

Steps towards circularity in the Swedish construction sector

Abstract

The high impact from the construction sector on the environment requires actions to reduce production of greenhouse gases. This is displayed in corporate sustainability reports of the four biggest construction companies in Sweden. The research presented explores where major construction companies put their focus regarding the environmental dimension and how this has developed, how this shows increased circularity in the sector and where in the business models circularity and sustainability has the highest impact. The studied companies display a homogenous picture with some variation, with a focus on areas with heavy climate impact as well as areas covering reducing, reusing, recycling and recovering materials in production/distribution and consumption processes. Major emphasis is on new projects and their execution. Tangible parts of the business are firstly in focus due to fast results, but more slow-moving aspects increasing circularity and sustainability are also conducted for long term effects and development.

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Authors names and affiliations

John Lindgren

PhD, Senior Lecturer, Construction Management

School of Business, Innovation and Sustainability

Halmstad University

Christian Koch

Professor Green Business Development

Faculty of Business and Social Science

University of Aarhus

Antoine Manès

MSc, PhD-student, Green Business Development

Faculty of Business and Social Science

University of Aarhus

Introduction

It is paramount that the construction sector decreases its environmental impact as it is one of the largest contributors in the world regarding negative environmental impact (Berardi, 2017). This has not least been highlighted and emphasized through the setting of agenda 2030. Accordingly, many companies globally publish sustainability reports to display their actions and intentions for sustainability. These reports are often framed using the GRI-standards (Gallego-Álvarez et al., 2018), which creates a common language for organizations to report on their sustainable impact. In Sweden, sustainability reporting has become a requirement by Swedish law for companies fulfilling two of the three following criteria: more than 250 employees; a total balance of more than 175 MSEK; a turnover of more than 250 MSEK. This means that many construction companies are under the obligation to create such a report. However, while the GRI framework is quite comprehensive, companies prioritize their attention and the sustainability reports present different areas on which the organization focuses. Furthermore, the reports often include different types of

measurements illustrating both the status and development of highlighted areas. This reminds us about the saying, what gets measured gets done, emphasizing the importance of measurements to show progress regarding sustainability.

Alongside sustainability, there has also been a growing focus on circularity and the concept of Circular Economy. CE can be understood with a plethora of approaches. Analysing 114 definitions of the concept Kirchherr et al (2017: 229) define CE as "*an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes*" (Kirchherr et al 2017: 229). This concept clearly drives sustainability forward while affecting society and organisations. For the building sector, as a major source for negative environmental impact, the focus on CE is a valid and promising avenue of sustainability. A connected area is also research on business models, where a pragmatic view is that these provide a holistic view of how companies work (Magretta, 2002) and also enables to see the interrelation between the cornerstones of organisations and how they actually work. When studying different themes of interest the business model concept enables the possibility of putting these themes of interest into context. Many different views exist but one way of seeing it is that it describes alignment between a company's offering, its internal and external resource base and activity systems (Normann, 1975, Hedman and Kalling, 2003). It is clear that Circular Construction requires an understanding and development of the company's Business Model as the set of activities, resources and capabilities within the firm or beyond it with the cooperation with partners, suppliers and customers (Zott and Amit, 2010). The framework of Business Models fits particularly well with the thinking about sustainability and circularity as they "*provide a structured way for sustainable business thinking by mapping the purpose, opportunities for*

value creation across the network, and value capture (how to generate revenue) in companies." (Bocken, et al., 2015: 67).

In the research context for this paper advancement of the area into circular business models becomes of special interest. Relying on Lüdeke-Freund et al. (2019) review of circular business models, "*The overarching goal of CEBMs is to help companies create value through using resources in multiple cycles and reducing waste and consumption*" (pp 41).

Furthermore, in this research they show opportunities related to value proposition, value delivery, value creation and value capture and they are a selection of typical CEBMs based on these four key areas.

To summarize this introduction, it is evident that both sustainability and circularity are important focus areas and this work is displayed through the sustainability reports. Since they are necessary to produce according to Swedish law, there are naturally a number of construction organisations that need to produce such a report and these can provide good views on what is in focus, how it progresses and how these organisations are moving towards improved sustainability and circularity. Hence, the purpose of this paper is to review and analyse the environmental dimension of sustainability and treat the following research questions based on a study on their sustainability reports:

- Where do major construction companies put their focus regarding the environmental dimension and how has this developed? (1)
- How does this show increased circularity in the sector? (2)
- Where, at the moment, in the business models does circularity and sustainability have the highest impact? (3)

Methodological approach

This study takes its basis in studies of sustainability reports of the four biggest construction companies in Sweden. The Swedish construction federation publishes annually and the selected companies are from the list from 2020 (Byggföretagen, 2021). The companies are PEAB, Skanska, NCC and Veidekke (where PEAB is the largest and Veidekke the smallest of the four). These reports were studied with the focus of the paper, i.e. what are the companies focusing on in terms of reducing the environmental impact, how is this measured, what do the companies emphasize in terms of circularity and what can be stated about the level of circularity? This basically addresses the first research question. The second and third research question are analysed in relation to the value proposition, value delivery, value creation and value capture.

Using annual reports as a source is not unproblematic. Annual reports are external corporate communication vessels with a marketing dimension (Frandsen and Johansen, 2011). However, sustainability annual reports are also directed towards the creation and redefinition of the company's service offers (Cova et al 2002). While the new concepts presented in the annual reports might be detached from the internal working activities (Frandsen and Johansen 2011), they contribute to corporate identity and impact external stakeholder (Brunton et al 2017, Frandsen and Johansen 2011). Nonetheless, we will remain critical toward the empirical material and use our knowledge of the case companies gathered as validation tool. It is thus maintained as a limitation that annual reports are limited sources and the aim is to develop future research to provide evidence of the development of the case companies.

Key Insights

The studied companies seem well aware of the increased pressure on improving sustainability from their context and the need to cooperate in their network. They all emphasize reduction of climate impact and Co₂-emissions as central and with some variation they focus on the same areas. Skanska stresses development as a key in their work and emphasizes better choice of materials, better resource-efficiency, circularity, zero- and plus-energy-houses. NCC focuses on the construction process, decreased usage of newly-produced material, waste reduction and separation of waste, i.e. reducing and reusing waste. NCC also participates in different strategic innovation efforts such as Smart Built Environment, InfraSweden 2030 and Re:Source. PEAB, besides reduced climate-impact, focus on resource efficiency and removal of environmental and health damaging products and highlight use of digital tools to increase efficiency and move sustainability work forward. Veidekke began in 2010 with efforts to create material balance between the company's activities and the emissions carried by the individual materials from their supplier. They participated in a nationwide project aiming at monitoring the CO₂emissions of the company and managing the risks and opportunities in climate change. Veidekke, as the rest of the companies, have a ISO14000 certification in a majority of their organization and CDP has awarded them for being in the top rank. In 2020 they also mapped the climate-impact from their industrial branch, that supports them in their strategic work.

Regarding emissions all companies have identified production of asphalt as a major development area. Skanska has nearly climate-neutral asphalt, where the manufacturing is driven by fossil-free-fuel, combined with the use of recycled asphalt and a binder from the forest. NCC works with reuse of material in the production of roads, constantly reviewed since it stands for a majority of the company's Co₂emissions. At PEAB, Co₂-neutral bio-oil is used in the manufacturing and 95 % of the produced asphalt is so called ECO-asphalt (reducing Co₂-emissions with about 50 percent). Furthermore, the reuse of asphalt has increased from 14 percent in 2014 to 22 percent in 2020. To

decrease environmental impact, Veidekke are converting their factories into using renewable energy sources, low temperature asphalt and plant-based oil as binder and also reuse used asphalt. All the companies furthermore focus on concrete since it is a major source for pollution. PEABs ECO-concrete is an example where slag from steel-manufacturing is used, resulting in a reduction of climate impact with 50 %, besides also having a longer life-cycle.

Reviewing the emissions in figures, Co₂-emissions is central for all the companies and a quite drastic decrease over a term of three years (for example Skanska -34 % and NCC -42 %) is visible. For PEAB there was an increase due to purchase of companies and businesses through the year, but the aim is still high and forward-viewing. For Veidekke, in 2019, when the company shared the evolution of their CO₂emissions it showed an increase in the previous three years. It is around that time that the company embraced new ways to reduce their environmental impact by creating a data base of material and dynamic layouts of transportation on site to optimize it thus showing an important reduction in their Co₂ emissions in 2020. The measurements regarding Co₂show a decrease with 11 % between 2019 to 2020 and the largest polluter is the asphalt production, with an increase from 2019, due to lower production with smaller batches. Otherwise, the companies display a few measures allowing for an openness regarding the development of the environmental work.

Another apparent area that all companies work with are certifications of different kinds. Skanska works with Living building challenge, BREEAM, LEED, "Miljöbyggnad", Svanen and RTS, PEAB work with Svanen, BREEAM and LEED. In this area, Veidekke regards their work with environmentally certified projects and to define those certifications on regional or industry wide contexts. There has been an evolution of those certifications over time but more importantly there was also an evolution of the way the company trained their employees and shared the experience obtained during those projects. They started in 2010 with a handful of projects and quality certification but in more recent years they have developed several programs for experience sharing while trying to position themselves as industry leaders over the years when it comes to those certifications. Veidekke also

won a prize for LEED-project of the year in Sweden Green Building Awards. Their main aim in this project was to prolong and reuse the original building as much as possible. For example the façade was taken down, cleaned and reinstalled and they made a green area on the roof. Excess material from the renovation was also reused in other projects.

The transition to renewable energy is also a common theme among the companies and also to use electricity when possible as well as using less energy. NCC for example work with reduction of energy usage in commercial buildings and housing. The companies furthermore work with other areas benefitting nature. Skanska work with other areas to reduce environmental impact such as reuse of water and more niched use of water (for example flushing toilets with so called grey water). PEAB actively promotes biological diversity and local eco-systems. In their examples they state that they want all business areas to cooperate and in one example they work with green roofs, rain gardens that filters storm water and more sustainable building materials. Veidekke also work with low-polluting transport alternatives, such as hydrogen-driven ships for transportation and also electrification of machines and vehicles. Another area that they work with is having construction sites that are fossil-free.

Notes on circular actions

Skanska stresses work to take place from design to demolition. They work with a tool they call the colour palette, which defines their vision of working with zero environmental impact. Another example is that they work with upcycling, i.e. new use of old materials. NCC also stresses circularity frequently in their report and stresses work with design that enables reuse and recycling. They stress and put emphasis on how they can work with materials and design and also the importance of working with this throughout the process. They also stress digitalization as a key ingredient to in different forms assess and simulate the use of materials in order to reduce environmental impact.

For PEAB circularity is about sorting waste and having good receivers of it, which is why they establish good cooperation with actors in this sector. They also highlight as an example that waste of

insulation goes back to the supplier to be reused in production. Excess masses are also recycled and has resulted in a decrease of waste placed in landfill with 80 percent. They also work with innovative design to reduce energy consumption and protect biological diversity. They also work with traceability to find more environmentally friendly products and reduce negative impact in the future. In terms of circularity, for Veidekke the term “circular” appears for the first time in 2019 two times in the report concerning identifying “opportunities for reuse in order to reduce materials consumption and the volume of landfill” when older buildings are demolished for a specific project in Norway. In 2020, “circular” is also mentioned once in the report about reusing crushed concrete and the launching of a long-term innovation collaboration with Norsk Gjenvinning focused on achieving 100% reuse of unpolluted heavy spoil.

Discussion and conclusions

Regarding the focus areas from an environmental perspective, the organizations show a quite homogenous picture, with some variation. In many ways the companies highlight the same areas, for example asphalt and concrete manufacturing since it has heavy climate impact and more environmentally friendly concrete is also a focused area, as well as other known high impact areas such as transportation. The findings indicate, based on the homogeneity of the companies’ efforts, that they work with the areas that are the heaviest polluters and also areas where solutions seem easy to find. This is also evident in terms of what the companies measure, which overall points towards the same areas, overall showing major improvements, but still a long way to go to central climate targets. It is also quite evident that major emphasis is placed on the production of new projects and their execution, but examples of renovation is also highlighted by for example Veidekke. A major part to reduce climate and environmental impact is to work with current buildings and in this

area, there seems to be a lot of potential for the future. Furthermore, the reduction of fossil-based is an apparent area at all companies.

Going back to the question about how increased circularity and “*reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes*”, the companies all work hard in reducing the amount of materials that become waste and are measuring this. Areas that proliferate in this case is to work with better planning and digitally. This seems to be of great help, but traditional linear material consumption continues, and examples are also shown that excess material is returned to the factory. Hence, viewing the results, the companies are working with all the identified parts of circularity above.

In terms of value proposition, I.e products and services, the most evident part seems to be regarding the products, possibly because it is a typical area that is easy to grasp. Reviewing this in relation to the typology by Lüdeke-Freund et al, the area from a product point of view, that is more complex, concerns long-lasting products. Construction outputs are typically long-lasting and a known factor in construction to reduce impact is to prolong the life-length of the building objects. There is also exhibited an increased focus in reuse of products. Examples of these efforts is shown in the reports, but major emphasis seems to be on new-production. The accompanying services to circularity come as an add-on to the product developments but tends naturally to be an enabling factor for circularity. The companies highlight that they work with different actors in the construction process and also with other stakeholders, so this part of the discussion naturally leads into the partner and value-creation part of the business model. The move forward are depending on both cooperation with and interest from other partners/stakeholders and joint improvement of

the circularity by all parts. They must cooperate in new ways ways. This is highlighted by the companies in different ways.

The value delivery and value capture can be discussed and analysed together. It is not possible to see from the sustainability reports how the increased sustainability and circularity pays off, but overall, the profit margin seems at its long-term average level for the companies. The sustainability effort is possibly not only a cost, but also key to creation of new turn over. This commercial aspect also raises questions to what degree the customers pay for the efforts made and how this value creation and revenue streams are managed?

To conclude, tangibility seems to be a major focus for construction companies regarding sustainability and circularity. The main focus seems to be in the value proposition and the products offered, especially in terms of new-production, but also to some extent regarding extension of life-length in existing buildings. This is enabled by surrounding work in the more intangible service part, where perhaps environmental certification and the future obligatory law-based climate declaration is the most evident support process to increase sustainability. Necessity of the other parts and activities to conduct in the business model is evident, but a need for further studies is also evident. Mapping the company's business models in detail and more exactly how they work and how diverse is necessary. It can however be concluded that from the sustainability reports, the companies seem to work with the same areas to lower their environmental impact. The study here can be used as a point of departure for further studies, preferably case-studies with several types of data sources, to provide a more deepened picture of what takes place and how sustainability and circularity are moving forward.

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