Adding Value to the Social Dimension of
Sustainable Building

Morten Bandholm Vinde Jensen & Maria Troelsen, 2017.

AALBORG UNIVERSITY
STUDENT REPORT

AALBORG UNIVERSITY
STUDENT REPORT

Department of Development and Planning
Environmental Management and
Sustainability Science
http://www.environmentalmanagement.aau.dk/

Title:
Adding Value to the Social Dimension of Sustainable Building

Theme:
Master's Thesis

Project Period:
Spring Semester 2017

Authors:
Maria Troelsen
Morten Bandholm Vinde Jensen

Supervisor:
Arne Remmen

Page Numbers: 69

Date of Completion:
June 2nd, 2017

Abstract:

The building industry has recently changed its focus from energy efficient buildings to sustainable buildings. The Danish DGNB certification scheme is the leading standard within sustainable building in Denmark and approaches sustainability based on the three dimensions social, economic, and environmental sustainability. The social dimension of sustainable building is the main focus in this project and it is investigated how sustainable building can add value to the users by contributing to their well-being.

Different perspectives on the concept of value is addressed in the theoretical framework in order to discover what value is. Furthermore, the theoretical framework explores how value can be added through the theory of co-creation. Interviews have been conducted with building professionals and users with the purpose of generating knowledge of their understandings of the social dimension in sustainable building. A workshop and a field trip with actors from the building industry have together with literature studies contributed with knowledge concerning the problem field.

Based on the theoretical framework it is analyzed how building professionals and users understand the the social dimension of sustainable building. These understandings are compared to social criteria in the DGNB certification in order to discover how the understanding be utilized in the DGNB certification in order to add value to the users.

It is concluded that the understandings can be utilized through inclusion of co-creation in the process criteria, and through a Post Occupancy Evaluation of social criteria. Implementation of these initiatives will improve the social dimension of the DGNB certification scheme as value will be added to the users.

Preface

Aalborg University, June 2, 2017

This Master's Thesis is written by two students from the master programme *Environmental Management and Sustainability Science* in the period 1st of February to 2nd of June 2017. The thesis concerns sustainable building with special attention to the social dimension of the concept. This is investigated in relation to the danish DGNB certification scheme, which is the leading certification within sustainable building in Denmark.

We take this opportunity to thank the interviewed respondents and workshop participants, who all have contributed with valuable knowledge to the research. Finally a special thank goes to our supervisor Arne Remmen, Professor Aalborg University Department for Development and Planning, for great and inspirational supervision throughout the project period.

Maria Troelsen
mtroel12@student.aau.dk

Morten Bandholm Vinde Jensen
mbvj12@student.aau.dk

Table of Contents

Chapter | 1 Introduction

People in the western world spend 90 % of their time inside buildings (Birgisdottir et al., 2013), so it makes sense, when the Danish Building Developer Association and other actors in the building industry, emphasize the following quote in a publication concerning sustainable building:

> "*Buildings are not constructed to be sustainable or with the purpose of reducing energy consumption. Buildings are constructed in order to add value to what people do, wish, and need to do.*" (Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013: s. 3)

People play an essential role in the built environment as well as people do in the concept of sustainability, which is defined in 1987 in the *Brundtland Report* as meeting the needs of present people without compromising future people's needs. The concept of sustainability was further developed in 1992 in the *Rio-declaration* as a balance between economic, social, and environmental dimensions (Arler, 2015).
This Master's Thesis addresses the social dimension of sustainability within sustainable building in Denmark, meaning the people related to sustainable building. The project is inspired by a previous project made by one of the authors namely "*Users' Experiences with Sustainable Building – A qualitative evaluation* (Troelsen, 2017). The previous project identified issues related to sustainable building, which established a foundation for further investigation on sustainable building. The issues identified were:

- The design of the buildings did not fully harmonize with the use
- A lack in communication concerning the building to the end users
- A lack of function in the technical installations in the buildings

The above mentioned issues caused frustrations among the people using the buildings, why it can be discussed if an imbalance is present in the sustainability of the buildings. Therefore, we are wondering how sustainable building integrates the social dimension of sustainability, when taking into consideration the Building Developers Association's focus on people's needs. Furthermore, it can be questioned how the social dimension of sustainability can be strengthened in the practices of sustainable building. In this project the social dimension refers to the use of a building and the related building process. A thorough investigation on the social dimension of sustainable building in Denmark will be conducted in order to create a framework for analyzing the problems within this field. Throughout the project the issues identified in the previous project by Troelsen (2017) will be an underlying basis for this research, but they will not be addressed directly in the project.
In the following problem analysis different aspects of sustainable building will be covered in order to create an understanding of the scope of this project and form the basis for the problem statement. This is done by investigating and questioning the development of sustainable building in Denmark with special attention to the Danish DGNB certification and to the social dimension of sustainability. Furthermore, a building process will be described in order to identify the actors involved in sustainable building.

Chapter | 2
Problem Analysis

In this chapter aspects presented in the introduction are further investigated. The format of the different sections in the problem analysis is organized in the way of first being descriptive then followed by a discussion, where the presented is questioned.

2.1 The Development of Sustainable Building in Denmark

In Denmark buildings has been debated frequently in relation to different political agendas throughout the past 60 years. Earlier buildings were seen as a welfare project and recently as part of the climate change debate. The building industry has changed its environmental focus from first focusing on improved energy use and insulation, to a focus on substituting dangerous materials by using environmentally friendly materials instead and recently, the focus has changed to concern sustainable building. However, focusing on sustainable building has not become mainstream in the building industry (Holm et al., 2014). At least not yet as the Danish Energy Agency has stated:

> "*Sustainable building is the future.*" (Energistyrelsen, 2015: p. 2)

The built environment is seen as an important area to focus on in the transition towards increasing the use of renewable energy sources in our society and is in correspondence to the previous extensive focus on energy efficiency in the building sector (Holm et al., 2014). Ambitious initiatives focused on the built environment are needed in order to achieve a transition towards a sustainable society, as in a European context the built environment is responsible for approximately 40 % of the energy consumption. Furthermore, the built environment is accountable for 20-35 % of the damages on the environment including resource use, waste generation, water consumption, and greenhouse gas emissions (Birgisdottir et al., 2013).
The term *sustainable construction* was originally suggested as an approach to indicate the responsibility of the building industry in attaining a sustainable industry. The essence of the concept was:

> "*Creating a healthy built environment using resource-efficient, ecologically-based principles*" (Hill and Bowen, 1997: p. 225)

Sustainable constructions has in recent years resulted in a focus on decreasing the energy use in buildings, why different low-energy and zero-energy building concepts have emerged. Alongside these concepts different voluntary sustainability certification schemes have been developed e.g. BREEAM, LEED, and DGNB, which have a broader approach to sustainability than only focusing on energy optimizations. In Denmark the leading sustainability certification scheme within buildings is the DGNB certification scheme (Brunsgaard and Fich, 2016). Overall, there has been an increased interest in certifying buildings within environmental and sustainable standards in the building industry (Bejder et al., 2014). Besides, the certification schemes new buildings ap-

proaches, which have their point of origin in sustainability, have emerged within the Danish building industry.
One of the new approaches is the concept of cradle to cradle, which was introduced to the Danish building industry in 2013 through the publication *CRADLE TO CRADLE® i det byggede miljø* emphasizing the importance of using deconstructable and recyclable resources in buildings (Huulgaard and Mosgaard, 2015). Another approach is Circular Building which originates from circular economy. The concept aims to keep products, components, and materials in circulation at highest possible value and utilization. At the same time circular economy seeks to preserve and enhance natural capital while stabilizing the economy (Ellen MacArthur Foundation, 2015). Different actors in the Danish building industry have worked with circularity in the built environment exemplified by the project *Building a Circular Future*. In the project it is challenged how to use and reuse resources in the building industry by designing for dissasembly (Jensen and Sommer, 2016). Common for these two approaches is an extensive focus on resources rather than a focus on social aspects.

Holm et al. (2014) present a general view on sustainable building that can be seen as focusing on:

- Social diversity
- Efficient utilization of sunlight and heat of the sun
- Fitting in the surrounding nature
- Climate adaptation
- Materials and indoor environment
- Energy-efficient constructions, architecture, design, and operation
- Integration of renewable energy resources

The seven points above illustrates that the building industry is governed by strict regulations on the energy use of buildings (Holm et al., 2014) as three of them are concentrated on energy. A focus on energy efficiency can be seen as encouraged by a concern for environmental and economic aspects of sustainability because energy efficiency is understood as beneficial for the environment and the economy. However, energy efficiency is not the only concern within the environmental and economic dimensions of sustainability presented in the general view as aspects such as resource efficiency is also included.
The social dimension of sustainable building is the main focus in this project. Therefore, it is noticeable how the social dimension is represented in the general understanding of sustainable building by the items *social inclusion* and *indoor environment*. In the following subsection the social dimension of sustainable building will be further explored.

2.1.1 The Social Dimension of Sustainable Building

From the general view on sustainable building presented above, it seems that the social dimension of sustainability can be incorporated even more in sustainable building. In the last decade research has emphasized an understanding of buildings being more than a technical artifact as buildings are influenced by its users (Holm et al., 2014). A way of incorporating and ascribing more importance to the social dimension can be the use of standards focusing on the social qualities of a building.
The *Well Building Standard* is an example of a standard, which concentrates on increasing human health and well-being in buildings (International Well Building Institute, 2017). Another exam-

ple is the European standard DS/EN 16309:2014 *Assessment of Social Performance of Buildings*, the standard provides specific methods for assessing the social performance of a building within predetermined categories (DS/EN, 2014). In a sustainable building context these standards can not fully cover all three dimension of sustainability. There are probably many different reasons why social standards seemingly have not been applied to a considerable degree, but one of the reasons could be the difficulties in locating the economic value of specifically focusing on the social qualities of a building. A way to meet this difficulty is attempted solved by the World Green Building Council, who examines different business cases of green buildings by converting the social initiatives made in these buildings into easy understandable economic value outcomes (World Green Building Council, 2016).

As mentioned the leading certification scheme within sustainable building in Denmark is DGNB (Brunsgaard and Fich, 2016). The first DGNB scheme was published in Denmark in 2012 (DK-GBC, n.d.), and since then the DGNB scheme has promoted itself on having equal focus on economic, environmental, and social sustainability (DK-GBC, 2016a). With the DGNB certification scheme a systematical focus on the social dimension of sustainable building was established. However, based on the historical review of the development of sustainable building and its lack of social integration one could wonder how DGNB includes social qualities in the certification scheme.

2.2 The Danish DGNB Certification and the Social Dimension

In this section the Danish DGNB certification scheme will be presented with a focus on origin and the division of qualities. Furthermore, the social dimension of sustainability in the certification scheme is explored.

2.2.1 The DGNB Certification

The Danish DGNB certification originates from the German DGNB certification (Deutsche Gesellschaft für Nachhaltiges Bauen), but the certification has been adjusted into a Danish context by the Danish Green Building Council (DK-GBC). DK-GBC is a non-profit organization with the aim of introducing sustainability in the building industry. The organization was founded in 2010 by stakeholders from the Danish building industry who has the desire of making sustainable building the common practice in the industry.
The DGNB certification focuses on the whole life-cycle of a building and approaches sustainability on the basis of the three dimensions of sustainability from the previously described Rio-declaration namely social, economic and environmental. The three aspects of sustainability form the basis for measuring the sustainability of a building. Furthermore, two aspects are included in the measurement namely technical and process quality because these two aspects are seen as influencing on the three other aspects. These five aspects are categorized as qualities in the DGNB certification scheme as they are all affecting the sustainable performance of a building. In order to assess the qualities different criteria are established for each quality (see complete criteria list in figure 2.2 on page 7).
The qualities in the DGNB certification are illustrated in 2.1 on the next page. The quality of process counts 10 % in the final score while the four other aspects each count 22,5 %. As it is

illustrated in figure 2.1 a sixth quality *surrounding area* is part of the DGNB measurement but this quality counts 0 % in the final score. This quality needs to be evaluated in order to achieve a DGNB certification even though the result is not included in the final score (DK-GBC, 2015).

Figure 2.1: The qualities in the DGNB certification (based on DK-GBC (2015)).

The DGNB certification can potentially influence the built environment in Denmark significantly due to its popularity (Brunsgaard and Fich, 2016) and the future expectations on sustainable building (Energistyrelsen, 2015). The question that appears is then; does the DGNB certification include the right qualities and criteria in order to attain a sustainable building? As an example of this Brunsgaard and Fich (2016) question the denition of a 'healthy building' in DGNB because it is primarily founded on an engineering approach and therefore they suggest that a certification scheme such as DGNB could result in limitations and unsatisfactory solutions (Brunsgaard and Fich, 2016). Another perspective on this matter is given by Grøn and Tree (2015) who indicate that social aspects of sustainable building are neglected. This neglection can be seen as a result of an uncertainty concerning the social dimension, which has caused a lack of research in this dimension compared to the other two dimensions of sustainability. Therefore, it is stated that social aspects should be enhanced in sustainable building in order to contribute to the well-being of people (Grøn and Tree, 2015), why it is relevant to explore how the DGNB certification scheme include the social dimension of sustainability.

2.2.2 The Social Dimension in the DGNB Certification

According to the DGNB certification social sustainability is about increasing the value of the building for its users. In order to describe and understand how social sustainability is included

in the DGNB certification scheme the publication *Guide to DGNB for Buildings* is investigated (DK-GBC, 2016b). The description features DGNB's own categorization of social qualities and other aspects in the publication, which concerns social aspects. The complete categorization of criteria can be seen in figure 2.2.

Quality	*Criteria group*	*Criterion*	*Percentage of the total assessment*	
Process	Planning	PRO 1.1 Quality in preparation of the project	1,7%	
		PRO 1.2 Integrated design process	1,7%	
		PRO 1.3 Evaluation and optimization of planning complexity	1,7%	
		PRO 1.4 Sustainability in procurement material and order awarding	1,1%	
		PRO 1.5 Guidance concerning maintenance and use in the building	1,1%	
	Performance	PRO 2.1 Building site and building process	1,1%	
		PRO 2.2 Documentation of quality in implementation	1,7%	
Environmental	Global and local environmental impact	ENV 1.1 Life cycle assessment (LCA) - environmental impact	7,9%	
		ENV 1.2 Environmental risk for building materials	3,4%	
		ENV 1.3 Environmental impact at extraction of materials	1,1%	
	Resource consumption and waste	ENV 2.1 Life cycle assessment (LCA) - primary energy	5,5%	
		ENV 2.2 Drinking water consumption and wastewater discharge	2,3%	
		ENV 2.3 Efficient land use	2,3%	
Economic	Life cycle costs	ECO 1.1 Building related life cycle cost	9,6%	
	Economic future proofing	ECO 2.1 Flexibility and adaptability	6,4%	
		ECO 2.2 Robustness	6,4%	
Sociocultural and functional	Health, comfort, and user satisfaction	SOC 1.1 Thermal comfort	4,3%	
		SOC 1.2 Indoor air quality	2,6%	(!)
		SOC 1.4 Visual comfort	2,6%	
		SOC 1.5 The user possibility for operating the indoor environment	1,7%	
		SOC 1.6 Quality of surrounding outside areas	1,7%	
		SOC 1.7 Safety and security	0,9%	
	Functionality	SOC 2.1 Accessability	1,7%	(!)
		SOC 2.2 Public access	0,9%	
		SOC 2.3 Condition for cyclists	0,9%	
	Esthetics	SOC 3.1 Architectural quality	2,6%	
		SOC 3.2 Art integrated in building	0,9%	
		SOC 3.3 Plan disposition	1,7%	
Technical	Technical performance	TEC 1.1 Fire precautions and safety	3,0%	
		TEC 1.2 Acoustics and sound insulation	4,5%	
		TEC 1.3 Building envelope quality	3,0%	
		TEC 1.4 The adaptability of the technical systems	3,0%	
		TEC 1.5 Building maintenance and cleaning friendliness	3,0%	
		TEC 1.6 Suitability for dismounting and recyclability	1,5%	
		TEC 1.7 Commissioning	3,0%	
		TEC 1.8 Documentation environmental product declaration (EPD)	1,5%	
Site	Site	SITE 1.1 External environmental impacts	0,0%	
		SITE 1.2 Image and condition of the neighbourhood	0,0%	
		SITE 1.3 Traffic connections	0,0%	
		SITE 1.4 Access to facilities in the community	0,0%	

(!) Knockout criteria where a minimum score is requried

Figure 2.2: The categorization of criteria in the DGNB certification (based on DK-GBC (2016b)).

As illustrated in the figure the social quality contains 12 criteria focusing on different aspects of social sustainability within the criteria areas: 1) Health, comfort, and user satisfaction 2) Functionality 3) Esthetics. As it can be seen in the figure 2.2 on the preceding page the social quality is the only quality where knockout criteria are present, meaning that a minimum score is required for a certification. It is noticeable that there are no knockout criteria in the other qualities, which could contribute with setting the bar for a minimum standard of sustainable building higher. Achieving the remaining criteria would then be additional focus areas for raising the level of sustainability.

The 12 criteria together with three criteria from the process quality and one criterion from the technical quality are described on the basis on the DGNB guide through purpose, relevance and focus, and evaluation (see table 2.1). The criteria are selected due to their relation to social aspects concerning the users of a building.

Table 2.1: Details of chosen criteria (based on DK-GBC (2016b)).

Criterion	Purpose	Relevance and focus	Evaluation
SOC 1.1 Thermal comfort	Increase the comfort and the well-being of the users.	Thermal comfort is related to the users' satisfaction with the indoor environment.	Quantitative evaluation of operating temperature and humidity. Qualitative evaluation of draft and other temperature parameters.
SOC 1.2 Indoor air quality	Ensure health and well-being of the users.	Avoid high concentrations of health hazardous substances.	Evaluation of air quality based on predetermined indicators.
SOC 1.4 Visual comfort	Increase the mental and physical comfort of the users.	Lighting in the building both natural and artificial.	Evaluation based on seven predetermined indicators.
SOC 1.5 The possibility for users to operate the indoor environment	Increase the possibility for users to regulate the comfort.	Users satisfaction and the energy consumption in the building are closely connected with the possibility for the users to regulate the indoor environment.	A qualitative assessment based on six predetermined indicators.
SOC 1.6 Quality of surrounding outside areas	Increase satisfaction with the building and the outside areas with the possibility of increasing social interaction.	Surrounding outside areas that are landscaped simultaneously with the building.	Quantitative evaluation of the quality of the outdoor areas. Qualitative evaluation of building related outdoor areas.

Continued on next page

Table 2.1 – continued from previous page

Criterion	Purpose	Relevance and focus	Evaluation
SOC 1.7 Safety and security	Increase security and the experience of safety.	Promote initiatives which increase security and the experience of safety.	Evaluation of clarity at access roads and parking spaces, lighting and security outside work hours. Furthermore evacuation plans, escape routes, and fire safety are evaluated.
SOC 2.1 Accessibility	Ensure equal accessibility for all both indoors and outdoors.	Everybody regardless of disabilities have equal access in line with the other users of the building.	Qualitative evaluation of four specific areas based on current norms within the building regulative.
SOC 2.2 Public access	Increase community's acceptance of the building.	Integration of the building in the existing urban space.	Evaluation based on five predetermined indicators.
SOC 2.3 Condition for cyclists	Ensure attractive biking conditions for the users of the building.	Sufficient number of bike parking lots and other initiatives promoting biking.	Evaluation of number and design of parking lots as well as facilities for cyclists.
SOC 3.1 Architectural quality	Ensure a high architectural quality and motivate maintenance of the building.	Increased durability and greater redesign potential.	The evaluation can be conducted on the basis of four different evaluation bases; architecture contest, turnkey contract contest, jury assessment, and qualification of af previous investigation.
SOC 3.2 Art integrated in the building	Positively contribute to the quality and expression of the building through different types of art.	.Art integrated in buildings can establish a coherency between the surroundings, the buildings, and its purpose.	Evaluation concerning the planning and the implementation of the integrated art based on three predetermined indicators.
SOC 3.3 Plan disposition	Ensure the functionality and flexibility of the building to different usage.	Buildings can provide changing purposes of use.	Evaluation based on the variation in possible usage and the quality of the areas in use.
PRO 1.1 Quality in preparation of the project	Increase the quality and sustainability of the building through early planning and project preparation.	Optimize the planning by identifying the demands of building developer and users.	Evaluation of how the construction plan defines the significant needs of the building developer and users.
PRO 1.2 Integrated design process	Ensure relevant competencies are included timely in the process already in the early phases.	Create the basis for qualifying the solutions and concepts in order to minimize the risk for errors and misunderstandings.	Evaluation of the, interdisciplinarity of the design team and the involvement of users in the planning process.

Continued on next page

Table 2.1 – continued from previous page

Criterion	Purpose	Relevance and focus	Evaluation
PRO 1.5 Guidance concerning maintenance and use in the building	Ease the future operation of the building by having documentation and guidance available.	Put forward advice and guidance concerning the building to users and owners.	Evaluation based on accessible guidance concerning usage, operation, and maintenance.
TEC 1.2 Acoustics and sound insulation	Increase the comfort, well-being, and efficiency of the users in relation to acoustics of the building.	Acoustics are co-determinant for the users' understanding of comfort and well-being.	Evaluation of the acoustics based on predetermined indicators.

Based on the review of the selected criteria, the description of the evaluation methods can be seen as indistinct in relation to how these evaluations are conducted. In some of the evaluation descriptions the guide uses terms such as qualitative and quantitative assessments and predetermined indicators, but it is not further described what types of qualitative and quantitative methods that are used to assess the criteria. When missing this information it is difficult to understand what the users actually achieve with the results of the evaluations, other than a certain score in the DGNB scheme based on the specific framework. However, it must be assumed that the social specific framework in DGNB is based on extensive research on users well-being in buildings.
The DGNB process criteria emphasize the importance of involvement of users in the planning of a building process. The users are not further included in the process criteria until putting the building into operation, where a manual about use, operation, and maintenance of the building is handed over to the users. One could argue that the users' understanding of a building can not be evaluated until they are using the building and because it is not included in the criteria, it indicates that the users' experience of the building is not valued in the same degree as other aspects. This seems to be out of line with the idea of building for people as presented in the introduction (chapter 1 on page 1). Therefore, it raises the question of how users could and should be further involved in the evaluation of sustainable buildings in order to obtain a higher degree of value for the users in a building.

2.3 The Process of Building Sustainable and the Involved Actors

In this section the process of building sustainable is described through its different phases and it is clarified which actors are present in a building process, and when they are involved in the different phases.

2.3.1 A Building Process

A building process typically consists of different phases, which are illustrated in figure 2.3 on the next page. The process includes multiple actors with different professions, cultures, and knowledge. (Holm et al., 2014)

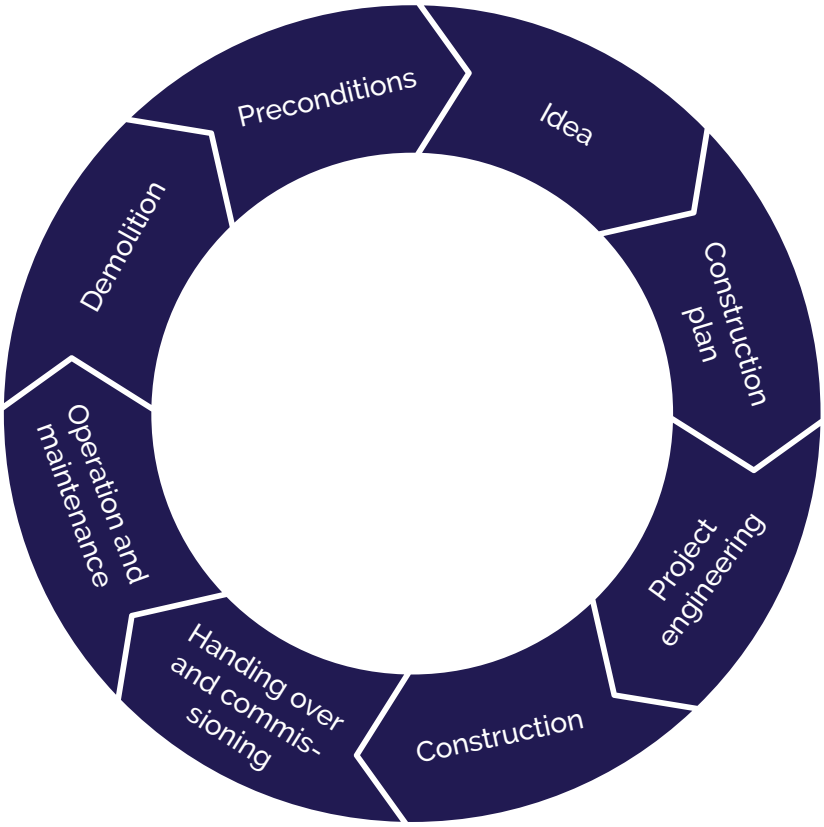

Figure 2.3: A typical building process (based on (Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013; Holm et al., 2014; Branchearbejdsmiljørådet for Bygge & Anlæg, n.d.)).

In the *precondition* phase the strategic direction for the building project is established in order to align the expectations with the realities. In the *idea* phase, ideas from all involved parties are presented. This phase should be approached holistically and is developed most efficiently through a life cycle costs perspective to prioritize the ideas. In the phase of the *construction plan* focus areas for the building are identified and prioritized in relation to the desired quality and function. In the *project engineering* phase the results of the three above mentioned phases are gathered, which then result in a specific main project. The *construction* phase includes an evaluation of the main project description and the actual construction of the project. In the *handing over* phase, the building is delivered to the building developer and users, whom should be informed about the facilities of the building. Furthermore, the technical installations of the building should be regulated to the specific use of the building and the technical installations should be measured for their actual performance. The *operation and maintenance* phase concerns the daily operations, use, and maintenance of a building. The result of the *demolition* phase depends on considerations in the early phases of the building process e.g. the degree of reuse-ability in the demolished components and other aspects considered in the design phases (Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013).

2.3.2 The Actors Involved in a Building Process

The different phases involve different actors related to a building process (see figure 2.4). The figure illustrates who, when, and to which degree actors are involved.

	Preconditions	Idea	Construction plan	Project engineering	Construction	Handing over and commissioning	Operation and maintenance	Demolition
Building developer	x	x	x	x	x	x	x	x
Client consultant	x	x	(x)					
Users	x	x				(x)	x	
Consultants	(x)	x	x	x	(x)	(x)	(x)	(x)
Experts		x	(x)					
Contractors	(x)	(x)	x	x	x	x	(x)	x
Subcontractors		(x)	x	x	x	x	x	x
Operating staff	(x)	(x)	x	(x)	(x)	x	x	x

Figure 2.4: The actors involvement during a building process – X meaning strong involvement and (X) meaning a lesser degree of involvement (based on (Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013)).

The *building developer* is in charge of a building project meaning responsible for economical and legal aspects. The building developer is to a high degree involved in all phases of a building process and therefore affects the ambition level of sustainability in the project e.g. if the building should be certified within DGNB. The building developer can be assisted by a *client consultant*, who then will be strongly involved in the initial phases and to a lesser degree in the project engineering and the handing over phases (Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013; Branchearbejdsmiljørådet for Bygge & Anlæg, n.d.).
There are many ways that *users* can be involved in a building process such as idea developers or as commentators. They are involved to a high degree in the initial stages, to a lesser degree in the handing over phase and then again to a high degree in the usage. To achieve a fruitful collaboration between building developer and users during the building process, the users should

experience the feeling of being sufficiently involved and informed about decisions concerning the building project (Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013).
The *consultants* can contribute to all competence areas and can therefore be involved in all phases to a given degree, but are strongly involved in the idea, construction plan, project engineering, and construction phase. Their main task is to design the building project based on inputs from the initial phases. When designing the project it is important to integrate all competencies of consultants in a common solution frame. The solution frame can be supplemented with inputs from *experts* concerning a certain area e.g. knowledge about DGNB (Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013).
The *contractors* and *subcontractors* have the responsibility of carrying out the project into a actual constructed building. Therefore, their involvement is in a high degree in the implementation phases, but they can be included in the initial phases depending on the procurement method. If the contractor and subcontractors are involved in the initial stages they can contribute to the mentioned solution frame and thereby, generating a common understanding of the project including the ambition level of sustainability (Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013).
The *operating staff* can be included in all phases of a building process but is highly involved in handing over the building and the following phases, because it is in the operation phases that it is recognized if the ambition level of sustainability is achieved in practice (Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013).

From the presentation of the building process and its actors it becomes obvious that the building developer has a significant influence on the ambition level of sustainability in a given project. However, all actors included in the idea phase have the possibility of influencing the project in a sustainable direction if this was not a focus area to begin with. Concerning the aspect of value for the users in sustainable buildings the question can be asked: Who are the users involved and how are they practically involved? Furthermore, it can be questioned why the users are not part of all phases because it can be assumed that decisions, influencing the finished building and thereby the end users, will be made in phases of project engineering and construction. This division of influence indicates that there is an imbalance in the idea of building for people, which should be addressed in order to achieve more sustainable buildings.

Chapter | 3
Problem Statement

Throughout the introduction and problem analysis it has been highlighted that there are inconsistencies in the understanding of *building for people*. Based on the aspects presented and discussed in the introduction and the problem analysis it is relevant to investigate how a sustainable building can add value to its users by contributing to their well-being. Actors involved in sustainable building influences the level of sustainability therefore, the actors can contribute with a strengthening of the social dimension of sustainable building.
Due to the position of the Danish DGNB certification as the leading standard for sustainable building in Denmark, the standard has the potential to influence the built environment in Denmark in a certain sustainable direction. In order to strengthen the social dimension in sustainable building and thereby add value to the users of a building the following is investigated:

How can understandings of the social dimension in sustainable building be utilized in the Danish DGNB certification scheme in order to add value to the users?

The following research questions have been developed in order to address the problem statement:

- What is value and how can value be added to sustainable building?
- What are the understandings of the social dimension in sustainable building among actors in a building process compared to the social dimension in the DGNB certification scheme?

3.1 Delimitation

In this project it is investigated how value can be added to the users trough the social dimension of sustainability in the Danish DGNB certification scheme. When referring to DGNB in the report it concerns the Danish Green Building Council's version of the DGNB standard if nothing else is mentioned. The DGNB standard used in this project is the overall certification guide to buildings, this means there is no focus on a specific building type. We are aware of the existence of DGNB guides for specific building types, however these are not used due to the focus on strengthening the overall presence of the social dimension of sustainable building.
In the project the social dimension of sustainability is seen in a micro perspective where the use of a building is the basis for the research. This means that the social dimension concerns the understanding of well-being among users. Well-being is thereby seen as value and the core of social sustainability, why value is not only understood in an economic sense.

3.2 Research Design

The research is designed in order to address the research questions and thereby enable the answering of the problem statement. Furthermore, the answering of the problem statement is supported by the problem analysis, which contributes with knowledge concerning the research

field.
The first research question concerning the concept of value is addressed in the theoretical framework, where value is investigated from different perspectives in order to discover what value is. The clarification of different perspectives on value creates the basis for understanding how value can be added to sustainable building by focusing on the building process. Through the theory of Co-creation it is investigated how value can be added to the actors in a building process specifically the users.
The second research question concerning understandings of sustainable building is addressed through qualitative data generation namely semi-structured interviews, a workshop, and a field trip. The interviewees were selected because of their relation to a building process identified in the problem analysis. The participants in the workshop were invited due to their professional background and interest in sustainable building. The field trip is seen as a way of getting insight into the building industry and its focus areas within sustainable building. Supported by the theoretical framework the generated data are analyzed in order to answer the research question.
The problem analysis and the outcome of the research questions enables us to draw a conclusion on how understandings of the social dimension in sustainable building can be utilized in the Danish DGNB certification scheme in order to add value to the users.

Chapter | 4 Methodology

The purpose of this chapter is to present the methodology of this project by describing the methods used and how they have been applied in the project.
The data generated through interviews, workshop and field trip have been conducted in Danish because this was the native language of the actors involved. As a result of this the quotes in the report are translated into English and have been adjusted to increase the readability. The different approaches will be described in the following sections.

4.1 Literature Study

In this project a literature study is used as a method to gain knowledge about the research field to understand and broaden the perspective of the investigated topic. A literature study contributes with a wide variety of data and knowledge. To achieve a high level of reliability it is crucial to critically asses the origin and purpose of the literature (Healey and Healey, 2010).
The literature study was initially conducted with the purpose of gaining knowledge about the building sector and its view on sustainable building with special attention on how the social dimension is described. This initial study led to a study of the Danish DGNB certification scheme more specifically how the social dimension is incorporated in the standard. The literature study has been an ongoing process, which has been applied throughout the project as new aspects have appeared and therefore new knowledge has been needed.

4.2 Interviews

Interviews can be used as a method to generate qualitative data when aiming for specific knowledge from selected interviewees. There are different versions of interviews however, in this project the semi-structured interview has been chosen as the underlying basis of the interviews. This gives the opportunity for covering aspects that appear in the interview which are not prepared in the interview guide. As preparation for the interviews an interview guide is created where specific questions are organized to ensure that the research questions are addressed (Brinkmann and Tanggaard, 2010). In this project different interview guides have been made for each interview due to the diversity of interviewees (see Appendix A on page 53). Furthermore, the knowledge gained from the completed interviews have supplemented the following interviews.
In order to gain insight into the perspectives of different actors related to sustainable building 12 interviews have been conducted. The interviewees have been selected on the basis of the research questions and the knowledge obtained in the literature study. Therefore, the interviewees are ranging from building developers to the users of a building. Based on the problem analysis of actors related to a building process, the contractors and the subcontractors were considered as not directly influential on the social sustainability of a building. It is recognized that they can affect the level of sustainability by e.g. the selection of materials, but they are mainly carrying out orders of a building project.

In the following table 4.1 a list of the interviewed actors and their positions can be seen. The interviewees highlighted with blue in table 4.1 do not have direct experiences with DGNB certified buildings. However, they could potentially be involved in future DGNB building projects and therefore the knowledge gained in these interviews is seen as valuable as knowledge from the other interviews. Furthermore, the majority of these interviewees are users, why their understanding of well-being is just as valuable as the understanding of well-being from users in DGNB buildings.

Interviewee	**Position**	**Position in a building process context**	**Duration of interview**
Niels Sloth, Region Nordjylland	Head of Department	Building Developer	59 minutes
Sven Buch, Himmerland Boligforening	Head of Development	Building Developer	47 minutes
Christina Myrdal, Aalborg Kommune	Project Manager within sustainable building	–	60 minutes
Claus Topp, Niras	Head of Section, Indoor Environment and Energy	Consultant	52 minutes
Dorte Grøn, DEAS	*Former*: Researcher within sustainable building, UCN *Present*: Client consultant	Client Consultant	46 minutes
Niels Engstrøm, Region Nordjylland	Operating Staff	User	36 minutes
Two employees, Alfa Laval Aalborg	Receptionist and Head of Communication	User	28 minutes
Two residents of an energy efficient renovated apartment complex, Frederikshavn Boligforening	Residents	User	16 and 10 minutes
Two residents of a non energy efficient renovated apartment complex, Frederikshavn Boligforening	Residents	User	9 and 8 minutes
Two residents facing major renovation, Himmerland Boligforening	Members of the residents' building committee	User	60 minutes

Table 4.1: Interviewees and their position (Created by the authors).

As it is demonstrated in table 4.1 on the facing page the duration of the interviews varies, which reflects the different knowledge aims of each interview. All the interviews were recorded with acceptance from the interviewees with the purpose of transcribing them for further analysis (reference to digitally uploaded transcriptions in Appendix B on page 61). Both before and after the recording device was recording there was a beneficial informal conversation.
In the interview with the employees from Alfa Laval, who work in a DGNB gold certified building, we were invited for a guided tour in the office facilities where the two employees explained their experiences of the building. This contributed with useful insight in positive and negative concerns regarding specific initiatives made in the building (see figure 4.1 and 4.2 on the next page). We also got the opportunity of having a guided tour in the apartments of the residents from Frederikshavn Boligforening, which gave an impression of what they valued (see figure 4.3 on the following page).

Figure 4.1: A friendly reminder of the activities in given areas in order to show consideration for colleagues. From the guided tour at Alfa Laval (Photo taken by the authors).

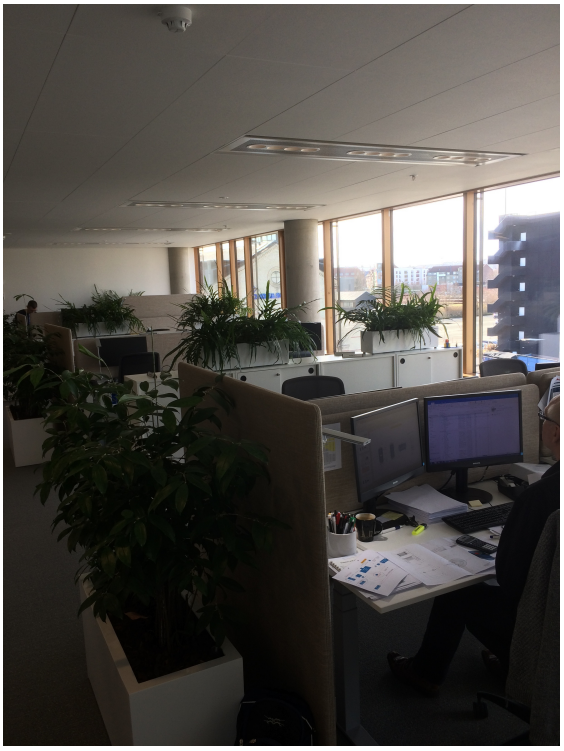

Figure 4.2: From the guided tour at Alfa Laval (Photo taken by the authors).

Figure 4.3: A resident shows her renovated bathroom (Photo taken by the authors).

Both group members participated in all the interviews and it was decided beforehand that each member would have equal opportunity to ask questions. In two of the conducted interviews two interviewees were present simultaneously, but the experience was that they did not affect each other in a significant way.

4.3 Workshop

The conducted workshop was inspired by the concept of a focus group debate. A focus group is a debate organized to explore specific topics by learning the viewpoints, ideas, and experiences of the participants discussing the topics (Kitzinger, 1994). In order to explore the insights the people in the focus group must be encouraged to share their thoughts concerning the topics (Kvale and Brinkmann, 2009). By doing a focus group it becomes possible to investigate the different viewpoints of the participants and how they reflect upon the other viewpoints presented. Such reflections can assist in clarifying why the participants put forward the viewpoints they do (Kitzinger, 1994).

In this project a workshop was arranged as part of a presentation regarding one of the group members former project work related to the social dimension of sustainable building as described previously. The presentation was designed through questions to actively involve the participants in a discussion about the social dimension in sustainable building. The presentation was finalized with three concrete questions in order to encourage a joint discussion among the participants. A snapshot from the fruitful discussion is seen in figure 4.4 on the next page, the discussion continued for 45 minutes. A summary of the complete event including the three questions asked was made for further analysis (see Appendix C on page 63).

Table 4.2 summarizes the participants attending the workshop, which illustrates a great variety of actors involved in different aspects of the building industry.

Name	Company	Position
Britt Kamstrup	Hjørring Kommune	Environmental Employee
Christina Myrdal	Aalborg Kommune	Project Manager Green Building A-Z, NBE
Dorte Grøn	DEAS	Client Consultant
Peter Munk	Aak Bygninger	Building Developer
Tine Steen Larsen	Aalborg Universitet	Associate professor, Department of Civil Engineering
Susanne Smed	Hjørring Kommune	Client Consultant
Brian Thomsen	Frederikshavn Boligforening	Energy specialist and Inspector
Trine Saaby	UCN	Lecturer in Energy and Environmental Educations
Dorte Hovaldt	Arkitektfirmaet Hovaldt	Architect and owner of the Architectural firm Hovaldt
Nina Priem	Arkitektfirmaet Hovaldt	Architect
Anne Sørensen	Arkitektfirmaet Hovaldt	Architect
Majbritt Wærn Jensen	Hjørring Kommune	Client Consultant
Henrik Dam	Hjørring Erhvervscenter	Consultant
Arne Remmen	Aalborg Universitet	Professor, Department of Planning and Development
Heidi Kristensen	Aalborg Universitet	Research Assistant

Table 4.2: List of workshop participants

Figure 4.4: The workshop participants during the discussion (Photo taken by the authors).

4.4 Field Trip

As part of the data gathering in this research a field trip was arranged to attend a two day conference concerning sustainable building. The conference *Building Green* was organized by multiple stakeholders in the buildings industry such as InnoByg, Dansk Byggeri, GBC-DK, Bygherreforeningen, Danske Arkitektvirksomheder, and Realdania. The event included exhibitors with products within sustainable solutions for the construction industry and several debates and presentations focusing on sustainability in the built environment (Building Green, n.d.) (see figure 4.5 and figure 4.6).

Figure 4.5: One of the presentations at the conference (Building Green, 2017).

Figure 4.6: The conference entrance (Photo taken by the authors).

Before going to the conference the group members examined the program and selected which presentations and debates that would be beneficial to attend. This selection was based on the problem field of this project. In addition to the predetermined plan the group was also present at other useful debates and presentations alongside with interaction with the exhibitors. A more detailed description of the outcome of the participation in the conference can be seen in Appendix D on page 65 where a summary is presented.

As part of the conference the group had the possibility of joining a study trip visiting sustainable buildings in the city of Aarhus. The study trip was focused on housing projects which have considered the three dimensions of sustainability. During the tour different professionals within the construction industry introduced the sustainable aspects included in the different projects (InnoByg, n.d.).

The study trip made it possible for the group to see and get an insight view of the visited buildings (see figure 4.7 on the next page, 4.8 on the facing page, and 4.9 on the next page). Throughout

the whole tour participants asked in depth questions to the guides, who was encouraging an active dialogue.

Figure 4.7: Presentation inside one of the projects (Photo taken by the authors).

Figure 4.8: Entering one of the visited buildings (Photo taken by the authors).

Figure 4.9: Visiting the newest project (Photo taken by the authors).

The methodological consideration behind the field trip has been inspired by the concept of participant observation (Spradley, 1980). The aim of the field trip was to get insight into the current understandings of sustainable building from different stakeholders, by being at the conference observing the other participants through the debates, presentations, and mingling.

Chapter | 5
Theoretical Framework

This chapter explores and presents the theoretical framework of the project, with the basis in the problem statement. The theoretical framework addresses the first research question: *What is value and how can value be added to sustainable building?* The research question is addressed through a combination of theories of value and co-creation. Value is explored in order to understand the complexity of the concept and to discover what value is to users. This is followed by an investigation of the theory of co-creation, which focuses on value creation through interaction among actors in a process.

5.1 (User) Value

There is no precise established theory for the concept of *value* as it has different meanings within different disciplines ranging from economic return to moral standards. The diversity of the many definitions of value are exemplified in the following quotes respectively representing an economic and a moral view:

> "*The monetary sacrifice people are willing to make for a product.*" (Boztepe, 2007: p.56)

> "*The notion of values as conception(s) of what is ultimately good in human life.*" (Boztepe, 2007: p.56)

The variety of perspectives on value are beneficial for a theoretical understanding of the concept, but these perspectives will not be further investigated here.
When referring to value here the focus will be on user value, where value relates to the evaluation of a certain object by a user e.g. a user's evaluation of a building. (Boztepe, 2007).

A perspective on value positions experiences associated with a certain product as significant for the creation of value for the user (Holbrook, 1999). As stated by Holbrook (1999: p.8):

> "*Value resides not in the product purchased, not in the brand chosen, not in the object possessed, but rather in the consumption experience(s) derived therefrom.*" (Holbrook, 1999: p.8)

The position on value as an experience is contradicted by another perspective on value concerning value as sign. Value as a sign has it roots in the anthropological and sociological disciplines stressing the cultural and social dimensions of value where the symbolic meaning is connected to an object (Boztepe, 2007). In this perspective objects are not valued by users based on the functionality of objects or the objects' tangible materiality but rather in the symbolic value users ascribe the object (Csikszentmihalyi and Halton, 1981). In this sense objects serve as communication elements where status, prestige, and identity are communicated to the surrounding society through an object (Boztepe, 2007).
Based on the views in sign value a premise for the position on value from Holbrook (1999) is that

the users desire the experiences provided by the object and not the object itself and its signal value. When this premise is present the value is determined by the experience the user has in the interaction with a product. However, the result of the user value is also determined by goals, needs, limitations, etc. of the user. Due to the differences in contexts in which the experiences occur a product can be valued differently by different users (Boztepe, 2007).

The presented perspectives on value gives clarity on the complexity of the concept and how value can be present for the users of a building. In this project we are taking point of departure in the concept of user value being an experience. Thereby, the user value of a building is determined by the experiences of the users.
In order to discover and possibly increase this value it is necessary to explore and evaluate the users' experience of a certain building. Post-Occupancy Evaluation (POE) is a tool to systematically evaluate buildings in use, both with a focus on building performance and the experiences of the users of a building (Preiser et al., 2015). The concept of POE has roots back to the 1960s, where architects returned to the building project to review the outcome of the design. However, it has not become a common practice in the building industry, one reason for this was the fact that the building developers to a rare degree wished to pay for the evaluation. Despite the lack of including this type of evaluation in the building industry, research concerning POE has continued and developed throughout the years (Bordass and Leaman, 2005).
A POE is done in order to improve the evaluated building and to be able to apply findings in future buildings as illustrated in figure 5.1 (Preiser et al., 2015).

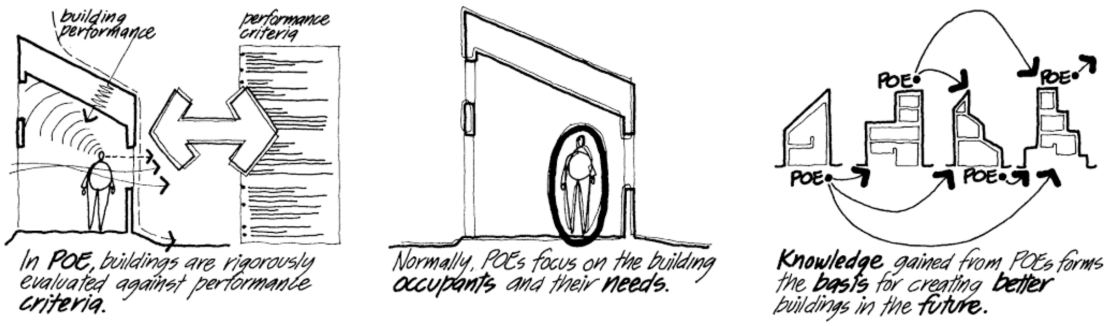

Figure 5.1: The process of a post-occupancy evaluation (Preiser et al., 2015).

The aspect of including users in POE is in line with the argument *measure with people* presented by the think-tank *New Economics Foundation* (nef) who states:

> "*The people who are closest to or most affected by an activity are uniquely positioned to identify its effects, whether positive or negative. They should therefore be involved as deeply as possible when creating and revising indicators. Without this input, measurement is unlikely to capture what really matters to people.*" (nef, 2009: p. 10)

From this quote it can be drawn that it is essential to include the users of a building when evaluating a building. Despite the obvious benefits of a POE, where users are included, it is not a common practice in building projects. This fact was also discovered in the previous project made by Troelsen (2017) concerning users' experiences with sustainable building. A reason for

this lack of evaluation could be linked to the narrow focus on building performance evaluation (commissioning) in the DGNB system, being the only voluntary tool for evaluation. Conducting a POE does not necessarily increase the user value unless the results are used constructively to improve the users experiences.

Besides POE, there are other tools that are working with increasing the focus on the experiences of the users in buildings. Watson et al. (2016) attempt to increase focus on the users and building design through the tool social return on investment (SROI). This is done by emphasizing the importance of designing a building for social relations, which are seen as fundamental for the building value. They work with the understanding that economizing user value is needed to bring focus on how users' experiences of a building can contribute with increased economic value to a building. With this economic transferability of user value for a building it is argued that future building design in a higher degree will take users' experiences and social relations into consideration. However, up until now the tool is not capable of specifically measuring the social value of a building in an economic sense. (Watson et al., 2016)

Continuing in the economic discourse of value, a building's market value is determined by the transaction price between buyer and seller. The market value of a building is influenced by its attractiveness to potential users (World Green Building Council, 2013). *World Green Building Council* has developed a business case including different determinants of value for different actors related to a building (see figure 5.2 on the next page).

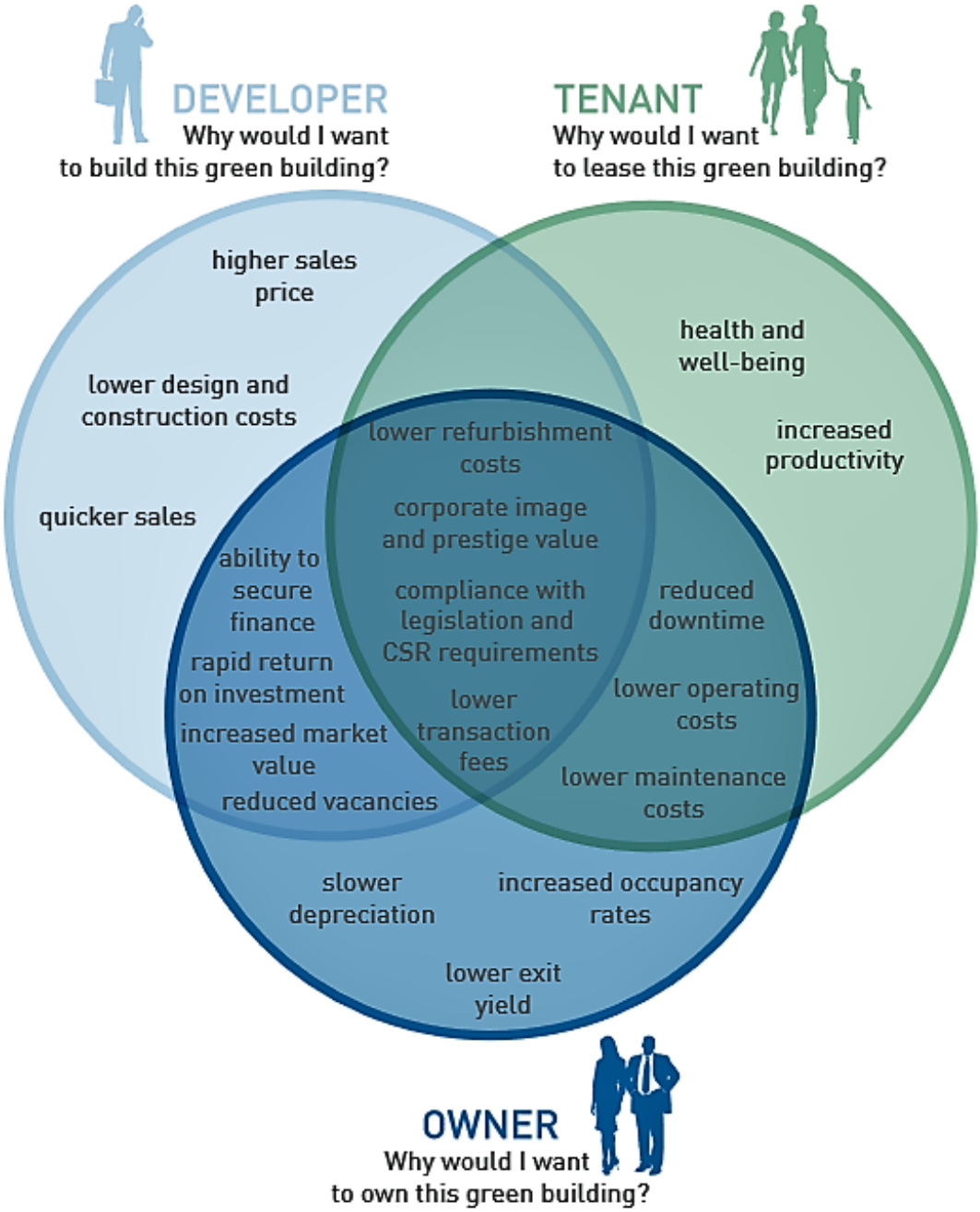

Figure 5.2: Determinants of value as they relate to the different stakeholders. (World Green Building Council, 2013).

As illustrated in the figure 5.2 the value determinants related to the developer and owner are associated with a directly economic perspective, which can be reasoned in the purpose of the publication of the business case as World Green Building Council (2013) has an interest in increasing investments in green buildings. However, the business case also illustrates that health and well-being of users, and increased productivity are significant for the economic value of a building as well as a value for the users themselves. It could also be argued that improved health and well-being, and increased productivity will not only be an economic benefit for the building, but will be a shared value for the whole society in regards of e.g. lower medical expenses and increased tax payments. The center of the figure indicates the shared value for developer, owner,

and tenant, but it can be questioned if these determinants cover the full aspect of shared value. An aspect such as the flexibility of a building is not present, but can be seen as a shared value because; the developer would increase the number of potential buyers, the owner would increase the number of potential tenants, and the tenants will experience a more adoptable building.
World Green Building Council (2013) stresses that a life cycle approach is needed from design to building operation to achieve the value potential of a building. Therefore, the decisions made in the design phase of a building process is of importance for the value of a building project.
In order to acknowledge and combine the different perspectives on value in a building project, it is essential how a building process is approached and carried out. A building project is a collaborative effort where different perspectives are present (see section 2.3 on page 10 concerning a building process). Therefore, a building process can be seen as a partnership where all involved actors' perspective on value are seen as contributing to the building design. This partnership calls for willingness to collaborate in the process, the collaboration can be supported by co-creation. The idea of co-creation is to achieve an interactive process where all actors are included equally (De Koning et al., 2016), which is crucial in order to obtain all perspectives on value.

5.2 Co-Creation

The theory of co-creation can in general be interpreted as a concept that creates value through interaction (Gummesson et al., 2014). Basically, the meaning of co-creation is:

> "*Together (co-) make or produce something (new) to exist (creation).*" (De Koning et al., 2016: p. 267)

Note that the term *creation* refers to more than the creation of things as it also concerns interpretation and meaning making of understandings (Ind and Coates, 2013).
The concept is used in different ways by people from different fields. There are different definitions on co-creation and therefore, there is no fixed framework or plan to follow when using the concept. Currently, the views on co-creation are ranging from a view on the concept as an open innovation movement to a participatory design method (De Koning et al., 2016). Co-creation can be seen from multiple perspectives but is often seen from a management perspective. However, co-creation can also include perspectives from other stakeholders e.g. users (Ind and Coates, 2013). Regardless of the perspective, co-creation brings actors together to interact and develop new opportunities for value creation for all involved (Gummesson et al., 2014).
One approach to co-creation concerning the design and innovation of products and services evolves around creating new more relevant products and services, which are more innovative and quicker brought to the market than traditional expert driven developments. An involvement of users in the design of products and services is fairly new to market research and businesses, but involving people that are going to use the products and services has been the approach since the 1970s in the design world namely participatory design. It is emphasized in participative practices that other groups than users can be involved. This illustrates that co-creation can include a powerful democratizing aspect, which can be utilized in social innovation in areas such as governmental and public services (Ind and Coates, 2013). Co-creation has been acknowledged for valuable and effective contributions to processes of change as it is not imposing changes top

down. It ensures room for diversity, a platform to be heard, and meaning for the people involved (De Koning et al., 2016). However, the value formed in the co-creation process is depended on the willingness, skills, and motivation by the involved parties (Grönroos, 2012). Furthermore, the relation between involved actors and the resources brought into the co-creation process are determining for the value outcome of the different actors (Jaakkola and Hakanen, 2013).

According to Ng et al. (2014) co-creation can be of great relevance to the building industry because building projects has a complex supply chain, which involves multiple layers of stakeholders. Despite of this, co-creation in the building industry is to a great extent unexplored. Ng et al. (2014: p. 167) understand co-creation in relation to building projects as:

> "*Having an organization that develops a certain product to involve their suppliers or customers in the design process in order to generate more innovative ideas and greater value.*"

Building industry stakeholders' view on the built environment needs to focus more on collectively creating value for the users of the given built environment. Through co-creation it is possible to capture stakeholders' expertise and experience and thereby further push the building standards due to joint problem solving and continuous dialogue between the involved stakeholders. By turning the different stakeholders into active partners, co-creation can redefine the way the building industry interact and innovate (Ng et al., 2014).
The idea of including co-creation in the building industry as presented by Ng et al. (2014) is due to the understanding of co-creation contributing with value (Gummesson et al., 2014). Different perspectives on the social dimension of sustainable building should be considered and brought together in order to improve the social dimension of the DGNB certification, thereby adding value to the involved actors and specifically the users.

Chapter | 6 Analysis

The following chapter presents the analysis, which is based on the theoretical framework in the project and data from the conducted interviews, workshop, and field trip. The analysis adresses the second research question: *What are the understandings of the social dimension in sustainable building among actors in a building process compared to the social dimension in the DGNB certification scheme?* The research question is addressed by identifying understandings from the generated data in the project. Thereafter, the identified understandings are analyzed and compared to relevant social criteria in the DGNB certification scheme. This is done in order to discover how the understandings can be utilized in the DGNB certification in order to add value to the social dimension and thereby the users.

6.1 Understandings of the Social Dimension

In order to identify understandings of the social dimension of sustainable building, it is analyzed and discussed how building professionals and users understand social sustainability and well-being in buildings. The understandings of the professional actors are presented first, then followed by the understandings of the users.

6.1.1 The Building Professionals' Understandings

The perspectives on the social dimension of sustainable building from professionals actors are given by building developers, clients consultants, consultants, and experts.
An overall perspective on social sustainability in buildings is given by a client consultant, who previously has worked with enhancing the social focus in buildings:

> "*All social parameters is basically about how we put people in the center and how we perceive the feeling of well-being.*" (Interview, client consultant Dorte Grøn)

The understanding of placing central focus on people in buildings and how the feeling of well-being is achieved is also underlined by the building developer Niels Sloth from Region Nordjylland:

> "*We are building for those who are going to have the building afterwards ... we are humans, we experience the world differently.*" (Interview, building developer Niels Sloth)

Both quotes emphasize the difficulty in building for the well-being of people because of the potential differences in their experiences of a building. The inconvenience of dealing with well-being of different people, is not a point of view that is uncommon in the building industry. The phrase *it would be a lot easier to build if we took humans out of the equation* has been expressed at several occasions during our data generation. The phrase refers to humans as a disturbing element, both in the development of a building and after a building is put into operation. Even though this is expressed sarcastically it indicates that the social qualities of a building are a

complicated matter for the building industry. A reason for the phrase of erasing people from the building equation, could lay in the unpredictability of the interaction between people and buildings. Furthermore, well-being is a complex concept and varies from person to person depending on their understanding of well-being. This complexity makes it difficult for the building professionals to approach aspects of social qualities due to their lack of concrete measurability. This lack of measurability has been pointed out by all the building professionals in this research exemplified with the following quote:

> "*Social sustainability has many different aspects, it is very difficult to measure it ... It is easy to measure and determine the effect that social sustainability elements such as indoor environment and daylight have on us as humans. But we can't measure the feeling of materiality we have when we enter a room.*" (Interview, client consultant Dorte Grøn)

Measurable aspects such as indoor environment and daylight is also understood as social qualities by the consultant Claus Topp, because these measurable elements are part of his main expertise as an indoor environment engineer. He acknowledges other social qualities e.g. accessibility, design, and functionality, when they are measurable, as they are in the DGNB certification. In the quote above Dorte Grøn describes how a feeling of entering a room can not be measured. However, with the knowledge of the accessible tool POE (presented in the theoretical framework section 5.1 on page 25 about value) it can be discussed if this is correct. If a POE is conducted on the basis of exploring the experience a user has with a given building, then information about users feelings with a building is gathered and becomes measurable. It could therefore be argued that the lack of measurability in certain social qualities does not concern the lack of measurability, but rather the lack of valuation of these social qualities.
The view on valuation of social qualities has been supported at the conducted workshop and at the conference Building Green with the argument that, social sustainability should be valuated in order to underline the importance of certain social qualities concerning well-being. It is especially the building developer who needs an understanding of the importance of well-being in order to see value in focusing on social qualities when investing in buildings. From a building developer's perspective, this value should be beneficial in an economic sense since the social qualities of a building project should be developed within the predetermined economical frame. The developer should therefore be informed about the potential economic benefits when focusing on well-being.
One way of informing the building developers about the economic benefits of sustainable building, including well-being, is through organizations like World Green Building Council, who through business cases attempts to highlight the value of investing in sustainable building (presented in the theoretical framework section 5.1 on page 25). According to the interviewed building developers, and statements from Building Green, another way of influencing the building developers, and thereby the sustainability of building projects, is through the consultants in a building process. However, the interviewed building developers are missing sufficient counseling on the subject exemplified through the building developer Region Nordjylland:

> "*The greatest resistance (in regards of sustainable building) is coming from our consultants – the consultancy business is not progressive.*" (Interview, building developer Niels Sloth)

The collaboration between building developer and consultants is struggling when it comes to

sustainable building. Therefore, Region Nordjylland has not primarily obtained their knowledge on sustainable building trough consultants, but from an internal interest and belief in sustainable building. A reason for the struggle between developers and consultants could be their different perspectives on a building project as indicated by the building developer Sven Buch from Himmerland Boligforening:

> "*The consultants are focusing on the construction process and projects but they are not focusing on the operation. This is the determining difference because we have to live with the building in many years. We are looking at the building in a different way than our consultants. They are just worrying about finishing the building on time.*" (Interview, building developer Sven Buch)

The actors in a building process have different interests in a building project. Typically, the consultants profit from providing counsel until a building is constructed. Therefore, a focus on sustainable building can be seen as a price-raising process for the consultants, as they have to spend more resources on this matter within the same budget (interview Niels Sloth Appendix B.1). In order to change the understanding of sustainability as being price-raising, consultants also need to see a value in counseling about sustainability including well-being. The transition about counseling on well-being can be seen as already happening in the consultancy business, with Rambøll's new liveability approach on sustainable building. This new approach to counselling on sustainable building places liveability as essential for obtaining sustainability (resume field trip appendix D on page 65).
Rambøll presented its new approach on liveability at the conference Building Green, where it was presented, that liveability is seen in a community perspective. However, as part of this community perspective, buildings are seen as an essential part of reaching liveability, why a human centered design of buildings through cultural, social, and physical dimensions is encouraged (Rambøll, 2017). Therefore, it was also expressed at the conference that a focus on liveability calls for investigating how users are experiencing a building when it is in operation as illustrated in figure 6.1.

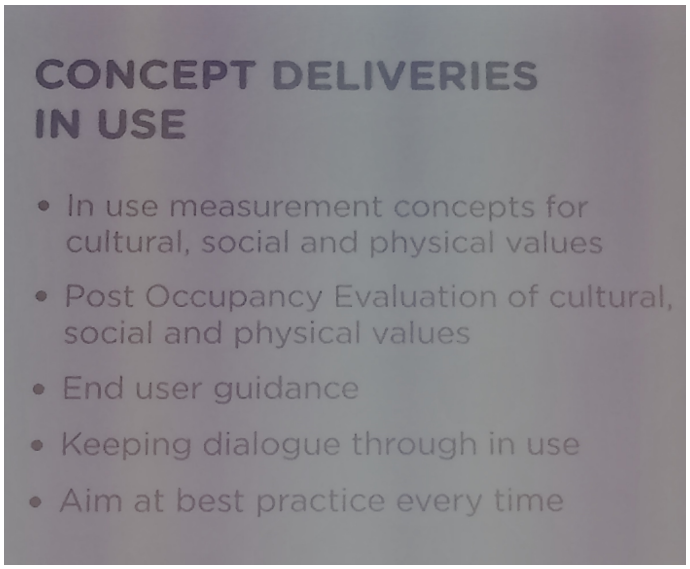

Figure 6.1: A slide from the presentation by Rambøll at the conference Building Green in Aarhus (Photo taken by the authors).

As seen in figure 6.1 on the preceding page POE is presented as a tool that consultants can apply for evaluating a building in use, due to the qualities of a POE (section 5.1 on page 25). The application of a POE could be of economic interest to the consultancy business due to counselling work in the operation phase of a building. This economic interest could trigger an increased focus on the operation phase, thereby valuating users' experiences of a building to a higher degree. An increased focus on the usage of a building would be of value for the building developer in the sense that counseling is given about the operation. Besides this, both consultants and building developers will benefit from experience gathering in the POEs, which can be transferred to future building projects. By transferring the knowledge gathered in the POEs and utilizing it in new building projects, it will be possible to overcome part of the problem in the building industry, which building developer Niels Sloth describes:

> "*I have been engaged in building in my entire life and something you should know about building in Denmark is that we start from Adam and Eve every single time.*" (Interview, building developer Niels Sloth)

As it is stated there is a certain process when starting a new building project. This reflects that the building industry to some extent is conservative, where routines are firmly settled (Interview, project manager Christina Myrdal Appendix B.3). Therefore, the roles of the different actors are tradition-bound as explained by Dorte Grøn:

> "*As Bachelor in Construction Management we are not raised in social sustainability but rather thinking in legislation, construct-ability, timetables, collaboration, and economy. We are not raised to have an understanding for the social parameters in building, that's the job of the architect. The engineer is raised to consider legislation, schedules, calculations, carrying capacity, and dimensioning of a facility ... So there is a division of the different disciplines.*" (Interview, client consultant Dorte Grøn)

A division of the fields of expertise does not necessarily promote interaction and collaboration between the actors, which can result in a lack of knowledge within each others fields of expertise and retain the existing field specific understandings of what is important in a building. This leads to a unfavourably result for the users of a building, as creating value for them is not a shared priority. If creating value for users should be a shared priority by the building actors, while still creating value for oneself, new ways of collaborating is essential. A theory on how to improve the interaction and collaboration between different stakeholders is co-creation as presented in the theoretical framework section 5.2 on page 29. Through co-creation opposing actors are turned into active partners where stakeholders' expertise and experiences are shared in a joint dialogue welcoming all perspectives equally (Ng et al., 2014). In co-creation the interaction between actors is seen as the basis for creating value (Gummesson et al., 2014). In order to create value for the users in a co-creation building process, it is necessary to involve the users and include their understanding of well-being.

From this part of the analysis it is seen that the building professionals understand the social dimension as being complex and difficult to measure. There is an understanding of the importance of focusing on the social qualities, but this focus is often neglected due to the division and different interest from the actors in a building process.

6.1.2 The Users' Understandings

The perspectives on the social dimension of sustainable building from users are given by users of DGNB certified buildings and potential users of sustainable buildings. The perspectives are analyzed in order to identify the users' understanding of well-being in a building. The perspective on well-being below is given by a user of a DGNB certified office building:

> "*I'm smiling every morning when I come into this building because the light is great, it is positive, and the surroundings are just fantastic.*" (Interview, user Anne)

This user experiences that the building is contributing to her well-being. The other interviewed user from this building agrees on the positive experience of the building and adds that the spaciousness in the building improves her social interaction with her colleagues:

> "*The light is great and positive. I can actually see people in the building, which brings a smile to my face because I don't feel that I'm sitting completely alone. I feel to a greater extend that I'm a part of the company.*" (Interview, user Gitte)

The positive evaluation can be a result of the fact that the two users have experienced a relocation from an old worn down building two years ago, so they have recently experienced a radical change in work environment. It is not to invalidate the users' statements, but it should be considered that they are influenced by their previous experiences. It can also be questioned if the evaluation would have been as positive if it was given shortly after the relocation, because the users experienced some operational issues in the new building:

> "*When you move into such a building as we did then there were many things which were not optimal. Among others the air-condition and regulation of heat were major issues ... Some were sitting in a lot of draft and some were feeling too warm, some too cold.*" (Interview, user Anne)

This issues were registered and corrected after user complains. Even though it was a long process to correct the issues, the users had the experience that they have been involved, listened to, and informed about the progress. However, they were amazed that so many wise minds within constructing this building could not succeed to a higher degree (interview Anne and Gitte Appendix B.7). The users were therefore also surprised when the building was gold certified within DGNB:

> "*I was a little surprised when we got the certification in the middle of a non-functional indoor environment.*" (Interview, user Anne)

Based on this perspective it can be discussed when a building can achieve its certification. An alternative could be, if a building should be in operation for a certain period of time before being certified. In this period an evaluation e.g. a POE of the operation and user experiences could be conducted and thereby assist in determining if the building meets the certification demands. In relation to this discussion, the interviewed daily operational manager of DGNB buildings expresses, that he has experienced that initiatives made with the purpose of scoring points in DGNB, have been adjusted to fit the use of the building even though it thereby no longer fulfill the original purposes (interview Niels Engstrøm Appendix B.6).

The operational manager is of the understanding that the DGNB certified buildings are more technical than ordinary buildings, which he believes has an influence on the users satisfaction:

> "*The fact that the users can't regulate (temperature) has an effect on the social, meaning the satisfaction. It can become too technical for an ordinary user ... In the health care house in Hurup, you have a bottom you can turn and it is often this that matters. If it works or not is not important it is just about them getting the feeling of doing something.*" (Interview, user Niels Engstrøm)

The technical aspects of DGNB buildings has forced the operational manager to spent some time on acquainting himself with the new systems, since there was no specific handover process. After getting acquainted with the systems he now experiences that his work with the buildings is affected in a positive way because, issues with the systems can be managed from a computer:

> "*For us (operational staff) it is a lot easier, we can send an e-mail explaining that we have fixed the problem instead of having to drive out there.*" (Interview, user Niels Engstrøm)

This way of managing buildings requires an understanding from the users of a given building, about them being excluded from regulating the indoor environment by themselves. Instead they must trust the operating staff and the technical systems.

Another perspective on the understanding of well-being in buildings is given by potential users of sustainable buildings. These perspectives contribute with user experiences that can be supportive in the understanding of what users value in a building.
All four interviewed residents from *Frederikshavn Boligforening* have a similar understanding of how a building contributes to their well-being. The three female interviewees describe how security and a sense of community are valued to a high degree when asked what they value most where they live:

> "*That you feel safe when you walk out of your door and feel safe at home.*" (Interview, user Marna)

> "*That it is safe to be here. We keep an eye out for each other.*" (Interview, user Jette)

> "*It is probably the time we (the other residents) have together. We have a very good sense of community here.*" (Interview, user Helene)

The understanding of well-being as being security and sense of community, can be reasoned in the interviewees age, civil status, and gender. The interviewees are all widows of a relatively high age, why feeling secure in their own home and having social interaction can be seen as having greater significance, than it might would have for other groups of residents. Another aspect, presented by the three elderly women as contributing to their well-being is the accessibility to both the private home and the common outdoor areas.

To the question of what is valued the most by living there, the fourth interviewee answers that he feels proud of living in an environmentally friendly building and he is very pleased with the economic benefits that comes along with living there (interview Keld Appendix B.8).

As it is indicated with the presented understandings of well-being it is seen that there are differences in what is emphasized as important. This can be a result of the building type that the users are referring to here e.g. offices versus private homes. The purpose and functionality of a building can change over time, which can result in a new user segment, why flexibility becomes a necessity in the building design in order to be able to adapt to other understandings of well-being.
The fact that people have different preferences on e.g. an indoor environment, results in a complexity concerning the concept of well-being because there is no definite understanding of when well-being is achieved in a building. Therefore, it is important to consider the type of building and involve the users of a building, in order to integrate the context minded understandings of well-being in a building.

6.2 Comparing the Understandings with Social Criteria in the DGNB Certification

In this section the identified understandings of well-being are compared and analyzed in relation to selected social criteria in the DGNB certification scheme (from table 2.1 on page 8). The social criteria specifically related to a building process are analyzed based on the theory of co-creation and process experiences from professionals and users. The section is structured in different subsections, each subsection addresses different social criteria.
This will create a basis for clarifying how the understandings can be utilized in the DGNB certification in order to add value to the users.

6.2.1 Indoor Environment Criteria

The criteria SOC 1.1, SOC 1.4, and SOC 1.5 concern the indoor environment of a building (see table 6.1).

Table 6.1: Details of the criteria SOC 1.1, SOC 1.4, and SOC 1.5 (based on DK-GBC (2016b)).

Criterion	Purpose	Relevance and focus	Evaluation
SOC 1.1 Thermal comfort	Increase the comfort and the well-being of the users.	Thermal comfort is related to the users' satisfaction with the indoor environment.	Quantitative evaluation of operating temperature and humidity. Qualitative evaluation of draft and other temperature parameters.
SOC 1.4 Visual comfort	Increase the mental and physical comfort of the users.	Lighting in the building both natural and artificial.	Evaluation based on seven predetermined indicators.

Continued on next page

Table 6.1 – continued from previous page

Criterion	Purpose	Relevance and focus	Evaluation
SOC 1.5 The possibility for users to operate the indoor environment	Increase the possibility for users to regulate the comfort.	Users satisfaction and the energy consumption in the building are closely connected with the possibility for the users to regulate the indoor environment.	A qualitative assessment based on six predetermined indicators.

Focusing on these criteria in a building is in line with what was understood as well-being by the users in the DGNB certified office building. The thermal and visual comfort were emphasized as important, however the lack of thermal comfort in the early operation phase caused frustrations and dissatisfaction with the indoor environment.
The focus of the SOC 1.1 is essential for a building suited for people because it is related to the user satisfaction with the indoor environment. It can therefore be questioned, if the evaluation method of the criterion is sufficient when a building is able to achieve a certification with a non-functional indoor environment as presented in subsection 6.1.2 on page 35.
The criterion SOC 1.5 covers an aspect, which the operational manager of DGNB certified buildings stresses has significant influence on the well-being of daily users. The operational manager also stresses, that the technical aspects of user regulation can be made so complex that it does not function in practice:

> "*In the health care house in Pandrup the users were supposed to be able to log in to each room and decide the temperature, but the people in charge of data security did not agree in this solution. So it (user regulation) was not thought trough from the beginning.*" (Interview, user Niels Engstrøm)

As presented in the subsection 6.1.2 on page 35 the operational manager has experienced an eased working procedure with the computer-controlled indoor environment. The criterion describes the possibility of regulating as highly influential on user satisfaction (DK-GBC, 2015). So the positive experience of the operational staff is not necessarily shared by the users, who do not have the physical possibility of regulating their indoor environment as planned. Once again the evaluation method of the criterion can be questioned, because the later change in possibility of user regulation in the health care houses could have had an effect on the certification score and thereby potentially effect the user satisfaction.

6.2.2 Criteria on Outside Areas, Safety, and Accessibility

The criteria SOC 1.6, SOC 1.7 and SOC 2.1 concern quality of outside areas, safety and security, and accessibility (see table 6.2).

Table 6.2: Details of the criteria SOC 1.6, SOC 1.7, and SOC 2.1 (based on DK-GBC (2016b)).

Criterion	Purpose	Relevance and focus	Evaluation
SOC 1.6 Quality of surrounding outside areas	Increase satisfaction with the building and the outside areas with the possibility of increasing social interaction.	Surrounding outside areas that are landscaped simultaneously with the building.	Quantitative evaluation of the quality of the outdoor areas. Qualitative evaluation of building related outdoor areas.
SOC 1.7 Safety and security	Increase security and the experience of safety.	Promote initiatives which increase security and the experience of safety.	Evaluation of clarity at access roads and parking spaces, lighting and security outside work hours. Furthermore evacuation plans, escape routes, and fire safety are evaluated.
SOC 2.1 Accessibility	Ensure equal accessibility for all both indoors and outdoors.	Everybody regardless of disabilities have equal access in line with the other users of the building.	Qualitative evaluation of four specific areas based on current norms within the building regulative.

Focusing on these criteria in a building are by the interviewed residents understood as essential for contributing to the well-being of living there. Therefore, including these criteria will increase the level of social sustainability in buildings.
The purpose of the criterion SOC 1.6 is about increasing social interaction. However, the evaluation method does not precisely state that an evaluation will take place after the outside areas have been taken into use. If a POE is not conducted it is difficult to get an indication of the actual social interaction. This discussion on evaluation can be further transferred to criteria on safety an security, and accessibility. For example the users' experience of feeling safe in a building, which can only be assessed when the users have experienced the building. The point of evaluating after having experiences with a building was introduced during the workshop with building professionals (resume workshop Appendix C on page 63). Furthermore, this approach was stated as an obvious method of evaluating a building by a user of the DGNB certified office building:

> "*Is it not possible just to measure the satisfaction of being here as an employee, more specifically how well we are feeling in the building.*" (Interview, user Anne)

Such an evaluation should be an integrated part of the DGNB certification in the future and could be organized through the POE method. Thereby, the result of the criteria will be based on actual experiences of the users.

6.2.3 Design Criteria

The criteria SOC 3.1 and SOC 3.3 concern the design of a building and to a higher degree the future usage possibilities within the design (see table 6.3).

Table 6.3: Details of the criteria SOC 3.1 and SOC 3.3 (based on DK-GBC (2016b)).

Criterion	Purpose	Relevance and focus	Evaluation
SOC 3.1 Architectural quality	Ensure a high architectural quality and motivate maintenance of the building.	Increased durability and greater redesign potential.	The evaluation can be conducted on the basis of four different evaluation bases; architecture contest, turnkey contract contest, jury assessment, and qualification of af previous investigation.
SOC 3.3 Plan disposition	Ensure the functionality and flexibility of the building to different usage.	Buildings can provide changing purposes of use.	Evaluation based on the variation in possible usage and the quality of the areas in use.

The reason for including these criteria is due to the fact that a building change purpose and functionality over time. This change can result in new users whom might have different understandings of well-being. A flexible building design can support different understandings of well-being by allowing the users to arrange themselves into their preferences of well-being. When focusing on these criteria a building is more likely to secure future understandings of well-being from different users. However, the result of how flexible the design is, is not fully evident until a change in usage is present.

6.2.4 Process Criteria

The criteria PRO 1.1 and Pro 1.2 are both related to a building process (see table 6.4).

Table 6.4: Details of the criteria PRO 1.1 and PRO 1.2 (based on DK-GBC (2016b)).

Criterion	Purpose	Relevance and focus	Evaluation
PRO 1.1 Quality in preparation of the project	Increase the quality and sustainability of the building through early planning and project preparation.	Optimize the planning by identifying the demands of building developer and users.	Evaluation of how the construction plan defines the significant needs of the building developer and users.
PRO 1.2 Integrated design process	Ensure relevant competencies are included timely in the process already in the early phases.	Create the basis for qualifying the solutions and concepts in order to minimize the risk for errors and misunderstandings.	Evaluation of the, interdisciplinarity of the design team and the involvement of users in the planning process.

Criteria PRO 1.1 and PRO 1.2 concern the planning and collaboration in certain phases of a building process, from the precondition phase to the construction phase (see figure 2.3 on page 11). In the early phases the building developer needs to make the decisions on what type of building is desired, this is often done with the future users and their understandings in mind. From the data generation it is recognized that the building professionals emphasize user involvement as a common and important practice in a building process for knowledge inputs, especially in the early phases:

> "*We spend an enormous amount of time on user involvement.*" (Interview, building developer Niels Sloth)

> "*In a new building project we establish a board of residents who we are in dialogue with. A lot of topics come forward, which gives us knowledge about what functions and what does not function.*" (Interview, building developer Sven Buch)

The fact that there is spent a lot of time on user involvement does not necessarily mean that the users experience a feeling of being heard and genuinely integrated in the process. Two residents from the building committee in *Himmerland Boligforening* experience the feeling of being non-influential in user involvement process:

> "*If there wasn't direct legislation on, that there should be a building committee consisting of elected residents then they (the building developer) would rather not have us there we are only trouble ... It is us versus them.*" (Interview, user Tove)

In addition to the quote the residents describe how they see the process of involvement as a struggle, where they are excluded from the decision making process and thereby not fully informed. Examples of where they have been excluded are on the matter of cooker hood and door options, which were practical matters that the residents considered as relevant for their well-being (interview building committee Appendix B10). The experienced lack of actual user involvement in this case may be extreme in comparison with other cases, but the interviewed building professionals also comments on difficulties in including well-being initiatives:

> "*There is a tendency to that it is the social initiatives that are neglected and downplayed due to a lack of measurability.*" (Interview, consultant Claus Topp)

It is the measurability that is the issue with social initiatives when economizing a building project. In relation to the issue of measurability Claus Topp applauds the DGNB certification because the scheme attempts to make social initiatives manageable (interview Claus Topp Appendix B.4). The client consultant Dorte Grøn agrees with the understanding about the lack of measurability resulting in the social initiatives being removed from a building project:

> "*Often it is the social initiatives, the ones we can't put numbers and parameters on and all them without legislative demands, it is these initiatives that are being removed when cost-cutting.*" (Interview, client consultant Dorte Grøn)

Despite the fact that the cost-cutting process concerns the social initiatives and thereby the well-being of the users, there is no tradition for including the users in this part of the building process. This was clarified when the client consultant was asked if the users are part of the main cost-cutting process:

> "*Nope, it is the architect, engineer, and building developer that are involved but no users. The users are usually just informed about the cost-cuttings; too bad you didn't get the 'slide' maybe later but not now.*" (Interview, client consultant Dorte Grøn)

There is a need for a higher degree of user involvement in the cost-cutting phase in order to secure the users understanding of what is seen as contributing to their well-being.
The criterion PRO 1.2 has the purpose of ensuring that relevant competencies are included timely in a building process. With this purpose the criterion has the potential of promoting user involvement in the cost-cutting phase. This focus is positive for the users as they can be seen as relevant competencies and thereby have the opportunity to affect e.g. the cost-cutting process. However, with the above illustrated tradition of user involvement in a building process there is a need for adapting a method of how to involve all actors equally in a building process such as co-creation.

The criterion PRO 1.5 concerns another phase of a building process, which is related to the handing over of a building (see table 6.5).

Table 6.5: Details of the criterion PRO 1.5 (based on DK-GBC (2016b)).

Criterion	Purpose	Relevance and focus	Evaluation
PRO 1.5 Guidance concerning maintenance and use in the building	Ease the future operation of the building by having documentation and guidance available.	Put forward advice and guidance concerning the building to users and owners.	Evaluation based on accessible guidance concerning usage, operation, and maintenance.

PRO 1.5 focuses on guiding the building users in order to ease the future operation of the building. However, the experience of the users and operational manager of DGNB certified buildings is that there is room for improvement in the handing over phase. The operational manager describes how the building was handed over without any transfer of knowledge on operational information, this left him to explore the technical system of the building by himself (interview Niels Engstrøm Appendix B.6). The users of the DGNB certified office building also experienced a lack of communication concerning the details of being a user of a DGNB certified building:

> "*We haven't had an explanation on what it means that the building is sustainable. When we got the certification we were told that it was a certification but we didn't go into detail at all.*" (Interview, user Anne)

In the investigated cases the criterion PRO 1.5 seems to have been overlooked at least in practice. The lack of focus in the use and handing over process could relate to the consultants not having an economic interest in these phases as presented previously (subsection 6.1.1 on page 31). If

the users of the buildings had been involved in the building process through co-creation they could have stressed the value of getting information about using the new buildings. The purpose of the criterion would then have been fulfilled by easing the future use and operation. Furthermore, an argument for focusing on the criterion is, that information about what it means to use a sustainable building will create the foundation for sustainable behaviour among the users (workshop and field trip Appendix C on page 63 and D on page 65).

Through the comparison it is identified that the chosen social criteria in DGNB is in line with the users' understandings of well-being. However, it can be questioned to which degree the criteria are fulfilled due to the lack of post occupancy evaluations. The comparison in the process related criteria (PRO 1.1, PRO 1.2 and PRO 1.5) illustrates that there is a need for an improved interaction between building professionals and users.

Chapter | 7 Conclusion

Through the theoretical framework the concepts *value* and *co-creation* have been investigated, in order to explore how value can be added to sustainable building. In the analysis different understandings on the social dimension of sustainable building and understandings of well-being have been analyzed and compared to chosen social criteria in the DGNB certification scheme. The two research questions addressed in the theoretical framework and in the analysis will serve as the basis for concluding on the problem statement:

How can understandings of the social dimension in sustainable building be utilized in the Danish DGNB certification scheme in order to add value to the users?

In order to utilize the understandings of the social dimension of sustainable building, user value must be seen as the experience of a building. Value is added if the users experience that their understanding of well-being is present in their use of a building.
A collaborative effort in a building process is needed in order to incorporate different understandings of the social dimension, from both building professionals and users. In this process all actors' perspectives on value should be seen as equally contributing to the process, which will create knowledge about fields of expertise from other involved actors and their understandings. By including co-creation in a building project the foundation for a collaborative effort with room for diversity is created. If the willingness of engaging in a collaborative building process is present among the involved actors, then the different actors can be turned into active partners and are able to create value for all involved, based on the knowledge of different understandings on value.
In order to increase the possibility of including users' understandings of well-being in a sustainable building, the concept of co-creation should be included in the DGNB process criteria, which concern the inclusion of relevant competencies in a building process and identification of user demands. By incorporating co-creation in the DGNB certification, the users will be seen as relevant competencies throughout the building project and their understandings of well-being will be integrated and acknowledged, thereby adding increased value to the users than in the current building tradition.

A building process is not complete when the building is put into operation, therefore the DGNB certification scheme should increase the focus on evaluating the criteria when a building is in use. This focus should not only be on the technical aspects of the building performance, but to a higher degree include evaluation of user experiences. By incorporating a method as Post Occupancy Evaluation, the user experiences of a building in use is evaluated, thereby determining to which degree the social criteria in DGNB fulfill the users' understanding of well-being.
Through a Post Occupancy Evaluation the actual understandings of what is valued by the users are captured. These understandings can be utilized to improve the social dimension of current DGNB certified buildings by utilizing the knowledge gained into initiatives, which complies with the understanding of well-being of the users, thereby adding value to the users. Furthermore,

the knowledge gained on the actual understandings of well-being from a Post Occupancy Evaluation, creates the basis for transferring this knowledge to future building processes and adds value to users in future DGNB certified buildings. If Post Occupancy Evaluations are conducted frequently it will create a continuous overview of what is considered as well-being by users. This overview will contribute with data that can be utilized in making well-being quantitatively measurable through indicators thereby, meeting the desired measurability from building professionals. The measurability would to a higher degree support the inclusion of social criteria in future DGNB certified buildings, as the social qualities would become manageable for the building professionals.

Overall, it can be concluded that the understandings of the social dimension in sustainable building can be utilized through the inclusion of co-creation in the process criteria, and through a focus on Post Occupancy Evaluation of the social criteria. Combined these initiatives will improve the social dimension of the DGNB certification scheme as value will be added to the users.

Chapter | 8 Perspectives

From this project it is concluded that value will be added to the users through the inclusion of co-creation and Post Occupancy Evaluation in the DGNB certification scheme. In future research concerning this subject it would be relevant to investigate how co-creation and Post Occupancy Evaluation could be implemented practically in a building project, which is to be built on the basis of the DGNB certification. If such a practical pilot project is established it will not only be beneficial for the users, who will get more focus, it will also be beneficial for the building professionals because they will have a tangible example to draw conclusions from in the future. The learning from the pilot project can support a transition in the building industry towards more social sustainable buildings, where co-creation and Post Occupancy Evaluation are naturally integrated in a building process.
This project is specifically focusing on the users well-being in a building. Another research could focus on a building and its influence on the surrounding community and vice versa. This will require an understanding of a building as an integrated part of the community and not as an isolated island. According to Rambøll (2017) it is therefore important to consider the three dimensions cultural, social and physical value of a community in the planning of a building (see figure 8.1).

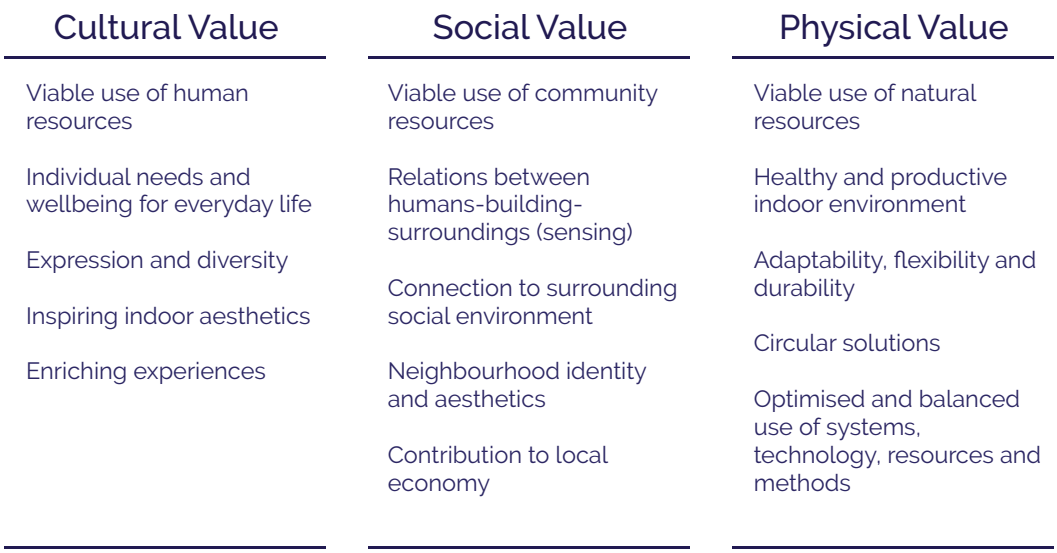

Figure 8.1: The three dimensions on value in Rambøll's liveability approach on buildings (Rambøll, 2017).

If a study on how a building and the surrounding community are influencing each other, trough liveability planning, is conducted. Then it would be relevant to address the results of such a study with the UN sustainable development goal 11 for making inclusive, safe, resilient, and sustainable communities (UN, n.d.). This would be relevant, in order to see if the liveability approach can support the transition towards achieving the sustainable development goals.

Bibliography

Arler, **2015**. Finn Arler. *Bæredygtighed og Bæredygtig udvikling*. In *Bæredygtighed–værdier, regler og metoder*, Editor Finn Arler, Mette Mosgaard and Henrik Riisgaard, chapter 1. Aarhus Universitetsforlag, 2015. ISBN 978-87-7124-311-6.

Bejder et al., **2014**. Anne Kirkegaard Bejder, Mary-Ann Knudstrup, Rasmus Lund Jensen and Ivan Katic. *Energineutralt byggeri: Designprincipper og byggede eksempler for enfamiliehuse*, SBi Forlag, 2014.

Birgisdottir et al., **2013**. Harpa Birgisdottir, Lone Hedegaard Mortensen, Klaus Hansen and Søren Aggerholm. *Kortlægning af bæredygtigt byggeri*, SBi Forlag, 2013.

Bordass and Leaman, **2005**. Bill Bordass and Adrian Leaman. *Making feedback and post-occupancy evaluation routine 1: A portfolio of feedback techniques.* Building Research & Information, 33(4), 347–352, 2005.

Boztepe, **2007**. Suzan Boztepe. *User value: Competing theories and models.* International journal of design, 1(2), 2007.

Branchearbejdsmiljørådet for Bygge & Anlæg, **n.d.** Branchearbejdsmiljørådet for Bygge & Anlæg. *Byggeprocess.dk*. http://www.byggeproces.dk/, n.d. Accessed 15 March 2017.

Brinkmann and Tanggaard, **2010**. Svend Brinkmann and Lene Tanggaard. *Interviewet: Samtalen som forskningsmetode.* In *Kvalitative metoder, en grundbog*, Editor Svend Brinkmann and Lene Tanggaard, chapter 1, page 29–53. Hans Reitzels Forlag, 2010. ISBN 978-87-412-5255-1.

Brunsgaard and Fich, **2016**. Camilla Brunsgaard and Lars B. Fich. *'Healthy Buildings': Toward understanding user interaction with the indoor environment.* Indoor and Built Environment, 25(2), 293–295, 2016.

Building Green, **n.d.** Building Green. *Event info*. http://www.buildinggreen-aarhus.dk/en/, n.d. Accessed 12 April 2017.

Building Green, **2017**. Building Green. *Twitter. Building Green DK*. https://twitter.com/BuildingGreenDK/status/847005568657215489/photo/1?ref_src=twsrc%5Etfw&ref_url=http%3A%2F%2Fwww.buildinggreen-aarhus.dk%2F, 2017. Accessed 12 April 2017.

Bygherreforeningen, Viegand Maagøe and InnoBYG, **2013**. Bygherreforeningen, Viegand Maagøe and InnoBYG. *Hvidbog om bæredygtighed i byggeriet. Et overblik over eksisterende initiativer*, Bygherreforeningen, Viegand Maagøe and InnoBYG, 2013. ISBN 978-87-993249-2-7.

Csikszentmihalyi and Halton, **1981**. M. Csikszentmihalyi and E. Halton. *The Meaning of Things: Domestic Symbols and the Self.* Cambridge University Press, 1981. ISBN 9780521287746.

De Koning et al., **2016**. Jotte I.J.C. De Koning, Marcel R.M. Crul and Renee Wever. Models of Co-Creation. I *Service Design Geographies. Proceedings of the ServDes.2016 Conference*, number 125, page 266–278. Linköping University Electronic Press, Linköpings universitet, 2016.

DK-GBC, **2016a**. DK-GBC. *Skab ny værdi i byggeriet. Dansk DGNB-certificering sikrer bæredygtige bygninger og byområder*, Green Building Council Denmark, 2016a.

DK-GBC, **n.d.** DK-GBC. *DGNB i Danmark*. http://www.dk-gbc.dk/dgnb/introduktion-til-dgnb/dgnb-i-danmark-historisk-rids/, n.d. Accessed 28 April 2017.

DK-GBC, **2016b**. DK-GBC. *Guide til DGNB for bygninger*, Green Building Council Denmark, 2016b.

DK-GBC, **2015**. DK-GBC. *Mini-guide til DGNB*, Green Building Council Denmark, 2015.

DS/EN, **2014**. DS/EN. *Sustainability for construction work – Assessment of Social Performance of Buildings – Calculation methodology*, European Committee for Standardization, 2014.

Ellen MacArthur Foundation, **2015**. Ellen MacArthur Foundation. *Circular Economy Overview*. https://www.ellenmacarthurfoundation.org/circular-economy/overview/concept, 2015. Accessed 15 February 2017.

Energistyrelsen, **2015**. Energistyrelsen. *Bæredygtigt byggeri*, Energistyrelsen, 2015.

Grøn and Tree, **2015**. Dorte Marie Frilund Grøn and Trine Bindslev Rask Tree. *Indfrielse af de menneskelige behov ved social bæredygtighed*. Værdisættelse af bæredygtigt byggeri, 2015.

Grönroos, **2012**. Christian Grönroos. *Conceptualising value co-creation: A journey to the 1970s and back to the future*. Journal of Marketing Management, 28(13-14), 1520–1534, 2012.

Gummesson et al., **2014**. Evert Gummesson, Cristina Mele, Francesco Polese, Marco Galvagno and Daniele Dalli. *Theory of value co-creation: a systematic literature review*. Managing Service Quality, 24(6), 643–683, 2014.

Healey and Healey, **2010**. Mick Healey and Ruth L. Healey. *How to Conduct a Literature Search*. In *Key Methods in Geography*, Editor Nicholas Clifford, Shaun French and Gill Valentine, chapter 15. Sage, 2010. ISBN 978-1-4129-3508-1.

Hill and Bowen, **1997**. Richard C Hill and Paul A Bowen. *Sustainable construction: principles and a framework for attainment*. Construction Management & Economics, 15(3), 223–239, 1997.

Holbrook, **1999**. Morris B Holbrook. *Consumer value: a framework for analysis and research*. Psychology Press, 1999.

Holm et al., **2014**. Jesper Holm, Jesper Ole Jensen, Bent Søndergård and Inger Stauning. *Introduktion*. In *Bæredygtig Omstilling Af Bolig Og Byggeri*, Editor Jesper Holm, Jesper Ole Jensen, Bent Søndergård and Inger Stauning, chapter 1. Frydenlund Academic, 2014. ISBN 978-87-7118-313-9.

Huulgaard and Mosgaard, **2015**. Rikke Dorothea Huulgaard and Mette Alberg Mosgaard. *Ecodesign*. In *Bæredygtighed–værdier, regler og metoder*, Editor Finn Arler, Mette Mosgaard and Henrik Riisgaard, chapter 17. Aarhus Universitetsforlag, 2015. ISBN 978-87-7124-311-6.

Ind and Coates, **2013**. Nicholas Ind and Nick Coates. *The meanings of co-creation*. European Business Review, 25(1), 86–95, 2013.

InnoByg, **n.d.** InnoByg. *Studietur til bæredygtige boliger i Aahus*. https://www.innobyg.dk/aktiviteter/events/studietur-til-baeredygtige-boliger-i-aarhus/, n.d. Accessed 12 April 2017.

International Well Building Institute, **2017**. International Well Building Institute. *About us*. https://www.wellcertified.com/, 2017. Accessed 18 April 2017.

Jaakkola and Hakanen, **2013**. Elina Jaakkola and Taru Hakanen. *Value co-creation in solution networks*. Industrial Marketing Management, 42(1), 47–58, 2013.

Jensen and Sommer, **2016**. Kasper Guldager Jensen and John Sommer. *Building a Circular Future*, 3XN and MT Højgaard, 2016. ISBN 978-87-998670-1-1.

Kitzinger, **1994**. Jenny Kitzinger. *The methodology of focus groups: the importance of interaction between research participants*. Sociology of health and illness, 16(1), 103–121, 1994.

Kvale and Brinkmann, **2009**. Steinar Kvale and Svend Brinkmann. *Interview Variations*, chapter 8. Sage Publications, 2009. ISBN 9780761925422.

nef, **2009**. nef. *Seven Principles for Measuring What Matters: A guide to effective public policy-making*, The economics foundation, 2009.

Ng et al., **2014**. S.T. Ng, M.M. Kumaraswamy and K.K.W. Wong. *Recognizing stakeholders in construction projects as co-creators of value in sustainable urban development: a Hong Kong perspective*. The Sustainable City IX: Urban Regeneration and Sustainability (2 Volume Set), 191, 1165, 2014.

Preiser et al., **2015**. W.F.E. Preiser, E. White and H. Rabinowitz. *Post-Occupancy Evaluation*. Routledge Revivals. Taylor & Francis, 2015. ISBN 9781317498230.

Rambøll, **2017**. Rambøll. *Livable Buildings Concept*, Rambøll, 2017.

Spradley, **1980**. J.P. Spradley. *Participant observation*, page 26–83. Holt, Rinehart and Winston, 1980. ISBN 9780030445019.

Troelsen, **2017**. Maria Troelsen. Users' Experiences with Sustainable Building – A qualitative evaluation. Unpublished semester project Aalborg University, 2017.

UN, **n.d.** UN. *Sustainable Development Goals. Goal 11: Make cities inclusive, safe, resilient and sustainable*. http://www.un.org/sustainabledevelopment/cities/, n.d. Accessed 24 May 2017.

Watson et al., **2016**. Kelly J Watson, James Evans, Andrew Karvonen and Tim Whitley. *Capturing the social value of buildings: The promise of Social Return on Investment (SROI)*. Building and Environment, 103, 289–301, 2016.

World Green Building Council, **2016**. World Green Building Council. *Building the Business Case: Health, Wellbeing and Productivity in Green Offices*, Better places for people. World Green Building Council, 2016.

World Green Building Council, **2013**. World Green Building Council. *The Business Case For Green Building. A Review of the Cost and Benefnits for Developers, Investors, and Occupants*, World Green Building Council and partners, 2013.

Appendix | A
Interview Guides

The interview guides used in the conducted interviews can be seen in the following sections.

A.1 Niels Sloth, Region Nordjylland

Samtale med Niels Sloth onsdag d. 22/2 2017	
Regionens syn på bæredygtigt byggeri	Hvordan arbejder regionen med bæredygtigt byggeri? (tiltag, tilgang) Hvordan tilgår regionen et projekt omhandlende bæredygtigt byggeri? Hvem er den/de styrende aktør(er) for at byggeriet bygges med fokus på bæredygtighed? (er det en selvfølge eller er det til diskussion?) Hvordan følger regionen op på de bæredygtige byggerier? Hvordan arbejder regionen med de forskellige dimensioner af bæredygtighed ved et bæredygtigt byggeri? Hvad er din forståelse af bæredygtigt byggeri? Og hvordan ser du udviklingen indenfor området?

A.2 Sven Buch, Himmerland Boligforening

Samtale med Sven Buch tirsdag d. 14/3 2017	
Himmerland Boligforenings tilgang til bæredygtigt byggeri	Hvordan arbejder Himmerland Boligforening med bæredygtigt byggeri? Hvad er Himmerland Boligforenings forståelse af bæredygtighed i byggeriet? Hvordan arbejder Himmerland Boligforening med de forskellige dimensioner af bæredygtighed ved et bæredygtigt byggeri? Hvordan tilgår Himmerland Boligforening den sociale dimension af bæredygtighed i deres byggerier? Hvilke tiltag er blevet foretaget med henblik på social bæredygtighed i byggeriet? Hvorfor arbejder Himmerland boligforening med bæredygtigt byggeri på den måde I gør? Hvordan følges der op på bæredygtige byggeprojekter? Hvorledes arbejdes der med beboerinddragelse i bæredygtige byggeprojekter? Hvordan vil Himmerland Boligforening i fremtiden arbejde med bæredygtigt byggeri? Hvordan påvirkes bæredygtige byggeprojekter af udefrakommende aktører? (rådgivere, entreprenører)

A.3 Christina Myrdal, Aalborg Kommune

Samtale med Christina Myrdal onsdag d. 22/2 2017	
Aalborg Kommunes arbejde med bæredygtighed i byggeriet	Hvordan arbejder Aalborg Kommune med bæredygtigt byggeri? Hvilke tiltag er blevet foretaget med henblik på bæredygtighed i byggeriet? Hvordan følger Aalborg Kommune op på de bæredygtige byggerier? Hvad er din forståelse af bæredygtigt byggeri? Og hvordan ser du udviklingen indenfor området?
Bæredygtighedsmanualen	Hvad er grundlaget for, at Aalborg Kommune har udformet en bæredygtighedsmanual? (formål) Hvordan arbejder Kommunen med de forskellige dimensioner af bæredygtighed i forbindelse med bæredygtigt byggeri? Hvad er fokus i dette projekt og hvorfor er projektet blevet igangsat?(tilgangen til bæredygtighed)
Green Building A-Z	Hvad er fokus i dette projekt og hvorfor er projektet blevet igangsat?

A.4 Claus Topp, Niras

Samtale med Claus Topp d. 20/3 2017	
Baggrund	Hvad er din baggrund for at arbejde med bæredygtigt byggeri? Hvordan har du arbejdet med bæredygtigt byggeri?
Hvordan arbejder rådgivere med bæredygtigt byggeri (den sociale dimension)?	Hvad er din forståelse af bæredygtigt byggeri? Hvordan vil du beskrive processen i et bæredygtigt byggeprojekt? Hvordan forstår du ved den sociale dimension af bæredygtigt byggeri? Hvilke tiltag mener du er blevet foretaget med henblik på social bæredygtighed i byggeriet? Hvad er rådgiverens rolle i forbindelse med et bæredygtigt byggeri? Hvilken indflydelse har rådgiveren på et bæredygtigt byggeprojekt? Hvem er ansvarlig for rådgivning af de sociale kvaliteter ved DGNB? Hvem påvirker byggeprojekter i en bæredygtigt retning, og hvorledes kommer bæredygtigheden til udtryk? Hvem efterspørger bæredygtigt byggeri? Hvordan tror du, at det vil "se ud" med bæredygtige byggeri i fremtiden? (Vil der være en øget efterspørgsel?)

A.5 Dorte Grøn, DEAS

Samtale med Dorte Grøn fredag d. 17/3 2017	
Baggrund	Hvad er din baggrund for at arbejde med bæredygtigt byggeri? Hvordan har du arbejdet med bæredygtigt byggeri?
Bæredygtigt byggeri + den sociale dimension	Hvad er din forståelse af bæredygtigt byggeri? Hvordan forstår du den sociale dimension af bæredygtigt byggeri? Hvorledes har du arbejdet med den sociale dimension af bæredygtigt byggeri? Hvilke tiltag mener du er blevet foretaget med henblik på social bæredygtighed i byggeriet? Hvem påvirker byggeprojekter i en bæredygtigt retning, og hvorledes kommer bæredygtigheden til udtryk? Hvordan tror du, at det bæredygtige byggeri vil "se ud" i fremtiden?

A.6 Niels Engstrøm operating staff, Region Nordjylland

Samtale med Niels Engstrøm tirsdag d. 28/3 2017	
Baggrund	Hvad er din faglige baggrund? Hvordan har du opnået viden om drift af bæredygtige bygninger?
Idriftsættelse af bæredytige byggerier	Har der været en proces, hvor du som driftspersonale har været involveret i udviklingen af, de bæredygtige sundhedshuse? Har der været en overdragelsesproces, hvor du er blevet informeret om, hvordan de bæredygtige bygninger fungerer? Er du blevet informeret om, hvad DGNB indebærer (certificeringsordningen som sundhedshusene er certificeret efter)?
Drift af bæredytige byggerier	Hvad er din overordnede oplevelse af de bæredygtige byggerier? Hvordan er det for dig at drifte en bæredygtig bygning? Kan du mærke forskel på, hvordan det er at drifte de certificerede bæredygtige,bygninger i forhold til de ikke certificerede bygninger? Kan du give nogle eksempler på, hvornår de bæredygtige bygninger fungerer godt/ikke fungerer?

A.7 Two employees in a Gold Certified DGNB Office Building, Alfa Laval Aalborg

Samtale med 2 medarbejdere fra Alfa Laval fredag d. 24/3 2017
Hvad er jeres overordnede oplevelse af bygningen? Kan I mærke forskel på denne bygning og andre bygninger, der tidligere har fungeret som jeres arbejdsplads? Tror I, at det, at bygningen er bæredygtig, har betydning for jeres velbefindende i det daglige arbejde? Hvad sætter I mest pris på ved bygningen? Hvordan understøtter bygningen jeres daglige arbejdsfunktioner? Kan I give nogle eksempler på, hvornår I oplever, at bygningen fungerer godt og hvornår der er mangler/ting der fungerer mindre godt? Har der været en proces, hvor I som brugere af bygningen blev involveret i udviklingen af bygningen? Har der været en opfølgningsproces, hvor bygningen er blevet gennemgået, og hvor I har været inddraget? Hvad betyder det for jer, at I arbejder i en bæredygtig bygning?

A.8 Two residents in an energy efficient renovated apartment complex, Frederikshavn Boligforening

Samtale med beboere Frederikshavn Boligforening, tirsdag d. 4/4 2017 (energirenoverede boliger)
Hvad er din oplevelse af boligen? Hvad værdsætter du mest ved bo her? Hvad synes du mindst om ved at bo her? Hvordan kan en bolig være med til at skabe rammerne for et godt liv? Ved du om, der har været en proces, hvor beboere har været involveret i udviklingen af bygningen? Har der været en opfølgningsproces på renoveringen, hvor I har været inddraget?

A.9 Two residents in a non energy efficient renovated apartment complex, Frederikshavn Boligforening

Samtale med beboere Frederikshavn Boligforening, tirsdag d. 4/4 2017 (ikke energirenoverede boliger)
Hvad er din oplevelse af boligen? Hvad værdsætter du mest ved bo her? Hvad synes du mindst om ved at bo her? Hvordan kan en bolig være med til at skabe rammerne for et godt liv? Hvis boligen skulle renoveres, ville du som beboer så gerne involveres både før, under og efter en renovering?

A.10 Two members of a building committee, Himmerland Boligforening

Samtale med beboere fra byggeudvalg Himmerland Boligforening torsdag d. 6/4 2017	
Baggrund	Hvor længe har I boet i boligforeningen? Vil I forklare, hvad der skal ske i jeres boligområde? Hvorfor er I en del af byggeudvalget?
Processen	Hvordan har I været involveret i byggeprojektet? Hvordan har processen foregået i forbindelse med byggeprojektet? Har I kendskab til, hvordan den fremadrettede proces vil forløbe? Føler I, at I er blevet hørt i processen? Ved I, om der er planlagt en evaluering af jeres oplevelse af boligerne efter ibrugtagning? Synes I, at processen burde have været anderledes i forbindelse med planlægningen af renoveringen?

Appendix | B
Transcriptions of interviews

The transcriptions and audio files can be found in the uploaded digital appendix.

Appendix | C
Summary of Workshop

Beskrivelse af arrangementet

Arrangementet startede med en præsentation af Marias praktikprojekt. Undervejs blev der lagt op til diskussion af det bæredygtige byggeri med udgangspunkt i brugerne (den sociale dimension). Som afslutning på præsentation blev deltagerne opfordret til komme med deres bud på følgende spørgsmål:

- Hvad forstår I ved den sociale dimension af det enkelte bæredygtige byggeri?
- Har I ideer til og erfaringer med hvordan man inkluderer den sociale dimension i bæredygtigt byggeri?
- Hvordan tænker I, at den sociale dimension af bæredygtigt byggeri kan styrkes - hvad skal der gøres?

Der var en god diskussion med input fra forskellige deltagere. Det var interessant at observere, hvordan de forskellige baggrunde gav forskellige perspektiver på det bæredygtige byggeri. Herudover hvordan denne baggrund også havde indflydelse på deres forståelse af den sociale dimension af bæredytigt byggeri. Nedenstående er en opsamling af nogle af de forskellige perspektiver fra den løbende dialog.

Output af arrangementet

Peter Munk: Få brugerne med til at justere bygningen (måske gennem data fra internet of things) i stedet for at justere bygningen på baggrund af en antagelse. Generelt er der kommet mere fokus på det brede bæredygtighedsbegreb. Nordstjerneskolen (i Frederikshavn) har en efterevaluering hver tredje måned. Det bliver målt på energi ift. at mål bliver overholdt, hvilket kan give en økonomisk gevinst til skolen.
Bæredygtige bygninger skal skabe bæredytige borgere og bæredygtig adfærd.
Der er en problemstilling i efterevalueringen, da der opstår et "trekantsdrama" mellem bygherre, rådgiver og entreprenør, som kan vare årevis, fordi ansvaret for eventuelle mangler og fejl skal placeres.
DGNB spiller fallit, da det ophører idet man er certificeret, den burde være løbende gennem driften.

Tine: Hvad er værdien i det, det skal være målbart, men det er svært at måle. Målbarhed mangler i social bæredygtighed.

Dorte H: På baggrund af erfaringer vurdere hvert eneste byggeri i forhold til hvilken form for bæredygtighed der giver mening (2020, DGNB, passivhus osv.).

Susanne: Point skala til social commissioning evt. smiley-ordning baseret på brugerens oplevede værdier. Hvad er forbedringen af det oplevede indeklima i forhold til det målbare indeklima.

Arne: Space management.

Trine: Nævner bygningsstyrelsen som et godt eksempel, idet de som bygherre først betaler en del af byggesummen, når bygningen er i brug og lever op til performance-krav.

Henrik Dam: Mennesket er et forstyrrende element i bygninger, da bygninger aldrig lever op til beregninger, og i øvrigt er beregningerne meget lettere hvis ikke der tages højde for de mennesker, der skal bruge bygningerne. Dette var der generel enighed om.

Brian: Der skal være samspil mellem alle de tekniske leverancer, hvorfor de tager dette ud af deres udbud. Frederikshavn Boligforening har den erfaring at problemerne med installationerne ofte opstår, når teknikken ikke taler sammen, hvilket den ikke gør, når de enkelte leverandører ikke vil frigive deres data, så de enkelte installationer kan tale sammen.
Brug af 3D/VR modellering til at opdage fejl og mangler inden opførelse af bygningen.

Knot-working blev nævnt som en mulig løsning til hvordan man undgår konflikter i byggeriet.

3D kan være vanskeligt at bruge på byggepladsen.

Generel enighed om, at der mangler erfaringsopsamling på byggerierne. Husk at få erfaringer med til næste projekt. Det er hele mindsettet i branchen der skal ændres for at opnå bæredygtigt byggeri.

Appendix | D
Summary of Field Trip to Building Green in Aarhus

Åbningstale: Aarhus er en by i vækst (Aarhus Kommune)

- Aarhus som kommune blev placeret på dagsorden inden for bæredygtigt byggeri.

Hvordan boostes værdiskabelse for bygherren gennem bæredygtighed?

Paneldebat faciliteret af Building Council Denmark (Allan Werge, direktør Al2Bolig; Gyrithe Saltorp, direktør Bygningsstyrelsen; Jørgen Lang, direktør FEAS; Olav De Linde, direktør Byggeselskab Olav De Linde, Moderator Mette Qvist, direktør Green Building Council Denmark)

- Hvordan man som bygherre fra starten af gør det tydeligt, hvad det er man vil med bygningen.
- At tænke langsigtet ved at tænke over materialer og fleksibilitet.
- Bæredygtighed er sund fornuft
- Brugerinvolvering og brugeruddannelse
- Større interaktion mellem de forskellige aktører i byggeprocessen
- Tænk over den eksisterende bygnings potentiale
- Bæredygtighed handler ikke kun om nybyg, men også om hvordan bæredygtighed kan indarbejdes i den eksisterende bygningsmasse.
- Branchen skal ændre mindset så der tænkes langsigtet, hvor totaløkonomi inddrages
- Som bygherre skal man være specifik i sine krav til bygningen

Byggebranchen i cirkler

Paneldebat faciliteret af Arkitektforeningen (Suna Genholdt, Partner Pluskontoret Arkitekter; Tina Snedker Kristen, Head of Marketing and Communication Troldtekt A/S; Lone Feifer, Programdirektør for bæredygtigt byggeri, VELUX group; Signe Kongebro, Partner and Head of Sustainability Henning Larsen Architects; Rie Øhlenschlæger, arkitekt og ejer AplusB; Moderator Natalie Mossin, Arkitekt og formand for Arkitektforeningen)

- Tænk over hvilke materialer der bruges
- Glem ikke, at jo længere levetid jo mere bæredygtighed. Det handler altså ikke kun om, hvad der skal ske med materialerne når de er udtjente, men også at de har et langt liv.
- Affald skal ses som en ny materialeressource, når der bygges

- Nye forretningsmodeller - leasing - men hvem vil betale for f.eks. servicen dagslys, som er en del af en bygnings klimaskærm? Problemstilling i forhold til nuværende låne forhold ved realkreditinstitutter.
- Der er mangel på pionerer/front movers, som er villige til at afprøve nye koncepter
- Optimal brug af bygninger, så de ikke står tomme på bestemte tidspunkter i døgnet
- Det er for billigt at smide ud - der er ingen værdisætning på affald - eventuelt en pantordning på affald
- Hvis der var viden tilgængelig for bygningsejere om værdien af de forskellige materialer i en bygning. Eventuelt en materialeklassificering, der tydeliggør dette
- Materialerne bliver ikke nødvendigvis behandlet som foreskrevet ude i bygningerne over bygningens levetid, så det kan være svært for producenter at tage dem tilbage, da de ikke har viden om eventuelle forureninger. Det er i hvert fald ressourcekrævende at undersøge dette

Fra affald til arkitektonisk ressource: Fremtidens værdiskabelse i byggeriet

Anders Lendager. Stifter og partner Lendager Group

- Atypisk arkitektvirksomhed, der beskæftiger sig med produktion og brug af eksisterende materialer, strategirådgivning og arkitektur
- Brug af ikke jomfruelige materialer i byggerier
- Hvordan kan materialer up-cycles så de får mere værdi og kan bruges i en anden sammenhæng
- Fokus på reducering af CO2-udledning og økonomi, det sociale aspekt blev dækket ind under design af bygninger.
- Se eksisterende tomme bygninger som en ressource i byggeriet

Arkitektur skaber merværdi

Peter Andreas Sattrup, Arkitekt PhD, Danske Arkitektvirksomheder

- Hvordan er arkitektur med til at skabe værdi i forhold til de tre dimensioner af bæredygtighed - link til eksempelsamling https://www.danskeark.dk/taxonomy/term/3
- For os virkede det som om, at de nogle af de forskellige beskrivelser af værdi i eksemplerne var upræcise i forhold til den dimension de var placeret i
- Der blev lagt op til, at der var brug for mere efterevaluering for at finde ud af, hvilken værdi, der skabes. I eksempelsamlingen havde det været svært at finde dokumentation herom
- Der mangler en metode til, hvordan værdien dokumenteres og evalueres

Hvordan bygger vi den bæredygtige by?

Lisbet Wolters, Stadsarkitekt Vejle Kommune; Peder Baltzer Nielsen, Stadsarkitekt Aalborg Kommune; Stephen Willacy, Stadsarkitekt Aarhus Kommune.

- De tre stadsarkitekter kom alle med et oplæg til, hvordan de arbejder med bæredygtighed i de respektive kommuner Co-creation blev omtalt som en måde at skabe værdi og inddrage borgerne i processen
- Der er brug for en ny måde at tænke byudvikling. Det skal ikke tænkes top-down, men være en fælles proces mellem politikere, byplanlæggere og borgere - alle kan og skal bidrage for at opnå et godt resultat - der er brug for nytænkning
- Der skal i højere grad tænkes i højder, så flere kan bo på det samme jordoverfladeareal
- Parcelhusene skal flyttes ud af byerne - haverne skal væk og der skal i stedet skabes fælles byrum
- Evaluering af om tiltag lever op til det teoretiske udgangspunkt i praksis
- Fokusere på det sociale
- Kommunerne skal bane og vise vejen i forhold til bæredygtighed i byerne
- Der er brug for nye strategier pga. de nye klimamæssige udfordringer - som i øvrigt ikke skal ses som problemstillinger men inkorporeres som nye muligheder
- Det er vigtigt at skabe byer for mennesker
- Involvere alle aktører fra start
- Lave retningslinjer for at undgå uhensigtsmæssig arkitektur
- Mere vidensdeling på tværs af kommuner og eventuelt bidrage til de kommuner, som ikke har stadsarkitekt med viden, ideer og erfaringer
- Åbenhed overfor ideen om social commissioning - altså evaluere byggerierne og byrummene, når de er taget i brug i forhold til brugen og oplevelsen deraf

Developing liveable buildings through smart collaboration

Neel Strøbæk, Group Market Director, Planning and Urban Design, Rambøll.

- Rambøll præsenterede en ny tilgang til byggeri, med hovedfokus i Liveability, hvor mennesket sættes i centrum, ved at fokusere på fysiske, kulturelle og sociale værdier for brugerne. Bæredygtighed ses som en fundamental forudsætning for at skabe Liveability.
- Der skal tages højde for hvor i verden bygningen skal bygges på baggrund af kulturelle forskelle.
- Ved at skabe Liveability får bygningen en øget værdi
- Processen mod Liveability skal indeholde en høj grad af integreret design, hvor aktører med forskellige baggrunde skal samarbejde gennem hele processen.

- Fokus på hver enkelt af de 8 definerede processer af byggeriet (se billeder på google drive)
- Brugernes oplevelse med Bygningen skal evalueres i højere grad end i dag.
- Mangler stadig en metode at måle Liveability på.

Studietur: Bæredygtigt boligbyggeri i Aarhus

Rie Øhlenschlæger, Arkitekt og ejer AplusB; Lars Kvist, Miljøchef Arkitema; Bjarke Mortensen, inspektør Boligforeningen Ringgården; Erling Deigaard, iværksætter andelssamfundet Hjortshøj; Peter Dalsgaard, Arkitekt CUBO Arkitekter; Palle Jørgensen, Direktør Boligforeningen Ringgården, Steffen Maegaard, kompetencechef energi og indeklima MOE; Henrik Laue Poulin, Bygninger og Miljø, Teknologisk Institut.

Første stop var Andelssamfundet, Ringgården adf. 30. Det var rækkehuse opført i 2002 med udgangspunkt i økologisk byggeri.

- Stor inddragelse af kommende beboere, som havde meget klare og specifikke ønsker til byggeriet.
- Løsningerne var ikke afprøvet før, men de fleste tiltag havde et positivt output.
- Fokus på socialt fællesskab - beboerne varetager selv vedligeholdelse af udendørsarealer. Stor ejerskabsfornemmelse af området, hvilket positivt har påvirket vedligeholdelsen og udviklingen af området
- Ca. Halvdelen af de oprindelige beboere bor der fortsat Vi var inde og se en af rækkehusene
- Ca. Halvdelen af de oprindelige beboere bor der fortsat
- Vi var inde og se en af rækkehusene

Andet stop var Aarhus Kommunes boliger for 16 voksne med udviklingshæmning, Vimby, som er en del af Andelssamfundet Hjortshøj. Beskyttede boliger opført 2012-2014

- Andelssamfundet inviterede Aarhus Kommune til at bygge boligerne der
- Der var fokus på at gøre området til en del af det eksisterende samfund, hvorfor der går stier gennem området Beboernes arbejdsfunktioner såsom bageri er en integreret del af hele andelssamfundet, da produkterne bliver solgt til de andre beboere.
- Fokus på at give beboerne deres "eget" hus for at kunne spejle sig med familiemedlemmer og venner (det normale samfund)

Sidste stop: Bakkehusene afd. 38, Boligforeningen Ringgården, Rækkehuse med 50 boliger, som er opført 2017.

- Hybrid konstruktion med beton lejlighedsskel og præfabrikerede lette facader energiklasse 2020 uden brug af solceller
- Ifølge kræfterne bag, er det opført med C2C tænkning (f.eks. er det let at udskifte enkelte dele af facaden)

- Vi blev vist rundt i en af lejlighederne af en inspektør (Bjarke Mortensen), som beskrev nogle af driftsovervejelserne bag bygningerne f.eks. at der var opsat savsmuldstapet selvom at dette blev debatteret heftigt med arkitekterne.
- Der er ingen haver, men i stedet er området designet til social interaktion og fællesskab
- Der var lavet en undersøgelse af, hvem de nye beboere er.
- Bygningernes bæredygtighed var årsag til at flere havde valgt at bosætte sig der.

Afslutningsvist på turen fik vi en præsentation af LCA-beregninger for byggematerialer - det tog udgangspunkt i et MUDP om bæredygtigt byggeri, hvor forskellige demonstrationsprojekter med undersøgt og vurderet. Vigtigheden af database-valg i forhold til LCA analyse blev understreget, da det kan påvirke det endelige LCA resultat betydeligt.

Samtale med Rasmus Olsen, Marketing og PR Green Building Council Denmark.

- DGNB er stadig under udvikling
- Det er ikke et rammeværktøj der nødvendigvis sikrer at bygningen er god, det er guidelines til branchen for at vise hvilke parametre der kan fokuseres på. Det er dog op til den enkelte bygherre at vælge, hvor man vil fokusere.
- Der arbejdes på at der i fremtiden kan laves evalueringer.
- Videreudvikling af DGNB gør at guld/sølv certificerede bygninger i dag nødvendigvis ikke er guld/sølv certificerede i fremtiden.
- Mener også at det er vigtigt at man ikke fastlægger en specifik metode for hvordan dette måles, da det kan skabe andre problemstillinger.
- Anerkender at det er vanskeligt at måle på den sociale dimension af DGNB certificeringen som ikke omhandler specifikke tekniske krav.

Andet

Udover at deltage i de forskellige oplæg præsenteret ovenover og studieturen gik vi rundt på konferencen og talte med personer fra de forskellige stande samt andre deltagere. Dette var med til at give indblik i nogle af de tekniske løsninger der findes på markedet i forhold til at bygge mere bæredygtigt.