IIIEE Theses 2015:23

Building Performance for a Greener Tomorrow:

Designing an Initial Assessment System for Green Building Certifications of Existing Buildings

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Thesis for the fulfilment of the
Master of Science in Environmental Management and Policy
Lund, Sweden, September 2015

THE INTERNATIONAL INSTITUTE FOR
INDUSTRIAL ENVIRONMENTAL ECONOMICS

Published in 2015 by IIIEE, Lund University, P.O. Box 196, S-221 00 LUND, Sweden,
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ISSN 1401-9191

Acknowledgements

This thesis was written for academic review for the fulfillment of the Master of Science in Environmental Management and Policy at the International Institute for Industrial Environmental Economics (IIIEE) at Lund University. It is also intended for the kind consideration of the WSP Group Byggnadsfysik, which supported this process. I'd like to thank my WSP supervisor Oliver Pearce as well as Anna Landfors Limdal and Jenny Wahl for making me feel welcome at the WSP Group. I also want to thank many of the sustainability consultants in the Byggnadsfysik department for sharing their experiences and expertise with me throughout the summer.

There were many who made the thesis process possible. I'd like to thank first and foremost my classmates who stayed in Lund throughout the thesis block and who became my thesis family at the IIIEE. Steven, Anna, and Ronja for countless hours of support from being there to take a break from work and enjoy the summer, to Swedish translation, to workshopping new ideas and being there when the old ones fell apart.

I'd also like to thank those who were farther away, but were equally as supportive: Joe, for being my wonderful confidante, believer, and a shoulder to lean on when the goings got tough. My dear friends back home Kati, Cristine, Julia, Annie, and Molly who motivated me and supported me in this next and final stage in my education. They were there for the first thesis and here in spirit for the second.

I'd like to also give my gratitude to the staff at the IIIEE, who have supported our learning all year. Thank you to my supervisor, Åke Thidell, who shared his strawberries with me and made himself available many times for further conversations about the project throughout the summer thesis journey.

Lastly, to my family.

My mother and father, who are always there for me, my family in California and Copenhagen, and to my late Farmor who is the reason I have made Scandinavia my second home.

Tusind Tak!

Abstract

Overconsumption of fossil fuels and an increase in greenhouse gas emissions are causing a greenhouse effect, which lead to a rise in average temperatures globally and contribute to global climate change. The construction sector has been identified as responsible for some of the highest levels of resource use and waste emissions across the globe, compared with other sectors. Tackling the construction sector in Europe through the operations and renovations of existing buildings will contribute to a major shift in reducing the negative impacts of climate change. Green building certifications offer a way towards improving an existing building's environmental performance. In Sweden, property owners of existing office buildings are interested in upgrading, maintaining, or achieving green building certifications to also increase their competitiveness on the market and improve their company's overall environmental performance portfolio. Amidst literature on green building certifications for design and new construction, few studies have been done on green building certifications for existing buildings. By identifying systematic challenges in the certification process for those who assess existing buildings with BREEAM In-Use, LEED EBOM, and Miljöbyggnad for existing buildings, the concept of a strategic tool to mitigate the challenges of the assessment process has been recommended. With such a tool to precede the assessment stage, sustainability consultants can identify client motivations and key performance indicators that target the most appropriate credits within the three schemes under study.

Keywords: BREEAM, LEED, Miljöbyggnad, assessment, certification, green building, sustainability, existing buildings, sustainable construction

Executive Summary

The focus of construction in Europe has been slowly shifting towards renovation projects with building stocks renewing at a rate of one to two percent annually (Crawley & Aho, 1999). 35% of all buildings in Europe are fifty years or older indicating the great opportunity to increase the environmental performance of old buildings (European Commission, 2015). With this stock being *in use* for decades there is the greatest improvement potential in the environmental performance of existing buildings (Crawley & Aho, 1999).

Most new office buildings in Sweden are being built with some level of green building certification (Peab, 2013; Skanska, 2015; NCC, 2015; sustainability developer, Skanska, personal communication, 2015; sustainability coordinator, personal communication, 2015; WSP Group, 2015). While this phenomenon continues to increase across the market, an emerging market for green building certification assessments for existing buildings through operation and maintenance is considered to be an important capability in the field of sustainability assessments and environmental performance of buildings (Cole, 2005).

Property owners of existing office buildings are interested in upgrading, maintaining, or achieving green building certifications to also increase their competitiveness on the market and improve their company's environmental performance rating. Consequently, existing office building owners, developers, and property managers are looking to work with sustainability consultants like the WSP Group to make their properties and portfolio more "green".

A preliminary literature review indicates that there are fewer studies done on green building certifications for existing buildings than on design and new construction (Juan, 2010 et. al; Kok et.al, 2011). This is in part due to the fact that many of the green building certification schemes for existing buildings were introduced within the last 5-7 years (BRE Global Ltd, 2-; USGBC, 2009, SGBC, 2014). However, as demand is expected to increase for green building certifications, successful application of green building certifications for existing buildings in Sweden will need to be better understood. Stakeholders, like sustainability consultants, and interested parties will need to understand differences among available schemes, the challenges in the process of certification, and any opportunities to overcome the challenges.

According to professionals in the architecture, engineering, and construction (AEC) industries in Sweden, there are three popular certifications for existing commercial buildings that are popularly used: LEED 2009 for Existing Buildings – Operations & Maintenance (LEED EBOM), BREEAM In-Use, and Miljöbyggnad Befintliga Byggnader (WSP, 2015). The former two are international certification schemes and the latter is national.

In order to achieve certification under any of the aforementioned schemes, an assessment study of the existing building's environmental performance must be done. However, while these assessments are crucial to identifying and communicating a detailed analysis of the building's current environmental performance and potential future level of certification, they are also a lengthy and burdensome process doubling as a documentation exercise that can take years to complete.

By identifying challenges in the certification process for those who assess existing buildings, the concept of a strategic tool to mitigate the challenges of the assessment process has been recommended. With such a tool to precede the assessment stage, sustainability consultants can identify client motivations and key performance indicators that target the most appropriate

credits within each of the aforementioned schemes. The basic tool would offer a systematic way to achieve context-driven outcomes that are both cost-effective (time and money saving) and simple. Additionally, it would facilitate the necessary, yet burdensome, process of data collection required for assessing an existing commercial building. Finally, such a screening tool would be able to facilitate communication with potential clients about their preferences before undertaking the assessment study of various certifications of the existing building.

The analytical focus of this paper is based on a review of rating schemes for existing buildings and issues in its application, as well as implications for firms using rating systems for existing buildings. It does not aim to be a technical paper, nor is it a consulting document or a market evaluation. Rather, the aim of this paper is to diagnose the assessment and certification process for green building certifications of existing buildings and to design a user-friendly tool for consultants that is meant to facilitate better communications with potential clients for green building certification as well as streamline or make more efficient the initial certification process for consultants. Ultimately, the design of such a tool sheds light on important decisions made about green building certification by both consultant and client prior to the assessment process inherent in the certification system. It should provide the first stream of information regarding the client's motivations and level of knowledge about the property, the current state of the building and its current operation and maintenance needs and routines thereby directing the planning process towards the most appropriate certification scheme.

Based on a lack of existing research on certifications for existing buildings and the aforementioned challenges associated with the initial assessment process, This study looks to examine three things: green rating systems for existing commercial buildings; identification of the challenges and opportunities in the initial assessment process of certification; and, conceptualization and creation of a screening tool that assists building professionals in the pre-assessment of green building certifications for existing commercial buildings in Sweden.

To facilitate such an examination, research questions in this study are:

> *RQ1: What are the differences between LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad for Existing Buildings v. 2.1 schemes?*
>
> *RQ2: What are the challenges in the initial assessment process of green building certification for existing buildings?*
>
> *RQ3: How do you determine the most appropriate rating scheme for a property owner to select for certification of an existing building?*

This paper advances the topic of consulting for sustainable building through green building rating systems for existing buildings. First, this study identifies differences in a few of the green building rating systems popular in Sweden that are focused on buildings currently in operation rather than new construction. Second, this study investigates the challenges associated with the assessment process for each of these schemes specific to existing buildings. Lastly, this study attempts to figure out how to better serve clients interested in green building certifications by understanding a variety of possible outcomes for the building as early in the process as possible. Through conversations with sustainability consultants in engineering firms, barriers unique to certification of existing buildings creates an opportunity for designing a process or tool to streamline the consulting process for green building certifications for existing commercial buildings.

In order to answer the research questions the following objectives were identified for this study:

Obj. 1. Investigate criteria of three green building certifications for existing buildings in Sweden and their respective criteria requirements.
Obj. 2. Develop the individual assessments in excel to facilitate practitioners performing an assessment for green building certifications of existing buildings.
Obj. 3. Make observations on the process of assessing a case study building.
Obj. 4. Diagnose the challenges in the assessment process and create a screening tool or matrix that could be used as a strategic approach to certification schemes for existing commercial buildings.
Obj. 5. Engage an expert focus group of practitioners for feedback and quality assurance.

A number of methods were employed to address the research questions proposed in this study. A *literature review* was used to draw important practical information from green building certifications of existing buildings. *Observation* was used on the assessment process of a feasibility case study contributed by WSP Group to draw preliminary recommendations on how to strategically address the assessment process. Finally, a *focus group* advanced the understanding of the assessment process, differences in the schemes, and quality assurance for preliminary findings from the earlier methods employed.

The study found that the LEED EBOM and BREEAM In-Use were most alike when compared with the Swedish scheme, Miljöbyggnad. Miljöbyggnad offers a simple and cost-effective approach to rating systems by suiting the local context and addressing only building performance specifications. Rather than permitting flexibility, Miljöbyggnad requires that all of the criteria be met in order to receive a rating. This is an effective tool for only looking at the building as a running object. Unfortunately, it neglects to address any procedures, policies, or plans that are necessary to manage and operate a building for high-performance.

The study found several challenges related to the assessment process of green building certifications of existing buildings. Certification schemes of existing buildings require some level of technical expertise not only to guide a client through the certification process, but also to give meaningful input on building performance.

Information management was shown to be a messy process of gathering the right evidence about a building's operational data from the right people. Without a clear channel of communication to facilitate the collection of evidence on the client's side, the assessment process becomes lengthy and difficult to navigate.

The Swedish context was found to play an important role in which certification schemes were most easily assessed by a consultant. The health and environmental issues represented in Miljöbyggnad were most accurate to address the Swedish context. It was concluded that LEED EBOM was easier to score points in due to the Swedish energy mix being far cleaner than the American, thus achieving a better overall rating. But, LEED EBOM and BREEAM In-Use failed to address critical criteria found in Miljöbyggnad such as an assessment of radon or asbestos. In all three schemes, it was found that daylight was one of the most difficult criteria to achieve. BREEAM's highest ratings are harder to achieve than LEED EBOM and so it was considered to be more comprehensive and competitive for high-performing buildings in Sweden. Overall, the local context played a large role in identifying challenges for the actual assessment process of the three certifications.

It was found that consultants spend a great amount of time educating their clients on the differences between the certification schemes because of the client's lack of understanding of what an assessment process entails, or what the rating schemes seek to address, beyond the market benefits. The success of the assessment project and ultimately the certification process hinges on the client's education and communications regarding green building certifications of existing buildings.

Preliminary work was found to be a crucial step in the assessment process, which also had the potential to overcome some of the challenges previously mentioned. A tool was created to develop a systematic approach to facilitate preliminary work.

A screening tool has been recommended to assist in determining the appropriate rating scheme for property owners and clients. The screening tool was made up of three main components: the strategic questions, a rapid checklist and ranking of criteria, and finally preliminary recommendations for next steps.

Recommendations for further research might include studies on green building certification for residential properties in existing buildings or new construction as there are many rating systems being developed to suit the property and the homeowner in the Nordic countries. Further studies on consulting strategies and practical issues of working with clients, the field of existing buildings, or even the application of this study in another context to test the generalizability and transferability of a screening tool would be meaningful to pursue.

The author had in mind that the design of the tool should be built into an excel template and then be used and assessed in a secondary study. Furthermore, in the 21st century where 'mobile apps' are so widespread, a vision of creating the matrix of questions and rapid checklist into an app has been considered.

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Abbreviations

ASHRAE – Air Conditioning American Society of Heating, Refrigerating, and Air-Conditioning Engineers

AEC – Architecture, Engineering, Construction Industries

BREEAM – Building Research Establishment Environment Assessment Method

LCA – Life Cycle Assessment

LEED – Leadership in Energy and Environmental Design

LEED EBOM – Leadership in Energy and Environmental Design for Existing Buildings: Operations and Maintenance

OVK – Mandatory Ventilation Standards in Sweden

SAP – Standard Assesment Procedure

QA – Quality Assurance

1 Introduction

1.1 Background

Overconsumption of fossil fuels and an increase in greenhouse gas emissions are causing a greenhouse effect resulting in a rise in average temperatures globally and catastrophically contributing to global climate change (IPCC, 2014). Scientific studies have identified the transport and building sectors to hold the largest share of responsibility for these negative impacts leading to the global greenhouse effect (UNEP, 2014). The construction sector is responsible for some of the highest levels of resource use and waste emissions across the globe, compared with other sectors (CIB & UNEP-IETC, 2002). On average, the construction sector alone is responsible for consuming roughly 40% of total energy production worldwide (WGBC, 2015). In Europe, the building sector alone accounts for about 40% of all primary energy use and 36% of all greenhouse gas emissions (European Commission, 2015). If serious commitments are to be made in Europe to address reductions in energy consumption as well as in greenhouse gas emissions, then, transitioning towards a more sustainable building sector will be crucial.

'Sustainability' was first coined at the United Nations World Commission on Environment and Development in the 1987 Brundtland Report, *Our Common Future*. In this report, common challenges such as poverty, decreasing resources, environmental decay, and pollution, among others were outlined. The report suggests that one solution towards our common future will be through sustainable development. Sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, p. 41, 1987). With this concept in mind, the idea of sustainable development began to take root in international discourse.

Shortly after the release of *Our Common Future*, the United Nations Conference on Sustainable Development was held at the Earth Summit in Rio in 1992. This conference mobilized an international action plan, on sustainable development known as Agenda 21(CIB & UNEP-IETC, 2002). The plan was created sector-by-sector, looking at the state of sustainability. An internationally agreed agenda on sustainable construction came to light and in 1999, after a lengthy and thorough collaborative research process, the International Council for Research Innovation in Building and Construction (CIB) published *Agenda 21 on Sustainable Construction* (CIB & UNEP-IETC, 2002).

According to *Agenda 21 on Sustainable Construction*, "sustainable construction is a holistic process aiming to restore and maintain harmony between the natural and built environments and create settlements that affirm human dignity and encourage economic equity" (CIB & UNEP-IETC, p. 8, 2002). Sustainable construction with this meaning attempts to address a holistic perspective, or a life cycle view, in relation to the construction and management of the built environment. The life cycle perspective seeks to imply not only new environmentally oriented construction designs, but also new environmentally friendly operations and maintenance procedures (CIB & UNEP-IETC, 2002).

Socio-economic factors are particularly powerful drivers in addressing the sustainability of the construction sector (CIB & UNEP-IETC, 2002). The economic landscape suggests that the construction industry plays a large role in domestic and international markets and therefore has the opportunity to greatly influence global environmental compromises and impacts. Construction is one of the main drivers of GDP and therefore highlights its importance not only environmentally, but also economically (WGBC, 2014).

Buildings, in many countries, represent a significant portion of public and private property (UN-DESA, 2012). Financial markets are closely linked with long-term value of real estate assets (UN-DESA, 2012). The construction sector grows or shrinks with the availability of wealth of property owners. Commercial and infrastructure development grows with the prosperity of business and public funding. Additionally, the sector plays a large role in employment opportunities. Worldwide, the construction sector accounts for 5 to 10 percent of jobs and is the second largest source of employment after agriculture (UN-DESA, 2012). Not only are construction jobs relevant, but also additional service sector employment opportunities are created through the management and maintenance of buildings (UN-DESA, 2012).

In Sweden, the construction industry employs 500,000 people representing 11% of all people working (Timetric Construction Reports, 2013). The Swedish government is investing in infrastructure development particularly between 2014-2025 in order to create more jobs and stimulate long-term economic growth (Timetric Construction Reports, 2013). During that time, a total of SEK 522 billion will be spent on infrastructure projects, solidifying the market position that infrastructure construction will be the fastest-growing construction market in the years ahead (Timetric Construction Reports, 2013). However, new construction and retrofits or renovation on existing building stock must be treated separately in order to understand the costs and benefits of increasing all buildings' environmental performance.

Based on the need for the building sector to increase sustainable practices in buildings, decision-makers in the construction sector must adopt a principle of sustainable construction. While there is no silver bullet to achieve sustainable construction and there are many approaches that exist either through political processes, economic instruments, sociological solutions, or even through legislation. Through scientific studies and a number of sustainability assessment methods and tools have been created help decision-makers in construction measure and benchmark the environmental impacts and performance of the building process. Rating systems are one such method to address environmental performance of buildings and are manifest in certification schemes. Environmental performance of buildings is often based on categories and criteria of highest environmental impact.

Green building certification schemes are rating systems that have been shown to target an array of environmental impact categories to meet the objectives of improving building quality and at the same time improving efficient operations that lead to decreasing environmental harms as well as offering many other advantages, targeting environmental impact areas in a building's performance for improvement can lead to many health and environmental benefits for property owners, tenants, and employees (Medineckiene et al., 2014). Among these benefits, they include: minimizing energy use in all stages of a buildings life cycle, making buildings more comfortable and less expensive to run; safeguards water sources and storm water systems, minimizes waste and maximizes reuse; promotes health and well-being with increased ventilation and concern for noise and natural sunlight; keeps landscapes open and green; anticipates and builds for resiliency and longevity (WGBC, 2014).

In addition to environmental and health and well-being benefits, commercial property-owners often have economic incentives and benefits to choose green building certification. These economic benefits include improving a company's green image, improvements in corporate social responsibility reputation, a reduction in running costs and an increased value of property (USGBC, 2014).

Two leading international standards for greening a building were created through third-party certification schemes (Crawley & Aho, 1999; Cole, 2006; Ding, 2008; Rivera, 2009; Alyami &

Rezgui, 2012; Lee, 2013). In 1990, a team of researchers in the U.K. developed the international standard known as BREEAM (Building Research Establishment Environmental Assessment Method) and in 2000, the U.S. Green Building Council developed the LEED (Leadership in Energy and Environmental Design) Certification (BRE Global, 2015; USGBC, n.d.). These systems specifically target environmental performance standards in the architecture, engineering, and construction (AEC) industries. Literature on the impact of certifications indicates their success in penetrating the construction market and promoting greener buildings (Lockwood, 2006). This success of standardizing green building knowledge has led to an interest in business strategies for performance of sustainable building worldwide and knowledge on how to build green has been successfully adopted in many countries.

In Sweden, as property owners begin to realize the benefits of green buildings, certification has increased with many newly constructed buildings being designed and constructed to meet environmental criteria (Mateus et al., 2011; USGBC, 2014). Major development and construction firms in Sweden such as Skanska, NCC, and PEAB have adopted company policies to build with either the LEED or BREEAM certification (Peab, 2013; Skanska, 2015; NCC, 2015). With the adoption of international systems in Sweden, a national scheme was created in 2005 to better contextualize the national environmental profile and building market called Miljöbyggnad (Environmental Building). The Swedish building sector is now seeing the opportunities for effective environmental performance of *buildings in use* (USGBC, 2014).

1.2 Problem Definition

The focus of construction in Europe has been slowly shifting towards renovation projects with building stocks renewing at a rate of one to two percent annually (Crawley & Aho, 1999). 35% of all buildings in Europe are fifty years or older indicating the great opportunity for and impact of increasing the environmental performance of old buildings (European Commission, 2015). With this stock being *in use* for decades there is the greatest improvement potential in the environmental performance of existing buildings (Crawley & Aho, 1999).

Most new office buildings in Sweden are being built with some level of green building certification (Peab, 2013; Skanska, 2015; NCC, 2015; sustainability developer, Skanska, personal communication, 2015; sustainability coordinator, personal communication, 2015; WSP Group, 2015). While this phenomenon continues to increase across the market, an emerging market for green building certification assessments for existing buildings through operation and maintenance is considered to be an important capability in the field of sustainability assessments and environmental performance of buildings (Cole, 2005).

Property owners of existing office buildings are interested in upgrading, maintaining, or achieving green building certifications to also increase their competitiveness on the market and improve their company's environmental performance rating. Consequently, existing office building owners, developers, and property managers are looking to work with sustainability consultants like the WSP Group to make their properties and portfolio more "green".

A preliminary literature review indicates that there are fewer studies done on green building certifications for existing buildings than on design and new construction (Juan, 2010 et. al; Kok et.al, 2011). This is in part due to the fact that many of the green building certification schemes for existing buildings were introduced within the last 5-7 years (BRE Global Ltd, 2-; USGBC, 2009, SGBC, 2014). However, as demand is expected to increase for green building certifications, successful application of green building certifications for existing buildings in Sweden will need to be better understood. Stakeholders, like sustainability consultants, and interested parties will need to understand differences among available schemes, the challenges in the process of certification, and any opportunities to overcome the challenges.

1.2.1 Sustainability for Existing Buildings

The following definitions allow for a more specific understanding of the various paths towards sustainability in the construction sector and a further discussion about the potential solutions.

Agenda 21 defines a number of important terms in order to clarify the debate of sustainability in the construction sector. It is helpful to understand that when construction is discussed, there may be four different meanings (CIB & UNEP-IETC, 2002):

1. Construction refers to activities on a site that lead to the formation of a building. In this case, construction is a particular stage in a project cycle.
2. Construction refers to the whole process of a building project covering the feasibility, design, build, operation, demolition and disposal.
3. Construction as a part of the economy and linked to important partner sectors such as material production and distribution or service sectors like transport and finance.
4. Construction refers to the process and realization of human settlements.

The second definition, which construction refers to the whole building process, includes operations and maintenance. This "in-use" phase is vital in addressing the environmental impacts found in a building project's life span (The Ecocycle Council, 2001). One of the major challenges of sustainable construction is management and organization. However, it has been identified that one solution to overcome these challenges, can be addressed through standards and regulations (CIB, 1999). Eco-labels and certification systems allow the environmental performance of buildings to be measured and certified, giving decision-makers and stakeholders the tools to achieve more sustainable outcomes (CIB, 1999).

1.2.2 Green Building Certifications of Existing Buildings

According to professionals in the architecture, engineering, and construction (AEC) industries in Sweden, there are three popular certifications for existing commercial buildings that are popularly used: LEED 2009 for Existing Buildings – Operations & Maintenance (LEED EBOM), BREEAM In-Use, and Miljöbyggnad för Befintliga Byggnader (for Existing Buildings) (WSP, 2015). The former two are international certification schemes and the latter is national.

1.2.3 Challenges with the Certification Process of Existing Buildings

In order to achieve certification under any of the aforementioned schemes in Section 1.1.2, an assessment study of the existing building's environmental performance must be done. However, while these assessments are crucial to identifying and communicating a detailed analysis of the building's current environmental performance and potential future level of certification, they are also a lengthy and burdensome process doubling as a documentation exercise that can take years to complete.

By identifying challenges in the certification process for those who assess existing buildings, the concept of a strategic tool to mitigate the challenges of the assessment process has been recommended. With such a tool to precede the assessment stage, sustainability consultants can identify client motivations and key performance indicators that target the most appropriate credits within each of the aforementioned schemes. The basic tool would offer a systematic way to achieve context-driven outcomes that are both cost-effective (time and money saving) and simple. Additionally, it would facilitate the necessary, yet burdensome, process of data collection required for assessing an existing commercial building. Finally, such a screening tool

would be able to facilitate communication with potential clients about their preferences before undertaking the assessment study of various certifications of the existing building.

1.3 Research Questions

The analytical focus of this paper is based on a review of rating schemes for existing buildings and issues in its application, as well as implications for firms using rating systems for existing buildings. It does not aim to be a technical paper, nor is it a consulting document or a market evaluation. Rather, the aim of this paper is to diagnose the assessment and certification process for green building certifications of existing buildings and to design a user-friendly tool for consultants that is meant to facilitate better communications with potential clients for green building certification as well as streamline or make more efficient the initial certification process for consultants. Ultimately, the design of such a tool sheds light on important decisions made about green building certification by both consultant and client prior to the assessment process inherent in the certification system. It should provide the first stream of information regarding the client's motivations and level of knowledge about the property, the current state of the building and its current operation and maintenance needs and routines thereby directing the planning process towards the most appropriate certification scheme.

Based on a lack of existing research on certifications for existing buildings and the aforementioned challenges associated with the initial assessment process, This study looks to examine three things: green rating systems for existing commercial buildings; identification of the challenges and opportunities in the initial assessment process of certification; and, conceptualization and creation of a screening tool that assists building professionals in the pre-assessment of green building certifications for existing commercial buildings in Sweden.

To facilitate such an examination, research questions in this study are:

> *RQ1: What are the differences between LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad for Existing Buildings v. 2.1 schemes?*
>
> *RQ2: What are the challenges in the initial assessment process of green building certification for existing buildings?*
>
> *RQ3: How do you determine the most appropriate rating scheme for a property owner to select for certification of an existing building?*

1.4 General Methodological Rationale

This paper advances the topic of systems for sustainable building through green building certifications for existing buildings. First, this study identifies differences in a few of the green building rating systems popular in Sweden that are focused on buildings currently in operation rather than new construction. Second, this study investigates the challenges associated with the assessment process for each of these schemes specific to existing buildings. Lastly, this study attempts to figure out how to better serve clients interested in green building certifications by understanding a variety of possible outcomes for the building as early in the process as possible. Through conversations with sustainability consultants in engineering firms, barriers unique to certification of existing buildings creates an opportunity for designing a process or tool to streamline the consulting process for green building certifications for existing commercial buildings.

In order to answer the research questions the following objectives were identified for this study:

Obj. 1. Investigate criteria of three green building certifications for existing buildings in Sweden and their respective criteria requirements.
Obj. 2. Develop the individual assessments in Excel to facilitate practitioners performing an assessment for green building certifications of existing buildings.
Obj. 3. Make observation on the process of assessing a case study building.
Obj. 4. Diagnose the challenges in the assessment process and create a screening tool or matrix that could be used as a strategic approach to certification schemes for existing commercial buildings.
Obj. 5. Engage an expert focus group of practitioners for feedback and quality assurance.

A number of methods were employed to address the research questions proposed in this study. A *literature review* will be used to draw important practical information from green building certifications for existing buildings. *Observation* will be used on the assessment process of a feasibility case study contributed by WSP Group to draw preliminary recommendations on how to strategically address the assessment process. Finally, a *focus group* will advance the understanding of the assessment process, differences in the schemes, and develop quality assurance for preliminary findings from the earlier methods employed.

1.5 Scope and Limitations

The scope of this study has been defined to focus on the environmental aspects and impacts of sustainability of the built environment.

It was determined by the project supervisor at WSP Group that there was a need to develop a process or a tool that assists with green building assessments for existing buildings in Sweden. A full study has been made in order to achieve this goal. Therefore, this study considers the consulting process for green building certifications of existing buildings, taking an overview of the schemes and how they function, practically speaking. The three certification schemes, LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad för Befintliga Byggnader 2.1, were chosen due to their usefulness in the Swedish market according to sustainability consultants (WSP Group, 2015). However, while much of the literature is from Europe or from the U.S., the focus of the study and analysis remains in the Swedish context, as the project developed alongside the Swedish branch of WSP Environmental Group's Building Physics department.

The distinction between new construction and existing buildings is an important scoping factor in this project, albeit the age range of the buildings was not a priority of this study. Additionally, a distinction between types of buildings was made to identify commercial properties and institutions from residential buildings. The reason for focusing on commercial buildings and institutions is based on the fact that green building certifications send market signals that may be more attractive to business and property owners looking to increase the market value of their property and assets (Crawley & Aho, 1999; Cole, 2005). Generally speaking, office buildings housing employees have an interest in operations and management of the building, creating a healthy and productive work environment as well as increasing the marketing potential of their portfolio.

Under the LEED program, the LEED EBOM criteria has been developed for institutions, commercial buildings, and high-rise residential buildings both public and private (USGBC, 2009). The BREEAM In-Use is developed for all non-domestic commercial, industrial, retail and institutional buildings (BRE Global Ltd., 2015). Miljöbyggnad for Existing Buildings is developed for homes, offices, and schools (SGBC, 2014).

Lastly, language barriers played a significant role in both accessing information and translating from Swedish to English regarding the Swedish building scheme Miljöbyggnad as well as the WSP feasibility Study. Both the manual for certification as well as the WSP feasibility study were in Swedish and much of the technical language was translated by Google translate in order to understand the technical information. At times, this single tool failed to elucidate the proper technical term in English and therefore made it more difficult to uncover the full understanding of technical aspects. As this became a barrier for completing the analysis of the feasibility study as originally planned, new project angles were discussed to better make use of such a case study and the decision to make observations instead of a more technical and extensive analytical comparison was chosen.

1.6 Audience

This final study was written to conclude the Masters of Science programme in Environmental Management and Policy at the International Institute for Industrial Environmental Economics (IIIEE) at Lund University, in Lund, Sweden. The intended audience of this study includes primarily sustainability consultants interested in using rating systems for existing buildings and building engineers who are interested in strategies for green building certification for existing buildings. Secondly, it will be relevant for the architecture, engineering, or construction industry as well as commercial property owners considering the use of green building certification for a number of added benefits. Thirdly, it is directed at academics in the fields of environmental management, sustainable construction and green building.

1.7 Ethical Considerations

Some documents and information used for data collection and analysis were provided by the WSP Group and were considered commercially confidential. Therefore, this study respected those boundaries and the sources were not included.

Additionally, this study maintained the integrity of all interviewees' and focus group participant's anonymity. The author was granted permission to use all information recorded. However, without having the participants in this study have the opportunity to review and confirm their personal quotations, the author chose to preserve their anonymity.

1.8 Outline

This study provides a thorough review of green building certifications of existing buildings and challenges in the consulting process for certification. In order to understand the language surrounding green building certification schemes, Chapter 2 introduces a literature review of environmental assessment tools for buildings.

Chapter 3 provides more detailed descriptions of the certification schemes under study, drawing pertinent information for analysis. The study builds upon the previous chapter

Chapter 4 presents the research methodology used in this study. A literature review and interviews make up the methods for data collection and a consulting process principle, observations, and a focus group make up the methods for data analysis.

Chapter 5 presents the relevant findings from the research.

Chapter 6 begins a discussion on green building certification schemes for existing buildings and makes recommendations for overcoming challenges in the assessment process. This Chapter aims to answer the research questions in this study. Finally, Chapter 7 consolidates the study into a concluding chapter.

2 Sustainability for the Built Environment

The scope of this chapter aims to describe the environmental impacts of buildings and introduce environmental assessment tools and their advantages and disadvantages as a background for this study. The built environment has a great opportunity to increase its overall sustainability. However, while the opportunity to transform the sector exists, challenges in many areas remain and so the importance of methods and tools to support sector transformation and transitions are necessary not only for society, but specifically for the technical professionals working to advance solutions in sustainability.

2.1 Environmental Impact of Buildings

The most common research on environmental impact of buildings has been done using a life cycle assessment method[1] (LCA) because it quantifies measurable environmental loads based on the resources that are used throughout the whole life of a building (Cole, 1998; Crawley & Aho, 1999; Lützkendorf & Lorenz, 2006; Pearce, 2010; Mateus et al., 2011). This method has shown that a building's use phase (after the building is constructed and before demolition) has the most significant negative environmental impacts associated with global environmental issues in categories such as climate change, acidification, and eutrophication (Cole, 2005).

Sweden's Ecocycle Council was created in 1994 as a network of representatives for the building and real estate sector and is cited as a source in Swedish literature for information on environmental impacts of buildings (The Ecocycle Council, 2001). The council is made up of four different stakeholder groups: clients and property owners, architectural firms and engineering consultancies, the building industry and the building materials industry (The Ecocycle Council, 2001). The Council conducted a major review of significant environmental aspects based on a LCA, which was conducted in 2001 on buildings in Sweden. They found that the energy consumption from heating and electricity for technical operation during the use phase (operations and management) of the building had the greatest impact on the environment (The Ecocycle Council, 2001). This is in-line with the literature on environmental performance of existing buildings that also usually focuses on energy consumption (USGBC, 2011). The other significant environmental impact categories in order of importance, during the use phase, were (The Ecocycle Council, 2001):

- Material consumption and waste management,
- The use of hazardous substances,
- Radon leaks from damaged buildings with inadequate ventilation lead to air quality and increased health risks,
- And finally, sound quality proved to have negative impacts on human health from inadequate sound insulation

[1] A life cycle assessment traditionally refers to phases of a product from beginning to end: the raw material acquisition, the manufacturing process, the utilization or use phase, and lastly the disposal and recycling of the product. For building projects,

2.2 Building Performance Assessments and Tools

According to Cole (2005), an assessment implies measuring how well or poorly a building is performing or could perform against a declared set of criteria. Most current building assessment methods attempt to measure improvements in the environmental performance of buildings relative to current typical practice or requirements (Cole, 1999).

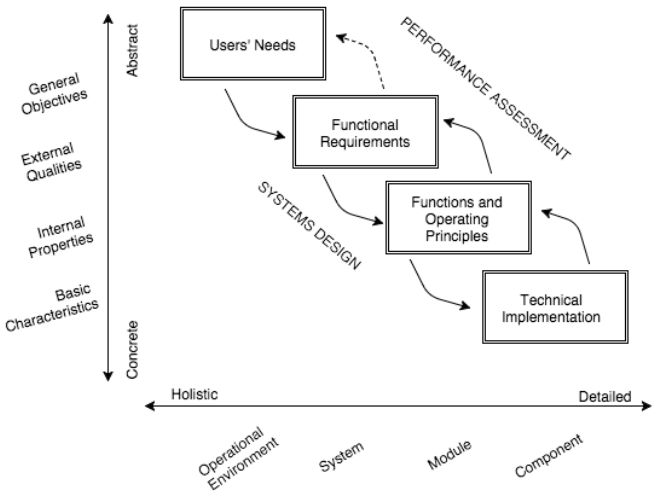


Figure 1 The Interrelationship and Conceptual Differences of Systems Design and Performance Assessment

Source: Adapted from Crawley & Aho, 1999

Crawley & Aho (1999) make an important distinction between building design and building performance. Building design can be considered a top-down process where the abstract ideas are being slowly implemented into more concrete actions. Building performance assessment by contrast, takes the reverse bottom-up approach, blending the overall environmental performance of a given design with concrete, technically detailed information and characteristics to the abstract system. Figure 1 provides a visual representation of these distinctions providing detail on what areas are considered abstract in building design or building assessment performance and which are concrete, technical aspects.

For performance assessments, the basis for analysis is the indicators or criteria (Crawley & Aho, 1999). Indicators and criteria designate the measurable outputs for benchmarking. Indicators were also used in Chapter 40, of Agenda 21, "to provide solid bases for decision making at all levels" (Pearce, 2010). Credits and points are pre-assigned to indicators and criteria and form the basis for the aggregated performance score that translates towards an overall rating according to an individual system.

Building environmental assessment tools have emerged to be used for evaluations of resource use, assessing the ecological impacts associated with building, and measuring indoor environmental quality (Cole, 2005). The information available through the use of these tools have created a much broader "culture of performance measurement" aiming to increase accountability in the construction sector as well as even education and healthcare (Cole, 2005).

Things to consider are not only the structure and design of the building itself, but also the systems employed in running the building during its operations (Lützkendorf et al., 2006). For existing buildings, the management process is highlighted as the most important way to target and monitor environmental management and reporting. However, the success of the management process is dependent on the ability to gather information on performance and make comparisons (Yates, 2001).

From the toolkit of sustainability assessment tools, a number of methods exist in order to assess buildings. The first steps of many kinds of assessments begin with data collection. Therefore, tools are generally divided into two different categories: those that rely on quantitative data, or those that require qualitative data. There are some tools that are also created to integrate both kinds of data for a more holistic approach (Pearce et al., 2012). The

following tools have been identified in Table 2-1 according to either qualitative or quantitative data requirements (Lützkendorf, 2007; Pearce, 2010):

Table 2-1 Sustainability Assessment Tools

Quantitative:	*Qualitative:*
• Multicriteria Analysis • Monetary Valuation (i.e. contingent valuation method, hedonic pricing, travel cost method, cost benefit analysis) • Sustainability Indicators • Life Cycle Assessment (LCA) • Biophysical evaluation (i.e. ecological footprint, material intensity per service (MIPS), environmental risk assessment (ERA))	• Environmental Assessments (i.e. EIA, SEA, EMS) • Social Impact Assessment • Rating Systems (i.e. LEED, BREEAM, Miljöbyggnad) • Checklists

Source: Lützkendorf, 2007; Pearce, 2010

The environmental performance of buildings can be assessed through different kinds of sustainability assessment tools. Sustainability assessment tools are made to assist decision-makers with the investigation and measurement of the environmental performance of the object under study. Many of the tools have been developed or intended as commercial products and therefore, the use of the tool, systems, and their results either have registration fees, certification fees, or consultation fees associated with them. Additionally, the scientific rationale for the development of the tool is not always presented in a transparent manner or is not thoroughly elaborated because they are not primarily built for an academic audience (Glaumann et al., 2006).

Because of these information gaps present in commercial tools, one can point to a tool's system boundaries and weighting choices as common topics under investigation across the literature (Glaumann et al., 2006). Because of the lack of transparency, the results of these methods can be difficult and laborious for comparison without technical expertise (Glaumann et al., 2006). Before investigating information or performance gaps in assessment tools, understanding how a particular tool, such as a rating system, has been evaluated in the literature provides context for its use.

2.3 Rating Systems for the Built Environment

A full evaluation of rating systems was outside the scope of this study and has been done by others in the field (Cole, 2005; Lützkendorf & Lorenz, 2006; Kaatz et al., 2006), but a few of the key critiques were found to provide sufficient insight into the discourse on rating systems for buildings.

Much of the research on rating systems have focused on analyzing either the methodology and creation of the tool, the process of using the tool, or the outcomes from using the tool and their benefits (Cole, 2005; Lützkendorf & Lorenz, 2006; Kaatz et al., 2006). There are certainly advantages and disadvantages associated with many of them and building science and research have employed different kinds of analysis in order to identify or propose adjustments or inclusions to many of the existing tools (Kaatz et al. 2006). It should be noted that the literature review used the terms environmental assessment method, building assessment method, and building performance methods interchangeably to discuss rating systems making

it difficult for the reader to differentiate the field of rating systems (Cole, 2005; Lützkendorf & Lorenz, 2006; Kaatz et al., 2006).

The literature suggests that rating schemes for the built environment have a number of advantages and disadvantages.

Advantages

Most rating schemes consist of design or operations checklists with associated credit rating computations. They were originally created to help designers identify design criteria and document design performance (Pearce, 2010). These checklists contain a number of criteria designated to environmental impact categories and can be aggregated according to their relative overall contribution to the impact (Pearce, 2010). This process of measuring relative impact is calling weighting (BRE Global Ltd., 2015). These credits with their weightings are then aggregated into scores that correspond with overall performance ratings (Pearce, 2010).

Cole (2005) indicates that one indirect advantage of building environmental assessment methods is that by organizing environmental criteria, they offer a structure and point of reference for design teams to create a unified language. More importantly, it is possible for these methods to act as a catalyst in the transformation of the building industry culture to include sustainability as a standard, consistent and integral part of decision-making (Cole, 2005).) They can act as marketing tools as well, taking on forms of environmental labelling and allowing for comparison of like-projects (Peace, 2010).

Disadvantages

Kaatz et al. (2006) describe the drawbacks and misconceptions between sustainable building assessment methods and green building assessment methods. Green building assessment methods apparently focus more on the building in relation to its performance standards and physical features (Kaatz et al., 2006). On the other hand, sustainable building methods emphasize the processes and transformations that take place in a building system (Kaatz et al., 2006). Finally, green building assessment methods mitigate the building's environmental impact and sustainable building assessment methods aim to address adaptation and restoration capabilities (Kaatz et al., 2006).

Pearce (2010) explains that rating schemes were designed to be generalizable; they sometimes fail to meet project requirements in a unique local context across various project stakeholders. Often, these rating schemes are used as add-ons in the design phase of a project (Pearce, 2010). This naturally separates environmental requirements from regular project requirements creating two-times the work of managing the same information and inputs for different goals (Pearce, 2010). Furthermore, Pearce (2010) finds that most rating schemes for buildings mitigate unsustainability rather than promoting paths for adaption and restoration (Kaatz et al, 2006).

Crawley & Aho (1999) perceive that the criteria in rating systems can be created through prescriptive technical specifications instead of performance indicators, which ultimately could inhibit integrative solutions towards sustainable outcomes (Pearce, 2010).

A common approach used in analyzing the outcomes of rating schemes is through a gap analysis (Carney, 2012). It is a method to identify how to go from a current state to a desired future state as shown in Figure 2. Gap analyses identify answers to questions such as: "where are we now?" "Where do we want to go?"; "how do we do that?" and "what do we need to do

to get there?" (Carney, 2012). By using a gap analysis one may be able to identify future states from current states for green building certification ratings (Carney, 2012). It is useful for a feasibility study to identify necessary upgrades, or cost-effective opportunities to increase overall certification level if it exists (WSP Group, 2015). Consultants use some kind of gap assessment to show clients where their building is falling against any of the rating system criteria (Carney, 2012).

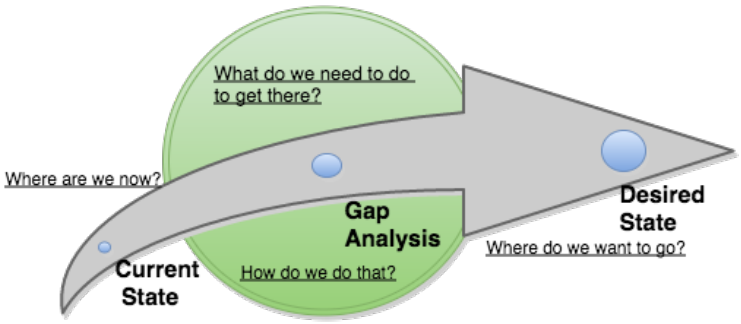


Figure 2 Gap Analysis Model

Source: adapted from Carney, 2012

2.4 Rating Systems for Existing Building Stock and Renovation of Buildings

As previously mentioned academic literature on rating systems for existing buildings is relatively new and studies done on both were difficult to find. However, there are a number of reports and studies looking at the energy efficiency potential in existing buildings.

Crawley & Aho (1999) found that rating systems provide a good starting point for renovation and refurbishment design. They can both identify critical aspects of environmental performance of existing buildings in comparing the potential impact of various renovation alternatives and in selecting and implementing the most cost efficient measures for environmental improvements (Crawley & Aho, 1999).

Identifying what is the most important areas of renovation in regards to sustainability, cost, and clients can be particularly challenging and context specific. Looking at the economics of green retrofits, Kok et al. (2012) focused on green retrofits through the lens of LEED buildings certified under Existing Building: Operations and Maintenance certification scheme between 2005-2010. They investigated types of improvements made as well as the investments required to do so. Additionally the researchers conducted a survey of building owners on what are considered typical improvements and their attitudes towards the costs and benefits of upgrades. Their results indicated that major improvements made during retrofit had a strong focus on energy, but that water is increasingly important. The low-hanging fruit such as increasing the energy efficiency of lighting came in first; second, updating HVAC systems; and third, water flow systems. The study also surveyed property owner's attitudes on the improvements made on the buildings (Kok et al., 2012).

Juan et al. (2010) studied sustainability for office building renovation and energy performance improvements and identifies that building renovation has recently been regarded as a good alternative to reconstruction or redevelopment as it reduces the costs, improves environmental performance, and does not disturb neighbours or any surrounding social

relationships. Their study looked at decision support systems for assessment and renovation strategies. They developed a framework, and a computerized tool, which involved three major processes: an assessment, a method strategy, and feedback (Juan et al., 2010). They concluded that the system functioned to provide a general analysis process that dealt with sustainable renovations and the core processor – the algorithm – successfully solved complicated and large-scale problems in the case studies (Juan et al., 2010).

In summary, this literature provided background information in the field of building assessment tools, rating systems, and existing buildings. The following chapter goes in greater detail into the leading certification schemes in Sweden and how they function.

3 Green Building Certification Schemes

This Chapter aims to build on the contextual information about green building assessment tools with an in-depth review of the three green building certifications for existing buildings introduced in Chapter 1: LEED EBOM, BREEAM In-Use, and Miljöbyggnad for existing buildings. Each rating system begins with an introduction to the rating scheme, followed by pertinent certification information and the structure of the scheme, and lastly, how the scheme performs in Sweden. Based on this review, information from this chapter will form the basis of a discussion found in Chapter 6 that will address the first research question:

RQ1: What are the differences between LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad för Befintliga Byggnader 2.1 schemes?

There are a number of green building certification schemes around the world developed by various stakeholders and building professionals to suit national and international contexts. As discussed, the most widely known certification schemes today are the BREEAM certification and the LEED certification (Cole, 2005; Lee, 2013). The U.S. Green Building Council is responsible for creating the Leadership in Energy and Environment Design (LEED) Certification system, the U.K.-based Building Research Establishment (BRE) developed the BREEAM certification, and the Swedish building industry created the Miljöbyggnad certification, now run by the Swedish Green Building Council (SGBC). Shortly after the two schemes were developed in the 1990's by established green building councils and research bodies, the World Green Building Council (WGBC) was created in 2002 as a union of national councils to oversee international green building efforts. Today, the WGBC's mission is to accelerate the transformation of making the built environment more sustainable (Medineckiene et al, 2014).

Green building certification schemes have been created to improve building quality by identifying criteria that relate to impacts on the natural environment. Harnessing new building science, technology, systems for operation and a focus on integrating the building process with sustainability criteria, have allowed designers, builders, operators, and decision-makers to build or renovate green, maximizing both economic and environmental performance (Lützkendorg & Lorenz, 2006; USGBC, 2009).

3.1 LEED 2009 for Existing Buildings – Operations & Maintenance (LEED EBOM)

3.1.1 Introduction to LEED EBOM

The LEED rating system is a voluntary, consensus-based, market-driven building rating system based on already existing and proven technology (USGBC, n.d.-e). The system was designed to evaluate environmental performance from a whole building perspective over the course of a building's life cycle (USGBC, n.d.-e). Since the first version of LEED was launched in 1998, the USGBC has expanded the LEED rating system to accommodate many different types of buildings allowing for a more detailed look at the context suitable to the building use, environment, and people. There are currently five rating systems that can address different building types. LEED for (USGBC, 2012-2015-b):

- Building Design and Construction
- Interior Design and Construction
- Operations and Maintenance
- Neighbourhood Development

- Homes

Figure 3 has been reproduced from MLM consulting (2015) to illustrate the different LEED rating systems for building types available based on the life cycle phases.

LEED EBOM concerns itself with the operations phase or in life cycle assessment terminology, the in-use phase of buildings (MLM, 2014). This is in line with the fact that this phase has the largest environmental impact as outlined above in Chapter 2.

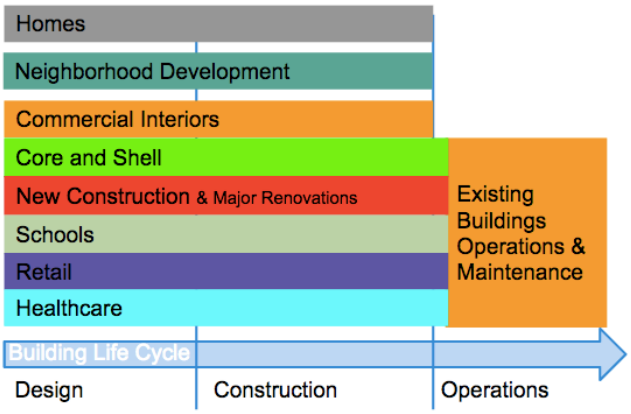


Figure 3 LEED Rating Systems According to Life Cycle Phases

Source: MLM, 2015

LEED EBOM was officially launched in 2005. Although LEED EBOM is a program created in the United States by the USGBC, there are Alternative Compliance Paths (ACP) specifically for Europe to make it more accessible and to address European approaches to particular credit requirements (USGBC, 2012-2015-g). For example, credit EQc3.3, in the original LEED EBOM reference guide, stands for "Green Cleaning – purchase of sustainable cleaning products and materials" and outlines two U.S. standards for approved sustainable cleaning materials (USGBC, 2012-2015-g). Through an ACP, LEED EBOM approves European standards in place of the U.S. Green Seal or Environmental Choice. This includes the EU Eco label, the Bra Miljöval, Der Blaue Engel, and Svanen among others (USGBC, 2012-2015-g).

LEED EBOM sets itself apart from the other LEED schemes as a set of performance standards for operations and maintenance of existing commercial or institutional buildings, both public and private (USGBC, 2009). LEED EBOM was designed to reward the continual improvement in sustainability of current operations in existing commercial buildings (USGBC, 2009.) Any of these kinds of buildings are eligible for a LEED EBOM certification, which include offices, retail and service buildings, institutional buildings (i.e. libraries, schools, churches, etc.), hotels and residential buildings (USGBC, 2009). LEED EBOM is intended for whole buildings only and therefore, multitenant buildings must consider meeting the minimum requirements of involving at least 90% of the total gross floor space (USGBC, 2009). The overall aim with this scheme is to encourage and promote high-performance, healthy, durable, affordable, and environmentally strong practices in existing buildings (USGBC, 2009). The environmental impacts associated with existing buildings have been identified in this scheme to include greenhouse gas emissions, fossil fuel use, toxins and carcinogens, air and water pollutants, and indoor environmental conditions (USGBC, 2009).

3.1.2 Certification Process

By Whom

The LEED EBOM certification process can be started by anyone who registers a project through the USGBC's online platform for LEED. USGBC is the parent organization of LEED green building rating systems and offers a suite of reference guides, rating system

information, and education programs, while its sister organization, the Green Business Certification Inc. (GBCI) receives the online LEED application submissions and is responsible for the building certification and professional accreditation (Long, 2015). The only ruling body on certification is the GBCI who reviews, makes the final decision over the application, and rewards the formal certification (USGBC, 2012-2015-d).

Together the USGBC and GBCI offers professionals in sustainability distinguished roles such as a "LEED professional credential," which certifies that you have passed an exam recognizing you as a leader in the field and an active participant in the green building movement (USGBC, 2012-2015-c). One can also register for other distinguished titles such as a "LEED Green Associate" or a "LEED AP" (USGBC, 2012-2015-c). Each of these professional titles requires separate exams and ultimately, the LEED AP is the title indicating that you possess advanced knowledge in green building as well as expertise in a particular LEED rating system (USGBC, 2012-2015-c). This title does not qualify that you have technical training in building engineering, nor does it mean that you reward certifications. However, if a property owner would like to certify a building, it is wise to consult those trained as LEED APs who are familiar with rating systems and can walk you through an assessment process. Most often, LEED APs are in fact building professionals and/or sustainability consultants.

How

According to Jenny Carney (2012), a reviewer for USGBC and GBCI, the complete certification process truly begins with a strategy for LEED EBOM. Because existing buildings are already in operation and likely meet some of the criteria intended for existing buildings, it is important first to know the performance specifics of the building and identify those already achieved requirements. Additionally, checking for prerequisites and the improvement potential of the building will save a lot of time later on during the assessment phase.

LEED EBOM is made to be flexible and comprehensive in its criteria requirements, which means there is no adherence to a particular assessment order or strategy to get certified – as long as the building meets the minimum standards of the scheme (USGBC, 2009; Focus Group, 2015). Generally, one is able to substitute various credits in order to receive points (Focus Group, 2015). Thus, it is a good idea to consider as an initial step, developing a kind of plan or approach before completing the assessment template. The project team is encouraged to clarify the intended approach to the assessment and the various responsibilities of all those involved on the project (Carney, 2012; USGBC, 2012-2015-d).

Figure 4 suggests the initial certification process (first-time certification) for LEED EBOM in six steps according to Carney (2012). A project needs to apply for recertification every 5 years or else it will have to go through the initial certification process all over again (USGBC, 2009).

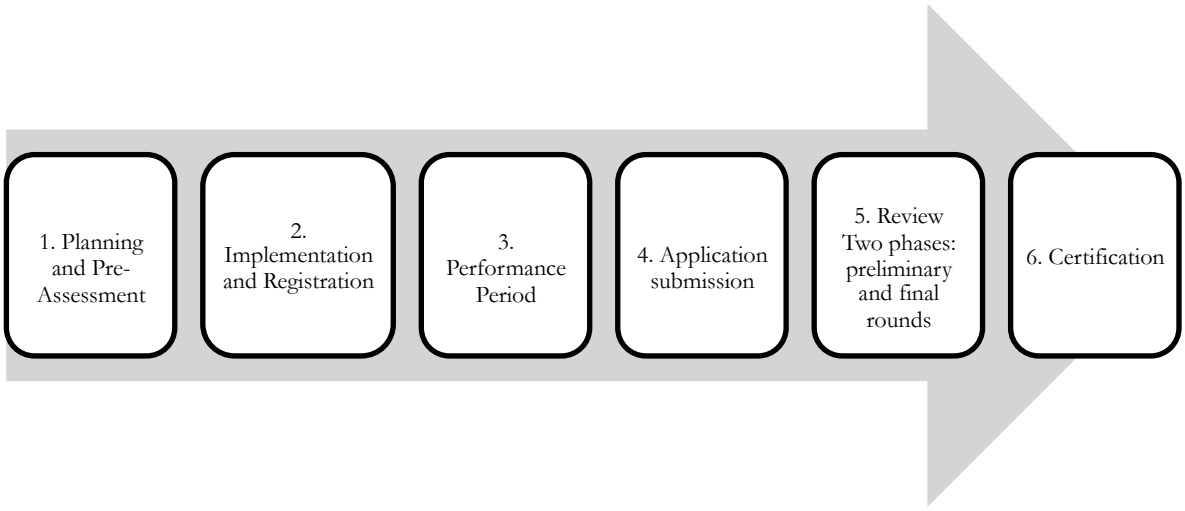


Figure 4 LEED EBOM Certification Process

Source: adapted from Carney, 2012

The first step according to Figure 4 is to create a plan as mentioned above and to do a LEED EBOM assessment of the building developing a LEED project feasibility study. This step can take up to three months on average to collect all of the information and collate it into a feasibility study (WSP, 2015; Carney, 2012).

The second step in certification is to register your project with USGBC and GBCI and to implement any upgrades, policies and processes intended to meet any of the credit requirements. This step needs to be done before the performance period begins and can vary widely. In general, any implementation can take a project team anywhere from three to six months to prepare depending on the extent of the work that is being implemented (WSP, 2015; Carney, 2012).

The third step in certification consists of a mandatory performance period of a minimum of three months - required for most credits. Energy performance, however, requires one full year of data collection due to seasonal variation in the data (Carney, 2012). So, a performance period can take up to a year if the information is not readily available to prepare the evidence.

At the end of the performance period, the project team has to be quick because they need to submit documentation within sixty days of when the performance period has ended. This is maybe one of the most important time stamps in the LEED process. At that time, that is the fourth step in the certification process: the submission of complete assessment templates via the LEED Online Program. This includes any gathered documentation as evidence and data, which indicates that the building meets the credit requirement (Carney, 2012). This is a strict deadline after the sixty-day performance period is up.

The fifth step is in two phases – the GBCI will review the whole application. The first phase of the review is a preliminary round where the applicant party will get feedback on the credit review explaining which credits were met and which were not (Carney, 2012). Additionally, they will address any pending credits which means that with additional evidence, the applicant may resubmit new or different evidence intended to satisfy the pending credits (Carney, 2012). The applicant party resubmits for the second time with any changes and the second phase – the final review begins. The last step ends with the decision on the final review, the final rating level and LEED certification. If necessary, there is a credit appeals process for any credits that

were denied by the GBCI. After the final review has been made, applicants can appeal those credits.

From start to finish, the entire LEED EBOM certification process can take as long as one and a half years. Ultimately, it depends on how prepared ahead of time the property owner and/or project team is in already having the building running to meet sustainable goals. In that case, LEED EBOM can be a documentation exercise rather than a project that requires major implementation efforts and first-time monitoring of systems.

Cost

As green building certification schemes are commercial products, they come with a price. The cost of LEED EBOM certification should be considered by all property owners, but vary widely depending on project. Although it varies by project depending on area by square footage, credit appeals, etc., a flat fee exists at two points of the certification process. Table 3-1 shows that registering a project as a non-member, the cost is 1,200 USD (approx. 1,068 Euros).

Table 3-1 LEED EBOM Fees in 2015 Exchange Rates

LEED 2009 EBOM Fees	Organizational or Non-Members	Silver, Gold and Platinum Level Members	Member Savings
Registration	1,200 USD (1,068 EUR)	900 USD (800 EUR)	300 EUR (267 EUR)
Certification Fees	Starting at 2,000 USD (1,780 EUR)	Starting at 1500 USD (1,335 EUR)	500+ USD (445 EUR)

Source: adapted from USGBC, 2012-2015-d

The certification fee or initial review for a building project with gross floor area (excluding parking) of less than 50,000 sq. ft. (4,645m^2) is 2,000 USD (approx. 1,780 Euros) (USGBC, 2012-2015-d). The larger the building project the more it costs. As mentioned, the costs presented here do not take into consideration credit appeals, consulting fees, or building size.

3.1.3 Structure of the Scheme

LEED EBOM has seven comprehensive scoring categories made up of individual credit requirements to achieve a high-performing sustainable building. Each category and their following credits are weighted according to their respective environmental impacts and human benefits (USGBC, 2009). Within these seven categories, some have pre-requisites that act as the system's minimum standards of performance that must be met in order to achieve certification. Appendix 2 illustrates the minimum requirements for certification under the LEED EBOM system. The seven categories for buildings in LEED EBOM are: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and bonus credits and points can be achieved in Innovation and design, and Regional Priority (USGBC, 2009).

Figure 5 shows the breakdown of points associated with each LEED EBOM category out of the total possible points, which is 110 (10 points are bonus points between ID and RP credits). Under each category, a number of credits exist detailing the requirements and performance standards of a high performing building. Points are then allocated by credit

depending on the degree of fulfilment. The weighting process is a simple one-to-one ratio meaning that the points indicate the value of the environmental impact (In the LEED EBOM reference guide, one finds the details of each pre-requisite and credit (USGBC, 2009). For each, the reference guide explains the objective or intent of the credit and pre-requisite, the requirements for what must be done to earn the credit, and also potential strategies, tools, and technologies as a method for achieving the credits (USGBC, 2009). Appendix 2 illustrates an example of one of the categories, Sustainable Sites, and points associated with each credit. Further information of the requirements of each credit can be found in the LEED EBOM reference guide (USGBC, 2009).

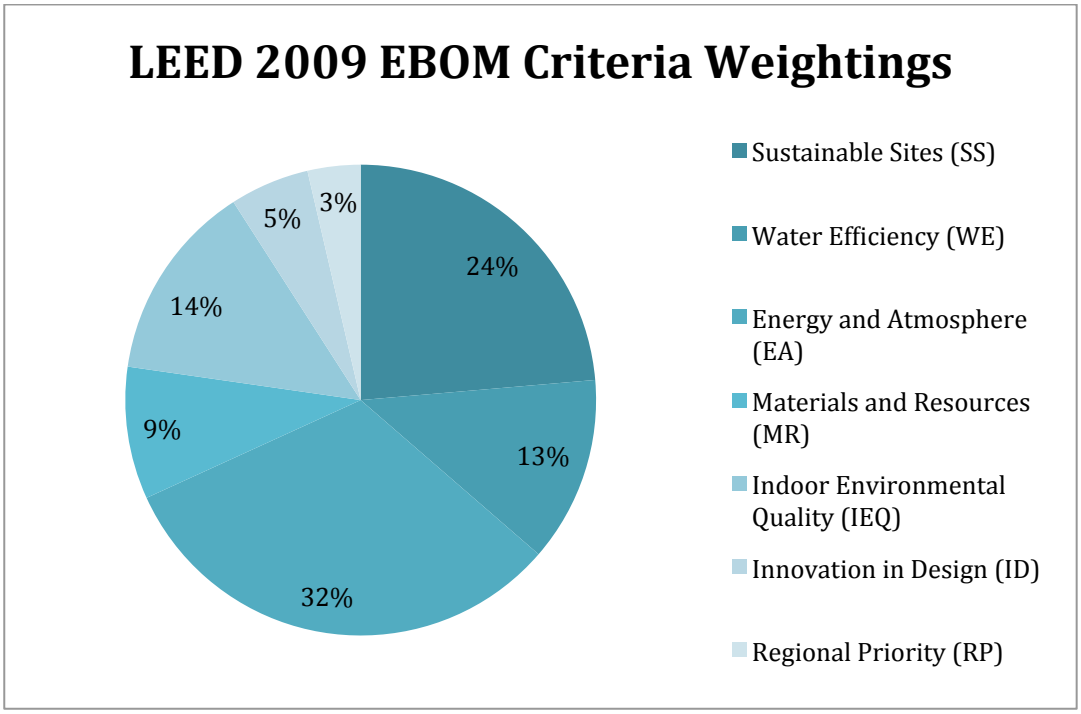


Figure 5 LEED EBOM Criteria Weightings. Source: data from USGBC, 2009

As previously mentioned, the LEED EBOM system is flexible and comprehensive. Apart from the mandatory prerequisites, performance levels can be achieved by various strategies and acquisition of a mix of credits and points in order to earn a rating level. Table 3-2 represents the available rating levels for LEED 2009 EBOM based on points achieved by meeting any portion of the credit requirements as detailed in the LEED EBOM reference guide (USGBC, 2012-2015-d; USGBC, 2009).

Table 3-2 Rating Levels for LEED EBOM

LEED 2009 EBOM Ratings	*Points*
Certified	40-49
Silver	50-59
Gold	60-79
Platinum	80+
Total points available	**110**

Source: USGBC, 2009

3.1.4 LEED EBOM in Sweden

LEED in general in Sweden has been growing steadily since the first projects in the country were announced in 2009. In 2015, less than a decade later, Sweden ranks among the top 10 countries in the world for using LEED certification (USGBC, 2015). Factors such as LEED becoming the preferable international rating system for leading development and real estate firms such as SKANSKA and Vasakronan (USGBC, 2014; anonymous, Personal Communication, 2015; anonymous, Personal Communication, 2015) have contributed to Swedish building industry's dedication to using LEED to achieve more sustainable buildings. These firms have chosen LEED over other systems because of the international popularity, and the ever evolving environmentally comprehensive and flexible credit-based system that is suitable for many different building types and contexts (WSP, 2015; SGBC, 2014; anonymous, Personal Communication, 2015). LEED has developed particular regional priority credits in order to better suit national contexts. For example, the SGBC has played an important role in highlighting particular LEED credits that further the applicability of this rating system in Sweden (USGBC, 2014). In LEED EBOM, the SGBC identified the following credits that are particular relevant to enhancing environmental performance of Swedish existing buildings:

- SSc4 – Alternative Commuting Transportation
- WEc2 – Additional Indoor Plumbing Fixtures
- EAc1 – Optimize Energy Performance
- EAc4 – On-Side and Off-Site Renewable Energy
- MRc7 – Solid Waste Management – Ongoing Consumables
- EQc2.4 – Daylight and Views

The SGBC has also proposed new credits that are uniquely relevant to the Swedish building market. The two credits being piloted focus on moisture-resistant construction and activity-based workshops (USGBC, 2014). The moisture-resistant construction credit looks at energy efficiency measures like airtight building envelopes and lower ventilation volumes because of their high influence on the moisture and humidity levels in buildings. The pilot credit seeks to follow the guidance of Swedish building regulation on moisture and humidity controls (USGBC, 2014). Sweden's geographic location and northern climate is notorious for contributing not only to the outdoor environment's wet weather, but also to the indoor environment's propensity for moisture and humidity as this new credit seeks to address. This is an important credit for Sweden and the greater Scandinavian region due to the impacts and lasting effects on indoor air and environment quality with the threat of airborne irritations like mold (as familiar to the author's personal experience).

The second pilot credit is focused on targeting companies looking to provide the cutting edge offering of flexible, activity-based office environments in order to attract top employees and to encourage employee collaboration (USGBC, 2014). This credit is suited more towards design considerations as well as processes and tools to achieve diverse workspace configurations that appeal for a number of activities in the workplace (USGBC, 2014).

It would appear that a combination of Sweden's stringent performance-based building regulations on energy and current national technological systems tend to accommodate the LEED green building system quite well (USGBC, 2014). This explains why Swedish buildings achieve so much of their points in the energy and atmosphere credits and lead towards such high ratings (USGBC, 2014).

Sweden is among the European leaders in sustainable building with almost 90% of all projects scoring the two highest ratings. According to a report done by the USGBC in 2014, there are

currently 57 LEED-certified projects in Sweden with 67% of all those certified scoring Gold level and 23% scoring Platinum level. An exemplary case of this trend can be seen with Skanska's new headquarters in Helsingborg called Väla Gård. As a newly built building it scored 95 points achieving LEED Platinum and becoming the highest LEED score in Europe as of 2013 (USGBC, 2014). Zero hazardous materials and zero waste were sent to landfills in the making of this building. Although not certified under LEED for existing buildings, this kind of "deep green" building contributes to the market push for buildings in Sweden to be so environmentally high performing (USGBC, 2014). In 2014, LEED EBOM became the most popular LEED rating system with 73% of all the LEED certifications going to existing buildings (USGBC, 2015). The upward trend for the use of LEED certifications in Sweden as well as the great opportunity for property owners to certify their existing buildings to stay competitive make LEED EBOM an increasingly popular system.

3.2 BREEAM In-Use Standard (BES 5058)

3.2.1 Introduction to BREEAM In-Use

The BREEAM (Building Research Establishment Environmental Assessment Method) certification system is the oldest of the three systems presented in this study and was the first of the three to set measures for a building's environmental performance as well as best practice standards in green building rating systems (BRE Global, 2015-a). It was developed by U.K.'s Building Research Establishment (BRE) in 1990 and is currently run by BRE Global, formerly BRE Certification, an independent, third party approvals organization, offering certification of products, services, and products (BRE Ltd., 2015). BRE has a long history in the U.K., which dates back to 1917 when the Department of Scientific and Industrial Research (DSIR) began to consider a new organization solely focused on building materials and the most suitable methods of construction for new homes after the First World War (BRE Ltd., 2015). Today, the organization has grown immensely and a number of sub-companies are held in the BRE Trust.

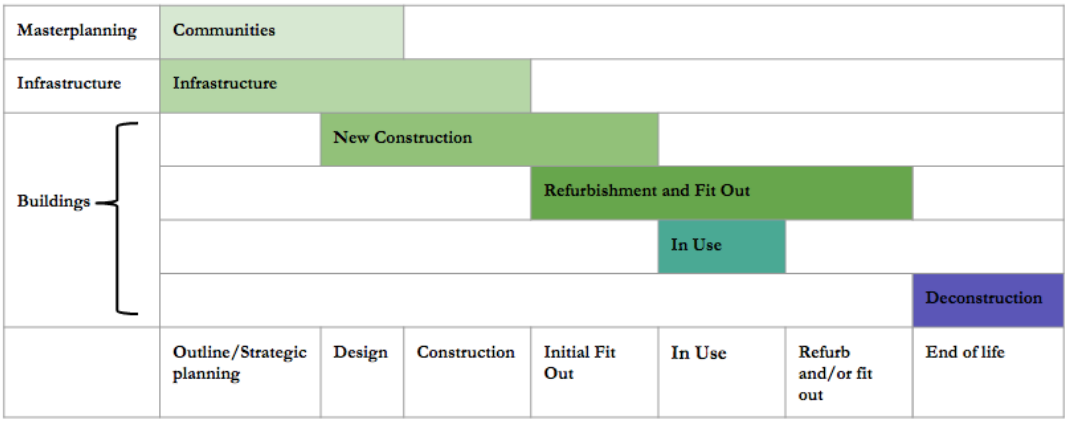
BREEAM is a voluntary, consensus-based certification system that measures performance set against established benchmarks to evaluate different stages of a building's life cycle (BRE Global, 2015-a). It considers the design, construction, and operation of buildings by offering a variety of versions to best suit the building type and life cycle phase (BRE Global Ltd., 2015). According to the official BREEAM website, this system aims "to encourage designers, clients and others to think about low carbon and low impact design, minimizing the energy demands created by a building before considering energy efficiency and low carbon technologies" (BRE Global, 2015-a). BREEAM exists in a variety of formats including country specific schemes like BREEAM SE in Sweden, adapted for local conditions, as well as international versions for individual projects anywhere in the world (BRE Global, 2015-a). Some of the international schemes were created in order to address various life cycle phases. BREEAM International offers (BRE Global, 2015-b):

- BREEAM New Construction
- BREEAM Refurbishment & Fit-Out
- BREEAM Communities Bespoke
- BREEAM In-Use

Each of these schemes addresses different life cycle phases. The BREEAM In-Use scheme, as indicated by its name, addresses the in-use phase of a building's life cycle and was introduced to the market in 2009 (Turner et al., 2012). This scheme is particularly focused on the operational performance of an existing building or a portfolio of buildings. Whereas

BREEAM Refurbishment and Fit out looks at specific choices like building fabric and structure, core services, or local services, or interior design (BRE Global, 2015). Table 3-3 illustrates the BREEAM schemes as well as BREEAM In-Use and the system boundaries for assessment according to the building's life cycle (BRE Global Ltd., 2015). It is not possible to assess buildings that fall in other life cycle phases under the BREEAM In-Use scheme. Therefore, Table 3-3 highlights the intentions for each scheme.

Table 3-3 BREEAM Schemes by Built Environment Lifecycle Stages



Source: BRE Global Ltd., 2015

Officially, the scope of BREEAM In-Use is an international performance based assessment and certification system for existing non-domestic buildings in-use (BRE Global Ltd., 2015). The goal of BREEAM In-Use is to decrease environmental impacts of the operations of existing buildings in a methodologically rigorous and cost effective way (BRE Global Ltd., 2015). It can identify parts of a property that are under performing and/or may require refurbishment and therefore can target investment opportunities and promote continual improvement (BREVideoUK, 2012). BREEAM In-Use recognizes that the use of a building, even if constructed sustainably can be managed inefficiently and can therefore have a high environmental impact and be expensive to operate (BREVideoUK, 2012). BREEAM In-Use certification offers organizations ways to (BREVideoUK, 2012):

- Reduce operational costs through energy and utility savings, improving productivity of the occupying business.
- Demonstrate a commitment to sustainability and the resulting superior performance of their property, which can go a long way to enhancing the value and marketability of property assets and portfolios as a whole.
- Comply with environmental legislation.
- Improve productivity and sustainable business practices with staff.
- Visualize impacts of their property portfolio and a pathway for continuous improvement.

3.2.2 Certification Process

By Whom

The BREEAM In-Use certification requires a licensed and qualified assessor/auditor who understands the technical issues covered by the scheme to audit the assessment (BRE Global

Ltd, 2015). The assessment can also be done by an assessor if the client requests. To become a licensed assessor, one must first take a three-day intensive training course to prepare for working with the BREEAM schemes followed by an exam (BRE Global Ltd, 2015). Pre-requisites of becoming a BREEAM In-Use assessor consist of already holding qualification for another BREEAM scheme by BRE Global or having at least two years of full-time experience (in the last five years) in either: building surveying, building regulatory (control) services, facilities management, product or manufacturing auditing, certification experience, environmental/energy background (BRE Global, 2014). With these pre-requisites and the completion of the BREEAM In-Use training course and examination the assessor may apply for licensing from BRE Global Ltd (BRE Global, 2014). As a BREEAM licensed assessor, one is kept up to date with the latest developments through direct communication monthly with BREEAM (BRE Global Ltd, 2015).

The demanding role of an assessor is to gather project information from an on-site visit and interpret the requirements of the scheme in a competent and impartial manner to communicate the assessed performance of the building to the client (BRE Global Ltd, 2015). The assessor must work with the rest of a project team to collect evidence, which is to be submitted with the assessment report (BRE Global Ltd, 2015). To receive certification, the assessor must be "satisfied beyond reasonable doubt" that all information collected shows unambiguous compliance with the criteria outlined in the BREEAM In-Use scheme (BRE Global, p. 31, 2015). All information must be referenced appropriately and made available for quality assurance checks upon request by the BRE Global Ltd (BRE Global Ltd., 2015).

BREEAM has also introduced the role of a BREEAM AP more recently. A BREEAM AP can offer expert advice to project teams on sustainability of the built environment, on environmental design, or an environmental assessment (BRE Global, 2015-c). The BREEAM AP is most helpful in the planning phases of preparing for a BREEAM certification. They can facilitate project meetings, set priorities for the assessment process, and balance the trade-offs of targeting a particular rating in the BREEAM scheme. Similar to the LEED AP, a BREEAM AP is a skilled specialist demonstrating a high level of competency in the BREEAM assessment process (BRE Global, 2015-c).

How

The certification process for a BREEAM In-Use rating can be followed in Figure 6. Similar to the LEED certification, it is generally understood across the BREEAM online platforms that project teams with or without a BREEAM AP begin to strategize and plan for a BREEAM rating by reviewing the necessary elements required to complete the scheme (BRE Global, 2015). This process, likely done by a gap analysis of some sort, allows the project team to start somewhere and to begin collecting all of the required information. This can be known as a pre-assessment phase. According to the BREEAM In-Use technical manual, they identify the following main steps in the assessment process as (BRE Global Ltd., 2014):

1. Measurement Registration & Payment
2. BREEAM In-Use Assessment
3. Assessor conducts audit and verifies results
4. Certificate requested by assessor
5. (QA of assessor if selected by BRE Global.)

Figure 6 illustrates these steps in addition to the recommended planning step as outlined by BRE Global Ltd. (2014). The measurement registration means the clients have determined which assessment method to use and depending on the method chosen there are different payment options available (BRE Global Ltd., 2014). A client or a licensed assessor on behalf

of the client is than able to fill in the online assessment template. The assessment process is based on a number of questions and client comments that become translated into achieved credits (BRE Global Ltd., 2014). After the assessment template is completed, it must be independently verified by a BREEAM In-Use assessor (BRE Global Ltd., 2014). This is like an audit and quality assurance practice. Once the assessor is satisfied with all of the answer options selected by the client and there is correct evidence to support all claims, they will submit a request to BRE Global for a certificate (BRE Global Ltd., 2014).

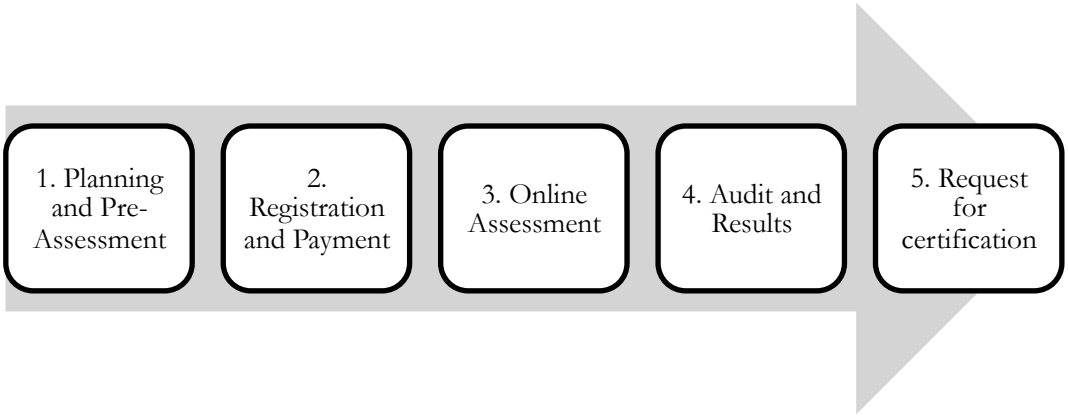


Figure 6 BREEAM In-Use Certification Process

Source: BRE Global Ltd., 2015

The timeline for this certification varies depending on project context, but it is likely to take up to a year or more in completion depending on how well-documented the building performance is at the time of investigation and assessment (this has been interpreted from the similarity in the scheme compared with LEED EBOM, actual timeframes have not been identified in the literature or in interviews).

Cost

The payment structure of a BREEAM In-Use certification is similar to LEED EBOM in that payment is done at time of registration. From the reviewed materials, it is unclear how much this scheme costs for basic registration fees specific to this scheme. The payment likely varies by which assessment is chosen and how large the building and occupancy rates are.

3.2.3 Structure of the Scheme

The BREEAM In-Use scheme was created with three unique assessment parts, each focusing on a different aspect of an existing building's performance (BRE Global Ltd., 2015). The three parts are as follows:

- Part 1 – Asset Performance
- Part 2 – Building Management
- Part 3 – Occupancy Management (only applicable for offices)

As soon as any building has been built, the building's performance characteristics such as the fixtures, fittings and installed services can be assessed in Part 1(BRE Global Ltd., 2015). BREEAM In-Use recommends that the client type for Part 1 would likely be the building owner (BRE Global Ltd., 2015). The management of a building is instrumental in a building's performance. Thus, Part 2 of BREEAM In-Use aims to address the policies, procedures and practices in place related to operating the building (BRE Global, 2015). It looks at

overconsumption of key resources and environmental impacts through managing the behaviour of its occupants. Therefore, Part 2 is best suited to client types who are facility/building management (BRE Global Ltd., 2015). Lastly, Part 3 is only available for office buildings as it relates to occupier management. Occupier management relates to the management of the building users and services and it looks at their understanding and implementation of the policies, practices and procedures through staff engagement and delivery of key outputs (BREVideoUK, 2012; BRE Global Ltd., 2015). The client type for Part 3 would be most suitable to occupants (BRE Global Ltd., 2015).

BREEAM maintains a flexible system by allowing the trading of credits. This means that non-compliance on one credit can be offset by compliance on another credit. The system assesses and benchmarks across a range of environmental issues identified by BRE Global. These issues, or similar to LEED's categories, where credits are earned are: management, health & wellbeing, energy, transport, water, materials, waste, land use & ecology, and pollution (BRE Global Ltd., 2015). However, minimum standards and mandatory fields of completion are set to ensure environmental issues are not overlooked quality performance is met above regulatory measures (BRE Global Ltd., 2015). Most of the mandatory fields are found in the energy credits in Part 1 and Part 2 and are needed in order to do the energy modelling that informs the level of achievement in energy credits. In Part 3, all of the minimum standards are outlined according to minimum acceptable level of performance (BRE Global Ltd., 2015).

BREEAM In-Use assessments are organized for the client or assessor to answer questions related to the building, operations, or occupier specific questions depending on the Part that is being filled out (BRE Global Ltd., 2015). Each part is divided into categories or issues (BRE Global Ltd., 2015). The BREEAM In-Use technical manual acts as a reference guide structured to elaborate further on the issue information, the questions, the aim, the available credit, the assessment criteria, and the type of evidence required (BRE Global Ltd., 2015). Evidence is expressed as an important area of note due to the very important role it plays in BREEAM In-Use. In order for BREEAM assessors to ensure consistency and credibility in their certification decisions, they need to collect verified and credible information that is traceable and linked to the building under assessment (BRE Global Ltd., 2015).

BREEAM In-Use makes note that credits have been created using a UK energy methodology and climatic conditions (BREVideoUK, 2012). There are around twenty questions that have been identified as UK specific, but organizations outside of the UK are currently awarded based on a baseline indicative report (BREVideoUK, 2012). Currently, BREEAM is developing an international core question set with input from international partners that will allow high comparability of issues from country to country. The international question set will be targeted towards property owners with an international property portfolio (BREVideoUK, 2012). Additionally, the scheme is working with national scheme operators – countries licensed to administer the scheme in local language including additional questions to reflect local conditions and regulations (BRE Global Ltd., 2015).

The elements that determine the overall performance according to the BREEAM In-Use scheme include (BRE Global Ltd., 2015):

- If doing Part 3 – the minimum standards
- The assessment issues and credits
- The environmental section weightings
- The rating level benchmarks

The BREEAM weighting system has been developed through a national consultative process and with a research body at BRE Global (Alyami et al., 2012). It is developed as a pre-weighted system assigning various weights according to the environmental issues (also known as sections or categories). For BREEAM In-Use, the section weightings have been designed differently for each Part as it has been identified that during these assessments, each issue holds varying impacts according to what aspect of the operational building one is looking at (BRE Global Ltd., 2015). Table 3-4 illustrates the different weights in the BREEAM In-Use scheme.

Table 3-4 BREEAM In-Use Category Weightings

Environmental Categories	**Weighting**		
	Part 1	Part 2	Part 3
Management	-	15%	12%
Health & Well-Being	17%	15%	15%
Energy	26.5%	31.5%	19.5%
Transport	11.5%	-	18.5%
Water	8%	5.5%	3.5%
Materials	8.5%	7.5%	4.5%
Waste	5%	-	11.5%
Land Use & Ecology	9.5%	12.5%	5%
Pollution	14%	13%	10.5%
Total	100%	100%	100%

Source: BRE Global Ltd., 2015

These weights are then applied to the scores achieved from each issue category. The scores from each issue category have been aggregated from the scores of the assessment credits achieved. Figure 7 illustrates the scoring system with the environmental weightings applied. To calculate the rating, one takes the credits achieved over the credits available and gets the percent of credits achieved. With that score, one multiplies the weightings against the score of credits achieved and receives the overall section score. These section scores are aggregated and ultimately, through this process, a single score is produced in a percentage, which corresponds to a BREEAM rating.

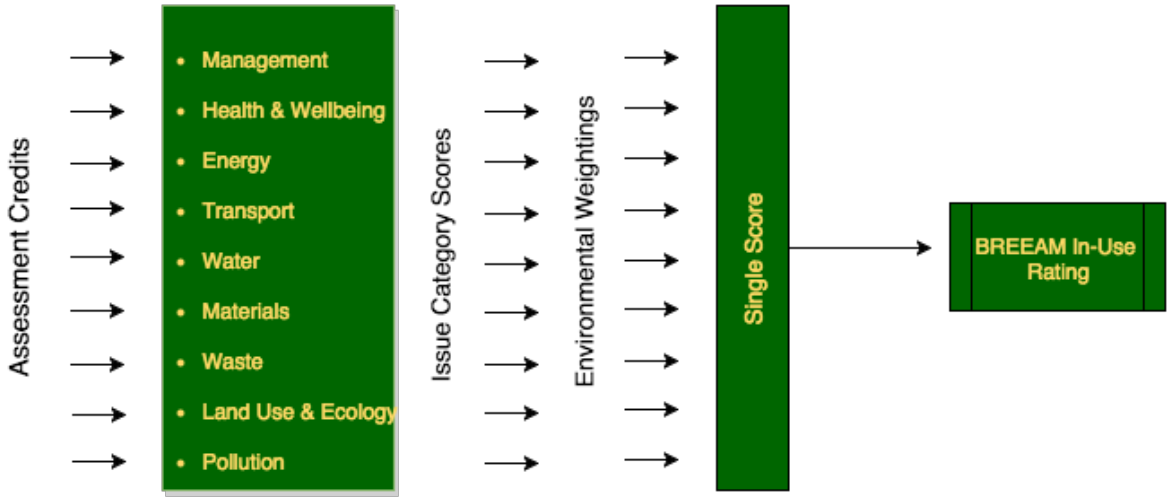


Figure 7 BREEAM In-Use Scoring Process

Source: Green Construction in UAE (n.d.)

The BREEAM In-Use ratings as shown in Table 3-5 are: unclassified, acceptable, pass, good, very good, excellent, and outstanding. Each rating is accompanied by a percent score threshold as well as a star rating.

Table 3-5 BREEAM In-Use Ratings

BREEAM In-Use Rating	% Score	Star Rating
Outstanding	≥85	★★★★★★
Excellent	≥70 to <85	★★★★★
Very Good	≥55 to <70	★★★★
Good	≥40 to <55	★★★
Pass	≥25 to <40	★★
Acceptable	≥10 to <25	★
Unclassified	<10	-

Source: BRE Global Ltd., 2015

3.2.4 BREEAM In-Use in Sweden

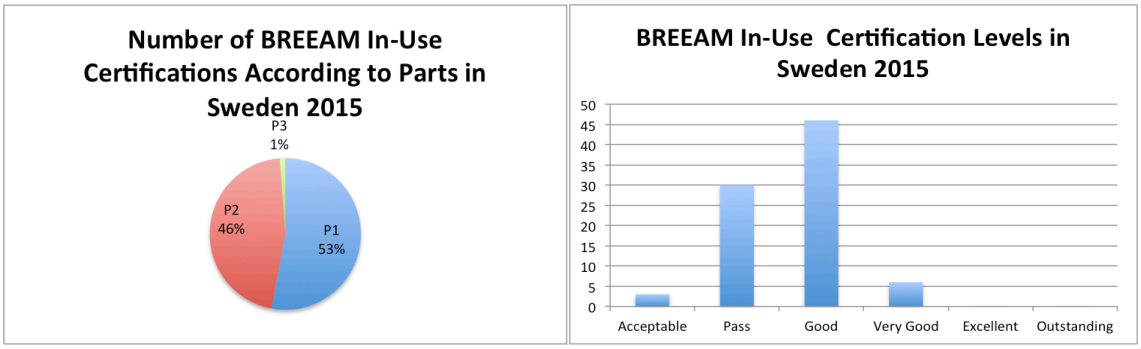
Similar to the trend of LEED certifications in Sweden, competing leading firms such as NCC and PEAB in the Swedish building and construction industry favour BREEAM (Focus Group, 2015). In 2009, NCC made it a policy that all proprietary commercial buildings will be certified by the BREEAM system (NCC, 2015). In 2011, PEAB decided that all in-house building projects should have some level of environmental certification. They have also made it a company policy that all commercial properties are certified according to BREEAM (PEAB, 2011). However, while these companies pave the way for commercial success of these certification systems, the focus on the In-Use version is still to be seen. It marks a steady trend in using the green building certifications in the building market and that many companies already housed in an office building may begin to feel the pressure of declaring environmental performance as a part of their asset portfolio.

BREEAM In-Use is a relatively new development in the BREEAM family and it shows in searching for BREEAM In-Use news and developments in Sweden. However, it is a rather strong indication that BREEAM in Sweden, likely to include the scope of BREEAM for existing buildings, will be more available as the SGBC has worked hard to become a national scheme operator. This also means that a new version - BREEAM SE will be available to the market. As previously mentioned national scheme operators have the authority from BRE Global to revise the scheme to include more country-specific environmental issue credits and to publish in the Swedish language.

As of 2012, globally, BREEAM In-Use had over 1000 assets registered and almost half of these have been certified and about 85% of existing certifications are renewing their BREEAM In-Use certification (BREVideoUK, 2012)

According to BREEAM's database on greenbooklive.com, as of 2015, Sweden has certified 45 buildings with most of them assessing at least Part 1 and most of them doubling up and assessing Part 2 as well (BRE Global, 2015-d). There were very few buildings assessed under all three Parts (BRE Global, 2015-d). The average score for the most common rating level, "good," as shown in Figure 8, was 45%.

Figure 8 Number of BREEAM In-Use Certifications According to Parts, in Sweden, in 2015 and BREEAM In-Use certification levels in Sweden, 2015



Source: Data collected from greenbooklive.com

"Very Good" buildings were on average achieved with a score of 60%. Greenbooklive.com shows 82 entries for certifications in Sweden with information regarding the name of the building, the client or developer, the rating and score, the validation dates, the company who assessed the building, and finally the location (BRE Global, 2015-d).

3.3 Miljöbyggnad för Befintliga Byggnader Version 2.1

3.3.1 Introduction to Miljöbyggnad

Miljöbyggnad (Environmental Building), originally Miljöklassad byggnad (Environmental classification building) is a Swedish green building system designed to protect human health and the environment. It was developed in 2005 in cooperation with the Swedish government, industry, and municipalities through the Bygga-Bo 27 dialogues (build-live-dialogue)(SGBC, n.d; Varnaite, 2013; SGBC, 2014). The funding to create a Swedish environmental certification system came from Formas-BIC, Swedish Energy Agency and participating companies (SGBC, n.d.-a). Miljöbyggnad was created to monitor building performance according to Swedish legislation and regulations (Bauer et al., 2013). The system was adapted to suit the construction and property industry's needs for simplicity, ease of certification and scientific

bases (SGBC, n.d.-a) It was first developed for residential housing and today the scheme covers various types of buildings including both residential and commercial properties (SGBC, 2014). It also may be used for new or existing buidings (SGBC, 2014). In 2011, the SGBC took control of the certification system and now oversee all registration and certification procedures (Bauer et al., 2013). Today, SGBC is working to develop the third version of Miljöbyggnad and to make the certification scheme a trusted Swedish system (SGBC, 2014).

3.3.2 Certification Process

By Whom

The SGBC is responsible for both certifying actual buildings under Miljöbyggnad as well as accrediting individuals to be an environmental coordinator of the scheme (SGBC, 2014). The accreditation process is a course run by the SGBC that trains coordinators to lead the assessment process with clients (SGBC, 2014). This means they review the different versions of Miljöbyggnad, go over the criteria and their requirements and discuss the kind of information and tools needed to collect as evidence such as prior certificates, declarations, surveys, questionnaires, or calculations (SGBC, 2014). There are two courses offered, the first level is the Basic Course (B-Kurs) and is open to everyone who want to know about Miljöbyggnad. The second course offered is the Certification Course (C-Kurs) where the pre-requisite to signing up includes having already done the B-Kurs (SGBC, 2014).

How

According to the SGBC (2014), certification for Miljöbyggnad for existing buildings can be done in five basic steps or less. The certification process requires registration of the building and project. Then, an application can be found online where you can begin to input building data, operations, calculations and measurements and other applicable evidence (SGBC, n.d.). Some of the required evidence can be prepared ahead of time by the property owner before a building professional or consultant intervenes such as energy bills, mandatory ventilation records (OVK), and radon measurements (SGBC, n.d.). The assessment application is then sent to the SGBC and will be reviewed by specialists for a final assessment. This review has up to two allowable audits in order to allow the property owner to submit more evidence if necessary. After the second review, the third round will be accompanied with a fee (SGBC, 2014). The final decision will be issued with a certification record (SGBC, 2014). The timeline for certification between steps three and five in Figure 9 can be one and two years until certification is issued. SGBC makes special note that one may register a project and apply over a maximum of three years before the registration process and fee will have to be done over (2014). One must also expect that SGBC has up to three weeks to review your application in step four.

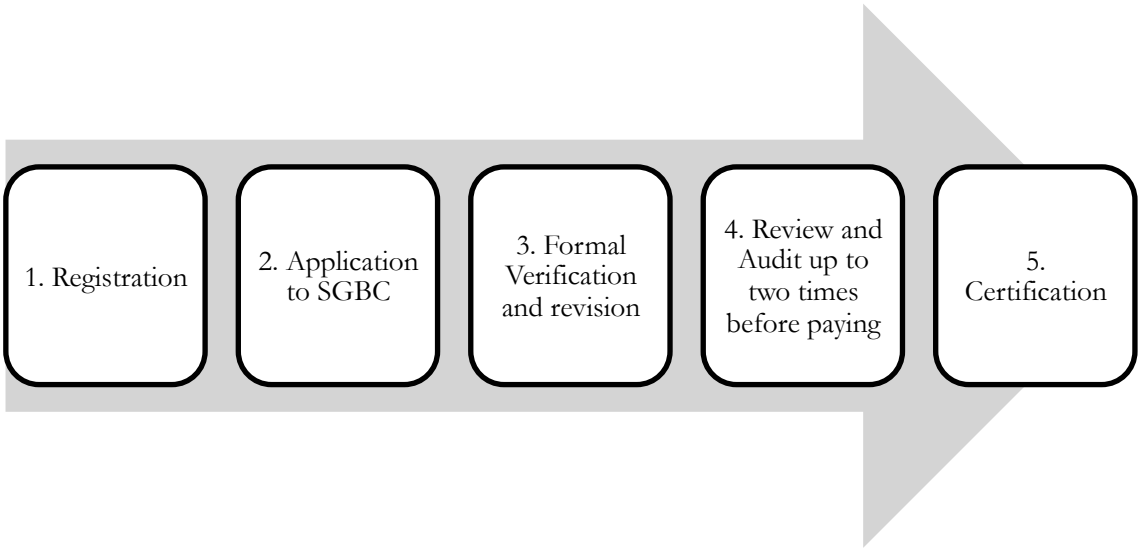


Figure 9 Certification Process for Miljöbyggnad for Existing Buildings

Source: SGBC (2014)

A certification is valid for up to ten years or until the building has any major refurbishment or renovation (SGBC, 2014).

Cost

The fees associated with the Miljöbyggnad for existing buildings can be found in Table 3-6 and vary depending on size of the building. There are also additional costs for any added review steps (SGBC, 2014).

Table 3-6Miljöbyggnad Fees not including items listed as "additional charges" and Based on 2015 Exchange Rates

Miljöbyggnad for Existing Buildings	**Small Building (<10,000m²)**	**Medium Building (10,00-40,000m²)**	**Large Building (>40,000m²)**
Registration	SEK 3,060 (325 EUR)	SEK 3,060 (325 EUR)	SEK 3,060 (325 EUR)
Review (default)	SEK18,360 (1952 EUR)	SEK 20,400 (21,69 EUR)	SEK 22,440 (2,386 EUR)
Certification	SEK 6,120 (651 EUR)	SEK 6,120 (651 EUR)	SEK 6,120 (651 EUR)

Source: SGBC, 2014

3.3.3 Structure of the Scheme

Miljöbyggnad for existing buildings assess only the building. It has three main categories: energy, indoor environment, and materials/chemicals. The assessment identifies environmental aspects that can be measured with fifteen indicators. Figure 10 shows the three levels considered.

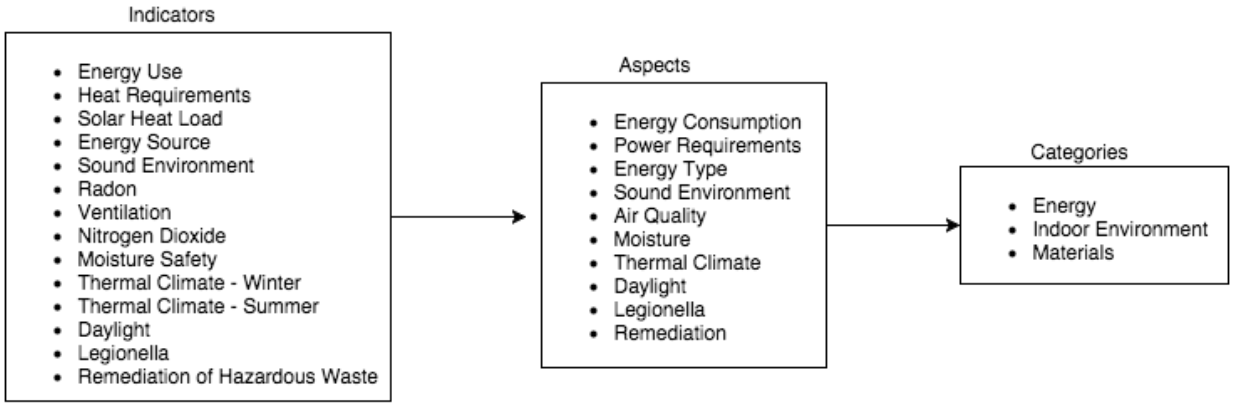


Figure 10 Three Levels Considered Miljöbyggnad for Existing Buildings

Source: SGBC (2014)

Unlike the two other certification schemes, Miljöbyggnad does not use a weighting system, but instead aggregates results through an outranking process (Glaumann, 2011). The available ratings are classified (Klassad), bronze, silver, or gold. According to Glaumann (2011), there are two aggregation principles employed in the outranking process:

> Principle 1: the worst score outranks the higher score.
>
> Principle 2: If the majority of the scores are higher than the worst score, then the ranking will be one higher than the worst score.

Table 3-7 shows how these two principles are employed with an example scoring sheet for a building that received a Bronze rating.

Table 3-7 Miljöbyggnad for Existing Buildings Weightings and Rankings

Principle 1		Principle 2		Principle 1		
Indicator		Aspect		Category		Building Rating
1 Energy Use	GOLD	Energy Consumption	GOLD	Energy	BRONZE	BRONZE
2 Heat Requirements	GOLD	Power Requirements	CLASSIFIED			
3 Solar Heat Load	KLASSAD					
4 Energy Source	SILVER	Energy Type	SILVER			
5 Acoustics	SILVER	Acoustics	SILVER	Indoor Env. Quality	SILVER	
6 Radon	BRONZE	Air quality	BRONZE			
7 Ventilation	GOLD					
8 Nitrogen Dioxide	BRONZE					
9 Moisture safety	SILVER	Moisture	SILVER			
10 Thermal Climate - winter	SILVER	Thermal Climate	SILVER			
11 Thermal Climate - summer	SILVER					
12 Daylight	GOLD	Daylight	GOLD			
13 Legionella	SILVER	Legionella	SILVER			
16 Remediation of hazardous waste	BRONZE	Remediation	BRONZE	Material	BRONZE	

Sources: SGBC (2014), Glaumann (2011)

3.3.4 Miljöbyggnad Befintliga Byggnader in Sweden

Miljöbyggnad is providing the Swedish certification market with something that claims to address the national environmental context for buildings and is in the process of developing its third version (SGBC, 2014). The first buildings certified under Miljöbyggnad were in 2010, so it is still fairly young compared with the certification systems like BREEAM and LEED and therefore statistics about Miljöbyggnad in Sweden are difficult to find (SGBC, 2014). However, in 2014, SGBC says that the 250th building had been certified and in 2013, there were at least 1000 buildings registered to certify (SGBC, 2014; Peab, 2013). According to the SGBC, there is a fast growing demand for environmental certifications in Sweden and Miljöbyggnad hopes to ride this trend and increase the number of certifications (SGBC, 2014). The SGBC recommend Miljöbyggnad because it offers a cost-effective and simple option to certify buildings (2014). Leading development and construction firms in Sweden like Peab, NCC, and Skanska all use Miljöbyggnad (Peab, 2014; NCC, 2015; Skanska, 2015). Peab and NCC have chosen to certify all residential projects in Sweden according to Miljöbyggnad (Peab, 2014; NCC, 2015). With all of these market indicators, the offering Miljöbyggnad for existing buildings in Sweden would likely see a marked increase as well.

4 Research Methodology

This chapter aims to describe all of the methods used for data collection as well as the methods for data analysis. WSP Group made key contributions to the methods of data collection. Morgan et al. (1998, p.12) said, "a distinctive feature of qualitative-based inquiries is that data gathering and data analysis are simultaneous activities." Therefore, the author chose to discuss the methods of observation and a focus group study as a part of the methods for data analysis due to their inherently integrated approach to data collection and analysis in this study.

4.1 Research Approach and Overall Structure

The following sections address methodological choices as to how the research questions and objectives have been considered and the steps taken to deliver findings. To review the research questions posed at the start of this study, the author looks to answer:

> *RQ1: What are the differences between LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad för Befintliga Byggnader 2.1 schemes?*
>
> *RQ2: What are the challenges in the initial assessment process of green building certification for existing buildings?*
>
> *RQ3: How do you determine the most appropriate rating scheme for a property owner to select for certification of an existing building?*

Figure 11 is shown to illustrate the general methodology of this study and to match it with further explanation about how each part will answer the research questions. Each box in Figure 11 required a literature review in order to identify relevant background information. Therefore, the literature review is described first in Section 4.2.1. Section 4.3.1 discusses Step 1 of the methodological diagram: it required a complete understanding of the consulting process and the role of the feasibility study before a diagnosis on the whole assessment process in Step 2 could be completed. The assessment templates that were built in Step 1 are explained in more depth in Section 4.3.2 and the rationale for a screening tool to accompany the assessment templates are briefly discussed in Section 4.3.3. The choices and framework for observations on the assessment process in Step 2 are further explained in section 4.4. The choices and framework for holding a focus group in Step 3 are explained in section 4.5.

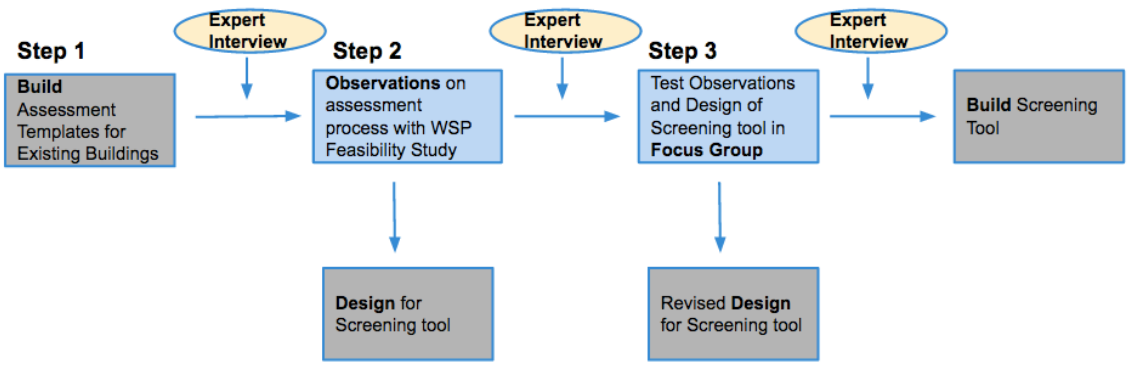


Figure 11 General Methodology

4.2 Methods for Data Collection

The methods for data collection in this study consisted of a literature review, interviews, observations, and a focus group. Below, the literature review and the interviews are explained while the observations and focus group will be presented in the Section 4.3, Methods for Data Analysis.

4.2.1 Literature Review

In order to answer and support the first two research questions, a literature review was conducted throughout all of the Steps in Figure 11 on a variety of important thematic areas in order to better understand the fields under study. The areas of study consisted of: rating systems and green building certification schemes, sustainability assessment methods and tools, environmental assessments of the building sector and buildings in general and in Sweden. Some sub-categories of study consisted of business strategies such as feasibility studies and communication tools.

The documents studied varied from grey literature from official green certification scheme programs' websites to various green building councils both in the U.S. and Sweden. White papers including reports written by other consulting firms about green building certifications as well as academic articles were chosen to develop a knowledge base on the material under study and to motivate the need for existing buildings to go green and to simplify one of the tools used for the process. The green certification schemes under study vary in age between the 1990s to the present date and therefore, the date of publication for various scientific articles ranges from the early 2000's up through the present. The motivation for using articles in the early 2000's comes from a boom in studies on green building certification developed in this field and being highly cited even today.

4.2.2 Interviews

It is necessary to also include that informal information was gathered throughout the thesis period from various WSP consultants in Malmö and Göteborg with their willingness to answer my questions regarding their experience with green building certifications, renovations of buildings, and experience with clients.

Semi-structured interviews were conducted with a group and two other individual interviews. The group interview was conducted with former U.S. Green Building Council members who contributed to the development of the LEED 2009 EBOM certification scheme as well as who have experience with commercial properties and clients. The second expert interview was conducted with the head of sustainability with the Swedish architecture firm White. The interviewee had familiarity with the topic of green certifications for buildings and sustainability of buildings in Sweden, but no implementation experience. The last interview was conducted with the sustainability manager of the Swedish real estate company, Vasakronan. This interviewee had experience at Swedish Green Building Council presenting a comparison between the different schemes for existing buildings that are focused on in this study. The questions asked were formulated ahead of time but mostly used to explore the topic further. All communications can be found in Appendix 1.

4.3 Methods for Data Analysis

The methods for data analysis include the framework for a consulting process for green building certifications, observations on the assessment process for certification, and a focus group study with technical experts.

4.3.1 Consulting Process for Green Building Certifications

The feasibility study is a critical step in any kind of business assessment process. Figure 7 illustrates the development process of an idea and business assessment (Hofstrand et al., 2013).

Many property-owners seeking a green building certification for their commercial property are interested in gathering more information about the "feasibility," or the viability, of a commercial certification. They need to consider the advantages and disadvantages of the market for green building, the technical aspects, the organizational management, and the economic scenarios for a certification (WSP Group, 2015). A good business owner and property owner does not go into any new business venture without thoroughly examining all of the factors and assessing the probability of its success (Hofstrand et al., 2013).

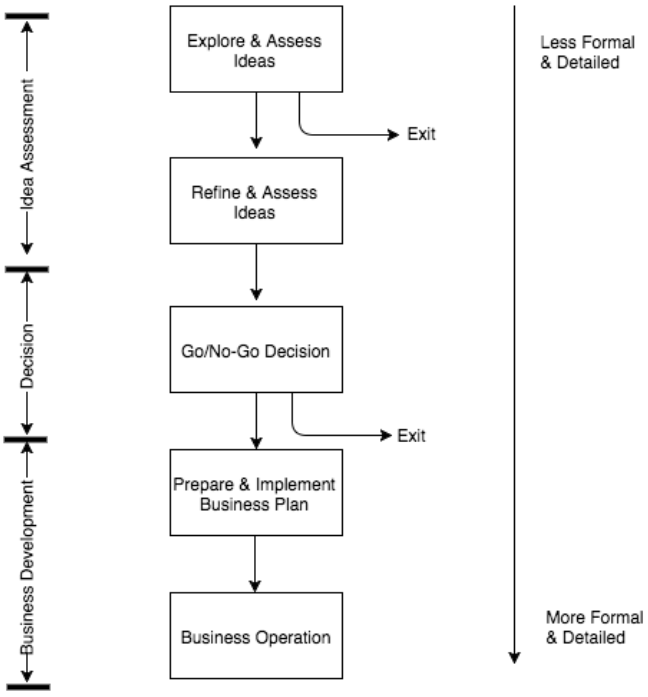


Figure 12 Feasibility Study Process

Source: Hofstrand et al., 2013

Because of the many technical criteria in green building certifications, property owners seek outside experts familiar with green building certifications. Sustainability consultants preferably with backgrounds in building engineering can conduct a proper analysis and assessment of the building in question to provide the necessary information for property owners to make the best decision to certify. However, there are many sustainability consultants who have become assessors or accredited professionals through the official websites of the green building certification such as with LEED. While you must pass the test to become an accredited professional, there are no requirements on your professional background to do so. Most consultants rely on some form of feasibility study to communicate with the client.

In order to apply for certification under any of the green building certification schemes, consultants are required to conduct an assessment. Each scheme has a slightly different version of the certification process and documentation required, so it is important to consider the details of each one separately. However, across all certification schemes an assessment is done after registration is complete to gather the relevant building information and data to measure against the rating scheme to identify achievement scores. The work a consultant puts into a project to do the assessment for certification can be a lengthy process that can take between three months to a year until completion depending on the context of the project (O. Pearce, personal communication, 2015). After the assessment is done, the consultant creates a feasibility study to present to the property owner with the full and complete picture including the aforementioned areas: technical, economic, and environmental.

Generally, the feasibility study in its finished form can be used to identify and explore different business scenarios (Hofstrand et al., 2013). Most business owners are familiar with

feasibility studies, as they are generally a good business practice for most new ventures. A feasibility study has a number of benefits including (Hofstrand et al., 2013):

- Outlines alternatives and narrows the options
- Identifies new opportunities or reasons not to proceed
- Enhances the likelihood of success by surveying all factors early on that may affect the project
- Provides thorough information for decision making as well as documentation that the options were thoroughly investigated
- Helps to secure funding and to attract equity investment

During the "Idea Assessment" phase, there are two steps included in Figure 12. First, one to explore and assess the idea where preliminary discussions between the client and the consultant expert help to form the validity of the proposal. This may lead to a rough assessment of the project and a decision by either client or consultant and someone may end the talks there, "exit," or continue the development of the ideas by going to the second phase where it is important to develop the idea into more concrete plans. Next, this is where the detailed assessment study happens that ultimately is synthesized into the feasibility study, which includes market information, technical, organizational, and economic factors. As you can see in Figure 12, before the feasibility study is completed, many details are collected to form a complete picture of all the advantages and disadvantages of the idea.

4.3.2 Green Building Certification Scheme Assessment Templates

Assessment for certification in all three certification processes is the first step after registration. Assessment templates facilitate a thorough analysis of the building before the feasibility study. They are useful for organizing the collection of information related to the rating scheme. Therefore, having an assessment template ready in excel for consultant use is standard practice to work with clients and in this case for the three certifications identified in this study: LEED 2009 for Existing Buildings: Operations & Maintenance, BREEAM In-Use, and Miljöbyggnad för Befintliga Byggnader v. 2.1 (WSP Group, 2015).

The assessment templates that were built for this study were adapted from WSP Group's templates from certification schemes for new construction and collated in an excel workbook for existing buildings. However, WSP Group provided the excel-based template for LEED EBOM, which was re-formatted and built in the same style as the exemplary templates for new construction. WSP Group also provided the author with the BREEAM In-Use template and because it was already excel-based and suited for consultant use, no changes were made to that template. The author built the Miljöbyggnad for existing buildings template from scratch in the same style as exemplary templates for new construction. These assessment templates were built for consultant use in mind with the goal of being able to develop a feasibility study based on their completion. The adaptation of the green assessment templates for consultant use included categories such as "Requirements," "Questions/Comments," and "Actions." Appendix 6 illustrates the three different templates in their excel format.

For LEED EBOM, Table 4-1 illustrates the main categories under which all credits, their requirements, and specific questions were input. Each category of credits also showed the total available points followed by columns to allocate the achieved points. The "Yes," "Maybe," and "No," columns distinguish the results of a gap analysis in which the current state relates to the points achieved in the Yes column and then the future state with the points achievable in the Maybe column depending on the client's interests and desires. The No

column was also useful in identifying which credits were not achieved as a portion of the category's total points.

Table 4-1LEED EBOM Assessment Template

Credit		Summary of requirements	Questions/Comments	Actions	Total Points Available	Yes	Maybe	No
SS	**Sustainable Sites**				**26**			

Source: WSP Group, 2015-a

The BREEAM In-Use assessment templates were commercially created by the BRE Global Ltd., owners of BREEAM. Seeing that it was already an excel-based, user-friendly format for consultants, no changes were made from the original version. Instead it was added to the workbook created for green building certifications for existing buildings where all three schemes can be found.[2] The BREEAM In-Use assessment template is structured with an overall category section at the top, such as "Materials" as shown in Table 4-2. Below that is a column that includes the reference credit being examined such as "MAT 01" for the category Materials and credit 01, which has a unique requirement like "condition survey." Across the row from "Reference" are the categories "Questions" and "Answer." The BREEAM In-Use template provides a question that the one filling out the assessment template (usually the client or hired consultant/assessor) that reflects the requirement. The user may choose from a drop-down menu the most suitable response, which is automatically calculated into "Credits Achieved" based on an excel formula made by BREEAM. The "Comments" sections are available for notations by each party involved in the assessment and the "Credits Available" indicates what score the total achieved credits are out of.

Table 4-2 Part 1 Asset: BREEAM In-Use Assessment Template

Materials						
Reference	**Question**	**Answer**	**Client Comments**	**Auditor Comments**	**Credits Available**	**Credits Achieved**

Source: BRE Global Ltd., 2015

As mentioned, the template for Miljöbyggnad for Existing Buildings was built from scratch with a former template for new construction made at WSP Group. The first column displays each of the fifteen indicators and their parameters for achievement for each rating level. For Bronze, Silver, or Gold, you can find the performance metrics' threshold in the first column. The second column holds information on what are the metrics for the criteria. The third column assigns a rating level on the current assessment of the criteria, either classified bronze, silver, or gold. The fourth and fifth columns provide the consultant with space to identify any issues or changes that may be examined for action to fulfil a certain criteria. Finally the last column provides a potential rating after action is taken if upgrading is cost-effective (WSP Group, 2015).

[2] The assessment templates are not included in this study but are available upon request. These templates are for commercial use.

Table 4-3 Miljöbyggnad for Existing Buildings Assessment Template

Kriterier från Betygs/Critera by level	Indikator/ Indicator	Aktuell Betygs/Current Level	Kommentar/ Comments	Åtgärder /Actions	Möjligt betyg efter åtgärd/Potential rating after action

Source: WSP Group, 2015-a

Ultimately, these assessment templates allow consultants to organize and prepare feasibility reports for their clients and they allow for better workflow and organization of information collected.

4.3.3 Planning for a New Tool in the Idea Assessment and Business Development Process

After registration, the certification process formally begins with the assessment study – the detailed credit requirements and point allocation that must be accompanied by the data from the building under consideration. It is for this reason that a screening tool is thought to be useful to help facilitate preliminary consultations with potential clients about the viability of a request for a green building certification before going through the detailed assessment templates and feasibility analysis to find out what is possible. Such a tool would be used in the first step of the certification assessment when initially working with a client to assess the gaps of information to target as well as to learn the motivation for the certification, and the overall requests. WSP has helped define potential functions of this tool as follows:

- To establish preliminary estimates for credits achieved (and hence overall rating) according to LEED EBOM, BREEAM In-Use, and Miljöbyggnad for existing buildings and make recommendations for which scheme would be most appropriate for a property owner to certify with.

- To identify recommendations for actions which property owners could take in order to increase the performance (rating) of their building?

- To identify issues which are not addressed by either of the above three schemes but which would be relevant and of interest to property owners in order to increase the sustainability of their buildings.

The objective of using the screening tool is to make the assessment study for the consultant much more efficient and cost-effective, targeting the gaps in information as well as the likely green certification scheme best suited for the property. From the first conversation to the last, clearly communicating to the client about the certification process or feasibility study is in the interest of many sustainability consultants. The process tool is intended to improve the consulting experience for the client and to improve communications leading to a more efficient study for green building certifications, which leads to better decision-making of the most viable certification and how to proceed in operationalizing the recommendations.

4.4 Observations: Feasibility Study Case and Assessment Process

Observation was chosen in order to identify challenges with the initial assessment process, differences between schemes, and to test the need for a tool that may facilitate the assessment studies for green building certifications using LEED 2009 EBOM, BREEAM In-Use, and

Miljöbyggnad. According to Flick (2009), observation as a method makes it possible for the researcher to learn how something factually works or occurs. The goal in this method is to gain an insider's knowledge of the assessment process by becoming a participant (Flick, 2009). Therefore, the role of the observer in this study was as a participant in a process.

There are three processes for conducting observation according to Kawulich (2005):

1. Descriptive Observation: where the researcher observes anything and everything assuming that nothing is known beforehand.

2. Focused Observation: where one's decision on what to observe is informed by interviews and therefore gives insight guiding the researchers decisions about what to observe.

3. Selective Observation: where the researcher makes systematic choices and intends to focus on certain kinds of activities.

Observation was instrumental in identifying areas for strategic information gathering from clients required to complete the assessment study, which without might also be seen as challenges or hurdles in the assessment study process. Working from the bottom-up as an observing participant, the author identified information of significant value for the consultant to conduct an assessment study on one of the three certification schemes under study and then considered the design of a potential tool. Therefore, the observations on the WSP feasibility study and subsequent assessment process was intended provide preliminary findings that supported answers to the first three research questions. The categories identified became the foundation of the design for the first version of the screening tool that might be needed, based on the author's personal observations on the assessment study process.

4.4.1 Feasibility Study Case Background

While the feasibility study is commercially confidential to include or reproduce, some background may be given to illustrate the type of information the author was examining. WSP Environmental Group was commissioned by Chalmers Technical University to develop an assessment on an academic building under the green building certification scheme Miljöbyggnad för Befintliga Byggnader v. 2.1. In this feasibility study, all fifteen indicators were analysed based on evidence through a gap analysis and communicated to deliver the final results and rating levels of both the current state of the building and potential upgrades or future state of the building. This assessment was carried out in November 2014 by a team of building physics consultants at WSP (WSP, 2014). The academic house at Chalmers assisted with documents such as building drawings and floor plans, energy statistics, and other environmental inventories and inspections carried out by staff.

With this feasibility study, the Chalmers Technical University's Mathematical Science (Matematisk Vetenskap 07:6) building was used as a test subject in identifying the steps performed in an actual green building certification assessment for a feasibility study. It was also used to review the amount of evidence collected and to continue learning how the certification schemes work.

4.4.2 Observation Tools

In order to conduct a descriptive observation of the assessment process using the feasibility study, a SWOT analysis of the assessment process and the assessment templates with the feasibility case was used in order to collect observations available for discussion. Table 4-4 illustrates the basic categories of a SWOT table.

Table 4-4 SWOT Table

Strengths	Weaknesses
Opportunities	**Threats**

The observations made on the feasibility study were meant to focus on the procedural process of an assessment study.

4.5 Focus Group with Technical Experts

The observations on the feasibility study were meant to provide hands-on experience using the certification schemes to arrive at conclusions regarding the assessment process. Therefore, the focus group was developed to *confirm* observations and to learn about the challenges experts face regarding the initial certification assessment, their needs from a pre-assessment stage tool, and to test a beta version of the author's proposed tool design. The beta design of the tool received feedback from the team of experts in the focus group regarding objectives, functions, and improvements. In essence, the intent of the focus group was to arrive at answers to the research questions by confirming the intended purpose of this study, which was to develop a tool to assist with streamlining the certification assessment process.

The Focus Group was conducted on August 14, 2015 in Göteborg, Sweden at the WSP Group office in the Byggnadsfysik department at 1pm. There were in total five participants, four present working in the Göteborg office and one who joined using a conference call from the Malmö office. Two of the five participants were project sponsors of this study and were both familiar with the area of study, but yet unfamiliar of the author's research prior to date.

A proper focus group study was developed using Morgan et al.'s (1998) "The Focus Group Kit," Volumes 1-6. Generally, focus groups require four main steps: planning, recruiting, moderating, and analysing.

Planning

In the planning stage, it is important to identify the intended goals of the research by identifying who will be invited to the focus group, what questions will be asked, and what will the analysis and reporting look like (Morgan et al., 1998). Most focus groups are lead by a team of researchers who take on titles such as the moderator, the assistant moderator, and the supervisor (Morgan et al., 1998). This focus group was lead by the author and performed most of the functions intended by such a team. Supervisors and other academic researchers played a role in the early stages of setting up and preparing the goals, the questions, and the logistics.

The author chose a well-defined group to study, identifying WSP's Byggnadsfysik consultants due to their technical knowledge and experience in green building certifications. As Morgan et al. suggest, "decisions about the composition of focus groups involve both how comfortable participants will be with each other and how productive their discussion will be" (1998, p. 86). The team of byggnadsfysik consultants were fairly familiar with each other's certification projects and therefore would be able to provide multiple viewpoints on the same topic under study. For the recruitment phase, demographics beyond that such as age or gender were not formally considered.

Recruiting

In order to recruit these technical consultant participants, WSP provided a list of ten potential participants in the byggnadsfysik division across all office locations in Sweden – Göteborg, Stockholm, and Malmö – and individual e-mails were sent out to ten potential participants. These emails were standardized and included information regarding the event logistics, information about the study, and incentives (refreshments recommended by Morgan et al. (1998). The initial email was used as a call for R.S.V.P.'s or confirmation for attending.

A second email went out to request confirmation of attendance. In line with methodological protocol, a final e-mail was sent a day before the focus group to remind participants of the study, the location, the time, and to send a copy of the excel assessment templates of the three green certification schemes for existing buildings under study (as explained in Section 4.3.2) that this author developed. The aim of sending these templates was to refresh the familiar experts with the schemes and their requirements and to provide opportunity to recall them during the focus group sessions.

The author anticipated that a smaller group than ten participants would attend the focus group, as the Swedish summer holiday schedule was likely to impede the recruitment process. According to Morgan et al. (1998), having a group of six or fewer matched the project goal of getting more in-depth understanding of what participants have to say. Other reasons included that the participants had a high-level of involvement with the topic; that the participants were experts or knew a lot about the topic; that the topic was complex; and the recruitment factors limited options (Morgan et al., 1998).

Moderating

To prepare for the moderating of the focus group, a document with guiding questions and introductions was created ahead of time and was reviewed by at least two experienced academic researchers at the IIIEE to assist with the quality of the proposed question guides which Morgan et al. (1998), recommend for novice focus group moderators. See Appendix 3 for the focus group guide and Appendix 4 for the full transcript.

Moderating takes practice and it is clear from the recommendations found in Morgan et al.'s "The Focus Group Kit" that a single moderator is not recommended for the multiple responsibilities a focus group includes. These responsibilities are: introducing the focus group, asking the questions, anticipating the flow of conversation, controlling personal reactions, probing as needed, listening, summarizing the discussion, and debriefing the session to your research advisors (Morgan et al., 1998). However, the author felt that due to the more structured approach emphasizing the project's focus, a single moderator with a recording device and back-up notation during the focus group was possible. This meant that the single moderator emphasized learning about a predetermined set of topics during the focus group and required knowing what the right questions were beforehand through the interview guide (Morgan et al., 1998). This decision of using a structured approach was made with the objective of delivering a maximum amount of well-targeted information (Morgan et al., 1998).

Analysing

The analysis of the focus group strove to be systematic and verifiable. The first systematic step taken was in the sequencing of questions found in the interview guide: through key questions, allowing participants to become more familiar with the topic and then giving each individual a chance to recollect personal opinions and listen to others' opinions (Morgan et al., 1998). The second systematic step chosen was regarding the processing and handling of data (Morgan et al., 1998). The findings of this method were based on an electronic recording of the focus group as well as notes taken by the moderator. Finally, the third and last systematic step taken, was choosing to analyse the focus group recording through a tape-based analysis which includes an abridged version of the transcript, focusing on comments that directly related to the question at hand as well as the moderator's summary of the conclusion of the focus group (Morgan et al., 1998).

The analysis of the focus group study aimed to be verifiable through an acquisition of a trail of evidence (Morgan et al., 1998). The trail of evidence began with field notes and the recording taken during the focus group and continued with a verification from the focus group sponsor that the session went well and was useful, followed by lastly, the transcript (Morgan et al., 1998).

Moving forward to the next phase of the study, findings were reported in Chapter 5. The findings of the focus group were transcribed, categorized and coded according to their value to the research questions originally posed and then included in the findings. Quotations and summaries of discussion will be used in Chapter 6, the Discussion of this study.

4.6 Methodological Limitations

The process of developing a screening tool for the assessment process has required delineating many choices and limitations in order to support a more concise and concerted review of this technical topic. In designing the tool, choices regarding which versions of each green building certification program were made in collaboration with the WSP Group. Both LEED version 2009 for EBOM and the latest version of BREEAM In-Use were chosen for practical reasons because it is what is offered by WSP's Byggnadsfysik team to clients. Miljöbyggnad för Befintliga Byggnader v. 2.1 was chosen for this study because it is used in the feasibility study presented in section 4.4.1. It was important, as a non-certified assessor of these programs, to become familiar with the different schemes and how they operate. For these reasons, v. 2.1 instead of the latest 2.2 is outlined to aid in reviewing the feasibility study.

5 Findings

This Chapter reports the results found in this study based on the methods employed in research. The chapter expresses the findings for a comparison between LEED EBOM, BREEAM In-Use and Miljöbyggnad for existing buildings. It gives an overview on the observations found on the assessment process through a SWOT analysis, and lastly, it presents the major findings of the focus group study.

5.1 Comparison of Schemes

Based on an analysis of Chapter 3, a review and comparison of the structure of the three schemes was made to illustrate the differences between them. Table 5-1 illustrates the different environmental categories found, the total number of points, credits, or indicators available, the weighting method, and lastly the rating levels.

Table 5-1 Certification Structures of LEED EBOM, BREEAM In-Use, and Miljöbyggnad for Existing Buildings

Certification Scheme	Categories	Credits/Indicators	Weighting Method	Levels
LEED 2009 for EBOM	Sustainable Sites Water Efficiency Energy and Atmosphere Materials and Resources Indoor Environmental Quality Innovation in Design Regional Priority	9 4 9 10 15 6 4 Total: 110	**Weighting:** Assign points **Aggregation:** sum of points	Certified Silver Gold Platinum
BREEAM In-Use	Management Health and Well-Being Energy Transport Water Materials Waste Land Use and Ecology Pollution	Total: **Part 1** – 157+energy Total: **Part 2** – 179+energy Total: **Part 3** – 630	**Weighting:** Assign points **Aggregation**: multiply by pre-weighted categories	Classified Acceptable Pass Good Very Good Excellent Outstanding
Miljöbyggnad Befintliga Byggnader v. 2.1	Energy Indoor Environmental Quality Materials	Total: 15	**Weighting**: - **Aggregation**: outranking	Classified Bronze Silver Gold

Source: BRE Global Ltd. (2015); USGBC (2009); SGBC (2014).

5.1.1 Issues Addressed

The author of this study created an excel table based on the technical manuals of all three schemes. This table is not included here in the findings due to size constraints, but it can be

seen upon request. All three Parts from BREEAM In-Use and their categories and issues were first reviewed in list form with their associated credits. Next to those three Parts, LEED EBOM was also correspondingly listed in a fourth column under the similar issue it corresponded to with BREEAM In-Use. For example, sustainable sites was matched with BREEAM In-Use's Land Use & Ecology category, and Indoor Environmental Quality was matched with BREEAM In-Use's Health & Well-being category and so on. This table enabled the author to survey the sub-issues related to both the schemes' categories and to make comparisons across the issues, which can be summarized in the Table 5-2 below. The check marks indicate that the environmental category is present in the certification scheme and the "x" indicates that there is a comment or note to consider in those categories. Miljöbyggnad was included in regards to Energy, Indoor Environment, and Materials, but it was shown rather early on that differences between the two international schemes and the national scheme were great and a comparison between BREEAM In-Use and LEED EBOM would first be made and then overall comparisons between those and the national scheme Miljöbyggnad for existing building would be made.

In Table 5-2, LEED EBOM has the symbols a check and an "x" in management to address the fact that management criteria was found in other categories, but that the category "management," itself, was not present. BREEAM In-Use has a check and an "x" in the waste management category because waste management was found largely in Part 3, which is not widely assessed/achieved in Sweden. For similar reasons, there is a check and an "x" next to ecology and location under BREEAM In-Use. These shortcomings presented in the Table 5-2 with an "x" will be discussed further in Chapter 6.

Table 5-2 Issues by Category Addressed in the Three Certification Schemes for Existing Buildings

Environmental Categories	Miljöbyggnad for EB	BREEAM In-Use	LEED EBOM
Management	-	✓	✓X
Energy	✓	✓	✓
Material	✓	✓	✓
Indoor Environment	✓	✓	✓
Water	-	✓	✓
Construction/Infrastructure	-	✓	✓
Waste Management	-	✓X	✓
Ecology and Location	-	✓X	✓

Sources: BRE Global Ltd. (2015); USGBC (2009); SGBC (2014).

5.1.2 Priorities Given to Different Areas

Charts were made based on the literature review that indicated the weightings that each scheme placed on environmental categories. BREEAM In-Use had three sections to weight separately and Miljöbyggnad for Existing Buildings does not use weighting. It was concluded that Miljöbyggnad requires the fulfilment of all of its indicators and therefore, priority is given to all of the environmental areas. A graph for Miljöbyggnad was not created.

BREEAM In-Use in Three Parts

According to Figure 13, BREEAM In-Use Part 1 ranks Energy as the highest priority, accounting for 27% of the overall score in a building's performance metrics. Next, Health & Wellbeing accounts for 17%, followed by Pollution with 14% of the overall score.

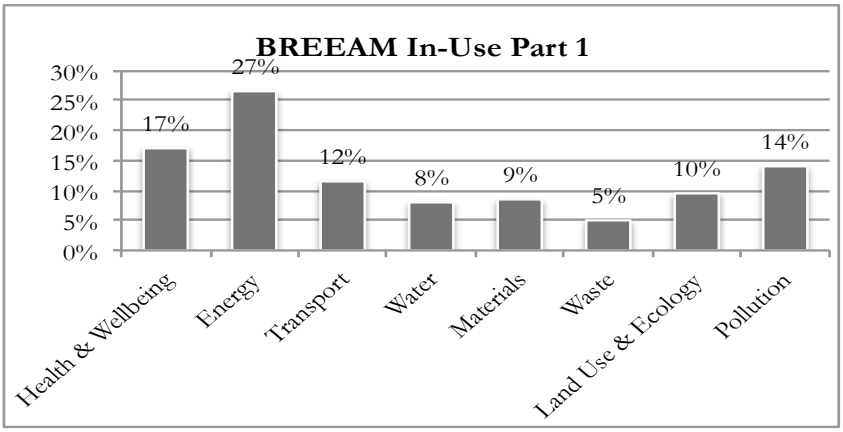


Figure 13 BREEAM In-Use Part 1

Source: BRE Global Ltd., 2015

In-Use Part 2 also places priority on managing energy consumption as it accounts for 32% of the overall score. In this Part, the categories Management and Health & Wellbeing are tied for second behind Energy accounting for 15% each. This is a slight margin over the considerations in Land Use & Ecology and Pollution, which account for 12% and 13%, respectively.

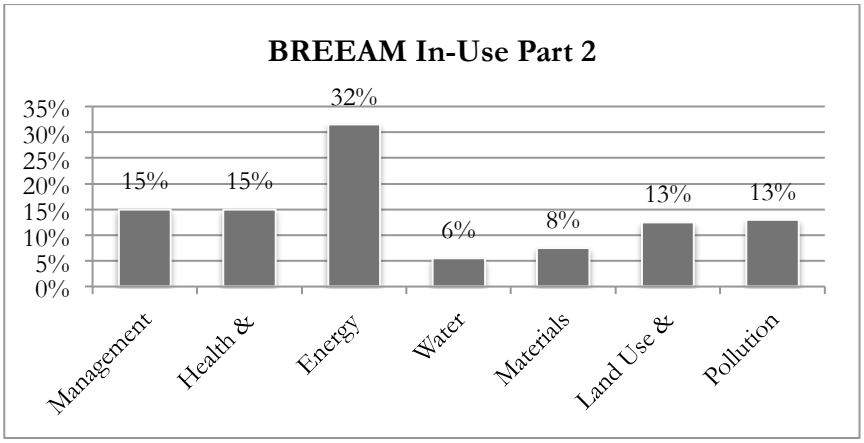


Figure 14 BREEAM In-Use Part 2

Source: BRE Global Ltd., 2015

Part 3 shown in Figure 15 is particularly unique of all the three parts because it is the only Part that has minimum standards as well as every BREEAM category represented. This does not mean that it alone could satisfy a thorough review or comprehensive rating of a building's performance (in considering the highest environmental impacts found in the use-phase of existing buildings) as the author found in the issues addressed section above. However, it can be seen that Part 3 also places marginal priority on Energy over the rest of the categories

accounting for 20% of the overall score. This category is followed closely by Transport with 19% and Health & Wellbeing with 15%.

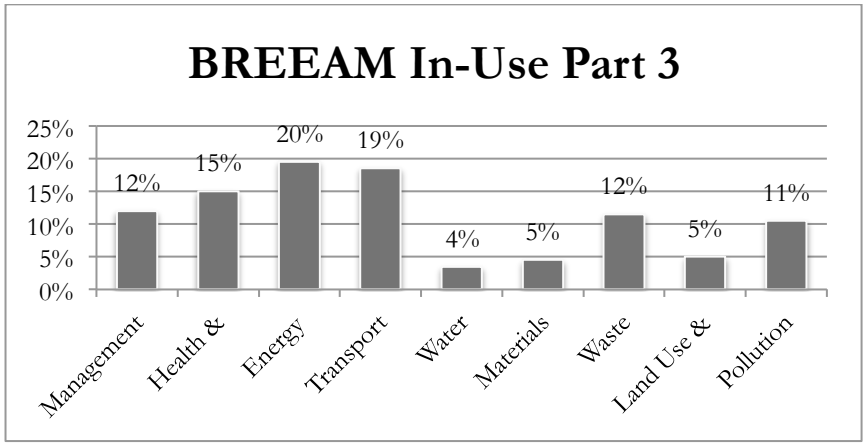


Figure 15 BREEAM In-Use Part 3

Source: BRE Global Ltd., 2015

LEED EBOM

When reviewing the Priority areas of LEED EBOM in Figure 16, it can be seen that Energy and Atmosphere also accounts for the largest portion of the credits with 32% and therefore is identified to having the highest priority. The category of Energy and Atmosphere had the highest priority followed by Sustainable Sites with 24% of the overall score, and Indoor Environmental Quality with 14%.

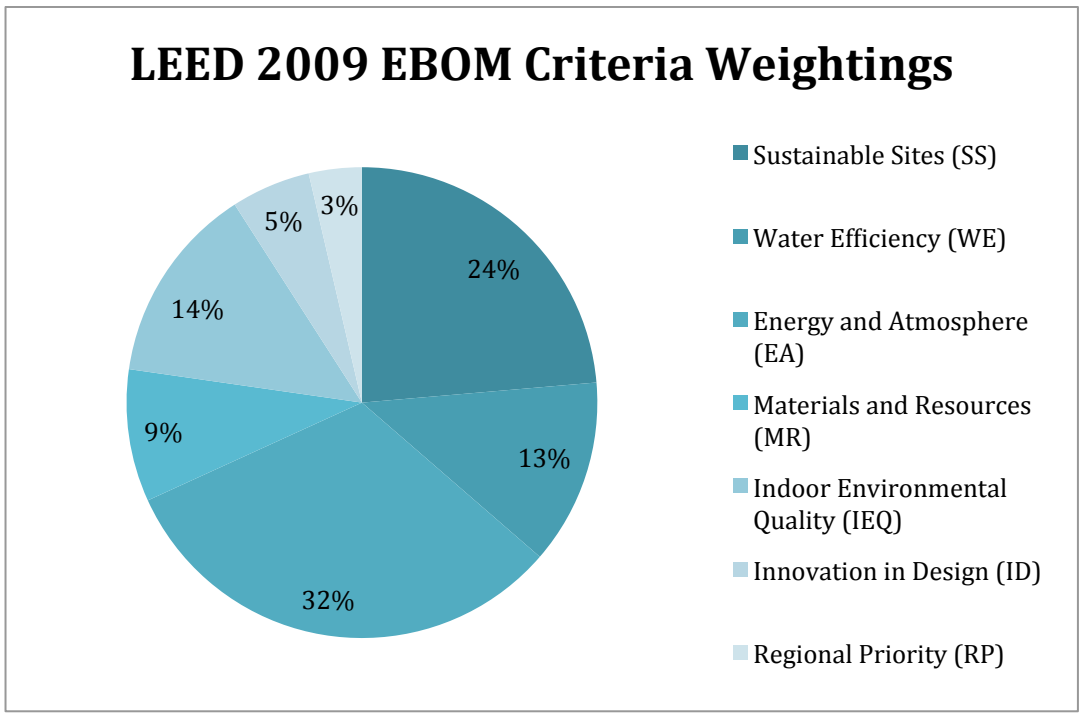


Figure 16 LEED EBOM Source: USGBC, 2009

Miljöbyggnad

Miljöbyggnad was not possible to create a weighting chart as there is no weighting used in the priority setting of the criteria. The scheme is created in order to fulfil all of the criteria to some level using the outranking method described in Chapter 3. Unfortunately, it is difficult to identify which indicators would be more important to achieve for the success of a rating above "klassad" or classified.

5.1.3 Ease of Certification

The certification process for each of the three schemes was presented in the literature review in Chapter 3. Based on that chapter, the following certification process has been created to highlight the similarities and the differences outlined.

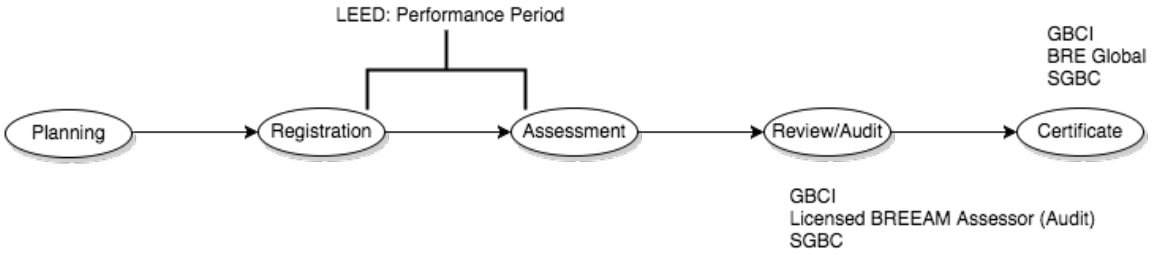


Figure 17 Certification Process for BREEAM In-Use, LEED EBOM, and Miljöbyggnad for Existing Buildings

Figure 17 shows that all three schemes have the foundational five steps seen here. Different actors conduct the review/audit phase, but the step is still similar enough across schemes. The only scheme that explicitly expressed the requirement for a performance period was LEED EBOM (USGBC, 2009).

5.2 Observations: Assessment Process

The following section describes the steps taken to observe and draw conclusions from the assessment process. The background to the feasibility case study only served to illustrate the basic building parameters of the building used for practical purposes in testing out an assessment process

5.2.1 Feasibility Case Study

Under observation of the assessment process, it became clear that the information from WSP's feasibility study, suited to Miljöbyggnad for existing buildings would not easily meet the information requirements of either LEED 2009 EBOM or for BREEAM In-Use. It may have been possible to come up with a rough estimate of the rating and level for these two other schemes on the matching data requirements; however, the aim of the observations was merely to understand the process involved to use the assessment templates of the varying schemes. In attempting to try preparing rough estimates, the author became familiar with the scheme requirements and how to earn points or meet requirements.

The case building used to examine the three certification schemes was built in 1944 and today it is used at Chalmers University to house the mathematics department where the building provides space for offices, meeting rooms, and five auditoriums (WSP, 2014). Additionally, archives, libraries, and several technology-focused areas exist in the basement. Further, it is known that there was an extensive renovation done to the property in 2006 (WSP, 2014).

Table 5-3 Case Study Building Details

Building parameters	Value
Location	Göteborg, Sweden
Service life	71 years
Gross floor area	6,737 m² (LOA – commercial area)
Structure	6 floors, Concrete frame,

Source: WSP Group, 2015

The feasibility study seemed to present the certification criteria in an organized manner making it easy to read through. However, when testing the same building against other certification programs it was found that even with all the data collected for the Miljöbyggnad certification, not all areas were transferrable and information gaps in the data collection information existed – primarily in the questions regarding systems of operation and management.

5.2.2 SWOT Analysis of Assessment Process

The descriptive observations (as outlined in Chapter 4) on the assessment process with the WSP feasibility study case building provided the author with a sense of the strengths, weaknesses, opportunities, and threats for a streamlined and systematic approach to the certification scheme. The following SWOT Analysis of the three assessment templates and processes described in Chapter 4, section 4.3.2 was used to create the design of a tool.

Table 5-4 SWOT Analysis of Assessment Process for BREEAM In-Use, LEED EBOM, Miljöbyggnad for Existing Buildings

Strengths:	**Weaknesses:**
• Hierarchical structures with scoring system in BREEAM In-Use and LEED EBOM easy to follow. • Detailed data requirements and allowable evidence. • Questions for operations and management – procedural vs. measurement based. • Accompanying manuals. • Schemes have some overlap.	• Time-consuming to do one assessment, let alone more than one. • Detailed data requirements and allowable evidence. • Incompatible metrics. • Lack of emphasis on planning and pre-assessment steps and strategies. • Availability of material for understanding.

Opportunities:	**Threats:**
• Certification/Rating ambition. • Targeted approach. • Prioritization. • Client education/Consultant qualifications.	• Technical experience. • Prescription for sustainability. • Client knowledge and awareness of rating systems for existing buildings. • Building performance vs. operations management.

5.2.3 Screening Tool Design Based on SWOT Analysis:

Based on the SWOT Analysis, categories such as "Questions to Client," "Rapid Checklist & Ranking of Criteria," and "Preliminary Recommendations for action" were created to utilize the strengths of the systems, consider the weaknesses and threats, and ultimately to address the opportunities for improvement. Elaborations on the idea behind the design can be found in the Discussion in Chapter 6. Figure 18 presents the concept of the screening tool as developed from Table 4-5 above.

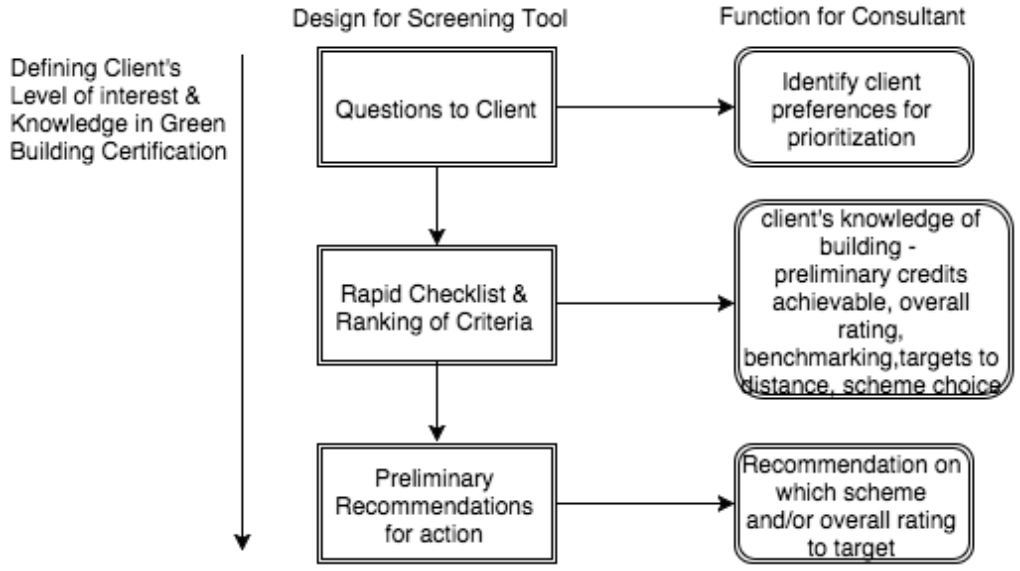


Figure 18 Screening Tool Design Based on SWOT Analysis

5.3 Focus Group Findings

The findings will be elaborated according to questions asked, followed by an interpretation or summary of the responses, followed by quotations of respondents in the focus group. It should be noted that wherever the abbreviations for the certification schemes are used, it is implied that the versions of each scheme are for existing buildings.

The questions asked were: how much expertise and knowledge is required to become an assessor? What do you perceive are the key challenges with assessments or feasibility studies? When performing an assessment, what factors about the building are most important to identify first? Out of the following criteria categories: energy, water, waste, pollution, land use and ecology, health and well-being, transport, materials, and management, is there a particular area in which old buildings in Sweden frequently have trouble performing well? Why such differences in operations and maintenance focus among the three schemes?

Figure 18 was presented to those in the focus group for recommendations and revisions.

MAJOR FINDINGS:

The focus group revealed important issues related to each of the individual certification schemes. While the discussion focused on a given topic, there were a number of common issues identified and very few competing ones. Most of the time there was enthusiastic agreement on the points raised and further elaboration by other participants. The following issues were identified by most of the focus group participants:

Technical Expertise:

Individuals without technical background are able to become accredited professionals in most schemes but there is a distinction between being "able to" and "being expert" in consulting for a rating scheme. There is also a distinction between assessor and accredited professional in some cases. The issue of quality and credibility depending on technical experience in assessors/AP's who consult for green building schemes was a concern expressed in various ways with attention placed on the capabilities of advising and making recommendations beyond meeting the requirements of the certification scheme.

Information Management

Equally difficult is gathering the quantities of evidence necessary to perform the assessments. Communication channels as well as point persons are necessary for overcoming the burden of collecting all of the information to perform the assessment.

Client Education and Communications

Client understanding of certification schemes as an area of importance, as well as information management and communications with clients as being particular challenges to work with. When clients are misguided about a certification system, it is difficult for a consultant to "give them what they want." Educating clients along the path towards certification is one way to overcome the client's knowledge gap, but requires a lot of effort.

Swedish Context

Participants listed a number of areas specific to Swedish conditions that are a challenge to work with for existing buildings such as daylight factor, solar heat load, acoustics, moisture control, and radon. Participants also discussed the differences between the schemes and the priority areas addressed such as targeting information for energy sections in LEED and BREEAM programs first.

Building Performance vs. Building Management

Participants discussed the history and intention behind the development of Miljöbyggnad and compared the advantages and disadvantages of a scheme that required total fulfilment based on building performance or a flexible and comprehensive scheme that allowed the trading of non-compliance credits for compliance and more of an overall focus on building management. Both schemes serve different, but good roles to fill in the rating schemes genre and each have their own strengths and weaknesses.

Preliminary Work is Crucial

Participants discussed and enthusiastically agreed that preliminary work with a client is the most important stepping stone to the successful conclusion of a full certification. Participants also identified that preliminary work with clients is their weakest step in the assessment process. This lead to a discussion on credibility of consultants and the idea that there is a potential to fail at closing the certification process with a client if the initial work is not done well.

5.3.1 Recommendations and Revisions to the Proposed Screening Tool

The proposed screening tool made during the observations phase of this study was shown to the focus group as the last exercise of the focus group session. Feedback on the screening tool's function, purpose, aims, and objectives was collected and the following comments were identified as important contributions in the revision of the design of this tool. A photo of the presented design and its various revisions made during the focus group (for my immediate verification) can be found in Appendix 5. Figure 19 introduces the revisions made to Figure 18 after the focus group. The categories within the tool remained the same save for a change to the first category where "Questions to Client" became "Strategic Questions to Client" to emphasize the important systematic focus of the first category. Additionally, process arrows were added to offer flexibility to the screening tool's application between consultant and client. Depending on the needs of the client, their motivation, knowledge of buildings and ambitions, the consultant may jump between categories or determine that it should be possible to begin a more detailed assessment and enter the certification process at a variety of stages within the tool's design.

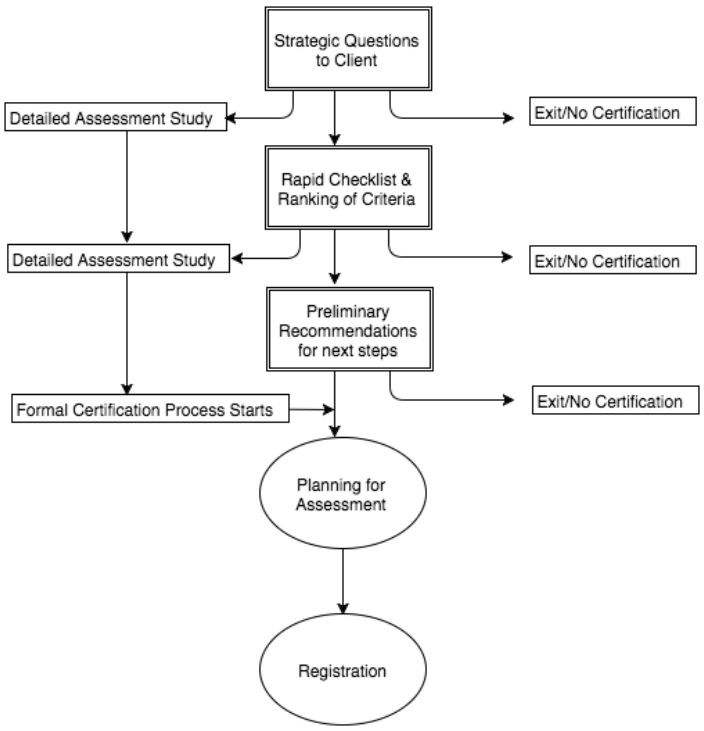


Figure 19 Revisions to Proposed Screening Tool

Next, the following headings represent detailed feedback from the focus group regarding the specific purpose or comment to each aspect of the tool's design.

Verification of the tool and its purpose:

Sometimes projects fail due to the lack of strategic efforts made early on in the assessment process as noted earlier in the focus group session. A design for the screening tool such as the one proposed to the participants was received very positively on the whole.

Strategic Questions to Client

In unanimous agreement, the first step in the process tool, the questions category, was the most important aspect of the tool. It should be called "strategic questions to client" to set a standard line of questioning. From the first box – you branch out – you either move on to do:

1. The rapid checklist and ranking of criteria.
2. A detailed assessment study [of all three] using the assessment templates.
3. A detailed assessment of just one using the assessment templates.
4. No certification (at present), i.e. "Exit" the process.

In other words, there should be multiple options from the first step:

Based on the answers from the client, you can go into a detailed assessment study right away on one certification scheme or you can do an easy assessment instead in which you do a rapid checklist for one certification scheme, but then you do a full feasibility on those. It's different levels of feasibility study, but it all comes from what the client wants.

It should also be possible to advise clients that no certification should be undertaken at this time. For reasons such as the client has not checked the corporate goals of the company and therefore might have unrealistic or over ambitious goals. Perhaps they are not ready in an organization to consider a long-term plan for certification.

Possible questions that participants came up with to serve as strategic questions were:

Table 5-5 Strategic Questions

	"What is the value of the certification for you?"
	"What did you want to do with the assessment? What purpose does it serve?"
	"WHY do you want to get a certification?"
	"What is the aim for you on a long-term basis?"
	"What standards do [you] have on a corporate level and what sustainability goals do [you] have in [your] company and from that, maybe you can scrutinize really what the client says…– you might come up with the idea that maybe we shouldn't work with this at all! (Because you don't have any idea what you want – there's a lack of context)…Get some corporate ideas before you start with your building"

Source: Focus Group, 2015

Rapid Checklist & Ranking of Criteria

The second step should be optional because they may have a specific purpose that may be clear after the strategic questions. Otherwise, it is a good idea to pin point the building early on. Things to consider in a rapid list would include the geometry of the building, the location, and the age. It would also be good to make sure health questions are on the list so that consultants can make a more concerted effort to ask about issues like asbestos, for example, because not every certification accounts for it.

Preliminary Recommendations for Action

This category and last step in the process could determine the choice of certification method. It should be possible to make recommendations, only based on what you learn from the client – a form of next steps planning for assessment studies. This last box had few comments and was deemed not a big concern for revision.

Important considerations:

The first and second boxed categories – questions to clients and the rapid checklist – are really the most important work that the consultants do. If you prepare those two categories well with a client, then certifications can be quite easy. If you start with the wrong understanding from the beginning, the assessment process will end up in chaos. It is true, as well, that consultants face a learning curve when working with certification programs and new clients – it can always be learning time.

6 Discussion

Based on the findings in Chapter 5, this chapter discusses the differences among the three green building certification schemes and identifies challenges in the assessment and certification processes in order to answer the research questions originally posed at the outset of this study. Finally, this chapter ends in a discussion with recommendations for building a strategic consulting tool that helps identify an appropriate rating scheme for clients and ultimately facilitates the work of sustainability consultants in green building certifications for existing buildings.

6.1 Comparisons of BREEAM and LEED

The literature review has shown that among the three green building certification schemes for existing buildings under review in this study, there are more similarities between the LEED EBOM and BREEAM In-Use and striking differences between the two and Miljöbyggnad for existing buildings. Miljöbyggnad is an inflexible rating scheme that aims to have all criteria met on specific indicators linked to the Swedish local context. The finding about the similarity of the two former certifications is not surprising given the vast comparisons done between them in the generic from existing literature (Crawley & Aho, 1999; Cole, 2006; Ding, 2008; Rivera, 2009; Alyami & Rezgui, 2012; Lee, 2013). Because there is an existing body of literature on the two international rating systems, this section begins with a review, delineating a few of the established comparisons between BREEAM and LEED and considers Miljöbyggnad separately. The following areas will be addressed in further detail based on findings where the three schemes vary on: issues addressed, priority given to different areas, and ease of certification.

6.1.1 Issues Addressed and Priority Given

The literature finds that BREEAM has the highest number of criteria over many existing schemes and that this correctly implies that the higher the number of criteria, the wider the scope of environmental impacts considered (Lee, 2013). However, the number of key environmental aspects covered between BREEAM and LEED are so similar that the advantage of having a higher number of criteria may be negligible (Lee, 2013). This degree of similarity can also be ultimately challenged in how the environmental aspects are weighted – just because there are a number of criteria covering a wider scope does not mean that the measured impact that the scheme has placed on the criteria is higher. However, BREEAM and LEED apply a simple additive approach where weights of different assessment items are accounted for by the maximum number of credits assigned to individual items. In essence, the way the two structures have been hierarchically organized and criteria considered, the weighting does reflect that under a simple additive method, the criteria account for the scope and measured environmental impacts (Lee, 2013).

LEED has only seven environmental assessment areas while BREEAM has nine (ten counting innovation, which is not present in BREEAM In-Use). LEED has chosen to integrate categories like "management," "transport," "waste," and "pollution" that are explicit in BREEAM into the credit requirements of the main categories, thus resulting in fewer categories (Lee, 2013). As Lee's comparison indicates, this could show that BREEAM gives these particular areas more importance than does LEED (Lee, 2013).

A review of the weightings of the environmental assessments done by Lee (2013) indicate that the most important impacts in both have been identified as energy efficiency, followed by sustainable sites, and indoor environmental quality.

Alyami and Rezgui (2012) have made detailed comparisons between BREEAM and LEED regarding the criteria of their environmental categories. Both certification schemes have identified that energy efficiency of buildings, as much of the life cycle assessment literature corroborates, has the greatest environmental impact affecting climate change, acidification, and sea level rise, among others (Alyami & Rezgui, 2012; Lee, 2013). Therefore, each have taken careful considerations of criteria related to energy design, renewable energy strategies, energy conservation and monitoring efficiency use of resources (Alyami & Rezgui, 2013). LEED requires the use of Energy Star ratings as well as the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) guidelines whereas BREEAM uses the tool Standard Assessment Procedure (SAP) for energy modelling (Alyami & Rezgui, 2012). Lee also notes that in regards to building energy efficiency, the scope seems quite comprehensive in these schemes. They do show consideration of both outdoor and indoor environmental effects, global and local influences, and design features to operational management (Lee, 2013).

As far as LEED's "Sustainable Sites", or BREEAM's "Land Use & Ecology" (and Transport), are concerned, both do an equal and fair job of covering the issue of impact of the building and surrounding infrastructure on the ecological systems (Alyami & Rezgui, 2012). These two categories review the integrity of the surrounding ecosystem by reviewing soil erosion, waterway sedimentation, CO_2 emissions and biodiversity protection (Alyami & Rezgui, 2012). It also includes a review of the communication of public services and access to facilities for cyclists, pedestrians, and cars (Alyami and Rezgui, 2012).

LEED's "indoor environmental quality" category can be compared with BREEAM's "Health and Wellbeing" category. Under this category, LEED has placed a higher emphasis on low-emitting material while BREEAM has more emphasis on HVAC systems, lighting, and illumination under "Health and Wellbeing" (Alyami & Rezgui, 2012). A curious difference noted is that in LEED, acoustics are not considered as much, compared with BREEAM (Alyami & Rezgui, 2012).

Unique to BREEAM, Alyami and Rezgui (2012) note that its emphasis on the category "management" has to do with the fact that it is a core sustainability principle for the BRE Global group. Such an emphasis demonstrates that it is fundamentally important to know how buildings should be operated well and maintained over time and thus should be a key area of performance. Compared with BREEAM, the emphasis on management criteria is weaker in LEED (Alyami & Rezgui, 2012).

Even though the outcome of the certification is different in BREEAM and LEED (numeric scores, stars, or overall environmental impact approach – pass to outstanding; bronze to platinum), both systems classify certified buildings with a rating level based on a percent of the score earned (Lee, 2013).

6.1.2 Ease of Certification

In regards to the certification process of the two international schemes, BREEAM certification process requires a licensed auditor to go on-site and verify the assessment of the criteria before issuing the certification. This is a step not found in LEED, which does not require a licensed auditor. Instead, LEED encourages the use of a LEED AP – an accredited professional, rather than licensed auditor – by rewarding one credit point if consulted with a LEED AP to complete the assessment before submission. BREEAM therefore places more responsibility on the auditor who verifies the assessment and applies for the certification through BRE Global than on BRE Global itself. BRE Global may perform a quality assurance call on the auditor to check that s/he has been consistent and accurate. LEED on the other

hand requires the USGBC GBCI to review and verify the assessment and thereby allows for a more public process to take place through open discourse.

The certification process brings up the issue of transparency between the two schemes. It was more difficult to find information regarding the methodological approaches and case studies of BREEAM than with LEED. The difficulty in access of information to the general public makes BREEAM more cumbersome and complex to follow, thereby possibly making it less attractive for clients to embark upon certification.

6.2 Comparisons of BREEAM In-Use and LEED EBOM

Based on the findings in Chapter 5, this section seeks to answer the first research question asked in this study:

RQ1: What are the differences between LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad för Befintliga Byggnader 2.1 schemes?

Similar to the comparisons of the overall schemes, the versions for existing buildings show that the approach is not drastically different. As identified in the findings, the areas of comparison will look at the issues addressed by the schemes, the priorities given to these issues, and the ease of certification. Miljöbyggnad will be discussed separately because the scheme is not structured in the same way as both LEED and BREEAM.

6.2.1 Issues Addressed

One major difference the author has found between LEED EBOM and BREEAM In-Use is the way in which the assessment scope is considered. In LEED EBOM, there is one assessment needed to carry out the entire scope of the scheme, whereas in BREEAM In-Use, there are three separate parts that offer even further scoping depending on what client-type or aspect of the building performance is being assessed. These three parts are assessed and registered through BREEAM separately. Therefore, as Figure 8 in Chapter 3 showed, completed certifications for BREEAM In-Use vary greatly between the Parts. It appears that in Sweden, an overwhelming number of commercial properties that have BREEAM certifications are certifying with both Part 1 and Part 2, but not Part 3.

BREEAM In-Use Part 1 Compared with LEED EBOM:

Starting with Part 1 of BREEAM In-Use and comparing it with LEED EBOM, the author has found some clear distinctions in the treatment of the issues addressed. Firstly, Part 1 is the assessment for the asset performance, which only takes into account the features and functional operation of the building and no management aspects. Therefore, Part 1 could be most attractive for the property owner due its benchmarking and target oriented approach to the asset. Looking at the issues that are found in BREEAM In-Use's Part 1, the "Waste" and "Land Use and Ecology" issues compared with LEED EBOM's corresponding issues are most striking. Specifically, Part 1 has just one criterion accounted for under waste and that is "storage of operational waste." In Figure 13, you can see that waste accounts for very little of the total assessment. Similarly, under BREEAM's "Land Use and Ecology," there are just two criteria: "planted area," and "ecological features of planted area." LEED EBOM on the other hand, in Figure 16, addresses "Land Use and Ecology" issues in its "Sustainable Sites," showing more points allocated to those issues relative to BREEAM In-Use's Part 1. LEED EBOM includes solid waste management policies in order to address the whole issue of waste. While Part 1 aims to scope down the profile of what goes into a building "in-use" in order to stay within the defined boundary of "asset performance," it neglects to consider the

advantages of offering one system like LEED EBOM's, where important management issues may be included such as solid waste management or even a hardscape managmenet plan. It is worth noting that even with an all in one system like LEED EBOM's, the project team may choose to trade out various credits like the solid waste management policies in "Materials and Resources" or the hardscape management plan in "Sustainable Sites."

Additionally, in BREEAM In-Use's Part 1, in an issue area as important as energy efficiency, the fixtures and technical components are calculated to provide an overall energy score, but the management of energy consumption and sources of energy are all criteria left to Part 2. In theory, by not addressing these issues of consumption in one part shows a weakness in the BREEAM In-Use flexibility from the point of view of a life cycle assessment and major environmental impacts of buildings.

BREEAM In-Use Part 2 Compared with LEED EBOM:

Part 2 in BREEAM In-Use is about "building management" and considers the operational procedures, policies, and processes employed to run the building well. This is generally an assessment that would be appropriate with someone familiar with building operations such as a facility manager.

BREEAM In-Use's Part 2 has a category for Management altogether. This is an all encompassing category that aims to ensure that building user guides, building education, building user information, operation and maintenance manuals, environmental policies, etc. are available to all. Part 2 includes management practices related to energy, water, materials, and land use and ecology. It provides a comprehensive view of building management whereas LEED EBOM can only cover a few management procedures or policies under each category. For example, in Indoor Air Quality, LEED EBOM requires best management practices and green cleaning policies; in Energy and Atmosphere, best management practices and performance measuring for energy efficiency are outlined, as well as fundamental refrigerant management.

Surprisingly, in BREEAM's Part 2, the waste category is not considered at all and all of the waste management is found in Part 3 – "occupier management." This is an interesting choice because it indicates that BREEAM In-Use has clearly identified a particular stakeholder group who should be responsible for such a task. But, seeing as Part 1 and 2 are far more in demand in Sweden than Part 3, it would be useful to include waste management into Part 2.

BREEAM In-Use Part 3 Compared with LEED EBOM:

Part 3 is for "occupier management" and considers each tenant's experience of the building and how well the building serves their needs. This is clearly a unique assessment offering since the other two systems rarely consider the experience of the occupier. In a few categories, surveys are done, such as in LEED EBOM's Indoor Environmental Quality category, occupant comfort is considered through an occupant survey.

Comparing the first two Parts in BREEAM In-Use with LEED EBOM, the target client types and the general scope of the criteria categories seem to show similar considerations. However, it is difficult to compare these two schemes side by side without choosing one of the Parts in BREEAM In-Use. Ultimately, all three parts in BREEAM In-Use have covered a much wider scope, many more categories and credits earnable.

6.2.2 Priority Given

According to the environmental impact studies of existing buildings that were described in Chapter 2, energy consumption of buildings in operation showed the highest environmental impact. Additionally, buildings in operation consider a variety of management issues that include the health and wellbeing of the occupants. A discussion on the importance each scheme has placed on varying environmental impacts have been analysed.

Each of the schemes for existing buildings placed the greatest importance on energy efficiency performance over all other categories. Next, Health & Wellbeing showed to be of highest importance. Substantiating these findings from the literature review shows these areas are to be of top priority in the generic of these schemes as well (Alyami & Rezgui, 2012; Lee, 2013).

Again, LEED EBOM and BREEAM In-Use showed mostly similarities in how they weighted the categories. However, differences such as their weighting methodology and the unique structure of BREEAM In-Use's three parts did not make it a direct comparison as the author did not take measure the impact these differences had on the priorities given.

Part 3 of the BREEAM IN-Use scheme shown in Figure 15 is particularly unique of all the three parts because it is the only Part that has minimum standards as well as every BREEAM category represented. This does not mean that it alone could satisfy a thorough review or comprehensive rating of a building's performance (in considering the highest environmental impacts found in the use-phase of existing buildings) as the author found in the issues addressed section above.

6.2.3 Ease of Certification

Surprisingly, the certification processes do not vary drastically. According to Figure 17 the main differences lie between BREEAM In-Use and the other two schemes. BREEAM In-Use is the only certification scheme, which uses licensed auditors to go on-site and audit the assessment before issuing the certification. These auditors actually apply for the certification rating they have assessed to be true of the building and then BRE Global receives the request to send out the certification. Therefore, the BREEAM In-Use assessor does all reviewing and auditing.

In the two other schemes, the assessment can be submitted to the certification body that reviews the application and designates the rating level and certification. The differences between assessor, auditor, and accredited professional become important in understanding what role they play in facilitating the ease of certification. According to the focus group (2015), BREEAM has only recently introduced a BREEAM AP role, similar to the LEED AP role where you can act as a project coordinator, advising and developing evidence alongside clients. As an assessor in BREEAM, one could not play a role in developing the evidence – only providing advice on how to improve the evidence through documented reporting (Focus Group, 2015).

It has been found that the LEED EBOM scheme in Sweden is an attractive certification due to its overall flexibility, like BREEAM In-Use, but also because of its ease of use and achievement in the energy category. According to sustainability consultants in the U.S. (personal communication, 7 July, 2015), the energy prerequisites were designed for the U.S. building market in which primary energy use and energy consumption issues are based on non-renewable energy sources and inefficient or old power systems. In Sweden, the combined heat and power plants for district heating has made achieving the energy prerequisites a breeze (Focus Group, 2015).

6.3 Miljöbyggnad for Existing Buildings

Miljöbyggnad for Existing Buildings is discussed separately due to the unique qualities in the issues addressed, priority it gives, and it's certification process.

6.3.1 Issues Addressed and Priority Given

Miljöbyggnad for existing buildings addresses issues in three categories: energy, indoor environment, and materials. Based on the literature review, observations on the scheme, and the focus group, it is clear that this scheme aims for compliance in all of the categories that it rates. Therefore, trading credits for compliance or non-compliance to achieve a rating is not possible in this scheme. The "aspects" as found in Table 3-7 in Miljöbyggnad which require complete fulfilment are: energy consumption, power requirements, energy type, acoustics (sound environment), air quality, moisture, thermal climate, daylight, legionella, and remediation (of hazardous materials) (SGBC, 2014).

Miljöbyggnad places more importance on the building as a system of fixtures and functions (Focus Group, 2015). It differs from the two other schemes in that it does not focus on operations or maintenance procedures, policies, or practices. Instead, the performance metrics of building specifications are rated. As the literature review found, this scheme was created by construction industry professionals and real estate professionals who wanted a simpler and cheaper way to measure a building's top three most important environmental impacts (energy, indoor environment, and materials).

6.3.2 Ease of Certification

Certification in Miljöbyggnad is not different from LEED EBOM in that it is suggested that a certain level of planning is done first to prepare evidence, followed by registration, and assessment, a verification and review of the assessment, and finally a certification. Both are administered by a certification body, which is made up of building experts and consultants who have the technical purview to review the application and demand further evidence and make consistent judgements on which criteria are justifiably met.

6.4 Challenges in the initial assessment process of green building certification for existing buildings

Based on Chapter 5, this section aims to answer the second research question asked in this study:

RQ2: What are the challenges in the initial assessment process of green building certification for existing buildings?

Arriving at the feasibility study is a time-consuming and sometimes rather unclear process of gathering all of the relevant information and data from clients that best fits the right green building certification (BRE Global Ltd., 2015; WSP Group, 2015). The focus group identified and reinforced previous findings from the observation phase that the challenges in the initial assessment process related to the following themes: technical expertise, information management, client education and communications, the Swedish context, and a distinction between building performance and building management. Through interviews and the focus group, some of the author's observations were confirmed to be important considerations for consultants and clients in their future endeavours to apply for a green building certification of existing buildings.

6.4.1 Technical Expertise

Findings from all methods shed light on the fact that there is a disparity among sustainability consultants and environmental coordinators who become certified to assess buildings for green building certifications. Even though each scheme has a different approach to the quality assurance on the assessment of the building for certification, it is certain that level of experience influences the quality of the assessment and certification process.

One focus group participant described a particular clientele – those who are accredited as a professional to assist with green building certifications and work in real estate business who may have a background in economics or environmental studies. These professionals sometimes do not have a background in buildings at all and do not have the knowledge on mandatory ventilation standards or radon levels, for example. You realize that when they want to apply basic services of a building to the certification scheme, they don't really know how (Focus Group, 2015).

Another participant described his experience that in Sweden, assessors would like to give advice but they are afraid to because they don't know buildings well enough. In the past in Sweden, the assessor was the environmental coordinator and they gave advice if they dared, but they wouldn't dare say if it was bad advice or not. Now, that there are AP roles, however, that shouldn't be a problem.

Ultimately, the assessor is supposed to be able to give advice, not just present the requirements of the scheme. They need to be able to give advice on different choices of which credits to target and how that would affect the overall assessment. In order to do this well, you need to have some knowledge and background in buildings (Focus Group, 2015).

It was found that even technical experts in green building certifications have specialty areas as well. This means that some information that technical experts have is 'siloed' or specialised in an area like energy, or moisture safety, or even in one certification system over another. This fragmentation of knowledge could lead to an operational lag time when consultants have to consult with the right specialists. There may not be a way to acquire more of the information necessary, given time and resources, but by mapping out a system of certification assessment studies for certifications, the operational lag time could decrease.

Some certification schemes are very vague in their treatment or control of a criteria requirement. For example, in Miljöbyggnad for Existing Buildings, moisture control is not clearly defined as to how to measure it consistently and thoroughly. As a consultant you have to also consider that you are going on a site visit to conduct an assessment sometimes and you cannot just disturb occupants because you want a sample of the wall (Focus Group, 2015). This example illustrates a case where the requirement to measure the issue is difficult to assess and would potentially be impossible for someone lacking any building experience.

6.4.2 Comparing the Schemes in a Swedish Context

The Swedish context played a role in identifying challenges in the assessment process. Sometimes, however, the Swedish context also provided a boon to the process. Whether it was a challenge or not, the local context was shown to make a difference in choosing which certification scheme to certify with.

When considering LEED 2009 EBOM criteria, many of the requirements are related to operations and maintenance procedures as the full-title of the scheme indicates. When comparing what information was available from the feasibility study of the case building at Chalmers, it was clear that much of the data used for the Miljöbyggnad assessment had very

little information regarding procedures, policies, or plans. Given that Miljöbyggnad only measures three areas: energy, indoor environment, and materials, it was clear that an incomplete picture was formed of the necessary information for LEED EBOM.

Even though cross-referencing the different rating schemes against one another proved difficult in the feasibility case study, interviews and informal conversations filled in various pieces of evidence to identify how the certification schemes performed in Sweden. One interviewee's company had chosen to work with LEED EBOM over Miljöbyggnad due to greater flexibility with achievable credits as well as the breadth of issues that it addressed. Unsurprisingly, many companies in Sweden are able to achieve high ratings in LEED EBOM due to the low energy prerequisites. While these prerequisites are challenging in the United States, the energy efficiency best management practices and minimum energy performance are surpassable in Sweden.

Weighting the same certification scheme differently to address local context specific was an idea recommended in the literature review by Crawley & Aho (1999). The idea was to use existing certification schemes but give the categories different weightings according to the country context. This innovative approach may be worthwhile, nevertheless time consuming to create nationally agreed upon priority areas across various schemes.

Miljöbyggnad for Existing Buildings suits the Swedish context because it address some of the major environmental impacts identified by Sweden's Ecocycle Council, mentioned in Chapter 2. It addresses energy efficiency, hazardous substances, radon leaks, and sound quality (The Ecocycle Council, 2001). Each of these significant environmental impacts identified in order of importance are addressed in Miljöbyggnad. While LEED EBOM and BREEAM In-Use both rate energy efficiency as the most important environmental impact, the three following environmental impact categories get very little coverage (Focus Group, 2015). It is possible that even if you achieve a BREEAM In-Use certification (depending on which Part), you could still have a moisture problem, high radon gas content, and lots of asbestos (Focus Group, 2015). The same is true of LEED EBOM. While these certification schemes may not address specific hazardous substances, environmental legislation or building codes may mandate compliance and it is necessary to be informed of national building codes in order to assess whether the schemes truly do not address such harmful substances.

There are even challenges in achieving particular credits in Sweden such as daylight factor, moisture control, solar heat load, and radon levels. The daylight factor credit can be found in all three certification schemes and across the board clients' buildings in Sweden struggle to meet this health & wellbeing consideration.

One interviewee in this study was critical of the coverage of green building certification schemes in Sweden saying that generally they do not begin to address the problem that buildings are not *used* in an efficient way to begin with. By that, the interviewee meant that if a building has one hundred employees working there, should there be so many desk spaces available? Should there also be empty rooms just to accommodate the occasional meeting or conference? She posed the questions to introduce the concept of sharing workspaces for different activities or needs saying that by doing this, noise, light, and thermal controls may not be so important to the whole building. Instead, there could be particular sites located to accommodate occupiers with particular preferences for the optimal use of the building. This innovative approach is reflected in one of the pilot credits mentioned in Chapter 3, Section 3.1.4 in the LEED program in Sweden. An activity-based workspace credit is currently being tested and seems to accurately represent the changing opinions on building users and their desire for a better use of workspace within existing buildings.

One thing is clear, in Sweden, each of the systems have different strengths and weaknesses and the challenge for consultants is to assess which will be most appropriate considering the client's expectations and the building itself.

6.4.3 Information Management

Evidence from observations on the assessment process as well as findings from the focus group indicated the difficulty with information management and strategic prioritization of all the building evidence was required for the certification schemes.

Particularly in certifications for existing buildings, the quantity of evidence required to meet the credit requirements can greatly impact the overall efficiency of the project. The smoothest path towards certification is one in which there is a champion of the project on the client's side who acts as the communication channel which can organize and acquire all of the necessary documents from the right people in the company.

Challenges with the initial assessment process occur when it is difficult to get the right evidence about the building or its management of operations because the project team is unaware of what was needed to complete the assessment (Focus Group, 2015). This challenge can stem from a basic lack of understanding across all of the people involved as to what documentation is required of the scheme (Focus Group, 2015). One solution might be to outline to the project team what is necessary from the start of the project and to reiterate it throughout the process. Consultants confirmed that by taking this kind of initiative and planning well, means you are more likely to get the right evidence you need rather than sifting through piles of data readings that have never been looked at before (Focus Group, 2015).

Table 6-1 illustrates the challenges associated with information management:

Table 6-1 Participant Quotation

"A lot of the frustration that comes with projects is from clients or contractors who didn't understand at the start what they were going to have to do."

Source: Focus Group, 2015

Complications with information management often arise in multi-national projects as well. In Europe, consultants may work on projects in different countries even and that can add another layer of difficulty as the many contractors and design teams need to be informed of all the necessary documents that clarify the advice given. Consultants need to make sure they understand everything because if you don't the process of working on a certification with a team abroad becomes impossible (Focus Group, 2015).

Depending on the certification scheme, different quantities of evidence are required for accompanying the assessment study. In Miljöbyggnad the thought was that property owners should use the data and documents they already have to be assessing the performance of their building. The idea that Miljöbyggnad capitalizes on the large amount of documents you already have as requirements for evidence is a very good one according to some consultants (Focus Group, 2015).

The one person who can act as a communication channel between the consultant and the company for which the building certification is being assessed, has far more power to gather internal building data than the consultant does. Regardless of which certification scheme is chosen, having one person who is on the side of the client in the project who is responsible,

dedicated and interested in what the consultant is doing, stands a much higher chance of overcoming the challenge of information management for existing building certifications.

6.4.4 Client Education and Communications

Often consultants find themselves working with a client who wants a certification scheme because they heard about it from environmental coordinators, competitors on the market, or in advertising (Sustainability Consultant, personal communication, 7 July 2015). Peer pressure can be a powerful factor driving clients to consultants for green building certifications. Unfortunately, without any knowledge of what kind of information is necessary about the building, who has the information, and whether your building could even meet the minimum standards, a certification scheme process is often unknown by the client (Focus Group, 2015).

Most clients cannot answer WHY they have chosen a certain certification scheme over another. It is for this reason that it is important to identify similarities and differences between the schemes not only from the consultant's perspective but also from the client's in order to facilitate better decision-making on appropriate green building certifications for existing commercial buildings. Flexible schemes such as LEED EBOM and BREEAM In-Use offer tradable credits in the form of non-compliance or compliance. This creates the opportunity for prioritizing particular categories or credits depending on what the client really wants out of a green building certification (Focus Group, 2015). Sometimes clients demand a particular rating outcome of the certification scheme that has been chosen, but either they don't want the building to achieve the requirements of the system to earn it, or they won't implement the actions necessary to reach that level (Focus Group, 2015).

A unique point of view was brought up on green building certification schemes in Sweden from a Head of Sustainability who expressed his general concern in certifications not addressing sustainability properly (personal communication, 13 August, 2015). He believed that by focusing on increasing environmental and sustainable awareness in the construction, engineering, and architecture industries, a demand for green building certifications would decrease as the knowledge to construct or operate environmentally better buildings would be readily available as a common competency (Head of Sustainability, personal communication, 13 August, 2015). In other words, with a better informed population, either property owner or developer, green building certifications would become unnecessary. However, this point of view must be contested as it does not take into account that even certification systems strive for continuous improvement and that the standards and criteria of many years ago need constant updating to continue to push the building market towards ever higher performing buildings.

Communicating clearly with clients about their background knowledge, commercial motivations, and resource constraints early on allows the consultant to work towards a long-term goal of successfully achieving a certification of the building on behalf of a client (Focus Group, 2015).

6.5 Determining the Appropriate Rating Scheme for Property Owners

Based on findings from Chapter 5, this section aims to answer the third and final research question asked in this study:

RQ3: How do you determine the most appropriate rating scheme for a property owner to select for certification of an existing building?

The literature suggests that one of the most fundamental characteristics of rating scheme success on the market with clients (likely property owners) is methodological transparency (Crawley & Aho, 1999). Property owners and companies in the market for a green building certification must be able to access the assumptions, data needs and other methodological issues that influence the overall outcome of assessments and their ratings of different buildings (Crawley & Aho, 1999). This allows clients to make deliberate choices, thoughtful comparisons, and well-informed decisions that are relevant to companies that are able to improve their performance and even effectively increase their competitive advantage on the market (Crawley & Aho, 1999).

However, as addressed in the sections above, in practice, property owners are not always well-informed and sometimes make poor decisions when initiating a conversation about which certification scheme is best for the company as well as whether their corporate structure and goals even support the certification for existing buildings at all (Focus Group, 2015). Thus, the work of the sustainability consultant is crucial to fill the gaps where there is a lack of methodological transparency. This underlines the fact that the preliminary work with a client for sustainability consultants is the most important step in successfully and efficiently achieving a certification (Focus Group, 2015).

The Focus Group participants underlined this finding and unanimously agreed that the preliminary work that a consultant does with a client can ultimately cause the project to "sink or swim." It appears that most of the participants also agreed that this work was the weakest step currently when working with clients (Focus Group, 2015). Participants expressed concern that by not conducting good practices in the assessment process and addressing a client's knowledge gaps and motivation as early on in the process as possible, there was likely to be a greater potential in failing to go through with the certification.

Some project teams who do not give the initial assessment process enough time or thoroughness may have clients get to the end of the lengthy detailed assessment and decide that ultimately, it was too much, or that one simple credit like daylight control in Miljöbyggnad, might cause them to exit the certification process. While the consultant is still paid for their services, the large amount of time and effort that goes into the gathering of data and the consulting with various building experts for different parts is void. This inefficiency potential in consulting firms to neglect the first steps in working with a client can be avoided if a strategic approach is taken.

6.5.1 Recommendations:

Overall, this study found that a tool would address challenges in the assessment process by targeting the right information as early as possible, as well as identifying an appropriate rating scheme for a property owner. The designed strategic tool shown in Figure 20 is recommended for assembly and can be used to facilitate the preliminary work of an assessment study. Table 6-2 highlights the premise for which this screening tool was considered and sought to ameliorate. Table 6-3 is the verification received that this strategic screening tool is a valuable instrument to consultants like those in the Focus Group (2015).

Table 6-2 Participant Quotation

"If you start with the wrong understanding, you will end up in chaos…" "That's why we have so much chaos."

Source: Focus Group, 2015

Table 6-3 Participant Quotation

"This is actually good use for us, because as consultants, you are so eager to please…If we could go one step back more often, we would learn so much more about a smoother project. So it's a very good tool for us to think a bit more before we start."

Source: Focus Group, 2015

The following sub-sections aim to address the concept formation for each of the strategic categories found in the boxes of the tool. The process begins with the box called "Strategic Questions to the Client" and then follows the arrows to the variety of client options that have been identified to move onto the next step.

Strategic Questions to the Client

Figure 20 presents the design of the screening tool. The first box that you start with is called the "Strategic Questions to Client" box.

Since the beginning of this study when asking how to determine the appropriate rating scheme for a property owner, the author was placed into the shoes of a consultant during the observation phase as the participant-observer. However, it seemed difficult to do so without first understanding the motivation of a client to earn a certification. At the premise of every good (or bad) idea assessment is generally the implied question of WHY (Hofstrand et al., 2013)? The issue of not having an actual case study client who would be interested in a green building certification made it difficult to assess an appropriate certification scheme. Through this realization, it became clear that the design for a screening tool to target abstract, yet crucial information, needed to start with a series of questions to the client regarding their motivations, ambitions, and constraints in applying for a certification system.

When Figure 18, as found in Chapter 5, was presented to the focus group (2015), unanimous agreement was found that this section – "Questions to Client" – may be the most important part of the tool and of what was called "preliminary work" for an assessment. Revisions were recommended to add that these were not just questions to the client, but they needed to be of strategic nature to set the standard for the line of questioning. That is, these questions would relate to the long-term, overall aims and interests of the client in achieving a green building certification for existing buildings. As Chapter 3 explained that many of the certification processes take close to a year, or possibly longer, it is important to establish motivations early on.

In order for the tool to be used in a different context such as for new construction or for another sustainability consulting firm, an evaluation or adaptation of this tool might be needed. Therefore, transferring the findings from the study's evaluation of the tool outside of the Swedish context and/or even to a different consulting company may be done with caution after thorough evaluation of the company's needs.

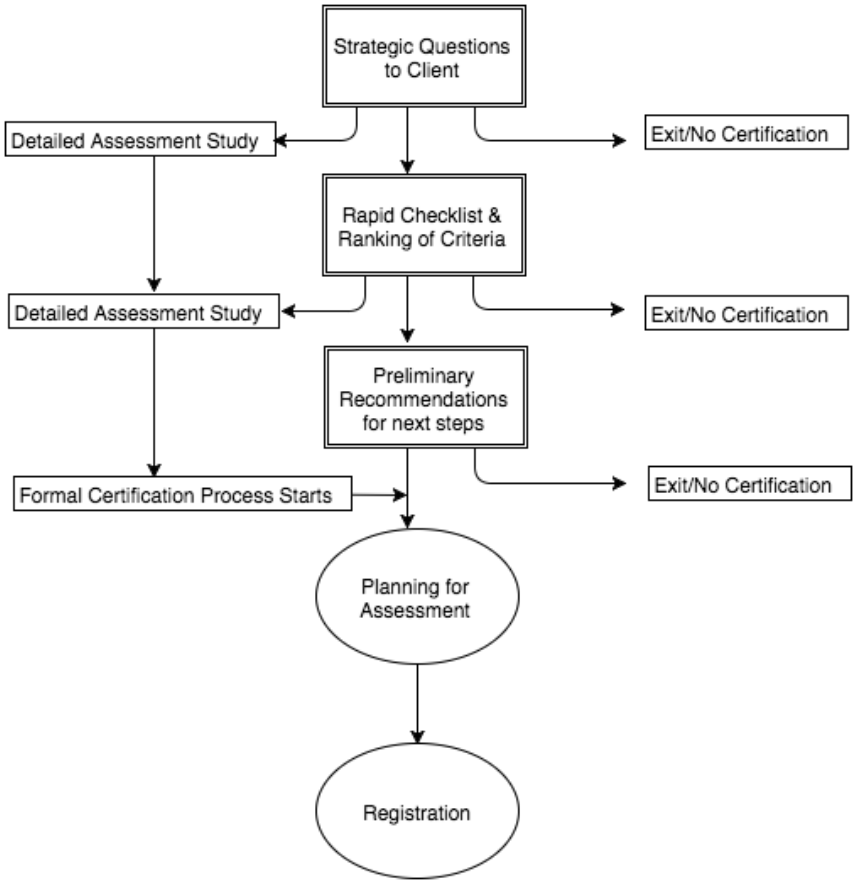


Figure 20 Recommended Strategic Consulting Process and Screening Tool Design

Rapid Checklist & Ranking of Criteria

The idea of creating a rapid checklist and ranking of criteria as a part of the design of a screening tool was inspired through literature and observations on the assessment process that confirmed the need for systematic, yet relatively quick assessments of building projects (Gething & Bordass, 2006).

Gething & Bordass (2006) have created a rapid assessment checklist for sustainable buildings based on existing practice-based methods that were developed to facilitate communications between design project members and their clients. An extensive review of sustainability assessment methods was made and an aggregation of the most important categories was synthesized into a simple, robust, and fair checking list (Gething & Bordass, 2006). Their checklist permits levels of ambition and achievement to be identified, and allows for comparisons between buildings of different types (Gething & Bordass, 2006). It would be useful in further studies to employ such a rapid checklist in order to test the success of it in this tool. Otherwise, a further study would need to be conducted on the indicators that are important in the context of Sweden, the coverage of the certification schemes, and even more broadly critical sustainability categories that sustainability consultants in the building sector in Sweden have the technical knowledge to refine.

Dammann & Elle (2006) describe that a strategic communication process throughout the decision-making process for the operation of a building necessitates a more common language among the many different actors involved. According to Nigel Howard, a former developer of the UK rating system BREEAM and Programme Director of LEED,

"There is always a buyer and a seller. If we want our indicators to be used, we have to ask ourselves three questions (Dammann & Elle, 2006):

1. For whom is the assessment?
2. Why does it matter to them?
3. How simple shall the indicators be?"

Preliminary Recommendations for Action:

This final category has been created for due process in the preliminary work. Depending on the context of the conversation with the client and the building, the consultant should have the opportunity to "close" the preliminary work with an idea of which path towards certification to take. Preliminary recommendations for action may be that no certification is best for the time being; it may be that one particular certification scheme and rating level is going to be prepared through the detailed assessment and full feasibility study; it might be that there are indicators found in the rapid checklist that sway the consultant to deliver a recommendation to proceed with one certification scheme over another based on either the desired outcome of the client, or the building's ability to perform. As necessary, the preliminary recommendations for action serve the consultant to formulate the next steps. It was mentioned by one focus group participant that it would be valuable to integrate a client education presentation on an introduction to the green building certification schemes in order to further deepen the conversation and gauge a client's commitment levels. This presentation could come after any of the presented steps in the tool's design.

The next steps recommended for consultants would be to build such a screening tool based on the design categories and discussion found in this chapter.

7 Conclusions

This study sought to answer three research questions. The first research question was, what are the differences between LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad for Existing Buildings v. 2.1 schemes? The second research question was, what are the challenges in the initial assessment process of green building certification for existing buildings? The third research question was, how do you determine the most appropriate rating scheme for a property owner to select for certification of an existing building? The following conclusions were found in this study:

I. What are the differences between LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad for Existing Buildings v. 2.1 schemes?

The study found that LEED EBOM and BREEAM In-Use were most alike when compared with the Swedish scheme, Miljöbyggnad. On a more analytical level, LEED EBOM was found to take a more consolidated approach to the issues addressed. Rather than three different Parts for commercial assessment like BREEAM In-Use, LEED EBOM offers all of the criteria and prioritises similar categories to BREEAM In-Use. However, the advantages of addressing multiple client types, as in the scheme BREEAM In-Use, allows for more credits to be considered and for environmental impacts to be shared across different stakeholders. By offering three Parts to choose from, BREEAM In-Use attempts to be more holistic in the aim that all three Parts complement one another for a full assessment of a building in-use. Lastly, Miljöbyggnad offers a simple and cost-effective approach to rating systems by suiting the local context and addressing only building performance specifications. Rather than permitting flexibility, Miljöbyggnad requires that all of the criteria be met in order to receive a rating. This is an effective tool for only looking at the building as a running object. Unfortunately, it neglects to address any procedures, policies, or plans that are necessary to manage and operate a building for high-performance.

II. What are the challenges in the initial assessment process of green building certification for existing buildings?

The study found several challenges related to the assessment process of green building certifications of existing buildings. Certification schemes for existing buildings require some level of technical expertise not only to guide a client through the certification process, but also to give meaningful input on building performance. Although technical expertise was found to be necessary when working with clients, individual specialists had to be sought to perform different parts of a project's assessment due to their knowledge in one field such as moisture safety. This segregation of knowledge could be a challenge in facilitating a more efficient assessment process.

Information management was shown to be an important factor in gathering the right evidence about a building's operational data from the right people. Without a clear channel of communication to facilitate the collection of evidence on the client's side, the assessment process becomes lengthy and difficult to navigate.

The Swedish context was found to play an important role in which certification schemes were most easily assessed by a consultant. The health and environmental issues represented in Miljöbyggnad were most accurate to address the Swedish context. It was concluded that LEED EBOM was easier to score points due to the Swedish energy mix being far cleaner than the American, thus achieving a better overall rating. But, LEED EBOM and BREEAM In-Use failed to address critical criteria found in Miljöbyggnad such as an assessment of radon

or asbestos. In all three schemes, it was found that daylight was one of the most difficult criteria to achieve. BREEAM's highest ratings are harder to achieve than LEED EBOM and so it was considered to be more comprehensive and competitive for high-performing buildings in Sweden. Overall, the local context played a large role in identifying challenges for the actual assessment process of the three certifications.

When a client inquires with a sustainability consultant about a green building certification, they usually have a particular one in mind. However, it was found that consultants spend a great amount of time educating their clients on the differences between the certification schemes because of the client's lack of understanding of what an assessment process entails, or what the rating schemes seek to address, beyond the market benefits. The success of the assessment project and ultimately the certification process hinges on the client's education and subsequent communications regarding green building certifications of existing buildings.

III. How do you determine the most appropriate rating scheme for a property owner to select for certification of an existing building?

Preliminary work was found to be a crucial step in the assessment process, which also had the potential to overcome some of the challenges previously mentioned. A tool was created to develop a systematic approach to facilitate preliminary work.

A screening tool has been recommended to assist in determining the appropriate rating scheme for property owners and clients. The screening tool was made up of three main components: the strategic questions, a rapid checklist and ranking of criteria, and finally preliminary recommendations for next steps.

Recommendations for further research might include studies on green building certification for residential properties in existing buildings or new construction as there are many rating systems being developed to suit the property and the homeowner in the Nordic countries. The two kinds of properties and property owners – commercial and residential – vary considerably, enough to develop different green building certification schemes that look at difference in building function, use, and operations. Additionally, further studies on consulting strategies and practical issues of working with clients, the field of existing buildings, or even the application of this study in another context to test the generalizability and transferability of a screening tool would be meaningful to pursue.

The author had in mind that the design of the tool should be built into an excel template and then be used and assessed in a secondary study. Furthermore, in the 21st century where 'mobile apps' are so widespread, a vision of creating the matrix of questions and rapid checklist into an app has been considered.

Bibliography

Alyami, S. H., & Rezgui, Y. (2012). Sustainable building assessment tool development approach. *Sustainable Cities and Society*, *5*, 52–62.

Azhar, S., Carlton, W. A., Olsen, D., & Ahmad, I. (2011). Building information modeling for sustainable design and LEED® rating analysis. Automation in Construction, 20(2), 217–224.

Bauer, K. & Johansson, V. (2013). Environmental certifications in the Swedish construction industry: For small to mid-sized construction companies considering to implement environmental certifications (Master's Thesis). Chalmers University of Technology, Göteborg, Sweden. Retrieved from http://publications.lib.chalmers.se/records/fulltext/182566/182566.pdf

Boarin, P., Guglielmino, D., Pisello, A. L., & Cotana, F. (2014a). Sustainability Assessment of Historic Buildings: Lesson Learnt from an Italian case Study through LEED® Rating System. Energy Procedia, 61, 1029–1032.

Building Research Establishment Ltd (BRE Ltd). (2015). BRE Global. Retrieved from http://www.bre.co.uk/page.jsp?id=383

Bre Global. (2015-a). Green Book Live: What is BREEAM? Retrieved from http://www.greenbooklive.com/search/scheme.jsp?id=8

Bre Global. (2015-b). BREEAM International. Retrieved from http://www.breeam.org/podpage.jsp?id=367

BRE Global. (2015-c). BREEAM Accredited Professionals. Retrieved from http://www.greenbooklive.com/search/scheme.jsp?id=172

BRE Global. (2015-d). Greenbook Live: Certified BREEAM Assessments. Accessed 26/07/2015. Retrieved from http://www.greenbooklive.com/search/buildingsearch.jsp?from=0&partid=10023&schemeid=10155&subschemeid=0&subsubschemeid=0&companyName=&developer=&productName=&buildingRating=&certNo=&certBody=&assessorAuditor=&countryId=34&addressPostcode=&standard=&notes=&projectType=Offices&id=202&results_pp=10

BRE Global Ltd. (2014). Operational Guidance for BREEAM In-Use Scheme SD096 – 24.1. Retrieved from http://SD096_-_Rev_24.1_BREEAM_In-Use_Scheme_Document.pdf

BRE Global Ltd. (2015). BREEAM In-Use International: Technical Manual SD221 - 1.0:2015 – Version: 0 – Version Date: March 2015. Retrieved from http://www.breeam.org/filelibrary/Technical%20Manuals/SD221_BREEAM-In-Use-International-Technical-Manual_V0.pdf

BRE Global. (n.d.)BREEAM In-Use: Driving sustainabiilty through existing buildings (Briefing Paper/White paper). Retrieved from http://www.breeam.org/filelibrary/BREEAM%20In%20Use/KN5686---BREEAM-In-Use-White-Paper_dft2.pdf

Carney, J. [buildinggreenllc]. (2012, November 9). *LEED EBOM: Eight Steps For Success* [Video File]. Accessed 17 July, 2015. Retrieved from https://www.youtube.com/watch?t=71&v=Q_Qcb-C3zII

Cole, R. J. (1998). Emerging trends in building environmental assessment methods. Building Research & Information, 26(1), 3–16.

Cole, R. J. (2006). Shared markets: coexisting building environmental assessment methods. Building Research & Information, 34(4), 357–371.

Comparing Estidama's Pearls Rating System to LEED and BREEAM. (n.d.). Retrieved July 21, 2015, from http://www.carboun.com/sustainable-urbanism/comparing-estidama%e2%80%99s-pearls-rating-method-to-leed-and-breeam/

Crawley, D., & Aho, I. (1999). Building environmental assessment methods: applications and development trends. *Building Research & Information*, *27*(4-5), 300–308.

CIB. (1999). Agenda 21 on Sustainable Construction. CIB Report Publication 237. Retrieved from http://www.irbnet.de/daten/iconda/CIB4675.pdf

Dahmus, J. B. (2014). Can efficiency improvements reduce resource consumption?. Journal of Industrial Ecology, 18(6), 883-897.

Dammann, S., & Elle, M. (2006). Environmental indicators: establishing a common language for green building. Building Research & Information, 34(4), 387–404.

The Ecocycle Council. (2001). Byggsektorns betydande miljöaspekter (The Significant Environmental Aspects of the Building sector), Byggsektorns kretsloppsråd (The Ecocycle Council), available at http://www.kretsloppsradet.com/Miljoutredning.asp

Focus Group. (2015). Personal Communications. Göteborg

Flick, U. (2009). An introduction to Qualitative Research (4th ed.), 222- 238. Sage: London

Green Business Certification Inc. (GBCI). (2015). About. Retrieved from http://www.gbci.org/about

Green Construction in UAE (n.d.) Retrieved from http://greenuae.hpage.co.in/breeam-gulf_86396206.html

Gething, B., & Bordass, B. (2006). Rapid assessment checklist for sustainable buildings. Building Research & Information, 34(4), 416–426.

Glaumann, M. (2011, 17 October). Weighting and Aggregation: Workshop on SB Assessment Methods and Tools [Powerpoint]. Retrieved from http://www.iisbe.org/system/files/private/Mauritz%20Glaumann_Weighting%20and%20aggregation.pdf

Glaumann, M., Sundkvist, Å., Malmqvist, T., Finnveden, G., & Eriksson, O. (2006). Development of an environmental classification system for buildings through a new kind of dialogue between stakeholders and researchers. In The 19th IAPS Conference. Alexandria, Egypt. 11-16 September, 2006.

Hofstrand et al. (2013). Feasibility and Business Plans. Ag Decision Maker, Department of Economics University Extension, Iowa State University. Available at https://www.extension.iastate.edu/agdm/wholefarm/html/c5-66.html

IPCC. (2014). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

Juan, Y.-K., Gao, P., & Wang, J. (2010). A hybrid decision support system for sustainable office building renovation and energy performance improvement. Energy and Buildings, 42(3), 290–297.

Kaatz, E., Root, D. S., Bowen, P. A., & Hill, R. C. (2006). Advancing key outcomes of sustainability building assessment. Building Research & Information, 34(4), 308–320.

Kawulich, B. B. (2005). Participant Observation as a Data Collection Method. Forum Qualitative Sozialforschung/Forum: Qualitative Social Research, 6(2). Retrieved from http://www.qualitative-research.net/index.php/fqs/article/view/466

Kok, N., Miller, N., & Morries, P. (2012). The Economics of Green Retrofits. Journal of Sustainable Real Estate, 4(1), 4–22.

Latest Development of Energy Service Companies across Europe - A European ESCO Update.pdf. (n.d.).

Lee, W. L. (2013). A comprehensive review of metrics of building environmental assessment schemes. *Energy and Buildings*, *62*, 403–413. http://doi.org/10.1016/j.enbuild.2013.03.014

Long, M. (2015). USGBC Press Release: GBCI Renamed Green Business Certification Inc. Retrieved from http://www.usgbc.org/articles/gbci-renamed-green-business-certification-inc

Lockwood, C. (2006). Building the Green Way. Harvard Business Review, 84(6), 129-137.

Lützkendorf, T., & Lorenz, D. P. (2006). Using an integrated performance approach in building assessment tools. Building Research & Information, 34(4), 334–356.

Mateus, R., & Bragança, L. (2011). Sustainability assessment and rating of buildings: Developing the methodology SBToolPT–H. Building and Environment, 46(10), 1962–1971.

Miljöbyggnad Befintliga Handelsbyggnader Manual 2.1. (n.d.). SGBC. Retrieved from http://www.sgbc.se/docman/certifieringssystem-1/161-bedomningskriterier-for-befintliga-handelsbyggnader/file?Itemid=157

MLM. (2014). LEED. Retrieved from http://www.mlm.uk.com/brands_sustainability_leed.php)

Morgan, D. L., & Krueger, R. A. (Eds.). (1998). Focus Group Kit (Focus Group Kit, Vols. 1-6). Thousand Oaks, CA: Sage.

Morgan, D. L. (1998). The Focus Group Guidebook (Focus Group Kit, Vol. 1). Thousand Oaks, CA: Sage.

Morgan, D. L. (1998). Planning Focus Groups (Focus Group Kit, Vol. 2). Thousand Oaks, CA: Sage.
Krueger, R. A. (1998). Developing Questions for Focus Groups (Focus Group Kit, Vol. 3). Thousand Oaks, CA: Sage.

Krueger, R. A. (1998). Moderating Focus Groups (Focus Group Kit, Vol. 4). Thousand Oaks, CA: Sage.

Krueger, R. A., & King, J. A. (1998). Involving Community Members in Focus Groups (Focus Group Kit, Vol. 5). Thousand Oaks, CA: Sage.

Krueger, R. A. (1998). Analyzing and Reporting Focus Group Results (Focus Group Kit, Vol. 6). Thousand Oaks, CA: Sage.

Medineckiene, M., Zavadskas, E.K., Björk, F., & Turskis, Z. (2014). Multi-criteria decision-making system for sustainable building assessment/certification. Science Direct. Retrieved from http://www.researchgate.net/profile/Edmundas_Zavadskas/publication/266749237_Multi-criteria_decision-making_system_for_sustainable_building_assessmentcertification/links/54d6320f0cf25013d02f351b.pdf

NCC. 2015. BREEAM: NCC. Retrieved from http://www.ncc.se/hallbarhet/vart-miljoarbete/miljocertifieringar/breeam/

Nelson, A, & AJ Rakau. (2010). Green Buildings: A Niche Becomes Mainstream. Deutsche Bank Research.

NCC. (2015). Miljöbyggnad. Retrieved from http://www.ncc.se/hallbarhet/vart-miljoarbete/miljocertifieringar/miljobyggnad/

OECD. (n.d.) Sweden. Better Life Index. Retrieved on 24/08/2015 from http://www.oecdbetterlifeindex.org/countries/sweden/.

Peab AB. (2013). Sustainability Report 2013. Retrieved from http://www.peab.com/Global/PeabCom/Reports/Sustainability-report-2013.pdf

PEAB. (2011). Sustainability Report 2011. Retrieved from http://www.peab.com/Global/PeabCom/Reports/Sustainability-report-2011.pdf

Pearce, O. J. D., Broyd, T. W., & Murry, N. J. A. (2012). Halstar: systems engineering for sustainable development. Proceedings of the ICE - Engineering Sustainability, 165(2), 129–140.

Pearce, O. (2010). Systems thinking for a sustainable built environment [Doctoral Dissertation]. University of Bristol: Bristol, U.K.

Poveda, C. A., & Young, R. (2015). Potential benefits of developing and implementing environmental and sustainability rating systems: Making the case for the need of diversification. International Journal of Sustainable Built Environment, 4(1), 1–11.

SGBC. (n.d.-a) MILJÖBYGGNAD – en svensk certifiering som värnar om människa och miljö. Retrieved from http://www.sgbc.se/docman/certifieringssystem-1/25-broschyr-miljobyggnad/file

SGBC. (n.d.-b). MiljöbyggnadBEDÖMNINGSKRITERIER FÖR BEFINTLIGA BYGGNADER: MANUAL 2.1 UTGÅVA 120101. Retrieved from http://www.sgbc.se/docman/certifieringssystem-1/105-bedomningskriterier-befintliga-byggnader/file?Itemid=157

SGBC. (2014). MILJÖBYGGNAD - KOMMUNIKATIONSPLATTFORM: FÖRDELAR, POSITIONERING OCH MÅLGRUPP. Retrieved from http://www.sgbc.se/docman/miljobyggnad-2015/484-kommunikationsplattform-for-miljooyggnad-v-1-01/file

SGBC. (2014). Miljöbyggnad baskurs. Retrieved from https://www.sgbc.se/kurstillfallen/603-miljobyggnad-baskurs

SGBC. (2014). Miljöbyggnad certifieringskurs. Retrieved from https://www.sgbc.se/kurstillfallen/609-miljobyggnad-certifieringskurs-c-kurs

Skanska. (2015). Environmental certifications/environmental management. http://www.skanska.se/sv/Om-Skanska/Prioriterade-omraden/Hallbarhet/Sa-har-arbetar-vi/Miljocertifieringar/

Timetric Construction Reports, 2013. Construction in Sweden – Key Trends and Opportunities to 2017. https://timetric.com/research/report/cn0178mr--construction-in-sweden-key-trends-and-opportunities-to- 2017/

Todd, J. A., Pyke, C., & Tufts, R. (2013). Implications of trends in LEED usage: rating system design and market transformation. Building Research & Information, 41(4), 384–400.

Turner, N., & Arif, M. (2012). BREEAM Excellent: Business Value Vs. Employee Morale. *Journal of Physics: Conference Series*, *364*, 012116.

UN-DESA. (2012). Challenges and Way Forward in Urban Sector. Retrieved 24 February, 2015 from https://sustainabledevelopment.un.org/content/documents/challenges_and_way_forward_in_the_urban_sector _web.pdf

United Nations Environment Programme: Sustainable Buildings and Climate Initiative (UNEP SBCI). (2009). Buildings and Climate Change: Summary for Decision-Makers. Retrieved from http://www.unep.org/sbci/pdfs/SBCI-BCCSummary.pdf

UNEP. (2014). http://www.unep.org/NewsCentre/default.aspx?DocumentID=2787&ArticleID=10825

U.S. Green Building Council (USGBC). (2009). LEED 2009 for Existing Buildings: Operations & Maintenance Rating System.

USGBC. (2011). A New Retrofit Industry: An analysis of the job creation potential of tax incentives for energy efficiency in commercial buildings and other components of the Better Buildings Initiative. Retrieved from http://www.usgbc.org/sites/default/files/Docs9531.pdf

USGBC. (2012-2015-a). About. Retrieved from http://www.usgbc.org/about

USGBC. (2012-2015-b). LEED Certification. Retrieved from http://www.usgbc.org/certification

USGBC. (2012-2015-c). LEED Credentials. Retrieved from http://www.usgbc.org/cert-guide

USGBC. (2012-2015-d). Guide to LEED Certification. Retrieved from http://www.usgbc.org/cert-guide

USGBC. (n.d.-e). Introduction: LEED for Existing Buildings: O&M. Retrieved from http://www.usgbc.org/Docs/Archive/General/Docs4512.pdf

USGBC. (2012-2015-f). LEED Overview. Retrieved from http://www.usgbc.org/leed

USGBC. (2012-2015-g). Green Cleaning – purchase of sustainable cleaning products and materials. Retrieved from http://www.usgbc.org/credits/existing-buildings/v2009/eqc33

USGBC. (2015). Sweden Ranks Among Top 10 Countries For LEED Green Building [Press Release]. Retrieved from http://www.prnewswire.co.uk/news-releases/sweden-ranks-10th-among-top-10-countries-for-leed-green-building-518113641.html

USGBC. (2014). LEED in Motion: Sweden. Retrieved from http://issuu.com/usgbc/docs/leed_in_sweden

Varnaite, R. (2013). From Green to Sustainable Urban Development: Analysis of Sustainability Performance in Swedish housing (Master's Thesis). LUCSUS: Lund University, Lund, Sweden. Retrieved from http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=4001642&fileOId=4001648

World Green Building Council (WGBC). (2014). What is green building and why does it matter? Retrieved on 2 March, 2015 from http://www.worldgbc.org/files/5613/6139/3673/Europe_Regional_Network_-_What_is_green_building_and_why_does_it_matter_-_screen_view.pdf

WCED. (1987). Report of the World Commission on Environment and Development: Our Common Future. Retrieved from http://www.ask-force.org/web/Sustainability/Brundtland-Our-Common-Future-1987-2008.pdf

WSP Group. (2015). Personal Communications. Malmö and Göteborg.

Young, S. [BREVideoUK]. (2012, April 2). BREEAM in Use [Video File]. Accessed 6 September, 2014. Retrieved from https://www.youtube.com/watch?v=x3cI5o

Appendix I. Personal Communications

WSP Group, Sweden, May-August 2015

Oliver Pearce
Matthias Lindberg
Bunmi Odubeyi
Anna Limdal-Landfors
Lena Kadmark
Kurt Möller

White, Sweden, 13 August 2015
Jonas Svensson

Vasakronen, Sweden, August 2015
Anna Denell

Skanska, Sweden, February 2015
Åse Togerö

Google, Mtn. View, CA, 7 July 2015

Dan Ackerstein
Lauren Riggs
Richard Navarro
Kati Kallins

Appendix II. LEED EBOM and BREEAM In-Use additions

Table 1. Minimum Standards for LEED EBOM

Minimum Standards for LEED 2009 EBOM (USGBC, 2009)		*Achieved?*
Water Efficiency		
WEP1	Minimum indoor plumbing and fitting efficiency	Y
Energy & Atmosphere		
EAp1	Energy efficiency best management practices	Y
EAp2	Minimum energy efficiency performance	Y
EAp3	Fundamental refrigerant management	Y
Material & Resources		
MRp1	Sustainable purchasing policy	Y
MRp2	Solid waste management policy	Y
Indoor Environmental Quality		
EQp1	Minimum IAQ performance	Y
EQp2	Environmental Tobacco Smoke (ETS) control	Y
EQp3	Green cleaning policy	Y

Table 2. Example of Environmental Category and Credit Scheme for Sustainble Sites in LEED EBOM

CREDIT	REQUIREMENT	TOTAL: 26 POINTS
SSc1	LEED Certified Design and Construction	4
SSc2	Building Exterior and Hardscape Management Plan	1
SSc3	Integrated Pest Management, Erosion Control and	1
SSc4	Alternative Commuting Transportation	15
SSc5	Site Development - Protect or Restore Open Habitat	1
SSc6	Stormwater Quantity Control	1
SSc7.1	Heat Island Reduction - Non-Roof	1
SSc7.2	Heat Island Reduction - Roof	1
SSc8	Light Pollution Reduction	1

Table 3. Minimum Standards for BREEAM In-Use

Minimum Standards for BREEAM In-Use International "Very Good" Rating	**Achieved?**
MAN 14 – Environmental Management Policy	Y
MAN 15 – Environmental Management Issues	Y
MAN 19 – Sustainability Report	Y
HEA 25 – Occupier Satisfaction	Y
ENE 68 – Energy management arrangements	Y
WAT 19 – Water Management Arrangements	Y
POL 15 – Pollution Management	Y
POL 16 – Pollution prevention arrangements	Y

Appendix III. Focus Group Guide

Introduction (5-7mins):

Hi Everyone,

You have all been invited to this focus group because of your technical experience and insight from working with either existing commercial buildings or either LEED, BREEAM, or Miljöbyggnad certification schemes.

This Focus Group is in conjunction with a thesis as a part of the Master's programme in Environmental Management and Policy at the International Institute for Industrial Environmental Economics of Lund University and is also a collaboration with WSP's Byggnadsfysik division in Göteborg with Oliver Pearce as leading supervisor.

(slide) The thesis looks to examine three things: green rating systems for existing commercial buildings, identification of the challenges and opportunities in the initial certification phase of the assessment process for LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad för Befintliga Byggnader 2.1; and, conceptualization and creation of a screening tool that assists building professionals in the pre-assessment of green building certifications for existing commercial buildings in Sweden.

(slide) The purpose of this focus group is to synthesize your experiences with either environmental performance of existing buildings, the use of green building certifications, and/or client preferences into the design of a screening tool that is currently in the development phase.

Briefly, to introduce some of the work that I have done thus far, I have compiled an existing building assessment workbook with the previously mentioned certification schemes that I sent out in the email yesterday. This has been done through the assistance of WSP's previously existing templates. Next, I have made some observations on the various systems associated with these assessments by way of a case study that WSP has provided me with. Towards the end of the session, we will spend some time discussing the potential aims and use of this tool by brainstorming it's functions and design.

We'll plan to wrap up in roughly two hours (120 mins). We will take a break after one hour, but if you need to leave sooner, just let me know. This session will be recorded. Anyone interested in remaining anonymous is welcome to let me know now. Any Questions?

Warm-up (10 mins) : (slides)

1. Would you mind briefly describing what you consider your area of specialization within the Byggnadsfysik division might be? – whether it is your experience with one certification over another or one area such as energy or indoor air quality?

2. How much expertise and knowledge is required to become an assessor?

Transition (40 mins): Practical Use

I recognize this was very short notice, but was anyone able to look over the existing building assessment workbook that I sent out yesterday evening? If not, I have some papers here for you all to look over (Bunmi, maybe we share the screen with you or you can pull up the email with the files?). You will see only selected sections of the assessment that were printed just in order to get the idea of it's general format.

Take a few moments and look over the assessment sheets for existing buildings according to LEED 2009 EBOM, BREEAM In-Use, and Miljöbyggnad Befintliga Byggnader 2.1.

1. What do you perceive are the key challenges with assessments or feasibility studies? (feel free to discuss a specific scheme, knowledge gap, client relation, or in general)

   follow up: how important are these challenges to being a potential key barrier for action?

2. When performing an assessment, what factors about the building are most important to identify first?
   (i.e. are there any "go/no-go" requirements that you know to search for first that have repeatedly shown difficulty in achieving certification in Sweden?)

3. Out of the following criteria categories: energy, water, waste, pollution, land use and ecology, health and well-being, transport, materials, and management, is there a particular area in which old buildings in Sweden frequently have trouble performing

4. What are the low-hanging fruits in renovation when considering upgrades in order to achieve a potentially higher level of certification?

Hour 1 Over – REFRESHMENTS and BREAK TIME (12 mins)

Transition (40 mins): Conceptualizing a tool

Hello again. We will transition now into discussing the potential for a screening tool. I'd like to present the concept of a feasibility study. SHOW DIAGRAM. Here we are familiar with the step in a certification process that is the assessment study, which allows for a feasibility study to be written. What I would like to do is focus on the step before the assessment and feasibility study:

Next, I'd like to present a current design of the tool that I am working on based on my observations and begin a discussion on it's use and core functions and then discuss any improvements that can be made.

Go to Flip Chart – drawing/design. Explain.

1. Now that you have seen my idea of a tool, based on our earlier discussion on the experience of doing an assessment and feasibility study, what improvements could be made to this tool, used in the pre-assessment step?

2. What could this tool be used to achieve? (the ultimate use, functions, outcomes, what could it be good for?)

   -Key parameters for Swedish-context buildings to achieve certification

-Stakeholder tool for understanding expectations? i.e. communication
-An automated tool for data analysis and rating scores?
-Identification of gaps between schemes or between transferability to other certifications using the data provided by the property owner?
-Benchmarking?
-Prioritization of renovations, upgrades, credits achieved?
-Client Preference
-Distances to target performance (distances from current state to future state)
-Design in the form of a checklist or a questionnaire?
-Scheme ratings background?

WRAP-UP (10 mins)

Thank you all for your participation today. I truly appreciate it. I'd like to remind you all again that the outcomes of this focus group will be included in my study and for those who wish to remain anonymous, please let me know. I am happy to share my results in the future, upon the conclusion of my project.

Again thank you for your time and have a nice day.

Appendix IV. Focus Group Transcipt

Introduction (5-7mins):

Hi Everyone,

You have all been invited to this focus group because of your technical experience and insight from working with either existing commercial buildings or either LEED, BREEAM, or Miljöbyggnad certification schemes.

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(slide) The thesis looks to examine three things: green rating systems for existing commercial buildings, identification of the challenges and opportunities in the initial certification phase of the assessment process for LEED 2009 for EBOM, BREEAM In-Use and Miljöbyggnad för Befintliga Byggnader 2.1; and, conceptualization and creation of a screening tool that assists building professionals in the pre-assessment of green building certifications for existing commercial buildings in Sweden.

(slide) The purpose of this focus group is to synthesize your experiences with either environmental performance of existing buildings, the use of green building certifications, and/or client preferences into the design of a screening tool that is currently in the development phase.

Briefly, to introduce some of the work that I have done thus far, I have compiled an existing building assessment workbook with the previously mentioned certification schemes that I sent out in the email yesterday. This has been done through the assistance of WSP's previously existing templates. Next, I have made some observations on the various systems associated with these assessments by way of a case study that WSP has provided me with. Towards the end of the session, we will spend some time discussing the potential aims and use of this tool by brainstorming it's functions and design.

We'll plan to wrap up in roughly two hours (120 mins). We will take a break after one hour, but if you need to leave sooner, just let me know. This session will be recorded. Anyone interested in remaining anonymous is welcome to let me know now. Any Questions?

Warm-up (10 mins) : (slides)

1. Would you mind briefly describing what you consider your area of specialization within the Byggnadsfysik division might be? – whether it is your experience with one certification over another or one area such as energy or indoor air quality?

L: work with env assess systems. Experience she adds is the BREEAM experience – mostly in Iceland with public projects.

O: lots of experience with BREEAM in England, but now work almost exclusively with LEED for NC – a couple of projects in Sweden but mainly around Europe. Some existing buildings. And a pre-assessment with Miljöbyggnad but not an area of expertise.

B: specialty is "solving problems regarding environ issues as an env coordinator" mostly work with Miljöbyggnad and with bream. The problems and the solutions are often the same regardless of what system you work with, is my experience. I have a background in existing buildings with building surveys.

1. How much expertise and knowledge is required to become an assessor? – terrible question (definitely leading the way it was asked…)

B: "to be an expert you need to have experience, but just to become an assessor or an AP you can take the test and that's, that's the bad thing in the business in my opinion because you can lack a lot of experience in the building process or how things are done and what it really means and still become an assessor. So just to be an assessor you just have to take a test. You really don't have to know anything about the process or why you are doing what you are doing."

O: "in general the process becomes all smooth and efficient when you have the experience in applying a lot and the experience of how designing and building and operating a building actually works in practice. You tend to work far more together with the rest of the project team than if you are just an assessor and you have your requirements and you read the manual and try to impose them. It generally results in far more conflicts and problems than if you work with everyone based on your experience in practicality of designing and operating a building rather than just meeting the requirements in a checklist."

Follow-up question: Do you all think that the training to be an assessor was created to a certain market for more people to become educated as assessor themselves or is it meant to be a tool for experts like engineers who do have the technical expertise?

O: it depends on the scheme to a certain extent. BREEAM assessors you do the assessment and they have to have some sort of certification of people to assure a certain, sufficient quality to be able to do it. LEED you don't need to be an AP or a green associate to go through the process because the assessment is done by the USGBC. Miljöbyggnad is more like BREEAM…

B: You don't have to be certified either.

A: If you go to the course and get certified, you can go to the course. There are no requirements to take the course.

B: The same for BREEAM. They have criteria before you are allowed to read the course. But the criteria is pretty low. You can go to the course as a newly examed engineer.

A: Some of our clients, esp. those working in real estate business and might have strictly economic or wider environmental background – not specifically in buildings at all – then they sometimes have problems because they don't know about OVK or Radon stuff. They don't know anything about houses or buildings. You realize that when they want to apply the services and don't really know.

L: At least my experience from Iceland, where I used to work with bream system, is that the assessor was supposed to be able to give advice, not just present the bream requirement, but also be able to give advice of different choices and how those would affect the bream assessment. You have to have some knowledge and background to be able to do that.

B: And often, my experience in Sweden, the assessors they want to give advice but they are afraid to do it because they don't know. They are evaluating their own advices in the end.

O: that's something that BRE says you are certainly not allowed to do. So it's a fine line.

B: so now that we have the AP role, that shouldn't be a problem. But in older projects in Sweden the assessor was the environmental coordinator, too and they gave that advice if they dared and then they were assessing, themselves, and then they couldn't say that that advice is bad.

A: So you were allowed to have da….??? 10:35

O: Not according to building research establishment you weren't.

A: there must have been a Swedish misunderstanding in the beginning.

B: No, the only role was assessor. The only thing you could be was assessor in BREEAM.

O: they only introduced the BREEAM AP role in the last few years, that's more of a LEED AP role where you can develop and advise on evidence – as an assessor you are meant to be entirely independent from the development of the evidence. But certainly as an assessor in England you could advise on how to improve the evidence so you'd write reports and say this evidence isn't good enough, and in order to improve it you can do this and this and this. But you couldn't have any role in actually develop the evidence.

(11:35) Transition (40 mins): Practical Use

I recognize this was very short notice, but was anyone able to look over the existing building assessment workbook that I sent out yesterday evening? If not, I have some papers here for you all to look over (Bunmi, maybe we share the screen with you or you can pull up the email with the files?). You will see only selected sections of the assessment that were printed just in order to get the idea of its general format.

Take a few moments and look over the assessment sheets for existing buildings according to LEED 2009 EBOM, BREEAM In-Use, and Miljöbyggnad Befintliga Byggnader 2.1.

1. What do you perceive are the key challenges with assessments or feasibility studies? (feel free to discuss a specific scheme, knowledge gap, client relation, or in general)

B: the first problem in my opinion is choosing the system because many of our clients have already decided this is the one we're going to use, but they can't answer why they have chosen that system and why they want the specific indicators in a certain level or class. So sometimes they want something, but they don't need it and they don't really want the building to achieve it, but they want the grade, but they don't want to implement the action to get the grade (Laughter from L+?). That in my opinion, is one of the first challenges that we meet to discuss WHY do you want this and what do you REALLY need.

A: and what affect does it get on the building. (B: Yeah, exactly). Sometimes they don't really know what extra costs or extra, you know, effort it will take. So they think they know it, but they might not know all about it.

O: to some extent that's why selling feasibility studies are attractive to try and help clients to understand why they are doing something and what's involved (B: Yeah) before they make those decisions….

A: Normally large consults they have a sort of policies taken already "we're going to use Miljöbyggnad, or we're going to use LEED" (B; Yeah). And you just have to deal with it in a way.

follow-up: what do you think is their motivation for choosing one of these? The brand, the certification itself, or the sustainability for the building?

B: I think you have to separate a difference between the clients and a difference between the main organization, like PEAB, they have one goal, but the project manager he has a completely different goal and they don't always match. I think for the company as a whole, they have it [certification] to show that they are working with environmental and boosting the company name, but for the one building they don't see that part. (A interrupts)

A: and they all have an economic response also at the level where you actually have to build it (new buildings??)

O: I believe PEAB has a requirement to use bream although it is also then up to project managers so we've done a feasibility study recently with looking at these three schemes for a project manager who didn't think that bream was necessarily, automatically the best choice. But the other thing is it depends a lot on the client level in the organization and the sector and what the motivation is. The client and the organization but also the sector will determine what the main motivation is for certification and what they'll choose.

A: he was also talking a bit about a recent project we had.

O: At PEAB, as far as I understand it, there is an organization company policy to use BREEAM, but it is still up to the project managers. So we have done a recent pre-assessment for new builds here in Gothenburg, which was precisely looking at these three schemes for a project manager who wanted to know actually which one would be most appropriate.

L: I have something to add – the question before you had was what big challenges- and at least my experiences are somewhat different because I used to live and work in Iceland but there we used the bream international schemes. I would say the biggest challenges was getting the design teams to work with new and international standards – not only standards – but to get them to work differently from what they were used to – that was really difficult. But I mean, here there is a Swedish bream scheme, so it is a bit different.

B response: But it's the same in Sweden. (A: it is, yeah). They are not used to structural environmental work. They are used to somebody saying, this is what you have to do and then they say yes. Then they do whatever they want to.

A: they want to be told what to do. Also, if you use Miljöbyggnad for existing buildings, now we are talking just about commercial buildings, isn't it? If you are not very experienced and

you have the responsibility for using the scheme in an org you might not think about that you have to go through all the building and have to access to areas so you have to disturb your customers, using areas. That could be something you don't really think about that you have to prepare your clients that someone is going to visit your building and you have to (B: yeah)…I think even more for flats when you visit somebody's homes…but we're not talking about that, but…

ME: I noticed that with BREEAM they have a client-training manual, so there's this idea that BREEAM has rightfully seen that there is a level of understanding and knowledge of your building before you kind of embark on this certification process. Is this something that is familiar or have used?

A: I don't really understand. Is it for…

B: But it's just for BREEAM In-Use and it is only for if the consultant doesn't take the part that the – the client has a choice to do it himself or let it to a consultant. If the clients do it themselves, then they have to go to client education.

O: We have plans for new construction Lithuania and Latvia – same company, sister companies, the one in Latvia is getting us to help with LEED for existing buildings and the one in Lithuania is doing BREEAM In-Use themselves having done that training and all the checklist. But I think it ties in to something which probably is one of the biggest challenges is with assessments is getting the right evidence and that is a lot down to the understanding of the other people involved in the process as to what is required. If they understand what they need to do from the start of the project, and you can repeat it to them throughout the process, in the end you are far more likely to get the evidence you need. A lot of the frustration that comes with projects is because clients or contractors didn't understand at the start what they were going to have to do.

B: and unfortunately a big problem is that as we, as assessors or APs, we don't have the understanding, so when they ask us we can't say we want this, we just refer to the manual and leave it to people who know even less than us. And that's a big problem in the business that consultants have too low competence in the areas and don't want to take responsibility to say do like that. (DON'T UNDERSTAND)

A: WE JUST ADDED K.M. (-25:15). So we are five here. He just passed the BREEAM IN-Use.

O: That issue, Bunmi, is something that we have tried to address with LEED because we work in so many different countries with a lot of contractors and design teams who are completely new to that and we try to spoon-feed them as much as possible and have all sorts of documents clarifying the advice and going through and reviewing it a lot during the process and meeting them to make sure they fully understand everything they have to do, as it becomes almost impossible if you don't.

A: Another problem also can be that some methods are uneven in qualifications to get the grades. Like if you work with Miljöbyggnad for existing buildings, some grades are very easy to get top notch to get a good grade and some indicators are very hard to get. But that's built within the system. I want to mention it because it is a reality. It could be very, very hard to get gold for radon, but very, very easy if you measure this NO2. For example.

ME: clarification – if a client says we want gold Miljöbyggnad –

A: these are very hard to get and you have to start explaining why can't get gold. For example in an existing building, if it's an old building, like built before 1975, there's always some asbestos somewhere in a fire protection or somewhere. You almost always get just bronze and if you have a newer building, you might have some other material – I mean its very rare to get gold. Silver, bronze, silver, bronze. And the client does not know that. It depends on the client's experience I suppose.

O: you can't write off credits with Miljöbyggnad.

(Response) A: no exactly you can't do that. That's a big difference between Miljöbyggnad and the others.

(27:33) K: I think when one makes the point – when it comes to LEED and BREEAM, when we started for example in the LEED projects in Poland, we didn't have one channel of communication, We sort of scattered the information among the different contractors and now we have what we call the LEED coordinator, I don't know if you talked about that, one person that sort of tries anyway to be the one channel of communication with the contractor side. I think it's the same when you do an assessment or certification on an existing building that you need one person at the client, you know, who you communicate with, because otherwise it's very hard for the client as well, to understand what you're doing.

O: and it is to a certain extent it is for the evidence as well. There's hands are caught and you don't really have the authority to demand things off anyone else. (K: exactly.) If you have one person on their side who's responsible, they have far more power to actually accumulate evidence on their side and have the responsibility to give it to us.

K: Process becomes much more easier. I think it's the same when it comes to existing buildings, you must have one dedicated person, or person that really is interested in what we're doing. You do need a lot of info during the process – and you call him or you call her – no, that doesn't work.

A: Also if you have an engaged partner at the client side. For example, when we have been working with Miljöbyggnad for existing buildings, if they have a resource there (a person?) meant to care about these issues in the organization, they can provide evidence for Miljöbyggnad – they're16 indicators – maybe they can do 10 of them or something. They can take all in the statistics and data regarding any consumption and stuff and we can do all the things they can't because they might have another qualification level or background, so that's a trend we see. People do not work themselves, so then they ask us for some indicators. For example, moisture safety, acoustics, hazardous substances - That is a service we are selling now. We do some indicators and the clients do other indicators. Because then they save money and also its much more easy for them to have a high impact in their organization. There's two advantage for that – it becomes cheaper for them and the process is more smooth and like we said they have more power to just fix things – to know where to get data and how they…

K: we don't have any power over the contractors really. (A: but this is not contract, This is existing –) (K: yeah, but anyway you need one person. You are the one that is going to provide us - we give you the questions, you provide us with the information we need for certification. Maybe, maybe its even more important when it comes to existing buildings.

A: So, then they know like "oh two years ago we did radon measurements in all our buildings in west Skåne, and they know that. We don't know that.

2. When performing an assessment, what factors about the building are most important to identify first?
   (i.e. are there any "go/no-go" requirements that you know to search for first that have repeatedly shown difficulty in achieving certification in Sweden?)

   (they looked at the next question to answer this one! The two were answered together)

3. Out of the following criteria categories: energy, water, waste, pollution, land use and ecology, health and well-being, transport, materials, and management, is there a particular area in which old buildings in Sweden frequently have trouble performing well?

B: well, the daylight factor that lies under health and well-being is a problem in existing buildings and in new buildings. (A: for Miljöbyggnad) yeah, Especially in Miljöbyggnad, I think it is the same in bream at least. I don't know about the LEED way to conduct measurements.

(Response in background) K: Energy is the important in LEED maybe…

O: I think there are various things in new and existing buildings that you cant change (B: YEAH) and it is, well to some extent, it is easiest to deal with them first, the sort of definite yes, no things which you can identify as yes we'll definitely get all the transportation ones or we cant and then you can prioritize what else you need to go for like – daylight….

B: Solvärmelast. A: Solvärmelast

A: you can't change the size of the rooms because they are already built. We have also seen clients like that study you have seen last November – they wanted us to look at one building at Chalmers and they had an internal courtyard and the rooms at the top didn't get a lot of Solvärmelast problems because of that – lots of window areas- compared to rest of the size of the room. When we started to address that feature, they didn't really want to put up any daylight shading or…well they could change it, but they didn't really want to.

O: I think with LEED or BREEAM the most important thing to look at first is the energy because it is about a third of the points in the scheme and it's the big uncertainty.

> Response K: that's maybe the easiest thing to get information from probably, because normally…
> response A: that's true, isn't it. In Sweden, you normally have good Statistics…well the landlord will know how much energy is used..
>
> Response B: But, not always in existing buildings measuring Fastighetsel…A: no that's true. Some you measure them all together. Divided… K: normally, you do.

B: it could be a tricky question and also if you get klassad in Miljöbyggnad on energy you're

screwed. And I don't know in BREEAM in –use they have points below a baseline or something.

K: I would say that normally, anyway, if compared to LEED, normal Swedish buildings often get quiet high scores on energy. Surprisingly high scores. Surprisingly (laughing) (stirring sounds).

O: not if compared to an American building. I think its very unlikely K (yeah, exactly) that you wouldn't meet the energy prerequisites in LEED. K: (no, no, wouldn't think so)

A: We also have the moisture question in Miljöbyggnad for existing buildings. We have done a lot of assessments with that now and sometimes we do find a moisture problem or mold problem, and depending if that is going to affect, a room which you are more permanently, or if it is a problem the basement and no one goes there, it wont affect anyone's health but you have to describe that correctly and we have to handle it. And we also see that sometimes we make the assessment in the building –a building visit- and then we make some kind of report statement and then they come back and fix the problem and then they can do the classification. Of course, we cant say that its safe if there is a moisture problem- we have to write Klassad and then they have to do it so it will take time to reach them. ALSO radon can be really bad to fix afterwards. It's complicated. If you have high radon values, its not very easy, it can take several years and you have to make several attempts. It's not easy to treat actually. You cant guarantee the first solution will work, you have to try and try and try.

B: Is there any hazardous materials questions in bream in-use and in LEED?
O: Don't think so…it's far more focused on environmentally friendly materials, which is a very different sort of criteria – (A: ah so nothing like PCBs or asbestos?) (All, no, no) K: no, they don't have the same standards) yes, its procurement policies but for correctional materials but again its environmental premise – so recycled content (A: So it's more into management than how you manage the building, isn't it. It's what's inside the building than what have you used) K: I don't think they focus at all about material use, much more with management.

ME: I had the opportunity for this project to interview some LEED assessors or Aps in the U.S. who were part of the USGBC and helped develop the EBOM and it was quite interesting to hear form them – this is probably quite obvious to you guys – but in the U.S., under LEED it's impossible to get the energy criteria. It's a major barrier to the certification and so for existing buildings the market is actually, there's huge potential but that is a huge barrier and I found that quite interesting to say that in Sweden, I don't think that's the same at all…

A: But in Sweden, you don't have the same criteria for existing buildings.

Me: right – this is looking at LEED for EBOM – they are not able to meet those criteria. They are not able to meet the prerequisites and so the consultants start with the energy assessment so that they can target, see immediately whether or not they can finish the certification. It is very common that they end right there. The potential for LEED for existing buildings in Sweden is much higher than in the U.S. where it was developed.

B: In Miljöbyggnad, we have a problem with the energy in existing buildings because you are allowed to use energy declaration and the energy declaration is crap! So…

A: 90% of them are just not very good. We have had problems with they have been so badly done that they have had the wrong areas and we have used those areas and so you know… (discussing the wrong inputs)

O: Can you do them without visiting the building? (B: Yeah) Can you produce an energy performance certificate, without even visiting the building?

Illegible voices

B: nowadays it is a requirement to visit the building.

K: no, it's always been a requirement you have to go around.

A: you have to go out, but sometimes people go out and around very fast.

K: some big housing companies had a contract and a consultant said they should sit with desktop versions and that leaked to authorities and they was quite clear that it is not accepted – that you have to be onsite. If you look at the prices people will pay to do them. They will have no chance that they will have time to go out and do it. But if you look at them, most of them are crap as you said. Really desktop crap.

B: and that results in, for many existing buildings, you can have an energy performance of about 80 kwh/m2 a year in a house from about 1900 and then you get a very good rating but you know that the house isn't that good but you have an energy declaration saying that's a good building. And that's a trustworthy issue for Miljöbyggnad, I think.

Swedish speaking…

(41:54) A: the thought with Miljöbyggnad is using documents you already have to a large amount as possible and that is a very good thought – a standard for doing things, they want you to use it – but they didn't think about how bad those energy declarations can be.

L: but new energy declarations are they just as bad as the old ones?

A: some are yes – because people do it for such a low sum.

K: we took the decision not to do any here in Gothenburg.

A: we don't do it at all.

K: they are quite useless.

Me-review-daylight factor, Solvärmelast, radon, moisture control –

A: moisture control is also very vague – the treatment, the control. I suppose they will look into that to define what you should do.

Me: follow-up question: Do you find the requirements in Miljöbyggnad can be quite subjective?

O: if you go for silver it is quite subjective, but if you go for gold the requirements can be quite different with the kinds of measurements.

A: But like the moisture are quite vague at all rates- bronze, silver, and gold. And when you read what you are meant to do to assess on the site visit and it's still quite vague. There's a risk that it all becomes like the energy declaration. If we think maybe you have to spend a lot of time out there with a moisture gadget in some way, maybe someone walks around and does no measure at all – that's no standard for that, and maybe someone can do it much cheaper than we. Its also hard when you have a building in use – you don't want to take holes and destroy the building and stuff and then you miss the moisture problems…so that's.

Me: is there anything for LEED and bream that…

A: there's one more thing if we are talking about commercial buildings and Miljöbyggnad, it's actually the acoustics question. Two very different ways of doing it – a person who actually works as an acoustic professional and then it becomes much more expensive to do it. And some of the standards are a bit vague…or you can take any person with relatively good knowledge of buildings and do some listening tests (laughter) and that's very fast to do and not very – the acoustics, they just sort of smile when you talk about that. Do you hear a traffic noise? Oh yes I do. Is it a lot or is it less? K: how is your hearing? Really bad? Ok. (laughs)…it's a bit like that. So if you want to have an acoustics in there then you get a totally different product.

Me: I noticed they use a survey for the acoustics –

A: that's the listening test.

Highly subjective.

…

K: especially commercial buildings – you need to check the acoustics.

Me: is there anything comparable with acoustics in LEED or BREEAM to Miljöbyggnad?

(B searches)

4. What are the low-hanging fruits in renovation when considering upgrades in order to achieve a potentially higher level of certification?

O: awning

K: venetian blinds

A: solar shading. That can be quite expensive, but it could help a lot.

K: solar shading. Thermal comfort.

A: the moisture control can be a low-hanging fruit but the spectrum is wide.

Waste management? Deciding a specific area for waste management?

K: low-hanging fruits are cheap and most of the improvements are costly. Solar shading is really actually a good low-hanging fruit.

A: it's much more easy if you have a building that is going to renovate anyway, and then it's easy to add some low-hanging fruits.

K: if you are going to make changes just to get points, it's often too expensive in that way.

A: I don't think people use it in that way.

K: I don't think it should be used that way.

A: Perhaps people are going through their property portfolio and they are taking 5 houses one year and 20 houses next year and they just see the differences – this one has bronze, this is silver…Maybe they start considerations of some buildings and start renovations on others. You get a good picture of a property portfolio – it's a nice way of using the assessments, if you want to learn more about the buildings.

K: If it's good if you just look at the certifications if you want to refurbish a building – you do it for other purposes than getting more points, you want to have new customers, A: you want to lower energy consumptions, you want to change the roof anyway…I think you always do that in combination with an ongoing project or planned project.

O: to some extent, there must be a difference with Miljöbyggnad and the other two, there you cant really have prescriptive low-hanging fruit, Miljöbyggnad, because often you'll find the one there's one credit which offs you getting gold. Example: in one project a building had pressure treated wood – clients were never going to change that – therefore it will not get you gold.

…

A: they clump all the hazardous substances, so if you fix one, you won't see the difference. It's not good for the motivation for peopled to do anything about it.

K: I would say that nobody would do anything if it costs more than the normal way of doing things.

Me: Back to Bunmi – did you find what you were looking for?

B: Yes, it was the acoustic I think and the question in the BREEAM In-Use is just if it has been considered. The answers are "yes, no, don't know"….(laughter).

K: but don't you have to provide any evidence for that?

B: yes, I am looking for that – it's a bit harder than I said, the question is "have internal acoustic conditions been monitored or reviewed to optimize acoustic comfort? No, Don't know, Yes" and if you answer yes, you probably have to send a report or something.

A: then it's a bit like Miljöbyggnad.

L: But what happens if you say, "don't know"?

B: Then you get zero points.

Me: I noticed there's quite a difference between the three…Curious about your thoughts on why such differences in operations and maintenance focus.

A: I think it's because Miljöbyggnad is developed by engineers not by property owners…

B: No, there was an active decision when this was [Swedish word] who developed the program, there was a big decision if we should assess the buildings or assess the buildings with the building tenants and the decisions was that it's the building so anything that can affect of the building, we shouldn't look at how the people use the building, its only the building as a system.

A: So they left out management…

K: Management of systems as well?

B: so that's why there is no waste chapter and so on

B: and there were builders and consultants and the government and people from the branch

A were there many property owners then?

B: there were I was representing a property owner at the time. I think Vasakronen was there. There were other property owners as well.

ME: so are there advantages with the style of Miljöbyggnad? Just informing the property owner how well the building performs, rather than how to take care of building over time…

A: but you shouldn't forget that some property owners really don't know that you should take care of asbestos (for example) so the need for that is good, but they should do the other thing (management) as well.

K: But miljobyggnad doesn't take into consideration operations and maintenance for example…

A: no and that's bad…but some property owners don't even know that they have asbestos in the basement. So the system does fulfill a task, but if you had done more, it would be better.

O: and that's something that won't be addressed in the other case, you could get a very good BREEAM or LEED certification,…

A: And still have asbestos in the basement.
A: which is a major hazardous substance risk for the inhabitants.

L: just wanted to add that I think that bunmi just said about Miljöbyggnad– that they want to keep the system simple and cheap and all of the requirements fulfilled. Otherwise it would be just like bream and LEED…and there would be other things.

A: So I you use BREEAM In-Use you could have a moisture problem, high radon gas content, and lots of asbestos as well. Is that so? (All: yes, yeah) And that's really no good

either, so its like you say, all o f the different systems have different strengths and weaknesses and I think that's our task when we meet our clients – if you pay for this you get that, and you pay for that then you get that and you have to know what that is.

L: and if you make the systems very inclusive and complicated then far less buildings would get assessed and that would be far…

A: worse.

…Eco-effect example

O: That's a general challenge of certifications is getting a general balance the breadth of what's covered, the evidence you need to provide, and the flexibility of the system. So on one end you have Miljöbyggnad, pretty limited in most categories –indoor environmental quality - but you have to do everything then you look at BREEAM and LEED and you have far more coverage, but more flexibility with what you can do…then you look at Orbis which can do two or three times more than BREEAM or LEED but it has to be very flexible.

K: It's easy to see the different countries when it comes to LEED you can check different certification items. In Sweden we get high points in energy, in the U.S. they get low points in energy, they focus on other things.

O: that's one of the reasons that makes LEED so attractive in Europe. (K: exactly) (All agree)

K: [In Sweden) You don't have to make an extra effort, if you use a normal technical system, you end up in gold at least.

A: you focus on low-energy anyway, so it makes it attractive

K: I think that our projects in Poland should really get a platinum level in energy. All: well compared to America…

B: I think Miljöbyggnad is a fairly new system compared to LEED and BREEAM. So a new version 3.0 is coming out…but now is actually the time with so much data to review and to make corrections…It has been a big testing period until now. I think there are a lot of problems with Miljöbyggnad but with a new building there are problems like a new building that has never been tested before, so give it two years and miljobyggnad will be a more easy system to work with.

K: Should it be easy to build a system for a building

A: No, but not to have the incoherent questions, you have so different scaling when you compare the indicators some are so easy to get, some are so complicated to get, some are so vague to describe, that, that's the problem now.

Hour 1 Over – REFRESHMENTS and BREAK TIME (12 mins)

Transition (40 mins): Conceptualizing a tool

Hello again. We will transition now into discussing the potential for a screening tool. I'd like to present the concept of a feasibility study. SHOW DIAGRAM. Here we are familiar with the step in a certification process that is the assessment study, which allows for a feasibility study to be written. What I would like to do is focus on the step before the assessment and feasibility study:

Next, I'd like to present a current design of the tool that I am working on based on my observations and begin a discussion on it's use and core functions and then discuss any improvements that can be made.

Go to Flip Chart – drawing/design. Explain.

1. Now that you have seen my idea of a tool, based on our earlier discussion on the experience of doing an assessment and feasibility study, what improvements could be made to this tool, used in the pre-assessment step?

2. What could this tool be used to achieve? (the ultimate use, functions, outcomes, what could it be good for?)
   -Key parameters for Swedish-context buildings to achieve certification
   -Stakeholder tool for understanding expectations? i.e. communication
   -An automated tool for data analysis and rating scores?
   -Identification of gaps between schemes or between transferability to other certifications using the data provided by the property owner?
   -Benchmarking?
   -Prioritization of renovations, upgrades, credits achieved?
   -Client Preference
   -Distances to target performance (distances from current state to future state)
   -Design in the form of a checklist or a questionnaire?
   -Scheme ratings background?

First discuss the different categories and if they would be useful in the first meeting:

Questions to client: motivations, values

"What have they done before? Any existing investigations or classifications?"

Preliminary meeting

"What is the value of the certification"?

"What did you want to do with the assessment?"…Based on that we made a plan.

"I think the first box is very important, extremely important, most important"

"I think it's a good idea to NOT have the questions about what they have done in the first step. Mainly strategic questions first, because the people we are going to talk to is possible not the people knowing what they have done...like if they have done a PCB inventory or something. So leave that questions for later.."

"Use the words strategic questions…then you set the standard in that first box"

"The problem in Sweden, when you talk about certification questions, the first question is how much does it cost? And that's always the first question."

The third box:

"The choice of method"

"Economic issues, marketing issues, and environmental value and then you compare those three"

1:29:20

"To a certain extent, the first box is separate, that's what you always have to do at the start and then as the result of that you might establish that in fact, the client wants just a quick and easy assessment instead of a full feasibility study with all of the all of the possible points, in which case you do this rapid check and can make a recommendation. That recommendation might be ok we just want to do Miljöbyggnad, but we'll do a full feasibility study on that now. Whereas you might find that in fact, the client wants something more like…a full assessment of all the possible points all of them summarized in a few pages, or they want that full assessment and then they want recommendations on how you implement what you need to do to change all of their technical descriptions and specifications in order to get there. So its different levels of feasibility study, but it all comes from what the client wants.

"The first box is maybe the most important one. Like what standards do we have on a corporate level and what sustainability goals do we have in our company and from that maybe you…you can scrutinize really what the client says today - you might come up with the idea that maybe we shouldn't work with this that at all! Because you don't have any idea what you want – there's a lack of context – no, no I don't think your corporation is ready for this yet. Get some corporate ideas before you start with your buildings." (This comes out right at the start)

"I would make the second box optional because not all clients are looking for the cheapest system or highest grade, perhaps they want to use the system for a specific purpose and if that comes up in the first box from those questions then you shouldn't compare all systems but choose the one that suits the best."

"Shouldn't you be able to say which system suits the client at the end of the first box?"

-Maybe, "it depends what the client wants"

"Some clients want to buy a choice between three systems rather than just a pre-assessment as well"

Comparing systems –

From the first box – you branch out – either you do:

1. The rapid assessment
2. A far more detailed assessment [of all three]
3. Or an assessment of just one
4. No certification

"No certification is also a good idea because as a consultant say certify even if it's a bad idea because…we want the job…so I think it's a really important question, vital, that we must say sometime don't do it…"

"If you want to go for a certification it says something about how you think about your buildings, doesn't it. Just to get to the point of gold or silver, tells something about your long-term commitments to it, to me"

"Not to say no, but to find a better plan"

"They're not ready in the organization and you can see that it will probably cost them a lot and you can already see that they will be unsatisfied and if you had waited one year, then maybe you would be satisfied instead…You know it will end up in chaos."

"WHY do you want to do this?"

"What is the aim for you on a long-term basis"

"I think we should be a bit more tough and really focus on why you are doing this, what is the value of this, how will you continue with this in the future"

"If you start up with the wrong understanding, you will end up in chaos…" "That's why we have so much chaos…"

"Find the right path"

"For some customers, they shouldn't do it…but perhaps you should have another solution for him"

Rapid checklist:

Based on a discussion from the client

"Pin point the building really early"

"The geometry of the building is very important – they layout of the room, the window placement…

"Second box geometry of building, location, and also the age of building because that will affect both energy consumption and hazardous materials…"

"Yeah, and the forming of the geometry is based on building year also"

"These parameters are highly dependent on the system – like location doesn't change anything or very little in Miljöbyggnad…"

"Oh but in LEED and BREEAM it's quite important"

"I think what we sometimes forget when someone does not want to go for Miljöbyggnad just go for BREEAM or LEED, what we could add, for example, is then you should actually know about the asbestos content…that if you choose this system, we should add some more

health questions. Because Miljöbyggnad is really affected by the laws. You're not allowed to have asbestos here. You could add a question about indoor quality, which we don't do now."

"But in bream in use you have questions about hazardous inventory"

Condition survey – durability

"Recommendations, again, only based on what you learn from the client…the last box is not a big issue"

Depending on client and context, the screening tool can be used in a number of ways before the assessment study is decided to be done.

"We did a lot of this…but it required a 4 hour workshop"

This is not a first meeting.

It could be a second meeting.

It could be a first address.

"What's the value for this"

"Most clients are not very familiar in the systems…the client would not know what it would mean if you go through this list…perhaps somewhere in the system, you have some sort of introduction or presentation material that shows the system or systems to present them in an easy way"

"I think we are quite bad at doing this preliminary work because as a consultancy you want to have projects anyway, but these are questions about credibility as well. If you, for example, you do a LEED and it might be 500,000 Swedish crowns and when you have done the certification and the customer says I don't see the point of this, then we have failed. These preliminary checklists, rapid checklists really to get the client to understand what we are doing, because if you just show them the questions…they don't understand anything…these first two [boxes] we have to work much more with them today."

"I think you have to do some really bad certifications before you do the good ones" (you have to fail a bit and then you know what to do better" it's learning time.

These two boxes are really the most important work we do, because if you have done those two well, the certifications are quite easy. If you haven't done them, then it's really crap"

1:57: --(ME: verifying the tool) Simplistic enough before you go into the detail of the assessment

> -Dependent on the context, the knowledge base, the client's motivations –what do they want
>
> -Rapid checklist

"And we should at least do box number one even if the client knows or thinks they know exactly what they want."

"This is actually the good use for use, because as consultants, you are so eager to please…if we could go one step back further more often, we would learn so much more about smoother project. So it's a very good tool for us to think a bit more before we start."

"What you often find out in the third box – we should never have started this journey"

"The companies phone us very late – with new buildings especially"

"If you look at LEED, it says leadership, doesn't it? You have to lead your customer in a good way that the customer doesn't have to do all of the work but they always have to be involved in the right way"

WRAP-UP (10 mins)

Thank you all for your participation today. I truly appreciate it. I'd like to remind you all again that the outcomes of this focus group will be included in my study and for those who wish to remain anonymous, please let me know. I am happy to share my results in the future, upon the conclusion of my project.

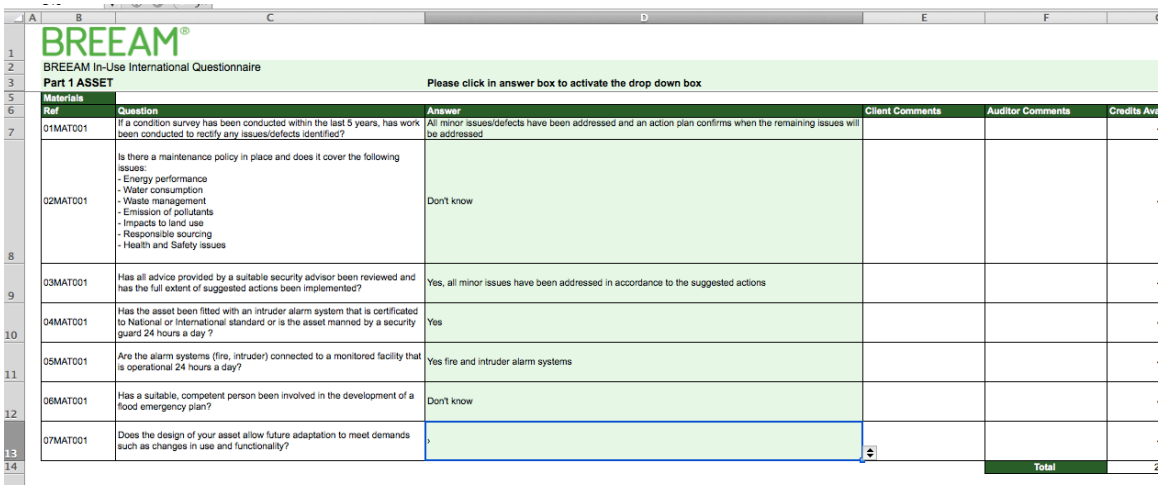
Again thank you for your time and have a nice day.

Appendix V. Photo from Focus Group

Revisions to the design of the screening tool based on the focus group.

Appendix VI. Worksheet Templates created for WSP Group: LEED EBOM, BREEAM In-Use, and Miljöbyggnad for Existing Buildings

	Credit		Summary of requirements	Questions/Comments	Actions	Total Points
2	SS	Sustainable Sites				
3	SSc1	LEED Certified Design and Construction	Choose 1 of 6 options: Show that the building has previously been certified under any of the LEED certifications - i.e. New Construction and Major Renovations; Schools; Retail: New Construction and Major Renovations; Healthcare: New Construction and Major Renovations; Core & Shell Development (AND at least 75% of floor area has also been certified under LEED for Commercial Interiors); or any version of LEED for Existing Buildings with ongoing performance tracking during the entire recertification period (initial certification until the recertification application).	1. Has the building been previously certified under LEED? 2. If so, which version? This is connected to PII5. Most certified buildings under one of the other systems for new constructions rarely continue to a post or recertification under LEED O+M.		
4	SSc2	Building Exterior and Hardscape Management Plan	Develop an environmentally sensitive, low-impact building exterior and hardscape plan that preserves ecological integrity. The plan must include best management practices in regards to: reducing harmful chemical use, energy waste, water waste, air pollution, solid waste and/or chemical runoff compared with standard practices. The plan must address all of the following operational elements that occur on the building and grounds: Maintenance equipment. Snow and iceremoval. Cleaning of building exterior. Paints and sealants used on building exterior. Cleaning of sidewalks, pavement and other hardscape.	1. How are painting and sealing activities managed for the building's exterior and hardscape? Are there opportunities for using less environmentally harmful products? 2. How is snow and ice removal handled on drives and walkways? Is there an opportunity to implement an "anti-icing" program? 3. How are building exterior and hardscape cleaning handled? What opportunities exist for reducing the environmental impacts associated with current practices? 4. What maintenance equipment is currently used onsite? How and when is maintenance equipment purchased? Are there opportunities for procuring low-impact equipment? Do opportunities exist for substituting manual practices for power equipment, or electric for gas-powered equipment? 5. Do your existing vendors offer environmentally friendly services? If vendors do not have eco-friendly offerings, are they willing to learn and adopt new practices? 6. Does your building have a staff person directly responsible for exterior and hardscape management? If not, it is important to have at least one point person to develop and implement the Building Exterior and Hardscape Management Plan. Once a point person has been identified, it is important to get that person involved from the start of the project to ensure that all the environmental best-management practices are thoroughly developed, included in any related vendor contracts, and implemented on an ongoing basis throughout the project site and associated grounds.		
	SSc3	Integrated Pest Management, Erosion Control and Landscape Management	Have an environmentally sensitive management plan in place for the site's natural components. The plan must employ best management practices that significantly reduce harmful chemical use, energy waste, water waste, air pollution, solid waste and/or chemical runoff (e.g., gasoline, oil, antifreeze, salts) compared with standard practices. The plan must address all of the following operational elements: Outdoor integrated pest management (IPM), defined as managing outdoor pests (plants, fungi, insects, and/or animals) in a way that protects human health and the surrounding environment and that improves economic returns through the most effective, least-risk option. IPM calls for the use of least toxic chemical	1. Is integrated pest management currently used at the project building and site? 2. What erosion and sedimentation issues occur, or could occur, on the project site, and how should these issues be managed? Remember, the potential for erosion and sedimentation exists on all properties. 3. How is landscape debris and waste handled? Are there opportunities for landfill diversion through practices such as composting the debris on site, using it for onsite mulching needs or bringing it to a municipal composting facility? 4. How are plantings maintained? Are there opportunities to introduce more native and adapted plantings in order to reduce fertilizer and pesticide use? 5. Which fertilizers are used on the site, and how are they applied?		

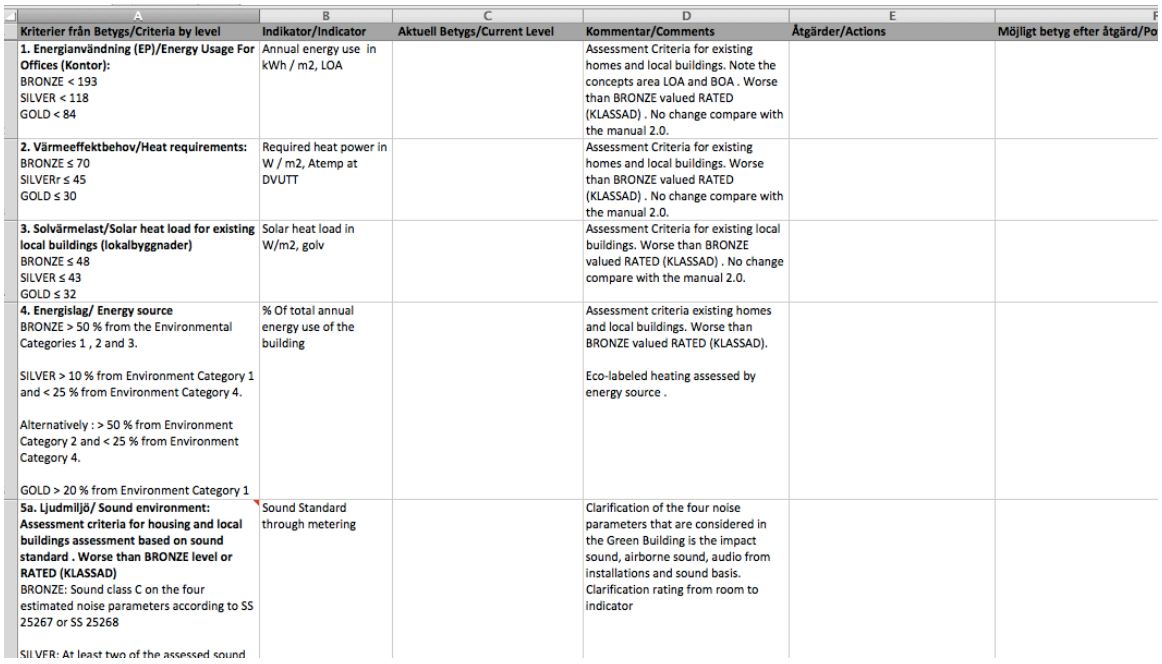


BREEAM®

BREEAM In-Use International Questionnaire

Part 1 ASSET — **Please click in answer box to activate the drop down box**

Materials Ref	Question	Answer	Client Comments	Auditor Comments	Credits Ava
01MAT001	If a condition survey has been conducted within the last 5 years, has work been conducted to rectify any issues/defects identified?	All minor issues/defects have been addressed and an action plan confirms when the remaining issues will be addressed			
02MAT001	Is there a maintenance policy in place and does it cover the following issues: - Energy performance - Water consumption - Waste management - Emission of pollutants - Impacts to land use - Responsible sourcing - Health and Safety issues	Don't know			
03MAT001	Has all advice provided by a suitable security advisor been reviewed and has the full extent of suggested actions been implemented?	Yes, all minor issues have been addressed in accordance to the suggested actions			
04MAT001	Has the asset been fitted with an intruder alarm system that is certificated to National or International standard or is the asset manned by a security guard 24 hours a day ?	Yes			
05MAT001	Are the alarm systems (fire, intruder) connected to a monitored facility that is operational 24 hours a day?	Yes fire and intruder alarm systems			
06MAT001	Has a suitable, competent person been involved in the development of a flood emergency plan?	Don't know			
07MAT001	Does the design of your asset allow future adaptation to meet demands such as changes in use and functionality?				
				Total	



Kriterier från Betygs/Criteria by level	Indikator/Indicator	Aktuell Betygs/Current Level	Kommentar/Comments	Åtgärder/Actions	Möjligt betyg efter åtgärd/Po
1. Energianvändning (EP)/Energy Usage For Offices (Kontor): BRONZE < 193 SILVER < 118 GOLD < 84	Annual energy use in kWh / m2, LOA		Assessment Criteria for existing homes and local buildings. Note the concepts area LOA and BOA . Worse than BRONZE valued RATED (KLASSAD) . No change compare with the manual 2.0.		
2. Värmeeffektbehov/Heat requirements: BRONZE ≤ 70 SILVERr ≤ 45 GOLD ≤ 30	Required heat power in W / m2, Atemp at DVUTT		Assessment Criteria for existing homes and local buildings. Worse than BRONZE valued RATED (KLASSAD) . No change compare with the manual 2.0.		
3. Solvärmelast/Solar heat load for existing local buildings (lokalbyggnader) BRONZE ≤ 48 SILVER ≤ 43 GOLD ≤ 32	Solar heat load in W/m2, golv		Assessment Criteria for existing local buildings. Worse than BRONZE valued RATED (KLASSAD) . No change compare with the manual 2.0.		
4. Energislag/ Energy source BRONZE > 50 % from the Environmental Categories 1 , 2 and 3. SILVER > 10 % from Environment Category 1 and < 25 % from Environment Category 4. Alternatively : > 50 % from Environment Category 2 and < 25 % from Environment Category 4. GOLD > 20 % from Environment Category 1	% Of total annual energy use of the building		Assessment criteria existing homes and local buildings. Worse than BRONZE valued RATED (KLASSAD). Eco-labeled heating assessed by energy source .		
5a. Ljudmiljö/ Sound environment: Assessment criteria for housing and local buildings assessment based on sound standard . Worse than BRONZE level or RATED (KLASSAD) BRONZE: Sound class C on the four estimated noise parameters according to SS 25267 or SS 25268 SILVER: At least two of the assessed sound	Sound Standard through metering		Clarification of the four noise parameters that are considered in the Green Building is the impact sound, airborne sound, audio from installations and sound basis. Clarification rating from room to indicator		