higher market value?
 - On real estate as well as on companies?
- Other incentives?

Do you see that there are any barriers?

What barriers are there for choosing an environmental classification of a building? (for different stakeholders)

- Higher production cost?
 - (material, classification cost, etc.)
 - With whom is the increased cost? (Contractors / Client)
- Time-consuming design and documentation?
 - Does the higher demand for resources state?
 - Is the competence sufficient for the company? (as well as industry in general?)
- Too low demand?
 - Need more marketing?
- Lack of knowledge?
 - How is the knowledge transfer between Serneke projects?
 - Is there a gap between stakeholders? Do you need to integrate more into the design?
- Control/Regulation
 - Should the state require certification on public buildings?
 - Should the rules be tightened so that all buildings are to be classified?
 - (BBR = environmental building bronze)
- Other barriers? What are the risks of a classification?

- What is the economy for choosing an environmental classification of a building?

- Higher production cost but lower operating cost = higher market value?
 - Is there a higher economic gain for Serneke to get projects with a classification than on similar projects without classification?
- Does the customer choose certification system for financial reasons?
 - Increases the value of the property / property aid?
 - Can you rent a higher rent?
 - Will the higher cost be amortized?
- How does the market look? (supply and demand, should the government subsidize or the like?)

What influence has different stakeholders in an environmental classification of a building?

- Client
 - Project group, different disciplines
 - Investors
 - Contractors
 - Can Serneke influence the customer to choose a classification?
 - Other?
-

Which / which of the different classification systems do you prefer? Why?

- Advantages disadvantages?
 - Differences and similarities?
 - Do you dislike anyone? Why?
 - When should you choose what? Can Serneke choose a system?
 - Is there a need for new systems? What needs to be developed?

(Leed, Breeam, Environment Building, Others (Green building, Swan etc.)

- Environmental databases (Sundahus, Basta, BVB)
-

What kind of contractual form do you provide Best conditions for a successful classification?

- DBB
 - Is the responsibility more placed on the Client here?
 - What does the contract look like?
 - Is it common with additional work attached to the classification?
- DB
 - Are there more opportunities to make simplifications / advances during the design and still meet the requirements here? (different ways to achieve the goals)
- Own developed project
 - Does Project Development (PU) have any goals regarding the number of projects we will develop and certify? (compared with JM's choice that the Swan certify all their homes)
- Does partnering have any benefits in the certification work?
 - Better cooperation -> easier to achieve goals?
 - Easier to get harder classifications?

- Are there a need for new cooperation forms?
 - Should any of the foreign contractors provide better conditions? (BOT, PPP, PFI, ECI etc.)
-

How can an environmental classification affect the procurement?

- Is it common to use environmental criteria? Why / why not? Are soft criteria difficult to define sufficiently clearly? (Measurability)
 - Are previously successful environmental classified projects a competitive advantage? (References)
 - Does the process need to change as classified buildings become more common?
 - How do you consider a classification in the calculation work and the tendering process?
-