SUSTAINABUILD

Analytical Framework

Project Result 1

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SUSTAINABUILD

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1. Introduction

The sustainable development goals (SDGs) were approved by the General assembly of the United Nations in 2015 and became implemented as a part of Agenda 2030. Since then, nations worldwide have applied the goals in their policies. European Union and EU countries have launched many policies and agendas approaching the different parts of SDGs. During the past few years, one of the main focuses has been fighting against climate change and the greenhouse effect.

The construction industry has much to give to sustainable development. Energy efficiency, carbon neutrality and waste management are essential both in the construction process and in the end products: buildings, houses, and homes. The life cycle assessment emphasizes that the building phase is not the only one to be considered when evaluating the impact of the construction on the climate and nature overall. Good and thorough design, wise living, well-planned maintenance and renovation, and finally, careful demolition, reuse and circularity have significantly impacted climate and nature over the years.

However, considering the climate and nature is only one part of sustainability. The sustainability and SDGs derived from this concept also cover economic, societal, and human dimensions. Unfortunately, these are often omitted or forgotten in discourse concerning the construction business. Although it is difficult or even impossible to directly promote such SDGs as 'No poverty' or 'Zero hunger' in the construction industry, there are many opportunities to impact these issues indirectly.

1.1 Reading guide

This report presents a strategic design framework on how to integrate the SDGs into construction projects. It will provide insights into the current state of implementation of the SDGs in construction in the partner countries, through national surveys and current local needs in the industry. These valuable insights will be used as a foundation for developing a new bachelor course for construction engineering students, and a handbook aimed at practitioners in the construction industry. The report is the project result of WP2 in the SUSTAINABUILD project.

The report starts with a brief introduction regarding SDGs (Section 1), this actual reading guide (Section 1.1), a short description of the SUSTAINABUILD project (Section 1.2), an overview of the implementation of the SDGs in the construction industry, and a summary of the main conclusions drawn along the analytical framework (Section 0). Then, a literature review is presented (Section 2), followed by the methodology (Sections 3.1 & 3.2), results (Sections 3.3 to 3.7) and conclusions (Section 3.8) of a survey and the methodology (Section 4.1), results (Sections 4.2 and 4.3) and conclusions (Section 4.4) of some focus group interviews. Note that several of the latter sections are subdivided to show the input received by each partnered country (Belgium, Denmark, Finland, and Spain). Finally, there will be general conclusions and recommendations for the academic course and the handbook to be developed in WP3 and WP4 respectively (Section 5). Additionally, some complementary information is presented in the appendices.

1.2 SUSTAINABUILD project

SUSTAINABUILD will support three higher education institutions in Denmark, Finland, and Belgium and a construction business association in Spain to develop activities to foster the acquisition of interdisciplinary green skills. The aim is to wake awareness towards the environmental challenges among students and lecturers. The activities to be developed will be based on state-of-the-art research and solid inputs and needs provided by several

stakeholders, the so-called quadruple helix that consists of industry, academia, public bodies and citizens.

Therefore, this project aims to equip students in construction engineering programs through increased sustainable knowledge, awareness, and interdisciplinary green sectorial skills in an international perspective by using innovative digital didactic learning methods and tools. Additionally, SUSTAINABUILD aims to provide valuable insights into the built environment's contribution to practitioners and lecturers within the field and to ultimately push the sustainability agenda in Europe and accelerate the implementation by offering internationally exchangeable ideas and good practices.

1.3 State of implementation of the SDGs in the construction industry Denmark, Belgium, Finland and Spain

The fight against climate change is an **urgent topic** on national, EU and global scenes recognizing the crucial role of higher education institutions in contributing to the changes needed to become climate neutral by 2050. Developing competencies and future-oriented curricula that meet the needs of the so-called quadruple helix are highly required as the construction industry holds great responsibility and potential for supporting this agenda. Developing green sectorial skills and future-oriented curricula are essential for preparing students, lecturers, and practitioners to become actual change factors. The **construction industry** is responsible for 40% of energy use, one-third of greenhouse gas emissions worldwide, and has one of the most significant waste streams generated within the EU[1]. This underpins the urgency of addressing the environmental aspects, supported by the EU Green Deal strategy, the Paris Agreement, and the UN's 2030 Agenda for SDGs.

The implementation level of the SDGs can be studied by analyzing the relationship between this framework and companies, academia, public bodies and citizens. According to the findings of preliminary research approaching the topic, it can be said that the implementation level of the SDGs is medium-low, in any case, with significant room for improvement. However, some **differences between the countries** participating in this project can be mentioned. For instance, Spanish companies do not know the importance of SDGs in managing their customer relationships. It must be noted that this **lack of awareness** about the SDGs is still present in higher education despite the **commitment** to the new sustainability trends in the construction industry. The willingness to improve SDG knowledge to include the framework in the future is, nevertheless, generalized among teachers and professors. Other public bodies are also carrying out activities to involve the citizens in the topic, as they are perceived as the primary stakeholders in leading the movement towards implementing the SDGs in the sector.

1.4 The SDGs and the EU taxonomy

The EU taxonomy[2] is a new framework that aims to classify any economic activity according to its degree of sustainability. It was developed to provide a common language for different stakeholders (academia, industry, public bodies, citizens) to clearly identify green activities. The EU taxonomy focuses on the objectives presented in **Fig. 1**.

[1] Eurostat, 2020. Final energy consumption by sector [WWW Document]. URL https://ec.europa.eu/eurostat/databrowser/view/ten00124/default/table?lang= (accessed 06.02.23).

[2] https://eu-taxonomy.info/info/eu-taxonomy-overview

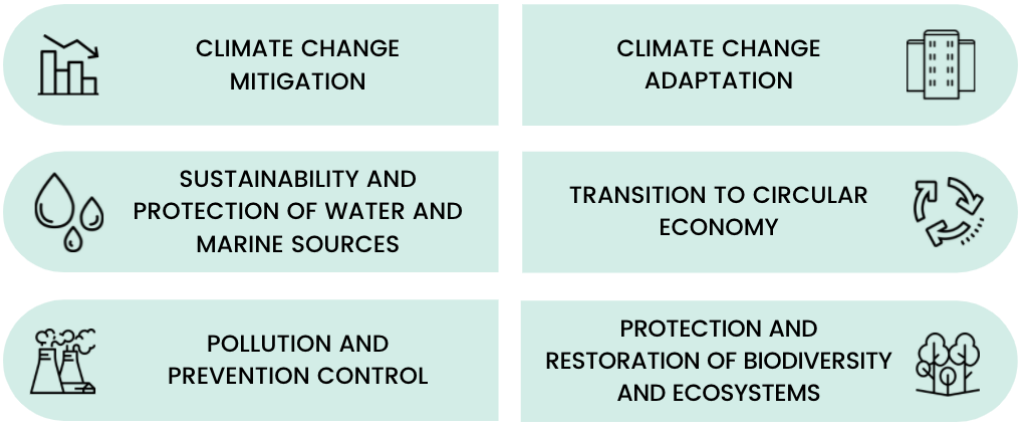

Fig. 1: EU taxonomy environmental objectives

The EU Taxonomy is an essential tool to achieve the objectives of the EU Green Deal, as it provides a framework for directing sustainable investments and ensuring the transition towards a climate-neutral economy. The green deal was established in 2019 and its objectives are shown in **Fig. 2**.

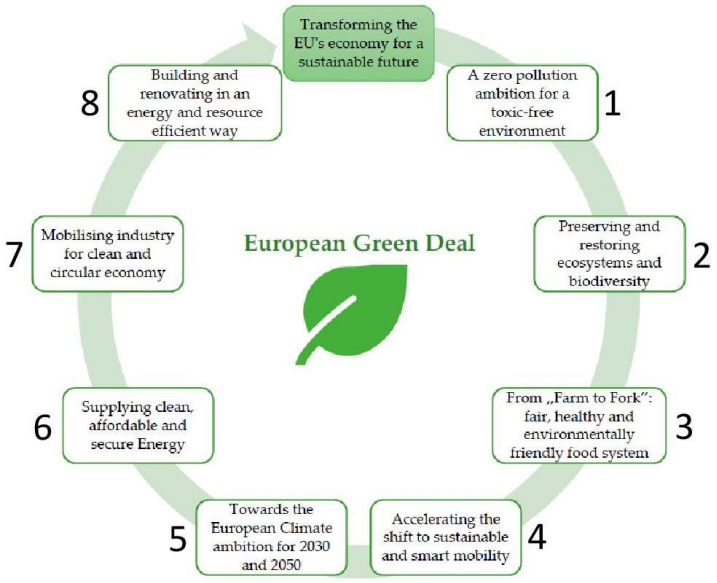

Fig. 2: Green deal objectives[3]

[3] Smol, M., Marcinek, P., Duda, J. & Szoldrowska, D. Importance of Sustainable Mineral Resource Management in Implementing the Circular Economy (CE) Model and the European Green Deal Strategy

The SDGs cover a broader range of issues, not only environmental, but also social and economic. However, they have been related to the green deal by some authors[4]. Therefore, with an ample interpretation of the EU taxonomy objectives, a relationship between the SDGs and the novel EU taxonomy can be proposed as in **Table 1**.

Table 1: Relationship between the EU taxonomy and SDGs, through the green deal. *Green deal objectives numbers as in **Fig. 2**

	EU taxonomy	Green deal*	SDGs
1	Climate change mitigation	3 4 5 6 7 8	All (except No.5)
2	Climate change adaptation	5 8	
3	Sustainable use and protection of water and marine resources	1 5 7	
4	Transition to a circular economy	7 8	
5	Pollution prevention and control	1 3 4 6 7	All (except No.5)
6	Protecion and restoration of biodiversity and ecosystems	1 2 3 5 6 7 8	All (except No.5)

[4] Koundouri, P., Devves, S. & Plataniotis, A. Alignment of the European Green Deal, the Sustainable Development Goals and the European Semester Process: Method and Application

1.5 Main conclusions

The main conclusions obtained from the SUSTAINABUILD project can be summarized as follows:

- The analysis of the current literature regarding the SDGs, surveys, and focus group interviews are valuable methods to advance a change **towards** better knowledge and **effective implementation of the SDGs** in the construction industry.
- Any action regarding implementing the SDGs in the construction industry should be approached from both **European Union and national points of view**.
- Although all the topics related to **sustainability** that can fit the SDG framework are generally known, there is a lack of knowledge regarding the **framework**.
- There are **legislative and economic barriers** to implementing the SDGs in the construction industry.
- The industry considers the SDGs a **valuable tool to improve** their environmental impact and overall efficiency. Companies and other organizations are willing to integrate the SDGs into their business strategies if they have not done it yet.
- Usually, the SDGs are not integrated into higher educational programmes. However, most of the **academia** members are **committed** to change this situation. It must be noted that not only the knowledge regarding the SDGs is essential, but also the **awareness** of the framework and sensitivity to apply it with regard to any action.
- There is a **lack of consistency** regarding the support for implementing the SDG framework in the construction industry when it comes from the **public bodies**. There are significant differences between European countries.
- People not belonging to the industry, academia, or public bodies but related to the construction industry (**citizens**) consider that the government has the main responsibility for the implementation of the SDGs and believe that the SDG framework would **improve** their quality of life, the environment, and the reputation of the construction industry.
- A **holistic approach** should be used in creating learning and dissemination materials for the SDGs in the construction industry (the **course** and **handbook** to be developed in WP3 and WP4 for the **SUSTAINABUILD** project).

2. Literature review

This section aims to present relevant information regarding the links between SDGs and the construction industry. The collected information can be divided into academic literature (section 2.3) and non-academic literature (section 2.4). The academic literature review provides a state-of-the-art overview of links between the SDGs and the construction industry found in the academic literature. On the other hand, the non-academic literature reviews present the core non-academic literature, policies, regulations, assessment methods, etc., relevant to the construction industry in Denmark, Finland, Spain and Belgium. In this way, the report provides a research-based, international foundation for how the construction industry can contribute to achieving the 2030 Agenda and the experimental conditions in the four respective countries.

2.1 Academic literature review

2.1.1 Methods

The academic literature review has aimed to investigate how the construction industry can contribute to the SDGs on a project level. The review was conducted using a four steps review process, following Martins et al. (2019)[5]:

a) Formulating the research question
b) Selection and evaluation of studies
c) Analysis of the content of the selected articles
d) Reporting the results

The research question leading the literature search was: “Which explicit links of the contribution of construction projects to the 2030 Agenda exist?” The investigation is limited to explicit links, meaning that the SDG contribution(s) have been stated in the included publications. Both journal and conference publications in English were included. The scale is limited to construction projects on a building level (and, e.g., not urban areas) and construction materials. Literature searches were performed in Scopus and Web of Science 26, using variations of the search strings: ”SDGs” OR ”SDG” OR ”2030 agenda” OR ” post-2015-agenda” in combination with “construction” OR “buildings” OR “built environment”. The articles found in the databases were then screened for relevance by reading the title and abstracts. Twenty-six papers were included for analysis. The content of the papers was analyzed for the contribution to the SDGs.

2.1.2 Results

The academic literature review results will be found in a journal paper published in the Journal of Building Engineering before the summer of 2023. Below is a summary.

The results showed that the SDGs most often referred to in the research in the area of sustainable construction are SDG 11, SDG 9, SDG 13, SDG 6, SDG 7, SDG 8, and SDG 12. They are followed by SDG 3 and SDG 15. On the other hand, SDGs 2, 5 and 16 were the least mentioned in the reviewed literature, while SDGs 1, 4, 10, 14 and 17 were only included in a few studies. The results of the review have been structured concerning the 17 SDGs, and the contribution to each has been elaborated. A conceptual framework was developed to reflect the SDG state of the art of the construction industry and guide practitioners and researchers in implementing the SDGs in construction projects. Furthermore,

[5] Martins, V. W.B., I. S. Rampasso, R. Anholon, O. L.G. Quelhas, and W. Leal Filho. 2019. “Knowledge Management in the Context of Sustainability: Literature Review and Opportunities for Future Re-search.” Journal of Cleaner Production. https://doi.org/10.1016/j.jclepro.2019.04.354.

insights for enhancing the construction industry's contribution to the SDGs are proposed, along with suggested directions for future research.

2.2 Non-academic literature review

This chapter presents the results of the national literature review of the relevant literature in Belgium, Denmark, Spain and Finland on the relevant requirements, policies, initiatives, assessment methods, etc. for sustainable construction. First, the following paragraphs show a national non-academic literature review for each participating country. After that, some discussion regarding the gaps encountered will be presented, and the principal conclusions will be drawn.

2.2.1 Methods

Regarding non-academic literature, online non-academic online sources have been used to find the documents presented in this section, mainly internet search engines. However, documents that were too old (i.e. created before the year 2000) and documents that did not clearly refer to the SDGs in their titles or contents, were excluded.

2.2.2 Results: Belgian literature

Legislative and regulation documents. According to the Belgian Constitution (Art 7bis), when exercising their respective authorities, the federal state (Belgium) and the different communities and regions (i.e., Flanders) must pursue the goals of sustainable development in all social, economic, and environmental aspects, taking in account the solidarity between the generations. Therefore, each level of government must contribute to sustainable development. The consultation and coordination between those levels are ensured by the Conference of the different levels (ministries) founded in 2012 and renewed in 2016 after the United Nations 2030 Agenda. SDG.be explains the different authorities and policies of the responsible political level. For Belgium, it is ‘In 2050’. For Flanders, it is ‘Visie 2050’, an extension of ‘Vizier 2030’. There is also a policy for Wallonia (the French-speaking part of Belgium), Brussels, and the German region. Voka, the Flemish network for entrepreneurs, has worked out a Charter for Sustainable Entrepreneurship based on the 17 SDGs to enable the Flemish companies to make a profitable action plan for the company itself, the people, and the environment. Voka claims that using the SDGs as a guideline creates broader support and is a valuable compass for a future-oriented and sustainable company policy. They hand out the Unitar certificate to those companies.

Some of the most representative documents created by public institutions or regulatory entities are collected in the following table:

Table 2: Belgian literature: Sources by public bodies and regulatory entities

Title	Author	Publication year	Publication type	Summary
Mijn MVO Bundel	MVOVlaanderen	2022	regional strategy	the sustainability challenges in Flanders

Federaal beleid	Federaal instituut voor Duurzame Ontwikkeling	2015	Report	Report about how the tasks have to be distributed to prepare and supervise the SDGs
Vizier 2030	Vlaamse regering	2018	Report	The Flemish policy of sustainable development using the SDGs for 2030
Visie 2050	Vlaamse regering	2021	Report	An updated version of Vizier 2030
Stratégie wallonne de dévelopment durable	Wallonie, service publique	2016	Report	Sustainable development strategy in the French-speaking part of Belgium
Het gewestelijk ontwikkelingsplan	Perspective Brussels	2005	Plan	A masterplan which specifies the goals and development priorities, taking into account the social and economic needs for environment and mobility
Nationale Strategie nachhaltige Entwicklung	Ost Belgien	2005	Report	Sustainable development strategy in the German-speaking part of Belgium
SDG wegwijzer	Vlaamse regering	2021	Instructions	General outline of SDGs and a guide on how to implement them
Over het beleid	SDG.be	2018	Website	SDG policy in Belgium clarifying which level is responsible

In 2050	federale overheid	2016	Brochure	A strategic federal long-term vision for sustainable development

Private companies' initiatives: ETEX. One of the largest construction material companies in Belgium has created a Green Team composed of 30 experts from their company to report on essential sustainability issues, such as optimizing the use of water, energy and materials and reducing waste and emission. They emphasize **SDG 13** (less CO_2), **SDG 7** (more renewable energy in their factories), **SDG 9** (searching for products with higher circularity potential), **SDG 8** (more and better jobs and growth), **SDG 8** (fewer accidents), **SDG 13** (monitoring and improving health and well-being), **SDG 17** (effective collaboration), **SDG 5** (gender equality), **SDG 6** (improving water efficiency in the factories) and **SDG 11** (supporting communities with safe, flexible and sustainable building solutions by offering a safe, esthetic and sustainable product portfolio). **CRH.** a company with 70,000 employees worldwide and over 3,000 in Belgium have specified in their charter **SDG 1** (no poverty and no slavery).

Some of the collected documents, tools, interviews, etc., linked to private organizations are collected in the following table:

Table 3: Belgian literature: Documents from private entities

Title	Author	Publication year	Publication type	Summary
Sustatool	Sustanon		Tool	Tool to determine sustainability goals in SMEs
MVO sectorpaspoort	Kristof Van Roy	2013	Passport	How to make a sustainability report in construction
Duurzaam bouwen in Real Estate	Transport media		Article	Solar panels fit in a sustainability policy
CO2 -reductieprojecten in de bouw	Trends		Interview	How consultants help to apply sustainability
Bouwen mensen, Groep Van Roey	Sustacon	2021	Interview	How to create added value from social challenges

Willemen groep, familiale bouwgroep	Sustacon	2021	Interview	Construction is at a tipping point
Derbigum, no roof to waste	Sustacon	2021	Interview	To promote sustainable roofing
Duurzaam ondernemen	Hans Verboven	2021	Book	How to implement SDGs in sustainability strategies
Sustabuilt	Sustacon		Website	Methods to help construction companies to work more sustainably
SDG's vinden hun weg naar de Vlaamse	Kamp C	2019	Article	Two construction companies explain how work in a sustainable way
SDG's in het DNA van Renotec	CFO magazine	2021	Article	SDGs belong to the DNA of Renotec company
Duurzaam ondernemen	Besix	2021	Website	The SDG vision of Besix company
Duurzaam inspireren	Siniat/Promat	2022	Brochure	Sustainability in the construction value chain
Circular skills in de bouw, een onderwijshandleiding	Daan de Kruijf	2020	Manual	Which skills are needed to make the transition to circular construction?

Circular skills, inspiratiedocument	Stichting Technotrend	2020	Website	A document to inspire students towards circularity
Competences of the professional of the fu-	Journal of Cleaner Production	2020	Article	Competences of the future professional in a circular economy
SDG Roadmap VOKA	VOKA	2020	Guidelines	VOKA roadmap to guide companies towards implementation of SDGs

2.2.3 Results: Danish literature

Legislative and regulation documents. The Danish national strategies for climate action and sustainable buildings, including CO_2 limit requirements. Action plan for carbon reduction and waste reduction and action plan for setting a framework to implement SDGs in construction. Building regulations requirements for energy and indoor climate. Furthermore, in June 2021, an action plan for the UN's World Goals, the government set the framework for the work with the World Goals in Denmark. Municipalities (KL) also support the Danish government's commitment to the UN 17 World Goals. Therefore, in the financial agreement between KL and the government for 2018 and 2019, KL has entered into a binding effort to contribute to raising the UN's World Goals in Denmark. They published an online catalogue inspiring the municipalities 'work with the World Goals and the municipalities' work with social, climate and environmental and economic sustainability, as well as partnerships, participating in all SDGs. A survey by KL in 2020 shows which SDGs municipalities focus on.

Some of the main documents created by public bodies and regulatory entities are collected in the following table:

Table 4: Danish literature: Sources by public bodies and regulatory entities

Title	Author	Publication year	Publication type	Summary
Denmark' s Long-term Strategy	Government	2018	Report	Reducing CO_2 emissions and enhancement of removals 2018-2040/2050

Climate action	Government	2019	Report	The binding target is to reduce greenhouse gases by 70% by 2030 (relative to the 1990 level), to reach net zero emissions by 2050 at the latest, and to set milestone targets based on a five-year cycle.
National strategy for sustainable buildings	Ministry of housing	2021	Report	The national strategy for sustainable construction constitutes the government's sector action plan for the construction industry.
Handlingsplan for cirkulær økonomi	Ministry of environment	2021	Report	Danish action plan for a circular economy, where Danish policy and the concrete efforts are described based on the circular value chain for the period 2020-2032
Handlingsplan for FN's Verdensmål	Regeringen, Finansministeriet	2021	Report	In an action plan for the UN's World Goals, the government sets the framework for the work with the World Goals in Denmark.
Erhvervslivet og verdensmålene - Danmark og nabolande	Danmarks Statistik	2022	Report	How will Denmark meet the World Goals, and what do the goals look like in a Danish context? Statistics about Denmark, based on the 17 World Goals.
Voluntary National Review 2021 Ministry of Finance Denmark	The Danish Government, Ministry of Finance	2021	Report, English	The report presents overviews, assessments, cases, initiatives and advice on efforts to implement the SDGs by the different entities in Denmark's pursuit of the SDGs.

AN ARCHITECTURE GUIDE to the UN 17 SDGs	Royal Danish Academy, Architecture, Design, Conservation, Copenhagen	2020	Book, English	The guide presents how the UN defines each Goal, outlines how it interacts with the built environment and gives examples of realised projects that illustrate architectural contributions.
AGENDA 2030- Transforming our world: 2030. Agenda for Sustainable Development	UDENRIGS MINISTERIET	2020	Report	An action plan to benefit the people, the planet and the prosperity of the world. At the same time, the plan aims to strengthen peace and freedom for all.
KADK vil bidrage til at realisere FN' s verdensmål – og skabe ny grøn vækstsektor- KADK	Det Kongelige Akademi	2016	Article	KADK has dedicated three academic years to the development of design and architecture that can support the UN's goals for a sustainable world.
The Capital Region and the 17 world goals	Pernille Kernel, Center for Regional Development	2019	Presentation	The Capital Region of Denmark's work with the UN's world goals

Roadmaps and case studies regarding the implementation of the SDGs in the construction industry. Danmarks Statistik: This institution actively reports how far organisations can meet the SDGs. In 2021, they published a statistical insight into efforts relating to the SDGs. The report contains 197 suggested Danish indicators related to the 17 SDGs. The indicators supplement the UN indicators for measuring sustainable development, thus contributing to measuring the progress of sustainable development in Denmark by the UN's 17 SDGs. **KADK:** Institute of Architecture and Technology, KADK, and the Danish Association of Architects, in January 2019, published a Guide for implementing the world goals in

companies and construction projects so that the SDGs can become a springboard to rethink businesses. ADK has dedicated three academic years to developing design and architecture that can support the UN's goals for a sustainable world and create a foundation for a new Danish growth sector driven by innovative solutions to national and global problems. The guide presents how the UN defines each SDG, outlines how it interacts with the built environment and gives examples of realized projects that illustrate architectural contributions. **Royal Danish Academy - Architecture, Design, Conservation:** In 2020, this institution published a book presenting how each SDG is defined by the UN, outlining how they interact with the built environment, and giving examples of realized projects that illustrate architectural contributions. **Urban Health Culture of the Future project:** In 2021, the Urban Health Culture of the Future is a research project focused on the UN's World Goals, particularly SDG 3 on 'Health and well-being' and SDG 11 on 'Sustainable cities and communities. The project aims to promote a better connection between urban development and citizens' health and well-being. The UN 17 village is the first building in the world, located in Copenhagen and created based on a complete method to address and incorporate the UN's 17 world goals into one complete solution. This approach to the construction of future challenges is presented in a holistic project that meets the highest standards in social, environmental, and economic sustainability. **Danish 92 Group of Global Focus:** In 2020, this entity highlighted the challenges regarding fully implementing the SDGs in Denmark and making a maximum contribution at the global level. As well as highlighting individual challenges, the report recommends how political action can be leveraged to solve these challenges.

Sustainability assessment methods: The Danish Green building certification system (DGNB), Swan ecolabelling, life cycle assessment (LCA) and life cycle cost assessment (LCC) of buildings' environmental impact. Danish environmental product declarations for sustainable building materials (EPD Denmark). In addition to the Danish building regulations for energy requirements in the building's operation phase, via the energy calculation tool (Be18). Indoor climate requirements in building regulations through the indoor climate simulating tool (Bsim). The voluntary sustainability building class launched in 2020 has set CO2 emissions limits, as buildings must not emit more than 8 kg CO_2 eq. / m²/ year. By 2023 the environmental impact of all new buildings must be documented, as buildings larger than 1000 m² must not emit more than 12 kg CO_2 eq. / m^2/ year. This must be reduced and adjusted every two years. The voluntary sustainability class has set nine requirements, including sustainability's social, environmental, and economic qualities. The Danish strategy to reduce waste from construction and demolition is one of the binding targets. Indoor climate target values, design guidelines and product requirements must be assessed as mandatory. In addition, carbon footprint calculations, assessments of environmental impacts, etc., are voluntary or mandatory before granting building permission. In Denmark, no regulation would connect assessment methods to specific SDGs. However, including them in a project according to DGNB certification will provide bonus points. Similarly, extra points will be granted when circular strategies are included.

The presented roadmaps and sustainability assessment methods are based on reports and studies. Some of the most remarkable are shown in the following table:

Table 5: Danish literature: reports and studies

Title	Author	Publication year	Publication type	Summary
Baseline for verdensmålene- Verdensmål 11: Bæredygtige byer og lokalsamfund	Dansk Arkitektur Center og Rambøll Management Consulting	2019	Report	The report forms a baseline for one of the SDGs, SDG 11, which concerns sustainable cities and communities
DGNB-System-Denmark	DGNB		Manual	Sustainability certification of New Construction and extensive renovations, DGNB Manual
MEASURING SUSTAINABILITY LEARNING by DOING	Simon Bell and Stephen Morse-Earthscan	2003	Book, English	
Immer Besser – fra global til lokal: Indsatsen i kommunerne	SAM-FUNDSØKONOMEN	2019	Article	The municipalities are key providers of public services, which can be a driving force in Denmark's efforts to achieve goals in 2030. Therefore, it is crucial that the World's goals can be translated into concrete local solutions and efforts.
Byerne har potentialet til at ændre verden	Realdania	2019	Article	An article about SDG 11 and its status in Denmark was produced in collaboration with the World's Best News.
Fremtidens Urbane Sundhedskultur- Urban Health Culture of the Future Project	Helle Juul, Founding Partner of JUUL | FROST Architects,	2021	Video	The Urban Health Culture of the Future is a research project based on the UN's World Goals, particularly SDG 3 (health and well-being) and SDG 11 (sustainable cities and communities).

” Hvem er det, der ved, hvem der arbejder rigtigt med verdensmålene?	Laura Amalie Kusk, Politik og Administration ved Aalborg Universitet	2005	Thesis	A qualitative case study of the UN17 task force's implementation process of the UN 17 world goals for sustainable development in the Central Jutland Region
FN’ s 17 verdensmål – fra globalt plan til kommunalt plan- The UN Sustainable Development Goals - from global context to local context	Politik og Administration, Dennis Lars Olof Steffensen. Clara Charlotte Walsh Lund. Sarah Jordan Torp. Anne-Marie Helene Nielsen Roskilde University, Denmark	2019	Bachelor project	Bachelor project that examines how far the Danish municipalities are working with SDGs and aims to understand why some municipalities are further in the process than others.
Beretning om nedsættelse af en parlamentarisk arbeids-	Finansudvalget	2018	Report	Report that discusses the progress concerning SDG implementation in Denmark, and new opportunities and solutions for SDG work towards 2030.
Difficult to live up to world goals	Adam Moe Fejerskov, PhD student, DIIS	2016	Article	Some considerations as to why the elements necessary for constructing and implementing a successful Danish action plan will also be able to act as legs for this particular ambition.

More documents are presented in section 6.1 (appendix) in this document.

2.2.4 Results: Finnish literature

Legislative and regulation documents. In Finland, the following legislation lays the background for construction: Land Use and Construction Act and Decree (under reform), Energy Efficiency Act, Energy Certification in Buildings Act, Waste Acts and Climate Act. Again, the links to SDGs must be dug out of the legislation. Similarly, the codes of the National Building Code and the Environment, Indoor Air and Health certifications must be followed. The numerous national strategies and roadmaps toward carbon neutrality must be studied carefully. It is worth noting that in Finland, no regulation would connect assessment methods to certain SDGs. The content of these documents gives the guiding principles for the operations and actions in the construction field. This material contains essential land use planning, zoning, and construction provisions. Regulation affects every municipality, contractor, landowner, and resident. This legislation is increasing the possibilities for comparing the energy performance of buildings by promoting energy performance and the use of renewable energy in buildings. They produce knowledge of the existing energy consumption profile of a company or all the units in a group, identifying energy-saving opportunities. These Acts also contain regulations aiming to prevent the hazard and harm to human health and the environment posed by waste and waste management, reduce the amount and harmfulness of waste, promote the sustainable use of natural resources, and ensure functioning waste management to prevent littering. Some of the principal legislative and regulatory documents found in the Finnish literature review are presented in the following table:

Table 6: Finnish literature: Sources by public bodies and regulatory entities

Title	Author	Publication date	Publication type	Summary
Hallituksen esitys eduskunnalle ilmastolaiksi (Government's proposal to Parliament on the Climate Act)	Finnish Government	2022	Legislation (proposal)	The proposal proposes a new climate law.
Kierrätyksestä kiertotalouteen : Valtakunnallinen jätesuunnitelma vuoteen 2027	Ministry of the Environment	2022	Policy programme	The National Waste Plan for 2027 includes a plan to reduce the volume and harmfulness of waste and a waste management plan. In terms of the geographical area, the plan covers the whole of Finland except for the Åland Islands.

Pitkän aikavälin korjausrakentamisen strategia 2020 - 2050	Ministry of the Environment	2020	National strategy	The long-term renovation strategy 2020-2050 aims for a highly energy-efficient and near-carbon-free building stock by 2050. Out of 85 measures presented in the strategy, 36 are already implemented, 16 are prepared, and 33 are recommended to authorities, property owners and other stakeholders.
Johdatus rakennusten elinkaariarviointiin (Introduction to LCA of Buildings)	Ministry of the Environment	2019	Guide book	Life Cycle Assessment (LCA) assesses the environmental impact of products and services and the consumption of natural resources. Life cycle assessment is also used in the construction industry, which plays an essential role in the ecological sustainability assessment of building.
Hiilineutraalin rakennetun ympäristön toimintaohjelma (Action plan for a carbon-neutral built environment)	Green Building Council Finland	2022	Book /action Plan	The organization-specific action programs are intended to serve as examples of the application of the Carbon Neutral Built Environment Action Program.
Definition and methods for the carbon handprint of buildings	Ministry of the Environment & Danish Housing and Planning Authority	2021	Book	The following actions for policy-makers were recommended: develop the content of buildings' climate declarations; develop benchmarking; restrict carbon handprint; boost the further development of standards, etc.
Rakentamisen päästötietokanta (Emissions database for construction)	SYKE & Ministry of the Environment	2022	Database	The service presents average emission data of construction products used in Finland and of construction processes and services. The aim is to harmonise the calculation of the climate impact of buildings throughout their lifecycle and, doing so, to promote low-carbon construction.

Alueellisen hiilijalanjäljen laskentamenetelmät ja pilottikohteet Suomessa	Green Building Council Finland	2021	Book / Review	An overview of the regional planning carbon footprint calculation tools currently in use in Finland and of pilot sites and projects where regional carbon footprint assessment methods have been used in recent years.
Level(s) – raportointityökalu ja ohje	LIFE Level(s) – projekti	2021	Tool and guide	An Excel-based tool for reviewing and reporting on the sustainability of a construction project in accordance with the voluntary Level(s) framework developed by the EU Commission.
Ohje: Näin maksimoidaan rakennustyömaan kierrätysaste	Green Building Council Finland	2022	Guide	This list of ideas contains tips for builders, construction companies and environmental maintenance companies to increase the recycling rate on construction sites.
Rakennusosat- ja materiaalit kiertoon - kokeiluilla uutta liiketoimintaa (HYPPY)	Green Net Finland	2022	Project report	The main goals of the HYPPY project were to develop new operating models for recycling building components and materials and to promote the development of reusable building components and materials, either as such or through further processing.

National sustainability assessment methods. The legal requirements relevant to sustainable construction are explained in the legislation. Carbon footprint, LCA and energy efficiency are used to assess sustainability. Also, the target for construction and demolition waste recycling (70%) is one of the binding targets. Defining the energy efficiency class is a mandatory assessment. Carbon footprint is connected not only to the climate goals but also to energy efficiency, material efficiency, and recycling and reuse of construction and demolishing waste. The carbon footprint calculations are voluntary, but if the Climate Declaration becomes mandatory in 2025, as it has been proposed, the calculations will also be mandatory. In addition to this, the new Land Use and Building Act will probably contain mandatory pre-demolishing assessments. Indoor climate target values, design guidelines and product requirements must be assessed as mandatory. In the social dimension of sustainability, specific duties are mandatory or, in some cases, voluntary, depending on the size of an employer, e.g., assessment of the workplace's equality. In addition, carbon handprint calculations, assessments of environmental impacts, etc. are used voluntarily or

mandatorily before granting a building license or permission to start industrial activities. Some examples are to be given.

Roadmaps and case studies regarding carbon neutrality. These documents are guiding and giving direction to the low carbon actions. These are also useful for policymakers when reforming the existing legislation and regulations. For example, the literature in this part includes how to create possibilities for construction professionals to make sustainable choices and apply certifications and classifications related to the environment, indoor air, and health issues. The literature also includes the action plan for a carbon-neutral built environment and a guide to drawing up an Energy Certificate for existing and new buildings. The second part includes documents about energy efficiency, LCA, LCC and material efficiency. In addition, there is some literature about legislation reform on construction and digitalisation. The reform is now progressing to bring the fight against climate change into the legislation governing construction. It encourages cutting emissions caused by the construction and use of buildings and reducing consumption of raw materials throughout the lifecycle of buildings. In addition, the literature defines the allowed levels of energy efficiency, and there are studies about threshold levels for the carbon footprint of buildings.

Roadmaps and case studies regarding circularity in construction. This literature concerns construction waste in the construction, renovation, and demolition phases. It includes reports, roadmaps, case studies, guidebooks etc., about the circular economy. Literature on this topic describes the criteria for building demolition for public procurement. It includes a report summarising the carbon footprint and life cycle impact of the renovation and development of buildings compared to demolition followed by the construction of a new building. In addition, there is guidance for utilising demolition materials, mainly because Finland has committed to utilising at least 70 per cent of the construction and demolition waste generated in the country as material. Under the Land Use and Building Act, a demolition project is a measure in which the parties engaging in the project have statutory obligations, as is the case in construction projects. For instance, the role of demolition as a part of a new construction project should therefore be emphasised more strongly than it is at present. These guidebooks have been drafted as an instructive tool for the high-quality implementation of demolition projects and pre-demolition audits. Pre-demolition audits are a new, voluntary measure for mapping out the materials and hazardous substances in buildings to be demolished. These guidebooks aim to create good conditions for the appropriate use of demolition materials while preventing environmental and health risks and ensuring a high-quality demolition process in all demolition projects.

The sustainability assessment methods and roadmaps described were created based on previous studies and guidelines. The following table presents some of the most important documents written by private organizations or research institutions.

Table 7: Finnish literature: Documents from private entities

Title	Author	Publication date	Publication type	Summary
Tiekartta rakennuksen elinkaaren	Bionova Oy	2017	Roadmap	This study outlines a roadmap to introduce regulations to consider the carbon footprint of buildings during their life cycle.
Miten kiinteistösalkun kestävän kehityksen tavoitteet saavutetaan selkeän vesistrategian avulla (How to achieve	Smartvatten	2021	Whitepaper	The real estate sector has significant potential to contribute to the protection of water resources and the responsible management of water, as households are responsible for more than 10% of the world's water consumption, and water is essential for the construction, renovation and management of the real estate.
Kestävä koti: Opas hiilineutraalimpaan rakentamiseen (A sustainable home: A guide to the most carbon-	Lahden rakennusvalvonta	2021	Guidebook	The Lahti Building Control Authority has published a guide to carbon-neutral construction for detached house builders. The guide clarifies the concepts and facts of climate-friendly construction and presents ways a builder can influence the carbon footprint of a detached house.
Attitudes and Approaches of Finnish Retrofit Industry Stakeholders toward Achieving Nearly	MDPI	2021	Article	A three-tier investigation was conducted, including surveys and expert interviews with several stakeholders. The structure of this approach was informed by preliminary data and information available on the Finnish construction industry.
Handbook for a Data-Driven Circular Economy in Finland	VTT Technical Research Centre of Finland	2022	Handbook	As one of the first components of the project, this report reviews data sources that are available for the design of circular solutions in Finland, tools that can be used to manage and extract value from the data, and governance issues that either hinder or promote the adoption of data-based circular design approaches.

Kestävän rakentamisen tavoitteet ja niiden toteutuminen	VTT Technical Research Centre of Finland	2011	Case study	This work is part of the research project Sustainable building processes – SUSPROC. The SUSPROC project aimed to develop knowledge and methods for sustainable building processes.
GLOBAALISTA PAIKALLISEEN KESTÄVYYTEEN: Planetaariset rajat, YK:n kestävän ke-	University of Jyväskylä	2021	Research report	This background report is part of the University of Jyväskylä's Resource Wisdom Community's Footprint on Sustainability in Regional Development, which seeks more effective assessment methods to promote the sustainability of regional development.
Elinvoimaa ja kestävyyttä teollisella puurakentamisella	University of Vaasa	2021	Project report	Wood as a building material effectively reduces emissions from the construction industry, as the carbon bound by wood remains in the structures for a long time.
Kestävä rakentaminen - klusteri	Lappi University of Applied Sciences	2018	Research report	A collection of research reports approaching the topic from various points of view
Rakennusosien kustannuksia 2022 (Costs for	Rakennustieto	2022	Guidebook	The annual manual contains typical costs for small, terraced, multi-storey, and industrial building structures, broken down into sales and costs for work and materials.
Asiaa energiasta Energiatehokkaan asumisen opas	Motiva & Energiavirasto	2021	Guidebook	For those who want to live in a cosy, energy-efficient and economical way, this guidebook explores how, through small actions and thoughtful purchases, one can improve one's living comfort, save on energy costs and reduce the climate impact of housing.

- Raksavirtaa -hankkeen päätösseminaari ja RAKAS -hankkeen aloitusseminaari	TTS Työtehoseura, Tuni, TAMK	2019	Initiative/Slide set	Metaskills, self-direction, and the ability to learn new are key elements of future work. RAKAS — The "Development of Attitudes, Collaborative Competencies and Working Capabilities in the Construction industry" project identifies and analyses the training needs of construction site supervisors and workers, particularly regarding so-called meta-skills, i.e. working life skills.
Tackling root causes Halting biodiversity loss through the circular economy	Sitra	2022	Report/studies	Buildings and construction: Fewer materials and less urban space are used by extending building lifetimes, optimising active use, reducing material use and reusing and recycling materials. More renewable materials are used in construction

More documents are presented in section 6.2 (appendix) in this document.

2.2.5 Results: Spanish literature

Legislative and regulation documents. In Spain, several non-profit organizations have published a considerable amount of resources regarding the SDGs and their implementation in the construction industry. Among them, the following are remarkable: Asociación Española de Normalización (AENOR), Clúster Hábitat y Construcción Eficiente (AEICE), Asociación de Empresas Constructoras y Concesionarias de Infraestructuras (SEOPAN) and Green Building Council Spain (GBCe). The activity of this organization is extensively described in the following paragraphs:

AENOR has been accredited for the following **SDGs: 7, 9, 11, 12, 13 and 15**. In addition, AENOR has become the first Spanish organisation to be accredited by the international organisation Verra under the new standard "Sustainable Development Verified Impact Standard" (SDVISta) to certify projects by public and private organisations related to the SDGs. The AENOR certification demonstrates the organisation's commitment by measuring and evaluating the economic, social, and environmental impact of its initiatives. The model used consists of two pillars: the sustainability of the influencing factors of a project (designer, materials, and construction company) and the evaluation of the Level(s) criteria in the building. This assessment of projects considers sustainability with a comprehensive approach, supporting good practices in a key sector of our economy and paying attention to the responsible use of resources.[6]

AEICE develops various initiatives and projects such as REAGEN, AEICE LEAN Community, CEC, Construccion 4.0, E3CN, DueroDouro, NetODS etc., in cooperation with partners at local, regional, national and international levels. They also organise a "Habitat Arte" competition for the ecological design of equipment for buildings for collective and/ or public

[6] https://www.en.aenor.com/certificacion/certificacion-de-producto/marca-n/edificio-sostenible

use. The initiatives and projects AEICE aim to contribute to no less than 14 of the 17 Sustainable Development Goals, namely **SDGs 3,4,5,6,7,8,9,10,11,12,13,15,16,17**. Projects are led to re-evaluating waste from the construction and demolition sector that can be used as raw material for new products. With the development of a guide for the environmental certification of products for the construction industry. Based on the development of a cooperation platform aimed at improving living and economic conditions by paying attention to limiting material and human losses due to floods or sudden storms of the population in vulnerable areas. They promote management and cooperation models using digital technologies, optimising energy innovation, and reducing financing through cooperation mechanisms and strategies. Developing an action model in ventilation equipment and/or air quality systems to ensure users' health. The efficient use of endogenous energy resources in autonomous rural areas to generate renewable energy.[7]

SEOPAN. SEOPAN is an association of construction companies and infrastructure concessionaires to actively promote investment in infrastructure and encourage public-private partnership projects as decisive elements for competitiveness and economic growth in Spain. Its objectives are to promote and defend the private initiative, the market economy and free enterprise in the construction industry, infrastructure concessions and water technology. By promoting investments that create a safer and healthier society by integrating sustainable development objectives into their investment strategy, they contribute to making Spain more sustainable. First, the current situation of the priority infrastructures will be examined in detail, after which the actions to be taken to achieve the objectives will be determined. For example, in function of **SDG 3**, it was examined to what extent investments are needed to improve the sustainability of the public health system in terms of hospital and road infrastructure. For **SDG 6**, it was determined that urgent attention must be paid to sewage treatment, water resource management and the protection and restoration of water-related ecosystems. **SDG 9** also plays an essential role in developing reliable, sustainable, resilient infrastructure, including regional and cross-border infrastructure, requiring investment in sanitation, distribution and water supply networks. The need to improve energy efficiency in the residential and tertiary sectors through investment in infrastructure to reduce primary energy consumption is related to SDG 7. Ensuring safe, affordable, accessible and sustainable mobility, as well as creating a green infrastructure in the urban area and improving air quality and municipal waste management, are in line with the objective aiming at **SDG 11**. Due to the fact that droughts and floods are common in Spain, it is essential to modernise irrigation, increase the surfaces, and install hydrological measuring and warning systems in flood-prone areas, SDG 15.[8]

Green Building Council Spain (GBCe). Green Building Council Spain (GBCe), belonging to the World Green Building Council (WorldGBC), is an organisation that provides advanced information and training. It facilitates, influences and promotes a practical, executive transformation towards sustainable construction, with attention to people's well-being. It offers tools for evaluating and certifying buildings, specially adapted to the Spanish market and taking into account social, environmental and economic aspects for a complete analysis of the building's life cycle. Developing cooperation and research activities at national and international levels in the search for improvements in sustainable construction. They are working with the European Commission on the Level(s) project to develop a new sustainability assessment framework with a common European approach. Experts from CBCe's **certification schemes**, VERDE and DGNB, have been working for years to find

[7] https://www.aeice.org/iniciativas/?lang=es.

[8] https://seopan.es/seopan/

the most efficient and effective way to progress towards the SDG goals through sustainable construction. The DGNB certification system is a planning and optimisation process that enables all parties involved in construction to realise projects that place equal emphasis on economic, ecological and socio-cultural factors. The certification system consists of several processes that are influenced according to the application but whose assessment criteria are closely aligned with **SDGs 3, 6, 7, 8, 9, 12, 13, 14, 15, and 17**. The VERDE system is intended to provide a methodology for assessing the sustainability of buildings from a life-cycle perspective considering its phases and the circularity of resources. This system's bases are the principles of bio-architecture and the construction of environmentally friendly buildings. In the VERDE system manual, the section "Contribution to the SDGs" for each criterion indicates the SDG objectives on which the building can have an impact if the objectives of the criterion are met. It mainly includes the contribution to **SDGs 3, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17**.[9]

Table 8: Spanish literature: Sources by public bodies and regulatory entities

Title	Author	Publication year	Publication type	Summary
Guia de Inclusión de la Mitigación y Adaptación del Cambio Climático en las Políticas Locales.	Francisco Victoria Jumilla	2020	Instructions	Instructions with regard to the mitigation of and adaptation to climate change drafted in the Region of Murcia. It sets out various objectives to be met and measures to be applied in new plans, projects or activities.
Plan de Acción para la Implementación de la Agenda 2030.	Gobierno de España	2018	Manual	Action Plan created by the Government of Spain, adapting the 2015 SDGs to the Spanish context and focusing on the objectives and key actions for developing the SDGs in the country.
Plan de Acción de Educación Ambiental para la Sostenibilidad (2021-2025)	Ministerio para la Transición Ecológica y el Reto Demográfico.	2021	Manual	Social education plan at all political, social and economic levels to live together sustainably, promoting sustainable values for the political and socio-economic transformation of the country.

[9] https://gbce.es/documentos/Informe_ODS.pdf

Estudio sobre la Contribución de la Empresa a la Agenda de Los Objetivos de Desarrollos Sotenible (ODS)	Agencia Española de Cooperación Internacioanl para el Desarrollo (AECID)	2017	Report	A study that focuses on Spanish companies as drivers of the SDGs. The study analyses the most appropriate methodology for the private sector's shift towards mainstream sustainability in its actions to facilitate Spanish companies' contribution.
Informe de Progreso 2021	Ministerio de Derechos Sociales y Agenda 2030	2021	Report	A study focusing on analysing the progress between March 2020 and April 2021 marked in the Action Plan for the Implementation of the 2030 Agenda and what Covid meant for this change.
Indicacdores de la Agenda 2030 para el Desarrollo Sostenible.	Instituto Nacional de Estadística (INE)	2021	Report	This study uses graphs to show progress in implementing the SDGs in Spain by analysing 148 indicators and 374 sub-indicators.

Private companies initiatives: There exists a strong interest in the SDGs among the big companies in the Spanish context. In the following paragraphs, the actions taken by some of them are described:

CETIM works on several innovative research projects that contribute to the SDGs. These include several projects focused on new innovative material solutions that reduce the need for oil-based raw materials, water resources or quantities of raw materials. For this purpose, research is being done on how organic waste can be recovered as a value-added material for the construction industry and to test its value as a raw material. Collaborations with various partners are an essential part of CETIM's research projects. For example, the co-operation with LIFE+ projects has a major contribution to various projects that positively impact the development towards a sustainable society. An example is the LIFE DrainRain project, where a sustainable urban drainage system was developed based on a photocatalytic porous concrete pavement and a specifically designed in-situ water treatment process. With these projects, they are committed to **SDGs 6,9,11,12 and 13**, among others.[10]

Onyx Solar is a company committed to the SDGs by transforming buildings and infrastructures into clean energy generation plants by implementing transparent photovoltaic (PV) glass. This innovative material influences several factors that lead to a high reduction in

[10] https://cetim.es/innovacion-en-construccion-para-un-mundo-mejor/?lang=en

energy consumption, CO_2 emissions, less artificial light, etc. They aim to enable buildings to be self-sufficient in energy, an essential factor in the fight against climate change. Onyx Solar's commitment to sustainability impacts corporate social responsibility policies and performance in three dimensions: economic, environmental, and social. The initiative to plant a tree per m² is making a double effort to increase the possibilities for combating CO_2 emissions by tackling them on both sides.

On the one hand, using photovoltaic glass will reduce CO_2 emissions from buildings and industries; on the other, planting trees will help absorb the CO_2 already in the air. In addition, planting these trees also avoids famine in some communities, protects biodiversity and supports local economies. By offering photovoltaic glass installations to society, any organization, private individual or industry that uses this can immediately contribute to more than 11 of the 17 sustainable development goals, **1, 2, 5, 7, 8, 9, 11, 12, 13, 15, 17.**[11]

BAXI constantly invests in R+D+i projects, which are intended to promote the development of their products. One example is the BAXI project. It is an innovative collection designed to achieve maximum comfort in the home, technologically equipped to connect people with BAXI devices in the home via sensors. A project that strives for perfect air conditioning, contributing to 5 SDGs, they are well organised by implementing actions in every part of the organisation. By providing a comfortable and safe indoor environment for their customers and a healthy, safe and sustainable work environment for their team, they contribute to **SDG 3**. Adopting an inclusive approach to diversity helps attract and retain talent, which improves the quality of the organisation's decision-making and operations, **SDG 5**. Importance is placed on training and developing a wide variety of installers to teach them skills needed to face the challenges of the energy transition, **SDG 4**. To reduce the emissions from the use of the products, as well as from the supply chain, they take actions such as using recycled packing material and recyclable components, implementing a waste management system and taking action to reduce the carbon footprint of the production process, **SDG 12**. To contribute to **SDG 13,** they invest 3% of their profits in R&D to provide solutions with a near-zero carbon footprint.[12].

Copsica Corp has set several goals based on the Sustain Development Goals. For example, they are committed to improving energy performance, promoting electric machines, eco- and zero-emission vehicles and calculating carbon footprints. They are also investing in R&D&I to implement self-sustaining working huts with photovoltaic panels, **SDG 7**. Furthermore, to contribute to **SDG 9**, the company is taking action to promote economic and social development in the areas where it operates. This is done through innovation in developing more sustainable infrastructure by applying new construction processes and using new materials.

Furthermore, there is a strong focus on responsible production and consumption (**SDG 12**) by implementing the selective separation of waste, improving recovery and recycling to reduce the consumption of raw materials, promoting the purchase of eco-labelled materials, and providing specific training on responsible consumption and waste management. With regard to **SDG 13**, efficiency and energy-saving criteria are applied to reduce emissions. This involves compliance with the Carbon Footprint Registry of the Ministry of Ecological Transition and the Generalitat de Catalunya. Furthermore, regarding the protection of biodiversity (**SDG 15**), various preventive measures are taken to reduce the environmental impact resulting from the activities. These include reforestation, placing nest boxes

[11] https://www.onyxsolar.com/sustainable-development-goals

[12] https://www.baxi.es/sobre-baxi/sostenibilidad

and insect shelters, restoring specific habitats, and preventing fire. Finally, **SDG 16** has also been implemented in the business objectives.[13]

Iberdrola. To ensure that vulnerable groups of society are not left without energy supplies, agreements have been made with governments and NGOs to charge special rates (**SDG1**). The consequences of the pandemic are having a major impact on the mental and physical health of society worldwide. A strategic plan was immediately implemented to guarantee employees' safety and working conditions. They immediately looked further afield and invested heavily in electricity facilities for hospitals and the like (**SDG 3**). **SDG 4** is contributed to by investing heavily in business training, volunteer projects and promoting the work of foundations, which also has a positive influence on economic growth (**SDG 8**). More than 70 leading practices have been established to reconcile family and work life and equal opportunity and reconciliation policies (**SDG 5**). A target here is to increase the percentage of women directors to 30% by 2025. At Iberdrola, much attention is paid to water productivity, renewable energy, R&D&I, environmentally friendly production processes, collaborations with other organisations and especially the protection of biodiversity in the countries where it operates. These actions greatly impact the fight against climate change, contributing to **SDG 6, 7, 9, 12, 13, 15 and 17**.[14]

Isolana. Isolana is a company that specialises in building and insulation materials for indoor renovation. They advise technicians and specialists in the sector to find the most appropriate, safe and economical solutions for the possible situations that may arise in this field. They contribute to the UN Global Sustain Development Goals by using ecological materials with sustainability criteria aimed at a favourable impact on the environment. A sustainability strategy is applied to production and distribution with a focus on recyclable materials, life cycle analysis, carbon footprint, the impact of the product on users' health, etc. Furthermore, they develop various initiatives to contribute to a sustainable living environment for vulnerable groups in society.[15]

Ferrovial. Ferrovial is an innovative company with the vision to develop and operate efficient and sustainable infrastructure. With several business lines, they are active in designing and building infrastructures in civil engineering, building and industrial construction, building and operating water treatment plants, mobility and providing solutions for developing and managing electrical transmission networks. With comprehensive objectives towards a sustainable society committed to achieving the goal of net zero energy, they contribute to replacing polluting energy sources with clean ones, guiding the transition to emission-free mobility, and promoting employment and a more energy-efficient society. To achieve this, much attention is paid to helping the most vulnerable local economies adapt to climate change. To this end, there are several infrastructure projects to improve their quality of life and increase their level of inclusion. The ESG (Environment, Social and Governance) criteria are used in the sustainability strategy.

Regarding the environment, several goals have been set. Firstly, actions are taken for using renewable energy, reducing emissions, carbon neutrality, and managing climate risks and opportunities in line with **SDGs 7, 12 and 13**. Much attention is paid to the water footprint, so actions are taken to reduce water consumption and combat water scarcity through the desalination of seawater (**SDGs 6 and 12**). To contribute to **SDG 15**, Ferrovial has developed the Integrated Natural Capital Assessment (INCA) methodology that contributes

[13] https://www.copcisacorp.com/es/csociedad.html

[14] https://www.iberdrola.com/sostenibilidad/comprometidos-objetivos-desarrollo-sostenible#ancla1

[15] https://isolana.es/social/

to preserving biodiversity and ecosystems. Many initiatives regarding sustainable mobility are in progress towards low carbon infrastructures (**SDG 8**). By building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation through a strategic innovation plan, they contribute to **SDG 9**. In social terms, they contribute to **SDG 3, 5, 8 and 17** by promoting a flexible, diverse and inclusive collaborative culture, attracting local talent and creating safe and healthy work environments. Finally, with good governance criteria, they contribute to **SDG 16**.[16]

Maxeon. Maxeon Solar Technologies designs, manufactures, and sells advanced SunPower-branded solar panels. A sustainability strategy is used to monitor the environmental impact of their actions. Criteria based on ESG (Environment, Social, and Governance) have been drawn. Maxeon's activities contribute directly and indirectly to all Sustain Development Goals, but focus on four development goals, namely **SDG 7, 10, 12 and 16**. Work is being done to increase access to sustainable energy and its benefits in developing countries. To this end, Maxeon strategically collaborates with partners and customers such as Water Mission, Nokero, Yolk and Mee Panyar, enabling it to contribute to this goal. How consumer products are made and used is closely monitored, and metrics on water consumption, energy consumption and greenhouse gas emissions from production are recorded annually. Optimising these processes includes waste and water management, incorporating the principles of Leadership in Energy and Environmental Design (LEED) certification and using automated processes that promote energy-saving efforts and ensure a safe and healthy working environment. Furthermore, Maxeon proactively works with socially just and environmentally friendly suppliers and regularly reviews its supply chain for compatible environmentally friendly practices.[17]

Carbonell Figueras. Carbonell Figueras covers all types of activities in the construction, electricity and mobility sector as well as in the chemical industry, petrochemicals, hydraulic engineering and public infrastructure. With a commitment to balance economic growth, care for the environment and social well-being without endangering tomorrow's resources, they contribute to sustainable development. The Sustain Development Goals are integrated into the business objectives by dividing them into three categories. The first category includes customers to where **SDGs 8,9,12, and 16** are applied. For these goals, actions are taken to optimise the processing of customer databases, ensuring product quality and data security.

Furthermore, a quality management and control system is integrated during the execution of the different processes based on prevention, quality and environment to improve and eliminate incidents in the future. The second category is employees, paying attention to **SDGs 4,5,6,8,10 and 13**. In order to achieve these objectives, the importance of quality, health and safety of employees, initial and periodic training on environmental issues, such as waste management and the like, as well as professional development and equality, are given great attention. Concerning the environment, consumption records are kept for fossil fuels, water, electricity, etc. Calculating and compensating for CO_2 emissions and the entity's environmental impact are also closely monitored.[18]

ABN Pipe Systems. ABN Pipe Systems' activities include the development of the most innovative thermoplastic connections and piping systems designed for a circular economy.

[16] https://www.ferrovial.com/wp-content/uploads/2022/02/presentation-sustainability-strategy-2030-ferrovial-v8.pdf

[17] https://corp.maxeon.com/sdg

[18] https://www.carbonellfigueras.com/en/quienes-somos/

The impact of their activities is closely monitored through strategic partnerships. For example, in accordance with EcoVadis, a sustainability assessment, environmental performance is measured in four areas: environment, labour practices and human rights, ethics and sustainable procurement. The Carbon Footprint Seal awarded by the Ministry of Ecological Transition also reflects their efforts in calculating, reducing and offsetting the greenhouse gas emissions generated by their operations.

Furthermore, they are members of the Pact for a Circular Economy, which aims to involve Spain's leading economic and social actors in the transition to this new economic model. ABN Pipe Systems participates in the international SDG Ambition programme to accelerate business actions favouring the SDGs. They are also participating in the Operation Clean Sweep (OCS) initiative to achieve "Zero Pellet Loss" and prevent it from entering the environment. ABN Pipe Systems is clearly committed to the Sustain Development Goals, and even though their website states that they are committed to **SDG 5, 6, 8, 9, 10 and 12**, you can see from their stated business objectives that they are (in)directly contributing to more of these goals. Sustainable water use is an important objective, and since their field of work is based on this, it is logical that they are committed to it. Their products contribute to a sustainable water cycle and the comprehensive management of wastewater and rainwater to return it to the environment in perfect condition. Their integrated quality, environment and occupational health and safety policy promotes the efficiency of products and processes and offers customers innovative products with a high technological value that offers certified quality. It also actively promotes the professional development of our employees on equal terms, the integration of disadvantaged groups, health and safety prevention and respect for the environment.[19]

A selection of the most meaningful academic articles found during the Spanish literature review is shown in the following table:

Table 9: Spanish literature: Reports and studies

Title	Author	Publication year	Publication type	Summary
Redes Vecinales y Emergencia Climática. Una Oportunidad para la Transformación	Cristina Contreras Jiménez	2020	Article	An article that recounts the experience of the "neighbourhoods for climate" environmental education pilot project. The project advocates using neighbourhood networks as a participatory and organised method of society in the fight against climate change.

[19] https://www.abnpipesystems.com/ods/

La construcción sostenible.	Aurelio Ramírez Zarzosa	2002	Article	A brief description of sustainable construction, where many possible interventions and choices can be made in constructing a building to minimise its environmental impact and increase its efficiency.
La Valoración de Criterios (…) en el marco de los ODSs (…) en los Asentamientos Informales (…)	Laura de la Cruz Cortecero	2018	Bachelor project	Exposition of the exceptional case in Spain of the Cañada Real Galiana, where several kilometres of the sector do not comply with the minimum water and sanitation rights as it is classified as an "informal settlement".
La dimensión global como escala necesaria para la implementación de los ODS en las ciudades: el caso de A Coruña	Antonio Alejo	2020	Article	Global analysis of the SDGs implementation in A Coruña, analysing and discussing various empirical factors of policies and social availability for the collaboration and implementation of the SDGs.

2.3 Discussion and Conclusions

After analysing the non-academic literature regarding the links between SDGs and the construction industry, the following conclusions can be drawn:

- The collected documents are very diverse regarding their content, structure, and source. Among them are the following types: reports, articles, books, and web pages; governmental strategies and legislation: policy recommendations and other guidelines; standards, certifications and case studies.
- In general, the collected information deals indirectly with SDGs. This means it is not common to find explicit references in their titles but only through their content.
- Furthermore, not all the SDGs are adressed when dealing with construction issues, but only those related to land use, energy use, water consumption, climate actions, responsible consumption and production, material efficiency and waste management.

- Finally, the principal gap encountered is the lack of educational materials regarding the SDGs that could be used to promote their implementation among the students and practitioners in the construction field.

Numerous legislative documents, policy roadmaps, and initiatives in private institutions were found among the collected information. However, there is a lack of items related to formal education and dissemination to practitioners. Therefore, innovative initiatives should be carried out to increase the presence of the SDGs in different educational instruments. For instance, some related content could be included in academic courses (WP3) or dissemination handbooks (WP4). Among these contents, the following can be highlighted:

- Description of SDGs and their implementation in the construction industry.
- The connections between results of different sustainability assessment methods.
- Digitalisation in the construction industry promotes sustainable construction.
- Energy efficiency.
- Construction and demolition waste reduction, reuse, and recycling.
- Promoting circular economy in construction.
- Use of life cycle assessment (LCA) and life cycle cost (LCC) in construction projects.
- The carbon footprint of materials.
- Social sustainability in the construction industry.

All these topics should be approached from both pan-European and national points of view, considering each country's EU regulation and national legislation. In addition, national public institutions and regulatory entities published many documents regarding implementing the SDGs in the construction industry. Therefore, it is necessary always to consider the specific guidelines each country promotes when adapting the content of the SDGs to a construction project.

The conclusions regarding the academic literature review will be included in a paper that will be published in the journal *Frontiers in Sustainability*.

3. Surveys

This study was conducted to find out how the different groups of stakeholders in construction business understand the SDGs, how they have promoted the implementation of the SDGs and which SDGs are considered to be important in construction business.

3.1 Research questions and defining

The study's primary research question was: how do the construction industry stakeholders understand the connection between the built environment, the concept of sustainability, and the sustainable development goals (SDGs) of the 2030 Agenda? The specific goals of the study were:

- to understand the importance of the SDGs for the construction industry from the point of view of companies, educational institutes, public administration and citizens in practice;
- to identify the goals most directly related/connected to the sector;
- to find out the current situation in 2022, including barriers and opportunities;
- to identify the opportunities to promote the understanding of the SDGs in the construction industry by training;
- to identify the differences, similarities, and synergies in promoting the understanding of SDGs in Denmark, Spain, Belgium, and Finland. This goal will be reached in the last phase, where the national results will be concluded together.

The study and results reported in this report were limited to surveys conducted in Belgium, Denmark, Finland, and Spain during May-June 2022.

3.2 Methodology

The data was collected by an online survey to which potential respondents were invited by e-mail. The survey was conducted by Google Forms. The questionnaire used in the survey can be seen in Section 7 (Appendix 2). The survey was designed by the Spanish partner of the project, CTCON, in collaboration with the other partners, bearing in mind the following goals:

1. Ease of response
2. The nature of questions (Quantitative and qualitative issues)
3. Ease of aggregating information and drawing conclusions
4. Common parts and specific parts depending on the group that respondents belong to
5. The focus of the questions on linking causes
6. Relevance of respondents

Four target groups were identified based on their roles in the construction industry and particularly in impacting the opinions and forming the attitudes to sustainability and sustainable development:

- People working in the educational sector, including academic training and research (**Academia**).
- People working in industry or business branches, including RDI-tasks (**Companies**).
- People working or acting in the governmental sector, politics, or the public service, from a local to an international level (**Public bodies**).

- Ordinary people, individuals, and citizens, either as individuals or organised in social, neighbourhood, consumer, professional associations, etc. (**Citizens**).

The questionnaires were translated into each country's mother language. The survey link was directly sent by e-mail to selected persons, in order to:

- avoid having too many responses from people from the same organisation, but prioritise people from different organisations;
- reach organisations of different sizes, as the difference between larger companies and SMEs in relation to SDG compliance is considered relevant.

The questionnaire started with a few common questions for everyone, including a 'group question' that asked respondents directly which group they thought to make part of. According to the answer to that question, the survey continued with questions targeted to the chosen group.

The questionnaire was opened on 17th May 2022 and closed on 15th June 2022. After the first week, several reminders were sent to remind those who had not yet answered the survey. The number of responses obtained can be seen in **Table 10**.

Table 10: Number of answers per country

Country	Number of answers	Invitations sent	Response ratio
Denmark	81	1620	5.0%
Belgium	74	425	17.4%
Finland	55	1549	3.5%
Spain	42	900	4.6%
TOTAL	252	4494	5.6%

After the survey was closed, the country-specific results were exported to Excel and analysed using Excel tools. It was found that although each country had sent an invitation to a randomised sample, trying to keep all target groups representative, in practice, the industry and business became overemphasized (**Fig. 3**). One reason for this might be the moment of the survey: the schools were ending their activities, and people were directing their thoughts toward the summer holidays.

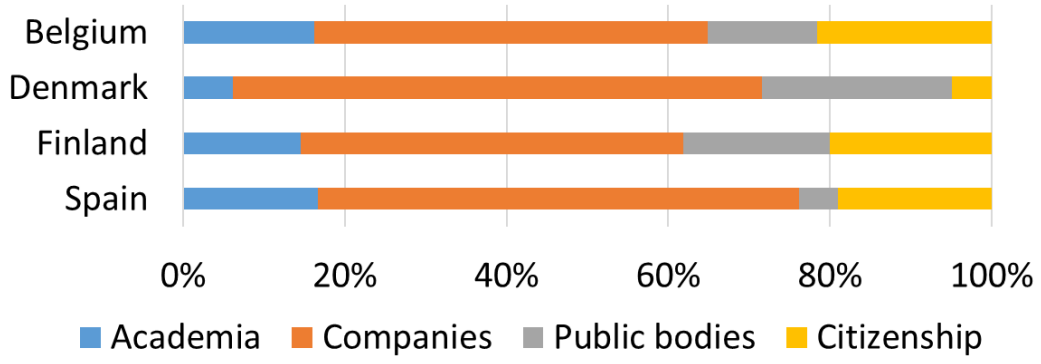

Fig. 3: Profile of respondents

The analyses were made separately in each country to avoid losing information on national differences in the aggregation process. Although the main goal is to look at common needs at the multi-national level in SDG training, considering the national differences (and causal

relations for these) will give valuable further information that supports especially the localization of SDG training.

After the partners analysed the situation in their country, CTCON concluded at a multinational level and then presented it to the partners for approval.

3.3 Results: General knowledge of the SDGs

3.3.1 Belgium

In Belgium, most of the respondents, 35 persons (48%), were employees or entrepreneurs in companies operating in the construction industry. In addition, there were 13 teachers or researchers, eight workers of public organizations and 14 members of civil organizations and ordinary people (**Fig. 4**).

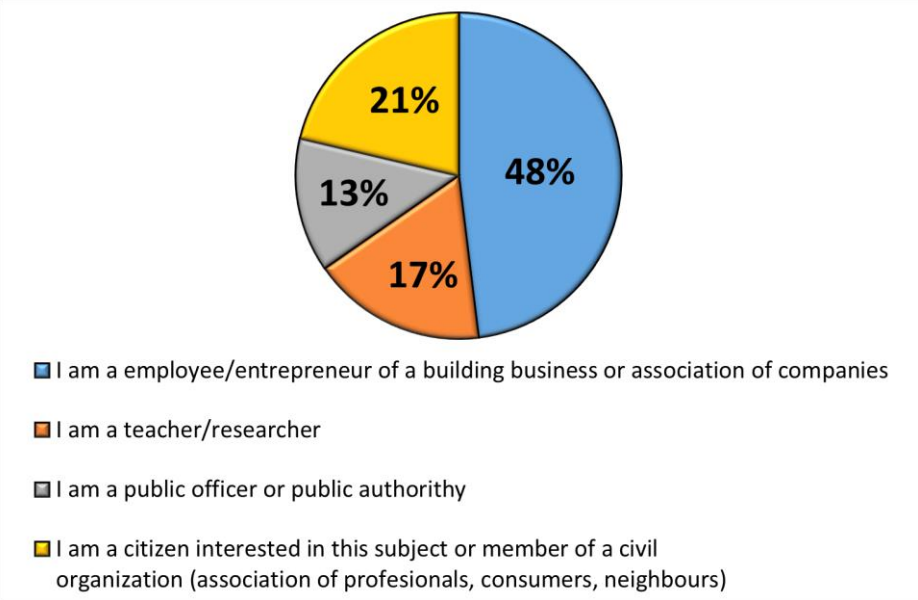

Fig. 4: Connection of respondents to the construction branch

Most of the respondents knew the SDGs and wanted to find out more about them, and a smaller part of the respondents was very interested in SDGs (**Fig. 5**). Those who had no idea or no interest represent about 25% of the respondents.

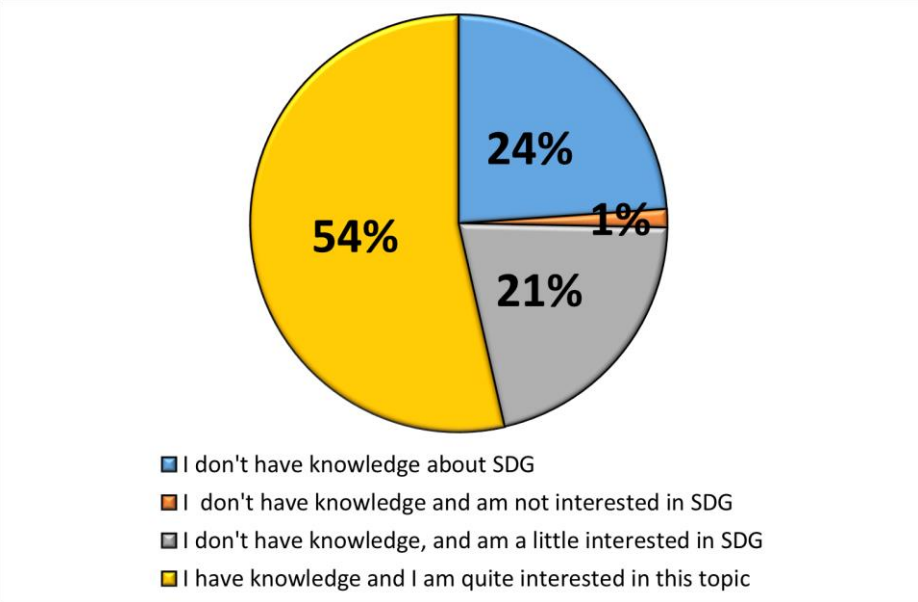

Fig. 5: Knowledge concerning the SDGs. (How well do you know the SDGs)

According to the respondents, the SDGs most directly connected with the construction branch were the goals of Sustainable industry, innovations, and infrastructure (SDG 9), Sustainable Cities and Communities (SDG 11), Clean water and sanitation (SDG 6), Affordable and Clean Energy (SDG7) and Climate Action (SDG13) (**Fig. 6**). More than 75% of the respondents indicated these SDGs as being directly connected with construction. The following SDGs were considered as being not at all connected with construction: Zero Hunger (SDG 2) and Gender Equality (SDG 5). Most respondents considered some goals as being indirectly connected to construction: No poverty (SDG 1), Zero hunger (SDG 2), Reduced Inequalities (SDG 10), Peace, Justice, and Strong Institutions (SDG 16).

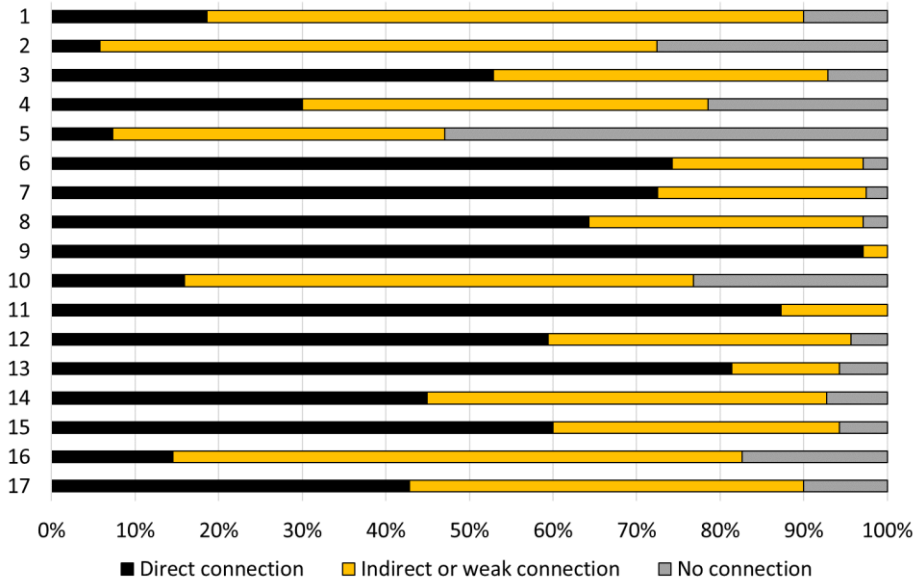

Fig. 6: SDGs and construction business (according to your opinion, how well the following goals related to the construction, per cent). Caption: 1. No poverty, 2. Zero hunger, 3. Good health and well-being, 4. Quality education, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure, 10. Reduced inequalities, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land, 16. Peace, justice and strong institutions, 17. Partnership for the goals

As for the factors believed to be a barrier for achieving the SDGs, the economic and political factors were considered the most prohibitive ones. (**Fig. 7**). The prohibitions due to economic factors greatly impacted SDG 11, SDG 9, and SDG 7. The political factors were important in SDG 11, 13, 12, 7 and 9. We also noted an essential cultural factor in SDG 5 (gender inequality). Citizen awareness played a significant role in SDG 5, 12 and 13.

Those who mentioned ‘other factors’ were asked to explain further. Seven respondents answered this further question. The following considerations were made:

- It will take time to change the mindset.
- One needs to be rich to afford changes
- Too many male human beings in construction
- Bad habits are difficult to change
- Denial of the reality
- Bad policy, as it will take decades to change that

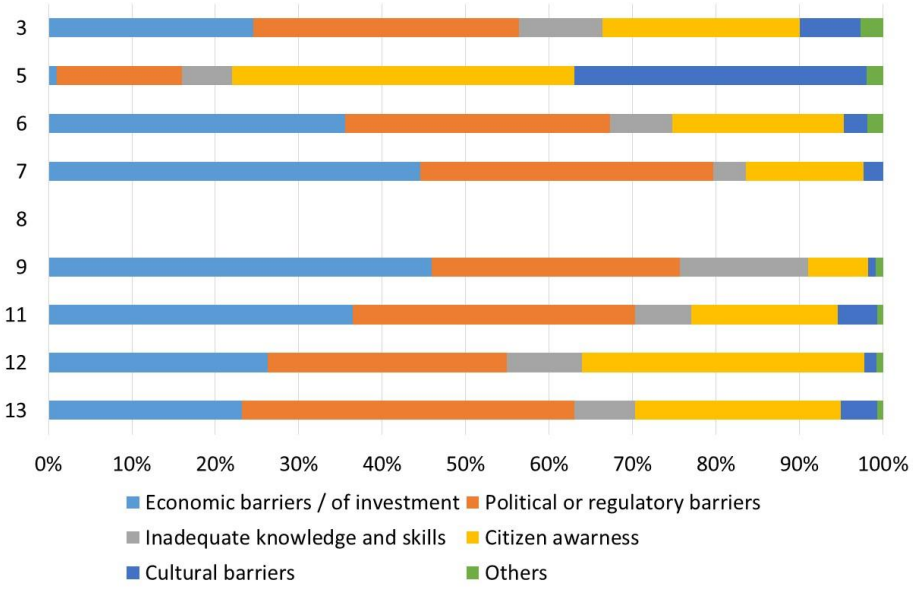

Fig. 7: Factors that prohibit reaching the SDGs (which factor prohibits reaching the SDGs listed, per cent). Caption: 3. Good health and well-being, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action

3.3.2 Denmark

In Denmark, most respondents (65%) were employees or building entrepreneurs, 6% were teachers or researchers, 24% employees within public organisations and 5% members of civil organisations and ordinary people (**Fig. 8**).

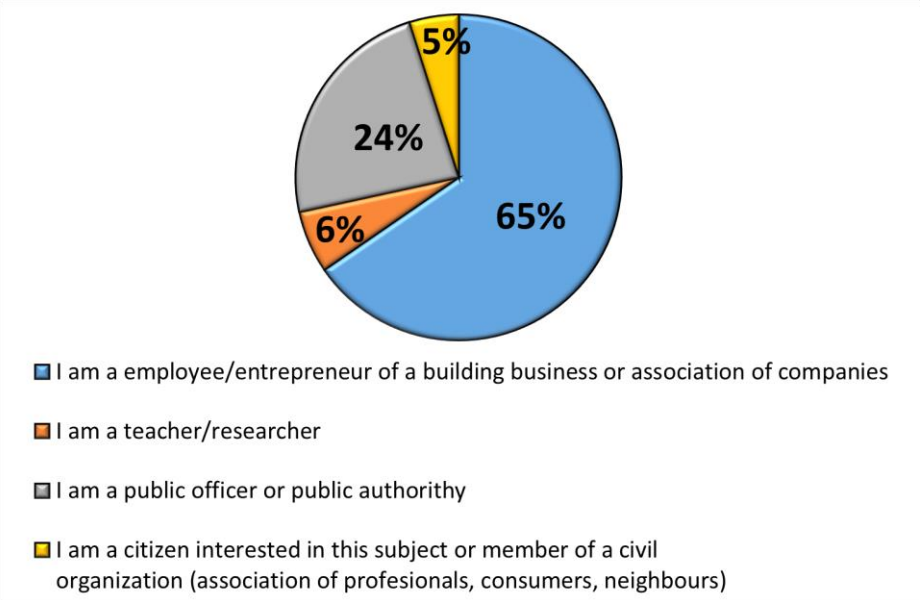

Fig. 8: Connection of respondents to the construction branch

Respondents were asked about their knowledge and interest in the SDGs. 74% of the respondents know the SDGs and are interested in them, 20% do not know and are slightly interested in them, while the respondents who do not know the SDGs are 5% and those who do not have the knowledge and are not interested represent were only 1% (**Fig. 9**).

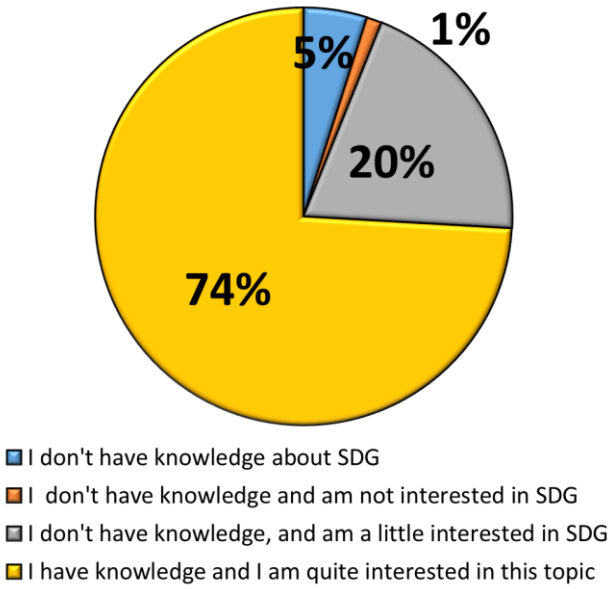

Fig. 9: Knowledge concerning the SDGs. (How well do you know the SDGs)

According to the respondents, the SDGs most directly connected with the construction industry were sequentially SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action), SDG 7 (Affordable and Clean Energy) and SDG 12 (Responsible Consumption and Production), as more than 70% of the respondents voted that they have a direct connection. On the other hand, the less connected SDGs were SDG 2 (Zero Hunger), SDG 1 (No Poverty) and SDG 16 (Peace, Justice and Strong Institutions), as these goals gained the most “No connection votes” (**Fig. 10**).

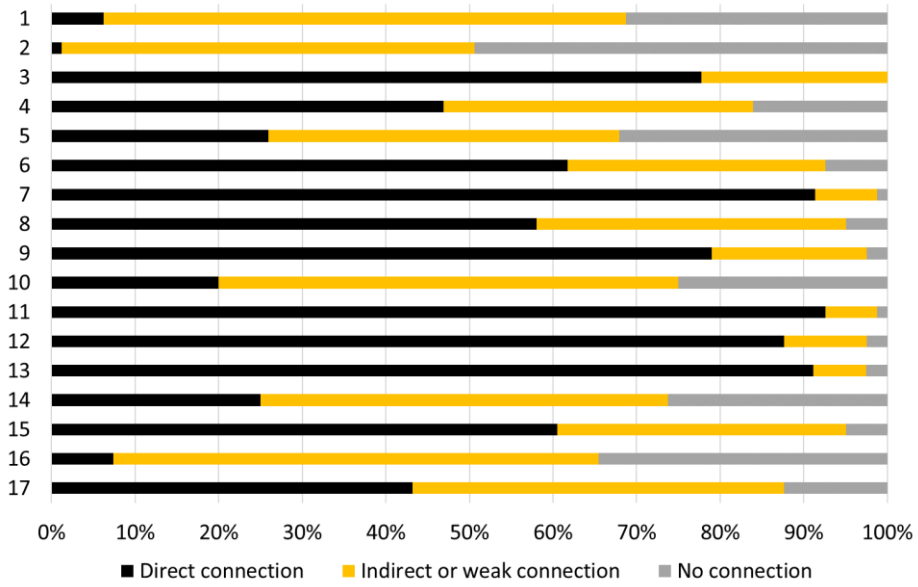

Fig. 10: SDGs and construction business (according to your opinion, how well the following goals related to the construction, per cent). Caption: 1. No poverty, 2. Zero hunger, 3. Good health and well-being, 4. Quality education, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure, 10. Reduced inequalities, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land, 16. Peace, justice and strong institutions, 17. Partnership for the goals

Concerning the factors that were consider to hinder the implementation of the SDGs (**Fig. 11**), the economic factors gained the most votes in many of the named goals, followed by political and jurisprudence barriers. The rest of the suggested factors were less problematic, with one clear exception: gender equality, in which the cultural factors were considered the most significant barrier.

Those who mentioned the ‘other factors’ were asked to explain these factors. Eleven respondents answered this question, indicating e.g. limitations in achieving the SDGs due to building owners’ wishes and political barriers.

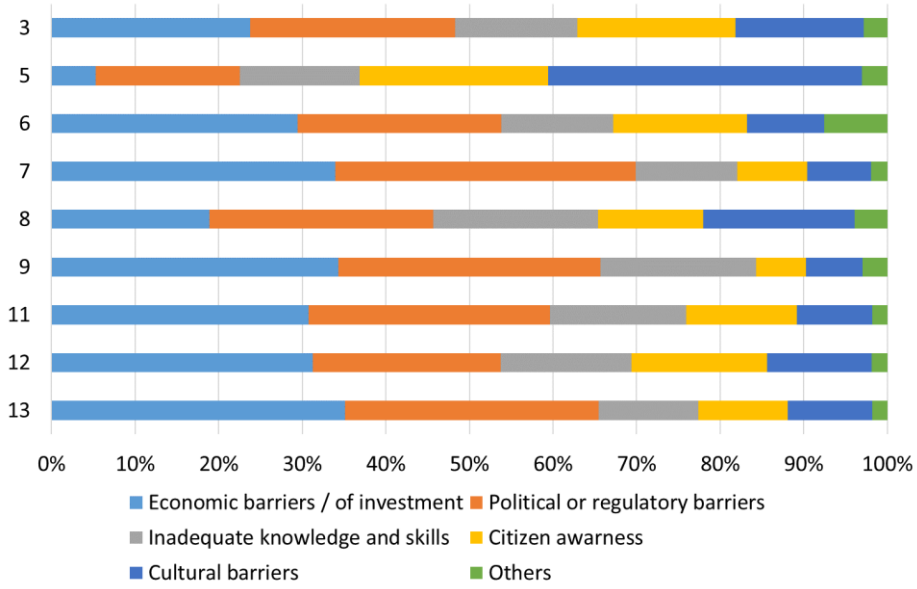

Fig. 11: Factors that prohibit reaching the SDGs (which factor prohibits reaching the SDGs listed, per cent). Caption: 3. Good health and well-being, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action

3.3.3 Finland

In Finland, most of the respondents (47%) were employees or entrepreneurs from companies operating in construction branches. In addition, there were 8 teachers or researchers, 10 workers of public organizations and 11 members of civil organizations and ordinary people (**Fig. 12**).

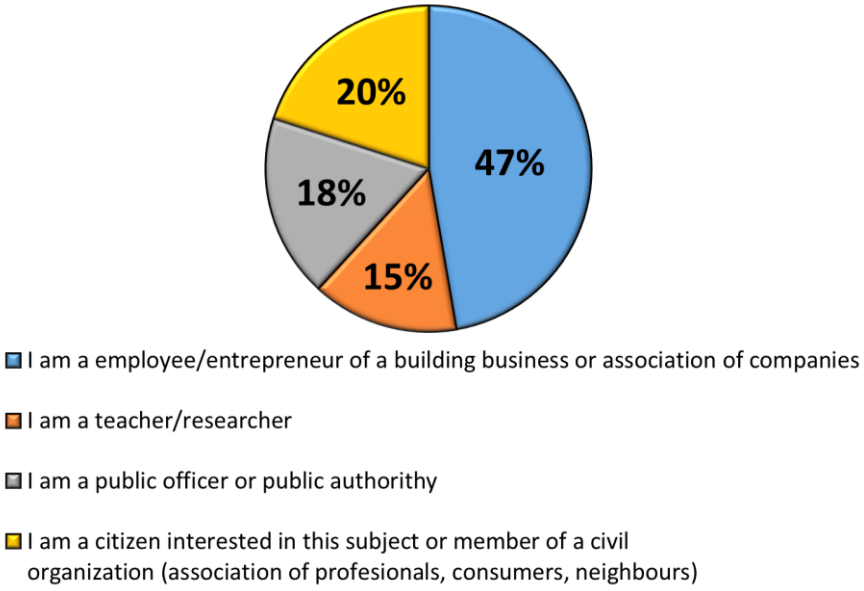

Fig. 12: Connection of respondents to the construction branch

Approximately half of the respondents knew the SDGs and had little interest, and a slightly smaller part of respondents was very interested in SDGs (Fig. 11). Those who had no idea or interest were a clear minority.

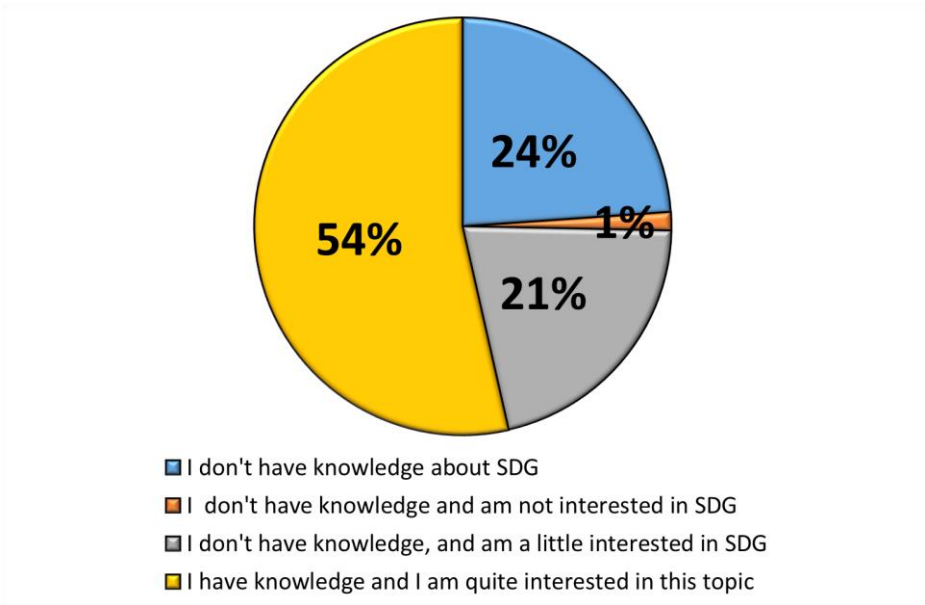

Fig. 13: Knowledge concerning the SDGs. (How well do you know the SDGs)

According to the respondents, the SDGs most directly connected with the construction branch were the SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action), SDG 9 (Sustainable Industry, Innovations and Infrastructure), and SDG 6 (Clean water and

Sanitation) (**Fig. 14**). More than 80 percent of the respondents voted those having a direct connection. Less than 20 per cent of votes for a direct connection to the construction sector were given to SDG 2 (Zero Hunger), SDG 5 (Gender Equality) and SDG 16 (Peace, Justice, and Strong Institutions). These goals gained the most 'No connection' votes too.

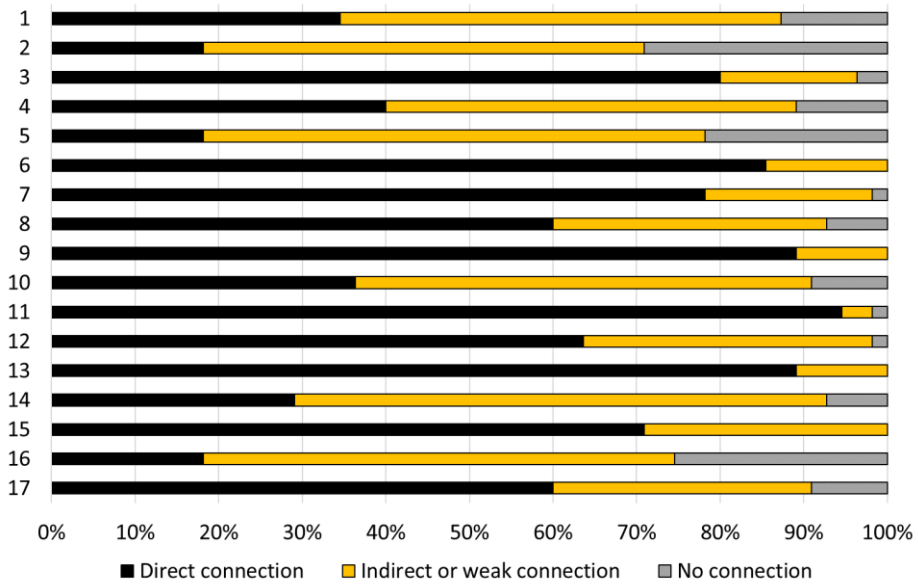

Fig. 14: SDGs and construction business (according to your opinion, how well the following goals related to the construction, per cent). Caption: 1. No poverty, 2. Zero hunger, 3. Good health and well-being, 4. Quality education, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure,10. Reduced inequalities, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land, 16. Peace, justice and strong institutions, 17. Partnership for the goals

As for the factors that were considered to prohibit reaching the SDGs, no precise number one was found (**Fig. 15**). Although the economic factors gained many of the votes, the rest of the suggested factors remained very close to the economic, with one clear exception: gender equality, in which the cultural factors were considered as the most significant barrier.

Those who mentioned the 'other factors' were asked to explain further. 11 respondents answered this further question, indicating e.g., masculine dissatisfaction with environmental and equality policy. However, there were also severe comments concerning the conservative and capital-intensive nature of business – and in this case, it probably meant the development business – which causes prolonged changes and takes time.

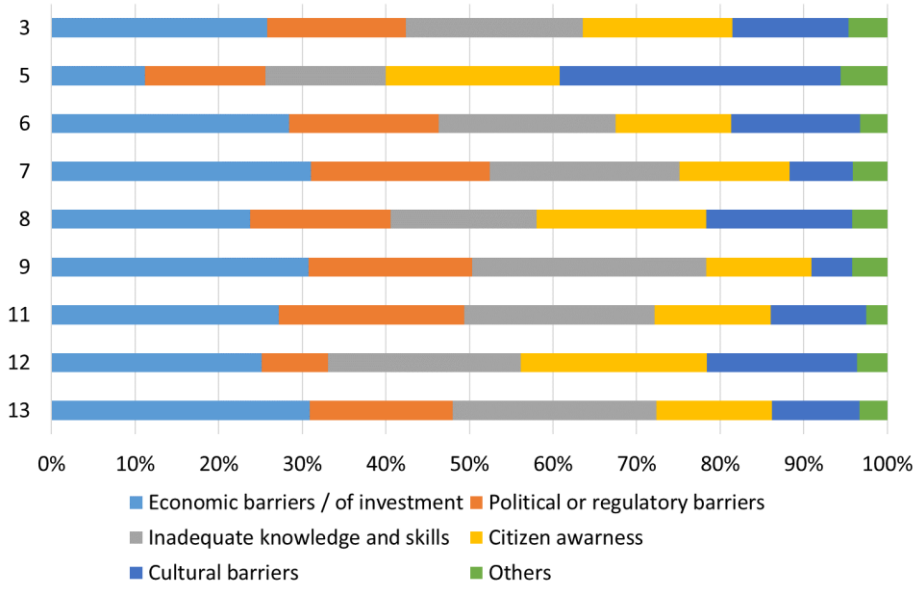

Fig. 15: Factors that prohibit reaching the SDGs (which factor prohibits reaching the SDGs listed, per cent). Caption: 3. Good health and well-being, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action

Summing up, it can be said that most of the Finnish respondents knew the SDGs and showed at least little interest in them, but they had difficulties seeing the connection between many of the goals and the construction industry. In many cases, the economic factors are the most significant barrier to reaching the SDGs, but jurisprudence, inadequate knowledge and skills, lacking awareness and cultural issues were seen as barriers to sustainable construction.

3.3.4 Spain

In Spain, most of the respondents (60 %) were employees or entrepreneurs in companies operating in construction branches. In addition, there were 7 teachers or researchers, 2 workers of public organizations, 8 members of civil organizations, and ordinary people. (**Fig. 16**).

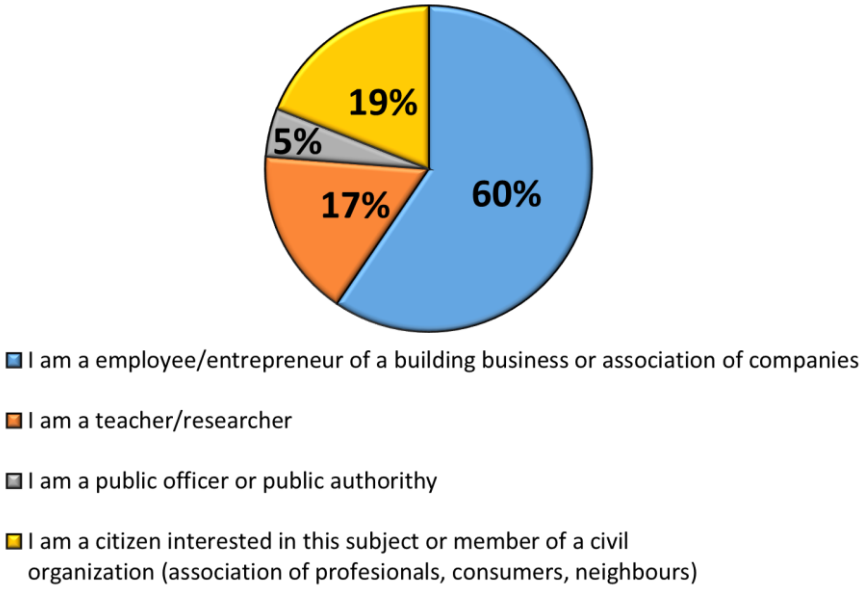

Fig. 16: Connection of respondents to the construction branch

Approximately half of the respondents knew the SDGs and had little interest, and a slightly more minor part of respondents was very interested in SDGs (**Fig. 17**). Those who had no idea or interest were a very small minority.

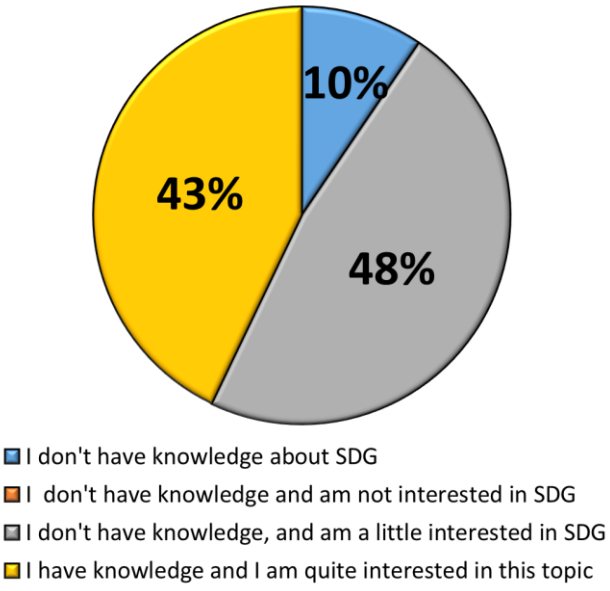

Fig. 17: Knowledge concerning the SDGs. (How well do you know the SDGs)

According to the respondents, the SDGs most directly connected with the construction branch were SDG 9 (Industry, Innovation, and Infrastructure), SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action) (**Fig. 18**). More than 80 percent of respondents voted those having a direct connection. On the other hand, less than 20 per cent

of votes for a direct connection were given to SDG 2 (Zero Hunger), SDG 5 (Gender Equality), SDG 14 (Life Below Water), SDG 16 (Peace, Justice, and Strong Institutions) and SDG 17 (Partnerships for the goals). These goals gained the most 'No connection' votes too.

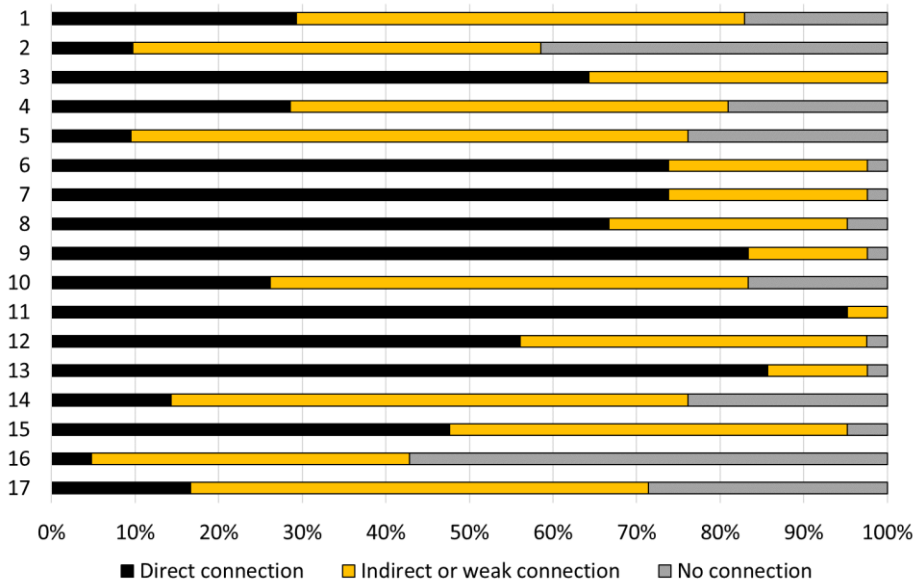

Fig. 18: SDGs and construction business (according to your opinion, how well the following goals related to the construction, per cent). Caption: 1. No poverty, 2. Zero hunger, 3. Good health and well-being, 4. Quality education, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure, 10. Reduced inequalities, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land, 16. Peace, justice and strong institutions, 17. Partnership for the goals

Concerning the factors that were considered to be a barrier for SDG implementation, no clear number one was found (**Fig. 19**). Although the economic factors gained (for many SDGs) most of the votes, the rest of the suggested factors remained very close to the economic. There was one clear exception: gender equality, in which the cultural factors were considered as the most significant barrier.

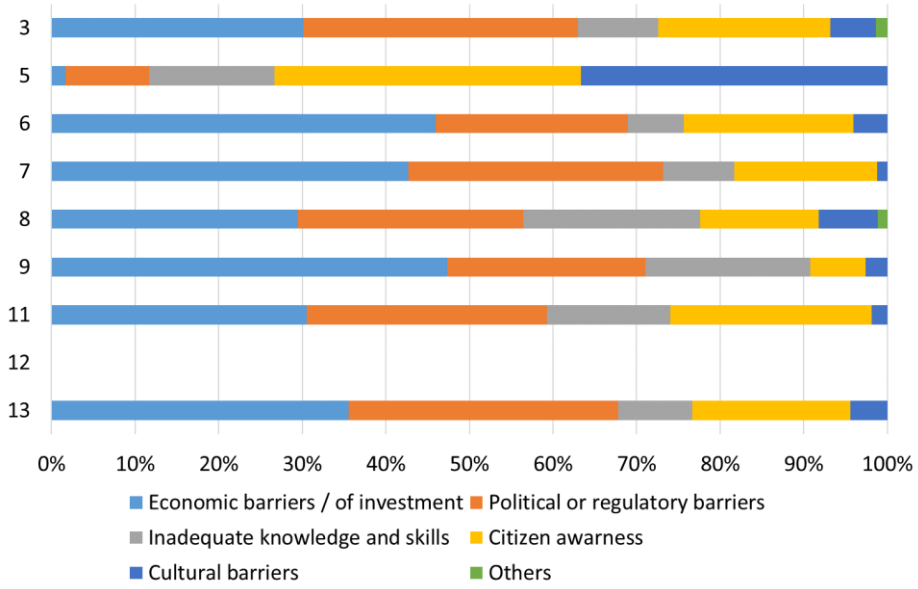

Fig. 19: Factors that prohibit reaching the SDGs (which factor prohibits reaching the SDGs listed, per cent). Caption: 3. Good health and well-being, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action

Those who mentioned the other factors were asked to explain further. These responses pointed towards labour intrusion and the black economy.

In conclusion of this part, it can be said that most of the Spanish respondents knew the SDGs and showed at least little interest in them, but they had difficulties seeing the connection between many of the goals and the construction industry. In many cases, the economic factors are the most significant barrier to reaching the SDGs, but jurisprudence, inadequate knowledge and skills, lacking awareness and cultural issues were seen as barriers to sustainable construction.

3.4 Results: Academia

3.4.1 Belgium

In the group “Schools and education”, there were 13 respondents (**Fig. 20**).

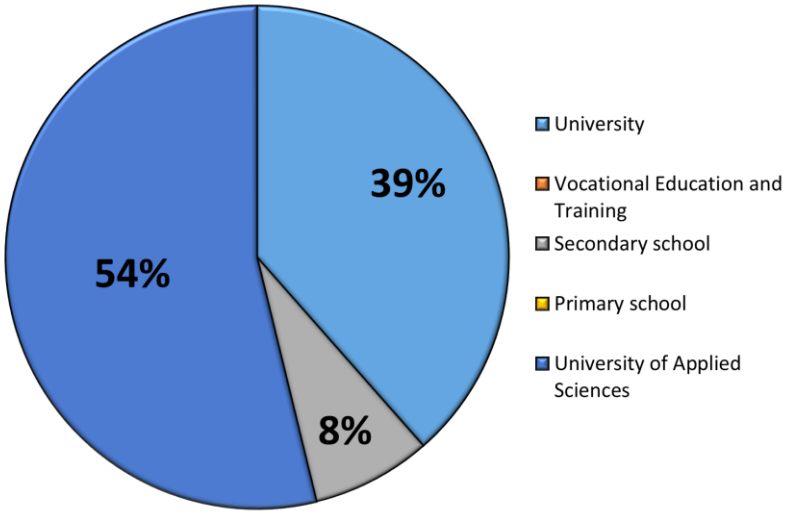

Fig. 20: Educational institutes

The university respondents belonged all to the building and architecture department. The lecturers and researchers employed at a university of applied sciences also belonged to the construction department. Their occupation is infrastructure, EPC calculations, architecture, building physics, and construction materials.

Eight respondents claimed that they already implement sustainability in their curriculum (**Fig. 21**). Sustainability is already implemented in the following courses:

- Lean construction
- Building Technology
- Smart Buildings
- Sustainable Construction
- Circularity

Some respondents said they do not implement it in their courses but know that colleagues use it.

Nine respondents know that the school they belong to elaborates plans and campaigns to create a higher awareness for sustainability themes.

Eight respondents use the following SDG-related topics:

- Energy efficiency
- Optimization of the use of natural sources
- Climate adaptive solutions
- Ventilation optimization
- Use of energy, water
- Nature inclusive construction
- The healthy environment within buildings
- Use of materials with lower environmental impact

No specific SDG is used at this moment.

Seven respondents explained how they use it: during information days, the communication of sustainable policy plans, a think tank of researchers, Green Office and anchoring the SDGs in policy plans.

The emphasis on using SDGs is necessary for climate change and environmental protection.

They are considered less important in developing cooperation and work against discrimination themes.

Promoting circular economy and innovation and infrastructure are also considered important.

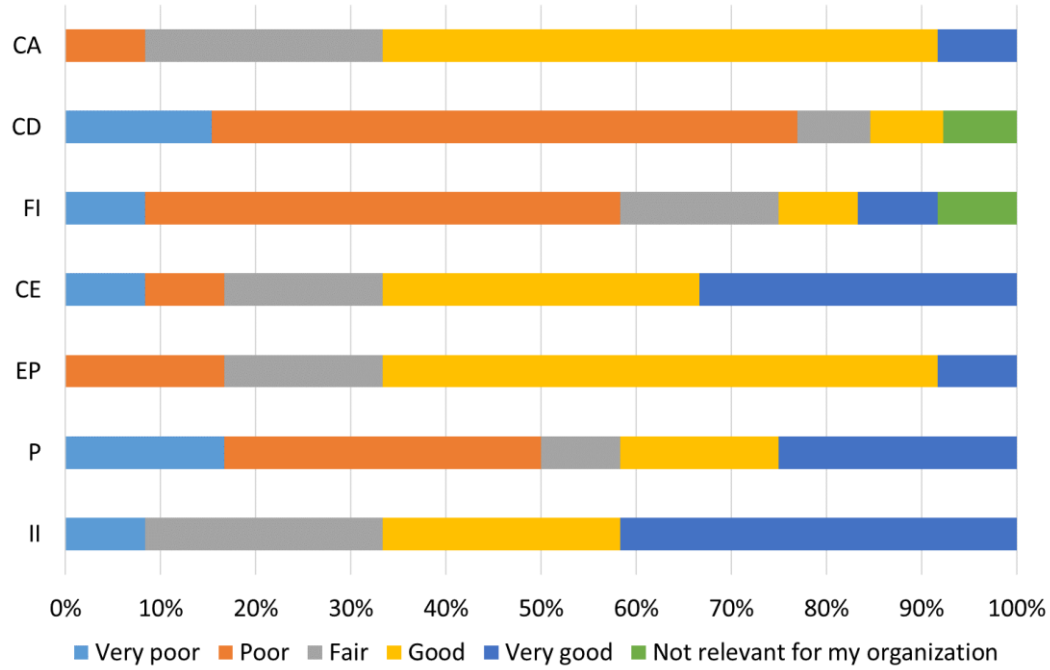

Fig. 21: SDGs in architecture-, engineering and construction education (how are the SDGs considered in architecture, engineering, and construction education). Caption: CA = Climate action, CD = Cooperation for development, FI = Fighting against inequality, CE = Foster circular economy, EP = Environmental protection, P = People: working conditions, equal opportunities, capacity building, collaboration, etc., II = Innovation and Infrastructure

3.4.2 Denmark

In this category, 24 responses were collected representing educational institutes in the built environment, mostly from universities 62,5%, 29% from Vocational Education (VE) and 8,3% from University Colleges (UC) (**Fig. 22**). Most of the respondents, 58%, revealed that the SDGs are not relevant for their education, and only 28% agreed that they are, while 16% do not implement them (**Fig. 23**).

For all the institutes that responded, their curricula included topics approaching sustainability, and there have also been official and unofficial activities where sustainability was taught to students. However, those who have not implemented the SDGs mentioned that it would take time to incorporate them into their courses. There is also a lack of interest and recognition of their importance from the leader's side.

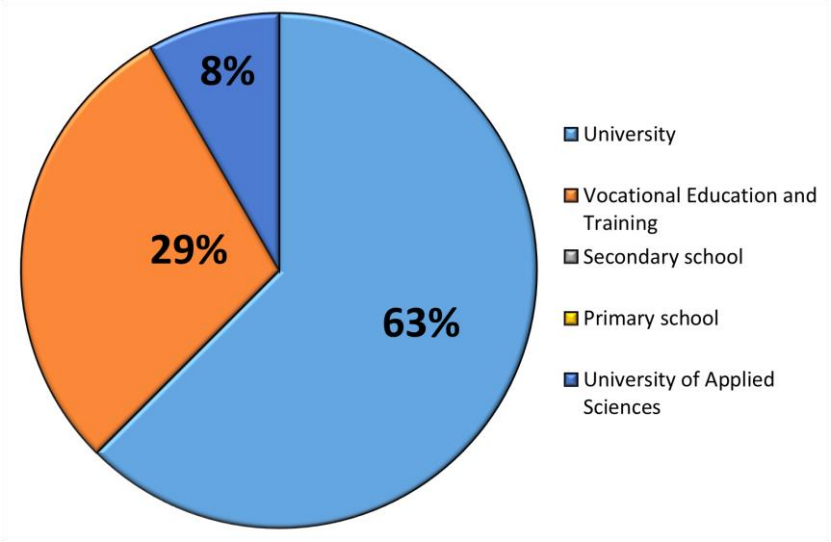

Fig. 22: Educational institutes

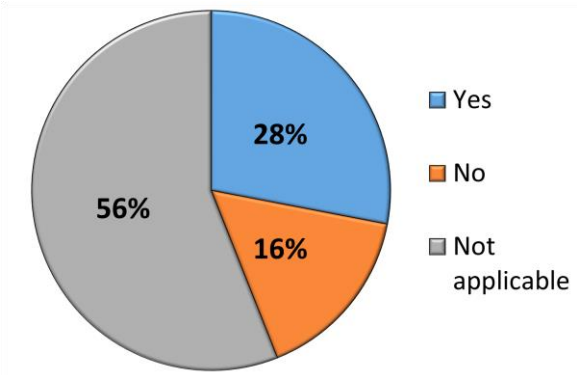

Fig. 23: Implementing the SDGs in educational institutes

Respondents were asked whether their institutes have already taken any initiatives to implement the SDGs in education. **Fig. 24** shows that 33% of the institutes have already developed initiatives to implement the SDGs, 8% have not, and 58% mentioned that they are not relevant to them.

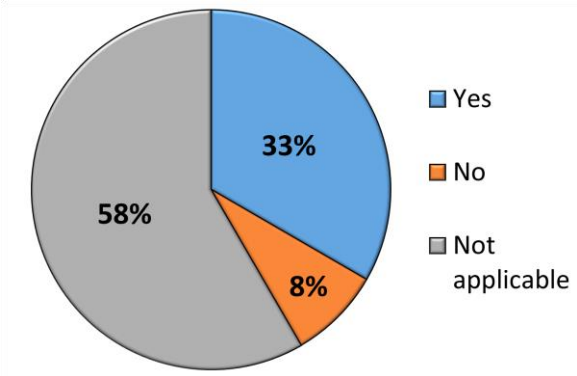

Fig. 24: Educational institute's initiatives to implement the SDGs

Positively, many responses expressed that institutions are willing to implement the SDGs in their plans, though 43% answered that the SDGs are not relevant to them, **Fig. 25**.

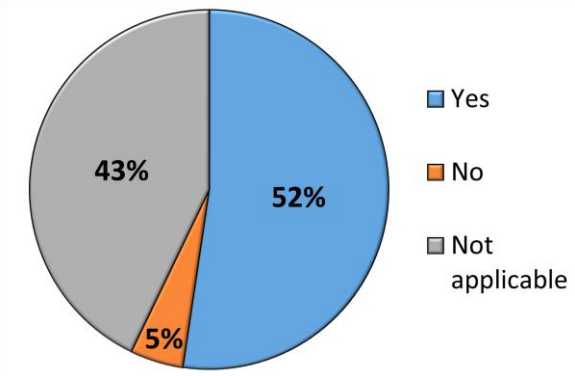

Fig. 25: Educational institute's initiatives to implement the SDGs

The extent of SDG implementation in construction-related programs was investigated according to several topics within sustainable development (**Fig. 26**). The SDGs approaching innovations and infrastructure, climate change, and the circular economy are considered well. In contrast, development cooperation, working conditions, and work against discrimination are addressed to a lesser extent. Development cooperation is not related to a certain SDG but relates to most of them. Environmental protection was considered less.

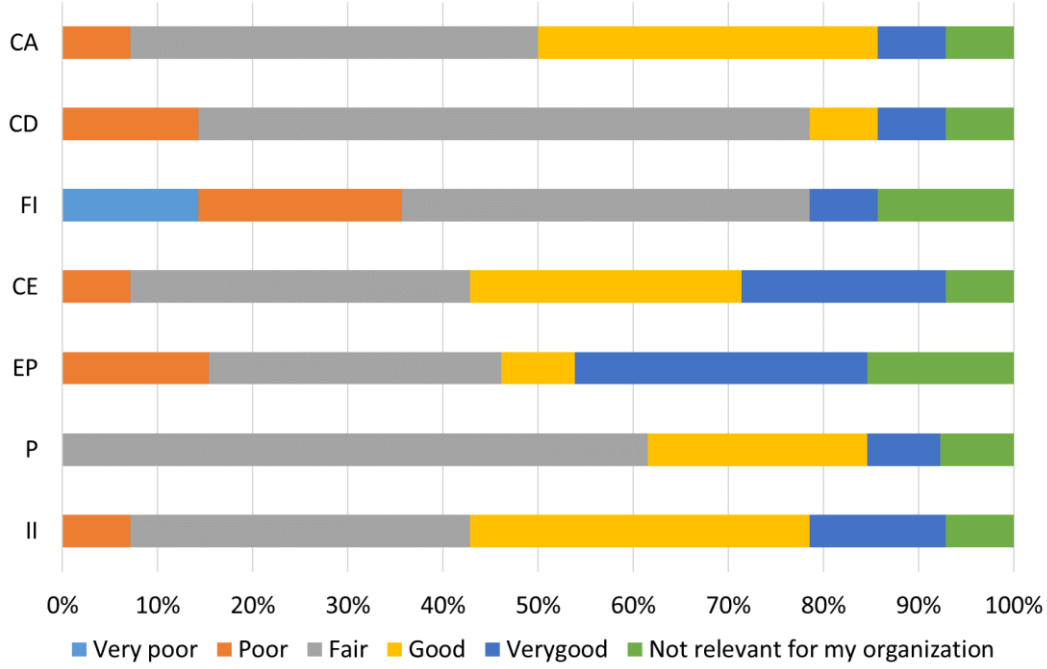

Fig. 26: SDGs in architecture, engineering, and construction education (how are the SDGs considered in architecture, engineering and construction education). Caption: CA = Climate action, CD = Cooperation for development, FI = Fighting against inequality, CE = Foster circular economy, EP = Environmental protection, P = People: working conditions, equal opportunities, capacity building, collaboration, etc., II = Innovation and Infrastructure

3.4.3 Finland

In the 'Schools and education' group, there were 8 respondents, 5 representing the universities of applied sciences (UAS), 1 from vocational education (VET), 1 from upper secondary school (USS) and 1 from comprehensive school (**Fig. 27**). All UAS and VET lecturers represented the discipline 'Built environment'. The USS representative worked in administration, and the teacher at a comprehensive school taught common subjects. In all the institutes, the curriculum included topics approaching sustainability, and there have also been official and unofficial activities where sustainability was made known to pupils and students. All the respondents considered the SDGs in their classes too, and 6 of the 8 respondents had planned some activities to be realised soon. The free speech question approached the goals focused on in teaching. The replies show that Finland focuses on specific issues such as carbon footprint, energy efficiency and digitalization. Only 2 of the 8 respondents said they are approaching the SDGs as a holistic concept.

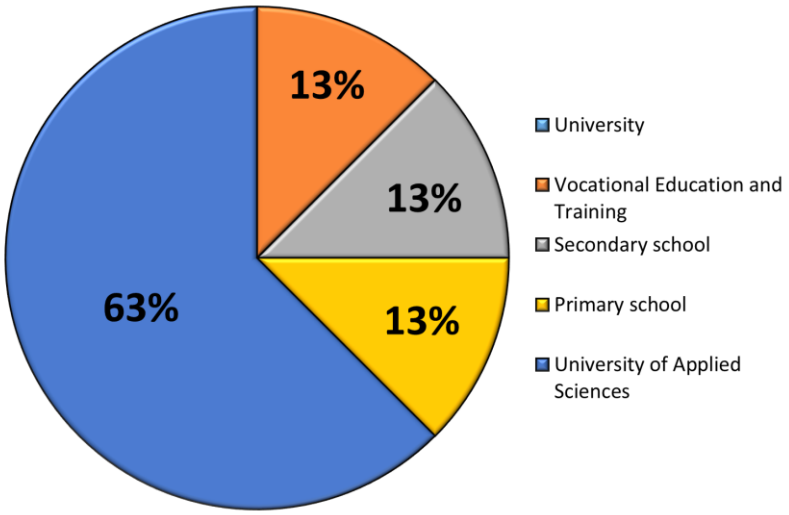

Fig. 27: Educational institutes

The respondents found it hard to describe how the SDGs are presented. This confusion might be due to the above: in Finland, the approach is more likely specific, focusing on particular local examples, not on policy papers and worldwide agendas.

The SDGs on innovation and infrastructure, working conditions and discrimination, environmental protection, circular economy and climate change were considered moderately or well in the curricula (average 3.5 – between moderately and well), whereas development cooperation and work against discrimination were in most cases considered only very weakly, weakly or moderately (average 2 – weakly) (**Fig. 28**). It is worth noting, that development co-operation is not a single SDG but can be derived from most of the goals, e.g., 1, 2, 3 and 4 are directly connected with development co-operational activities.

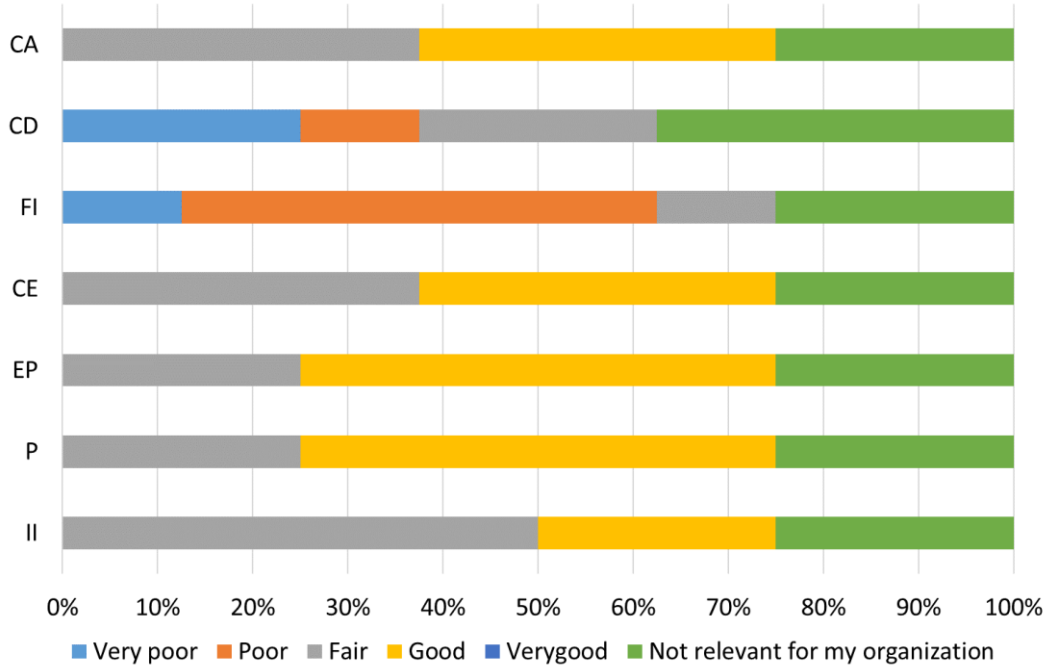

Fig. 28: SDGs in architecture-, engineering and construction education (how are the SDGs considered in architecture, engineering, and construction education). Caption: CA = Climate action, CD = Cooperation for development, FI = Fighting against inequality, CE = Foster circular economy, EP = Environmental protection, P = People: working conditions, equal opportunities, capacity building, collaboration, etc., II = Innovation and Infrastructure

3.4.4 Spain

All the academic respondents in Spain work as professors at university (**Fig. 29**). They teach, among others, the following subjects: building, structural, hydraulic, mechanical, automation, electrical and electronic engineering, building information modelling, geography and land use planning, politics, international relationships, legislation and information and communication technologies.

Most respondents considered the SDGs not applicable to their classes, and only 28% have already incorporated them into their teaching curriculum. The reasons for not incorporating them, when applicable, are the lack of knowledge, interest, and the fact that the subjects are focused on particular technologies.

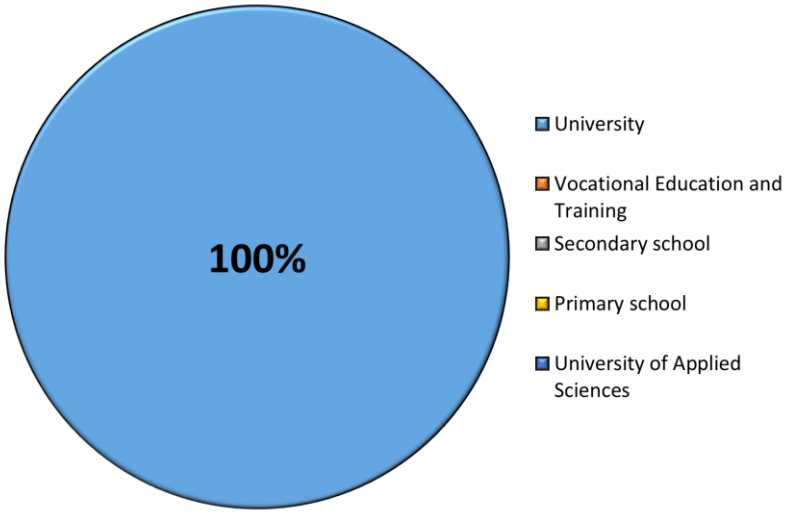

Fig. 29: Educational institutes

When asked about the quality of the training given to students regarding several sustainability items, the results indicate that this is generally poor or very poor (**Fig. 30**).

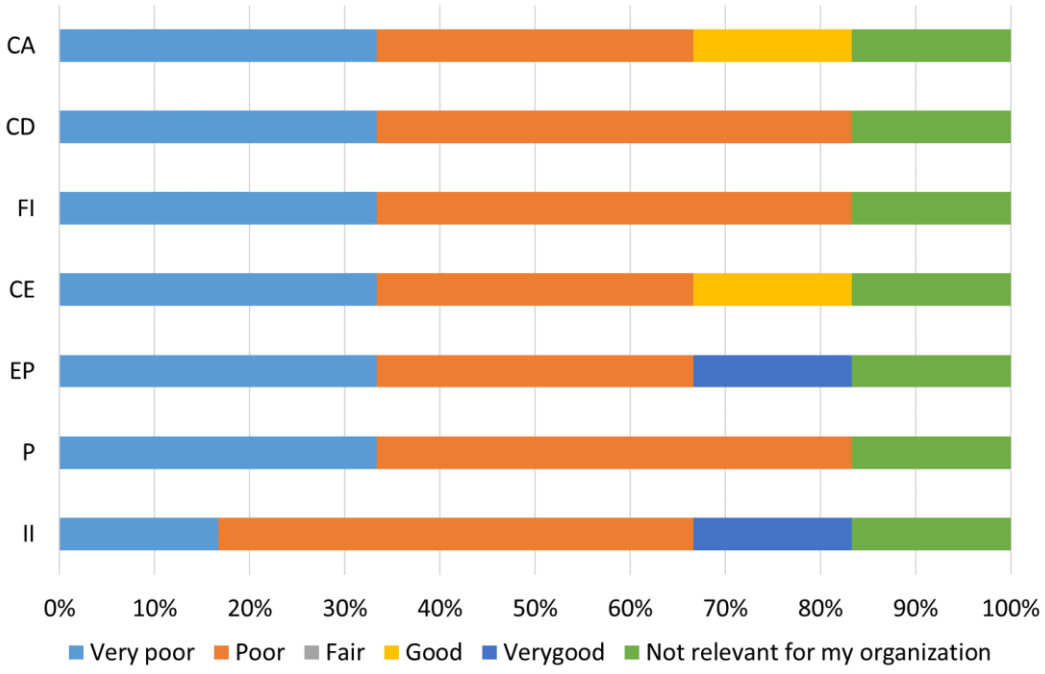

Fig. 30: SDGs in architecture-, engineering and construction education (how are the SDGs considered in architecture, engineering, and construction education). Caption: CA = Climate action, CD = Cooperation for development, FI = Fighting against inequality, CE = Foster circular economy, EP = Environmental protection, P = People: working conditions, equal opportunities, capacity building, collaboration, etc., II = Innovation and Infrastructure

3.5 Results: Companies

3.5.1 Belgium

35 respondents belonged to the group of companies. The biggest subgroups, measured by the number of employees, were those in which there were less than five employees (33,3%) and those with more than 250 employees (16,7%). Between these ends, there were 18 companies divided into four subclasses. (**Fig. 31**)

Compared to their activities and tasks, the group of respondents working in the construction branch was relatively homogenous (**Fig. 32**). Although most of the respondents were from construction companies (46%), the other respondents were (or belonged to) real estate (14%), architects (14%), suppliers and producers (17%) and installation companies (11%) The other branches were not well represented (less than 5%).

Most of the respondents found the sustainable development goals to be an opportunity to decrease the environmental impacts of the business (74%), to improve their processes and products (57%) and to stand out favourably from competitors (57%) (**Fig. 33**). Few respondents indicated that there wouldn't be a negative impact on the environment (14%). However, 40% feared there would be a negative impact on their productivity.

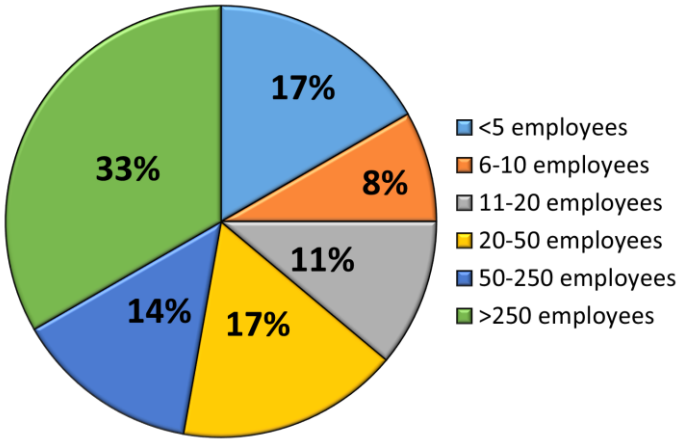

Fig. 31: Size of respondent companies

Real estate buisness	14%
Construction company	46%
Architecture, Landscaping and/or Urban planing	14%
Engineering (Industrial, Civil, Mining, etc) or quantity surveyors	6%
Environmental consultancy	3%
Manufacturing and or sell of construction products and materials	17%
Extraction and commercialization of construction minerals	0%
Services for the construction industry (Geotechnics, Topography, etc.)	3%
Quality Control and/or Certification	3%
Demolition work	6%
Management and treatment of Construction and Demolition waste	6%
Product or interior design	0%
Installer (Electricity, plumbing, air conditioning, fi re protection, home automation,etc.)	11%
Others	9%

Fig. 32: Branch of the respondents

An opportunity to be more efficient or productive.	37%
An opportunity to improve the quality of our products or processes.	57%
An opportunity to reduce our environmental impact.	74%
A trend that is embodied in legal or regulatory obligations.	49%
An opportunity to better connect with our customers.	26%
An opportunity to differentiate from our competitors.	57%
An imposition that reduces our competitiveness.	23%
A trend that increases our costs or reduces our productivity.	40%
An opportunity to reduce inequalities.	11%
A trend that creates inequality between companies based on their size, location, etc.	14%
A political or social trend that is difficult to implement in practice in companies.	23%
An initiative with little capacity for real positive impact.	14%
Other	3%

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Fig. 33: Sense of SDGs for business (the sense of SDGs for the company/business

21 of the respondents answered the free speech question 'What are the goals of your company in sustainability and responsibility?'. The following answers occurred:

- Not only people have to be considered, but also nature.
- Making employees aware of sustainability
- Also, other companies than their own have to become aware
- Circularity and modular construction methods
- Implementing sustainability in design
- To distinguish yourselves from competitors
- Efficiency in energy use

- To lower footprint

There were no real answers as to how the employees were aware of the SDGs. The companies know what sustainability means but need to implement it for the employees.

More than two third of the respondents seem to believe that sustainability awareness will become more important for private persons, companies, and public organisations in the future. (**Fig. 34**).

From the company's point of view, the most critical issues related to the SDGs seem to be energy efficiency, material efficiency and renewable energy (**Fig. 35**). climate change was fourth. Water efficiency, biodiversity, pollution of the air, and certificates gained only random votes.

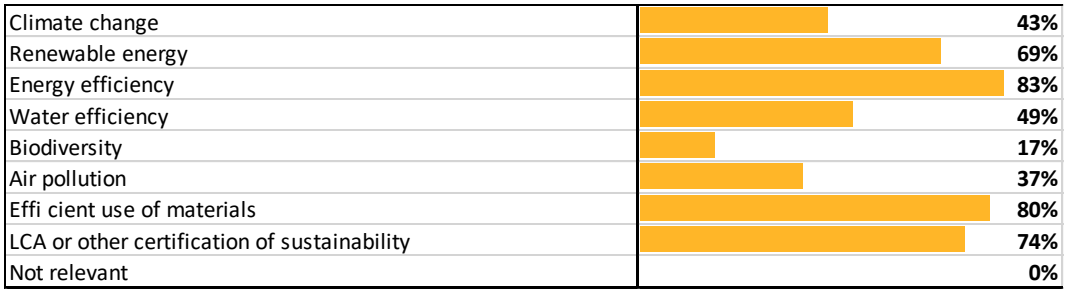

Fig. 34: Important for companies (Important issues from the point of view of the company)

Only three companies did nothing during the past five years to promote sustainable development. When describing past efforts, the respondents listed the following examples:

- Installation of solar panels
- Possibility for employees to lease bicycles
- Optimisation of energy consumption
- Diminishing waste
- Investigation of gains by circularity
- Waste management improvements
- Efforts to reduce CO_2
- Buying green electricity

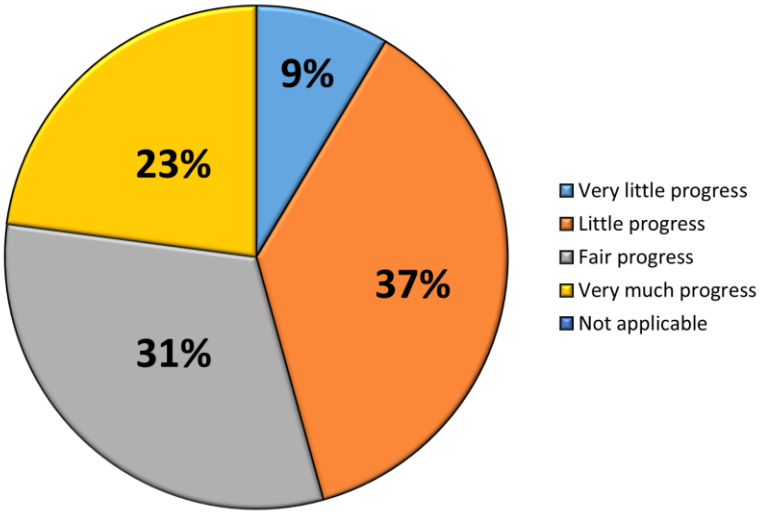

Fig. 35: Companies have promoted sustainable development (how much a company has done during the past five years to promote sustainable development)

The respondents were asked to evaluate how the architecture and construction branches considered the user- and customer orientation in specific named targets of their activities, like neighbourhoods or office buildings. In office buildings, private housing and public buildings, there is a considerable increased awareness that buildings must be more liveable for users. However, in transport and renovation, that does not seem so important currently (**Fig. 36**).

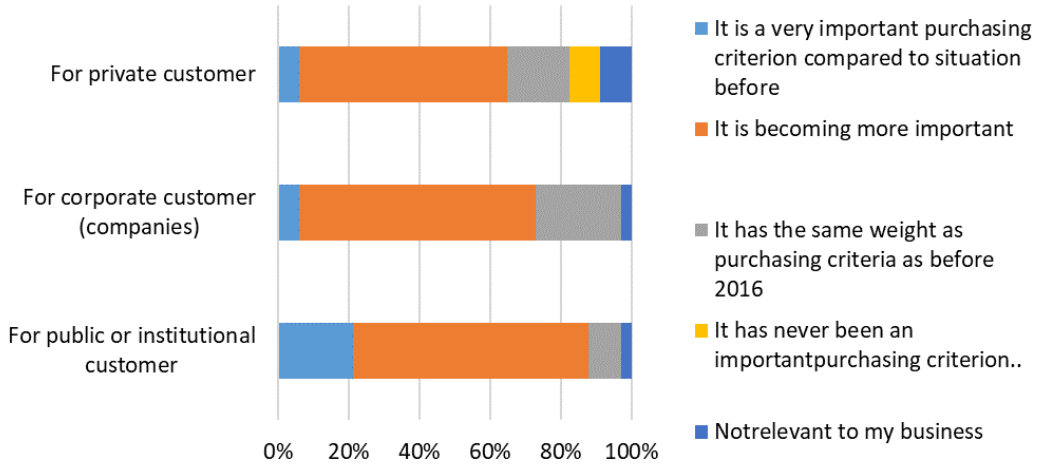

Fig. 36: Customers and the SDGs (how do the customers value the SDGs)

3.5.2 Denmark

The highest number of responses, measured by organisations' number of employees, were collected from big organisations with 50-250 employees, then the middle ones with 20-50 employees, followed by small organisations with less than five employees (**Fig. 37**).

Most of the respondents, measured by their activities and tasks, are architects (43,4%), followed by engineers and contractors (24,5%) (**Fig. 38**).

Most of the respondents (68%) found the SDGs to be an opportunity to reduce the environmental impact and 57% found it a possibility to improve their processes or products. 40 % think that the SDGs will improve their competitiveness among others, and 26% think that they provide easier access to clients. According to 21%, the SDGs are primarily political or social, challenging to implement in practice, and 15% consider it an opportunity to increase the productivity or effectiveness of the operations (**Fig. 39**).

Fig. 37: Size of respondent companies

Real estate buisness	4%
Construction company	25%
Architecture, Landscaping and/or Urban planing	43%
Engineering (Industrial, Civil, Mining, etc) or quantity surveyors	25%
Environmental consultancy	4%
Manufacturing and or sell of construction products and materials	0%
Extraction and commercialization of construction minerals	0%
Services for the construction industry (Geotechnics, Topography, etc.)	2%
Quality Control and/or Certification	4%
Demolition work	0%
Management and treatment of Construction and Demolition waste	0%
Product or interior design	2%
Installer (Electricity, plumbing, air conditioning, fi re protection, home automation,etc.)	0%
Others	11%

Fig. 38: Branch of the respondents

An opportunity to be more efficient or productive.	27%
An opportunity to improve the quality of our products or processes.	12%
An opportunity to reduce our environmental impact.	58%
A trend that is embodied in legal or regulatory obligations.	12%
An opportunity to better connect with our customers.	23%
An opportunity to differentiate from our competitors.	39%
An imposition that reduces our competitiveness.	0%
A trend that increases our costs or reduces our productivity.	4%
An opportunity to reduce inequalities.	8%
A trend that creates inequality between companies based on their size, location, etc.	4%
A political or social trend that is difficult to implement in practice in companies.	0%
An initiative with little capacity for real positive impact.	4%
Other	15%

Fig. 39: Sense of SDGs for business (the sense of SDGs for the company/business

Respondents were asked about their organisation's goals in sustainability and whether the employees are aware of them. Accordingly, 44 responses were collected, showing

that the organisation's most significant focus is reducing the environmental impact, carbon footprint, circularity, and energy consumption, primarily through sustainable building certification systems (DGNB). Responses show that many organisations already have a clear sustainability strategy with ambitious goals and have invested in educating employees about sustainability. Others do not have a specific sustainability goal; few have not included sustainability yet but are willing to.

According to 30 respondents, customers consider that the SDGs do not influence private clients, neither now nor in the future. Moreover, 27 respondents agree that the SDGs are becoming more critical for organisations, while most public and institutional clients believe that the SDGs are essential criteria (**Fig. 40**).

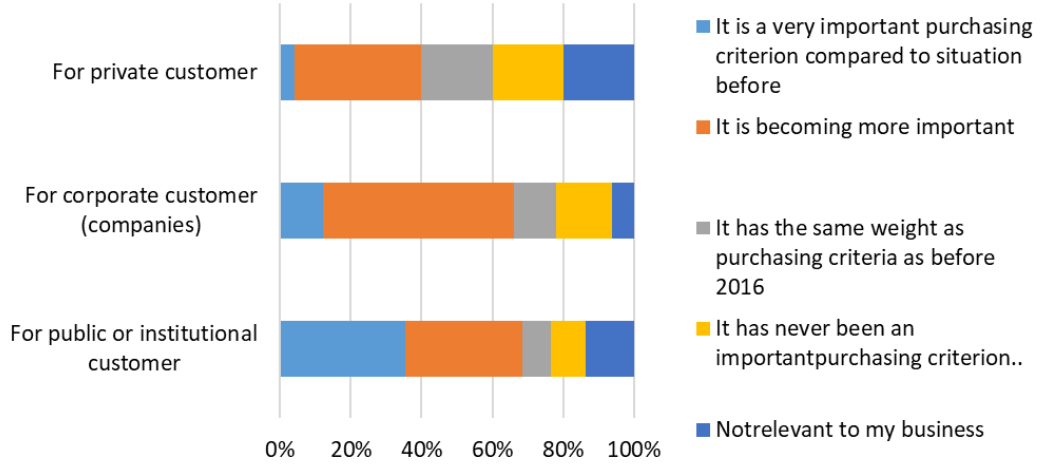

Fig. 40: Customers and the SDGs (how do the customers value the SDGs)

According to organisations most considerable interest in environmental sustainability (**Fig. 41**), firstly is related to the life cycle and other sustainability assessments (83%), followed by energy efficiency (81%), renewable energy (77,4%), effective material application (75,5%), climate changes (68%), water efficiency (43,4%) and air pollution (40%). On the other hand, there is much less focus on the circular economy, indoor climate, legislation change and increased requirements for sustainability.

Climate change	68%
Renewable energy	77%
Energy efficiency	81%
Water efficiency	43%
Biodiversity	57%
Air pollution	40%
Effi cient use of materials	76%
LCA or other certification of sustainability	83%
Not relevant	0%

Fig. 41: Important for companies (Important issues from the point of view of the company)

Organisations were asked about their progress in promoting sustainable development in the last five years (**Fig. 42**). Accordingly, 44 responses were collected. Most respondents (37%) have good interest and progress in the sustainable development initiatives to implement the SDGs. 28,3% reported an outstanding progress, while 20,8% had reasonable progress. The rest of the responses indicated a lack of interest in sustainable development.

Some of the sustainable development initiatives were mentioned several times, including circular principles such as sustainable renovation and demolition, waste sorting and reduction. The circle house is the world's first general project built according to circular principles. Several organisations work on massive scales, e.g., one organisation mentioned working with climate screening of approximately 1,500 homes for energy optimisation. Another organisation has a major urban development project, including more than 5,000 homes based on the SDGs. Generally, there is a significant focus on energy improvements by using efficient and intelligent solutions, renewable energy. Furthermore, organisations focus on fulfilling sustainable building assessment methods such as Swan labelling, DGNB and the building regulations voluntary sustainability building class.

Also, organisations use sustainable building materials with lower CO_2 emissions, such as fewer heavy materials, paper wool and recycled bricks. Other initiatives included developing new products, e.g. a new sustainable beam which will reduce CO_2 emissions and increase the bearing capacity. Another examples is increasing the use of cross-laminated timber (CLT) in buildings. One of the organisation's latest projects that a company has worked with is Troldebakker, a completed sustainable building in wood with healthy housing and communities. In addition, several organisations focus on creating biodiversity, rainwater harvesting and focus on the indoor climate.

One respondent mentioned that they work on smaller scales, and the most significant impact achieved was with nudging in terms of building smaller, consuming fewer materials, and operating smaller volumes. Another mentioned, "I always propose clients quality materials that last longer and therefore put less strain on them".

On a strategic level of some organisations, one response revealed that they had developed an SDG roadmap to help their members implement the SDGs across the value chain and in all construction phases. Particular focus has initially been on SDG 5, 8, 12 and 17. Another respondent mentioned that they had used the digital dialogue tool.[20]

In addition, one organisation mentioned that they had created a brand-new position (Sustainability Officer), and several DGNB consultants were trained to increase the implementation of sustainability. On the other hand, some responses revealed not having worked with SDGs, and one organisation had not referred to them since 2013. One respondent mentioned: "Unfortunately, I have not used the 17 SDGs as they are too vaguely worded and not at all targeted enough".

[20] https://www.verdensmålsbarometeret.dk

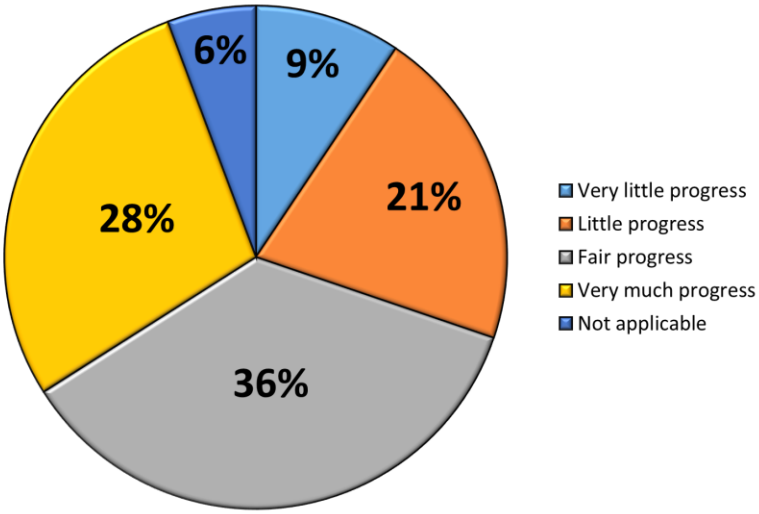

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Fig. 42: Companies have promoted sustainable development (how much a company has done during the past five years to promote sustainable development)

The respondents were asked to evaluate how the architecture and construction branch considered the user- and customer orientation in specific named targets of their activities, like neighbourhoods or office buildings. Accordingly, more than half of the respondents argued that user- and customer orientation had been considered well or even better (**Fig. 43**). However, transport infrastructure has a lower level of customer orientation than the other building sector areas.

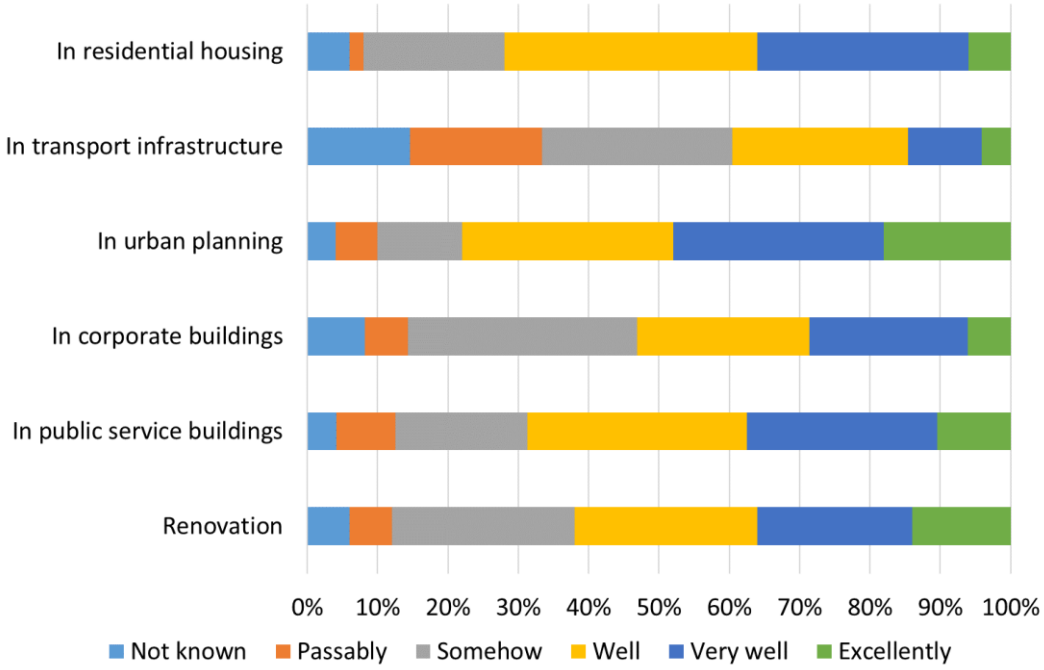


Fig. 43: construction business vs the customer orientation (how have the architecture and construction branches considered the customer orientation)

3.5.3 Finland

26 respondents belonged to the group of companies. The significant subgroups, measured by the number of employees, were those with less than 5 employees and those with more than 250 employees. Between these ends, there were 8 companies divided into 4 sub-classes. (**Fig. 44**)

Compared to their activities and tasks, the group of respondents working in the construction branch was relatively homogenous (**Fig. 45**). Although most of the respondents were from construction companies (6 respondents), also many other branches were represented with a proportion from 10 to 16% (3 to 5 respondents). Therefore, the number of branches is not precisely comparable with the number of companies. In the questionnaire, more than one branch was allowed to choose, and some companies selected two branches. The group 'others' (4 answers) consists of one auditor, one business management consult, one manufacturer of energy production systems and one real estate and construction branch organisation.

A majority of respondents found the SDGs an opportunity to decrease the environmental impacts of business and stand out favourably from competitors (**Fig. 46**). Many respondents thought that SDGs will be an opportunity to improve customer relationships and/or to increase productivity or effectiveness of operations. Only a few respondents considered that taking into account the SDGs had no negative impact on the business.

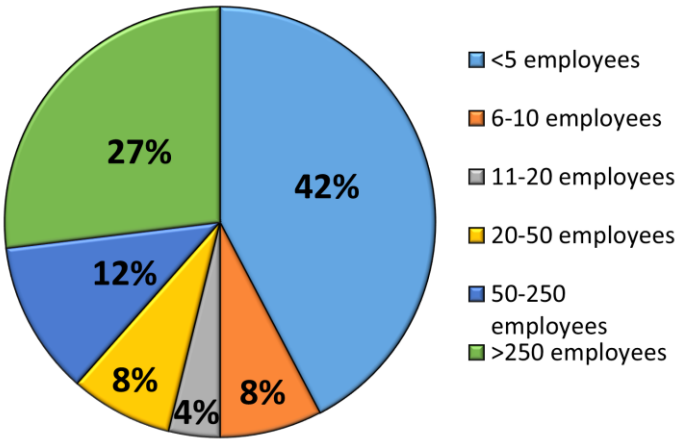


Fig. 44: Size of respondent companies

Real estate buisness	15%
Construction company	23%
Architecture, Landscaping and/or Urban planing	15%
Engineering (Industrial, Civil, Mining, etc) or quantity surveyors	12%
Environmental consultancy	0%
Manufacturing and or sell of construction products and materials	19%
Extraction and commercialization of construction minerals	0%
Services for the construction industry (Geotechnics, Topography, etc.)	0%
Quality Control and/or Certification	8%
Demolition work	0%
Management and treatment of Construction and Demolition waste	0%
Product or interior design	0%
Installer (Electricity, plumbing, air conditioning, fi re protection, home automation,etc.)	12%
Others	15%

Fig. 45: Branch of the respondents

An opportunity to be more efficient or productive.	27%
An opportunity to improve the quality of our products or processes.	12%
An opportunity to reduce our environmental impact.	58%
A trend that is embodied in legal or regulatory obligations.	12%
An opportunity to better connect with our customers.	23%
An opportunity to differentiate from our competitors.	39%
An imposition that reduces our competitiveness.	0%
A trend that increases our costs or reduces our productivity.	4%
An opportunity to reduce inequalities.	8%
A trend that creates inequality between companies based on their size, location, etc.	4%
A political or social trend that is difficult to implement in practice in companies.	0%
An initiative with little capacity for real positive impact.	4%
Other	15%

Fig. 46: Sense of SDGs for business (the sense of SDGs for the company/business

Only 19 of the respondents answered the free speech question 'What are the goals of your company in sustainability and responsibility?' In their answers, many respondents highlighted carbon neutrality, carbon footprint, and responsibility in relation to both employees and surrounding society. The responsibility in relation to society was, in many cases, defined as 'following the rules and paying taxes'. The responsibility in relation to the employee was described in terms of work safety, absence due to sickness, work satisfaction, and gender equality. All these concepts come from existing legislation. Thus, to reach SDGs, no extra actions were taken.

Furthermore, the equality was limited to gender equality, and no one mentioned race, ethnic origin, religion, or disability. This may be due to Finnish legislation, in which the Equality

Act is older than Non-Discrimination Act and stricter towards companies too. Thus, considering the SDGs, SDG 5 (Gender Equality) is on the agenda, whereas SDG 10 (Reduced Inequalities) remains omitted.

Although most respondents named goals that can be derived from SDGs, some respondents ignored sustainability and responsibility or even rose against the requirements. 'Our task is to make a profit. Our work does not promote sustainability nor responsibility', one of the respondents wrote. Another said that the professional pride of the production is the goal. Finally, two respondents said that they have no SDGs or other goals.

The second part of the question was whether the employees knew the goals. In companies that could name some goals, the people working were in common aware of the goals and knew what they were, whereas, in companies that ignored the SDGs, the employees did not know whether there were goals or not, and what these goals might possibly be.

Most respondents seem to believe that customers consider sustainability and responsibility values more important in the future (Fig. 45). However, 12 respondents considered that it does not influence private customers, neither now nor in the future. This is not easy to believe, because people's awareness is always awakening. One explanation might be that these companies do not see private persons as their customers.

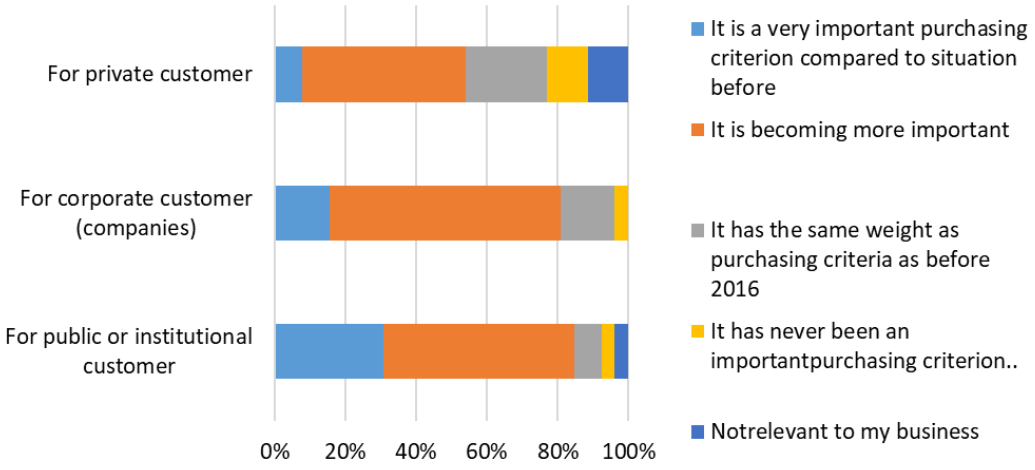


Fig. 47: Customers and the SDGs (how do the customers value the SDGs)

From the companies' point of view, the most critical issues related to SDGs seem to be energy efficiency, material efficiency and renewing energy (**Fig. 48**). climate change was fourth. Water efficiency, biodiversity, pollution of the air, and certificates gained only random votes.

Climate change	50%
Renewable energy	65%
Energy efficiency	89%
Water efficiency	35%
Biodiversity	35%
Air pollution	23%
Effi cient use of materials	65%
LCA or other certification of sustainability	27%
Not relevant	0%

Fig. 48: Important for companies (Important issues from the point of view of the company)

24 of 26 companies had done at least something during the past five years to promote sustainable development (Fig. 47). As examples of what they had done, the respondents listed the following issues:

- Implementation of a waste sorting point for the warehouse.
- Promoting timber construction through the exchange of information and the sharing of know-how.
- Implementing a responsibility program and low-carbon project.
- Developing high-strength, low-carbon concrete.
- Implementing low carbon rating.
- Implementing the CO_2 calculation in construction projects and developing measures to increase the waste recycling rate.
- Building the Breeam-certified offices in Finland.
- Reducing material waste and energy use (decreasing CO_2 emissions) in our functions. E.g. all electricity used has been renewable.
- Changing from papers to electronic filing has reduced wood harvesting.
- Developing an energy self-sufficient district.
- Installing geothermal heating, water-regulating sanitation furniture and balancing the heating in several properties.
- Reducing water use.
- Compensating the carbon.
- Developing the products and joining SBTi.

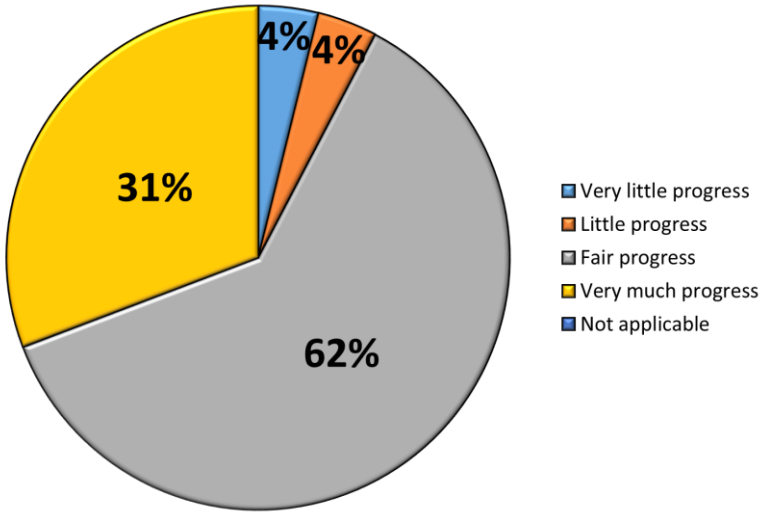


Fig. 49: Companies have promoted sustainable development (how much a company has done during the past 5 years to promote sustainable development)

The respondents were asked to evaluate how the architecture and construction branch considered the user- and customer orientation in specific named targets of their activities, like neighbourhoods or office buildings. In this case, more than half of the respondents argued that user- and customer orientation had been considered well or even better (very well, excellently) (**Fig. 50**). However, there was one activity type that remained lower level than the others: renovation.

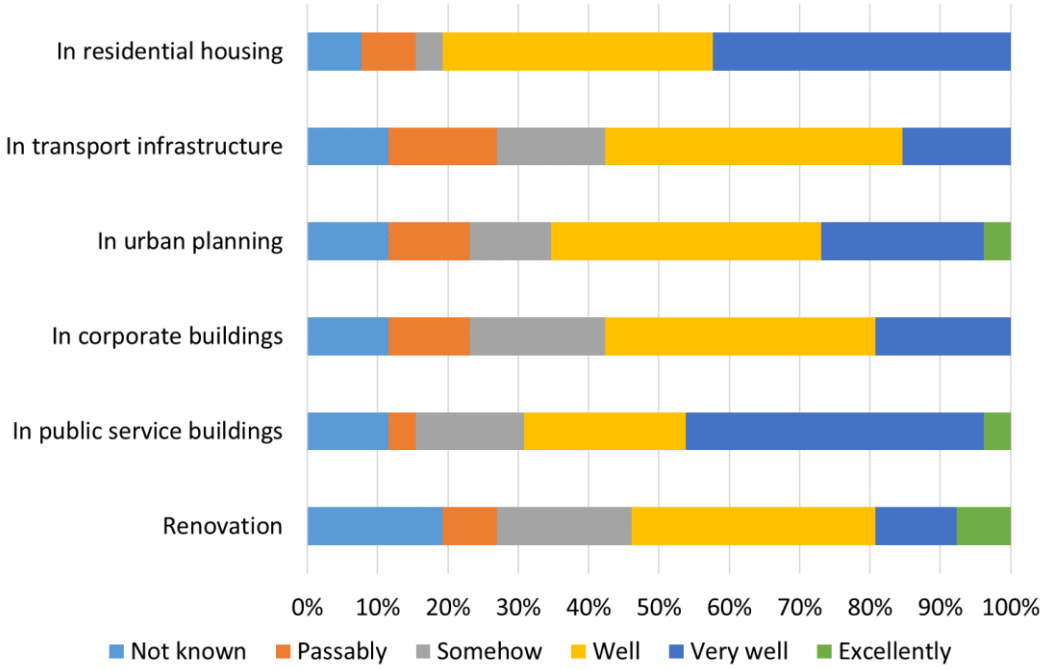


Fig. 50: construction business vs customer orientation (how have the architecture and construction branches considered the customer orientation)

3.5.4 Spain

60% of respondents belonged to the group of enterprises, with a balanced representation between companies of different sizes (**Fig. 51**).

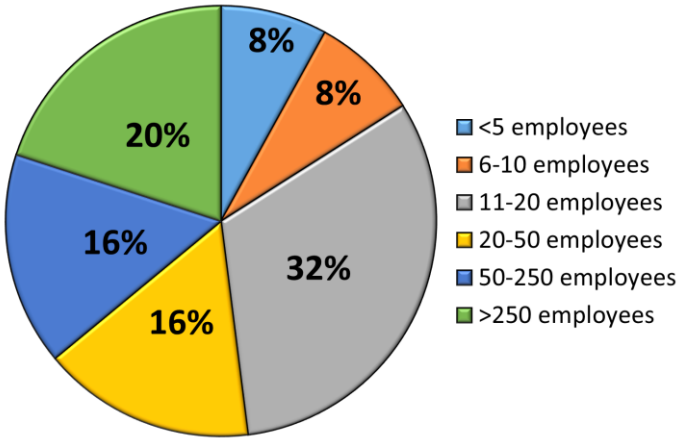


Fig. 51: Size of respondent companies

In this section, the activities to which the respondents felt more identified were architecture, landscaping and/or urban planning, environmental consultancy and installer (**Fig. 52**). The rest of the categories were chosen by less than 20%. The 36% of the respondents identified as “others” and described themselves mainly as researchers or material manufacturers.

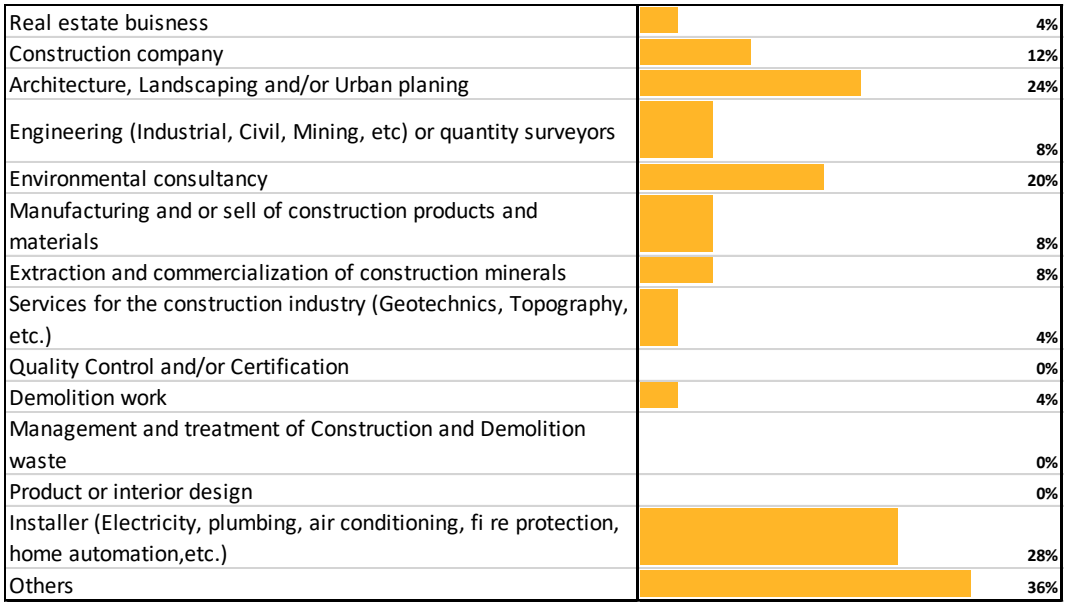


Fig. 52: Branch of the respondents

Most of the respondents think the SDGs are an opportunity to reduce the environmental impact of their activities and to be more efficient and productive (**Fig. 53**). The following answers that were chosen are: an opportunity to differentiate from our competitors (52%), an opportunity to improve the quality of our products or processes (48%), a trend that is embodied in legal or regulatory obligations (48%), and an opportunity to reduce inequalities (32%). The rest of the possible answers were not chosen (or only by a few respondents).

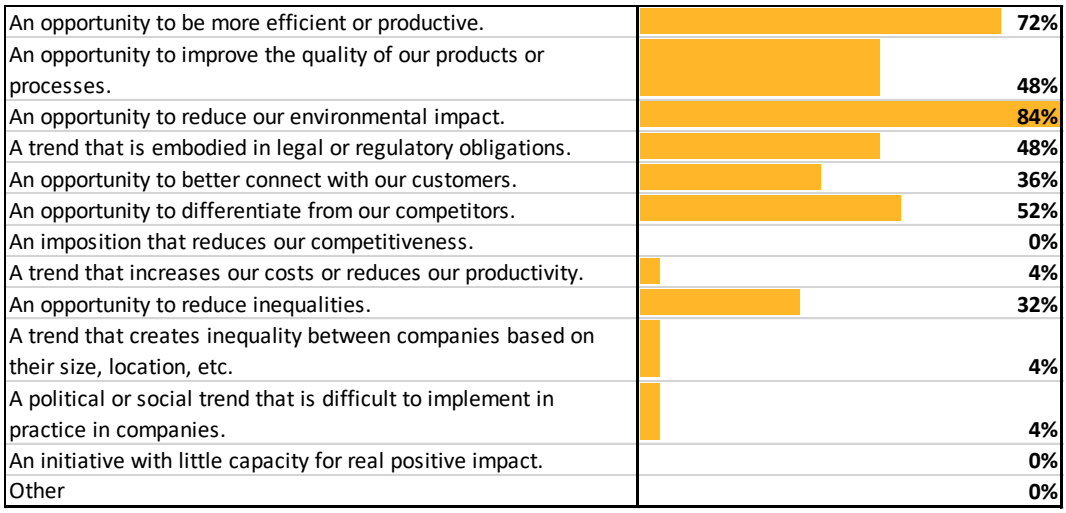


Fig. 53: Sense of SDGs for business (the sense of SDGs for the company/business

Among the responses to the question 'What are your company's sustainability objectives?' the following can be highlighted: some respondents directly pointed out specific SDGs, and most of them were covered; furthermore, other respondents pointed out some topics that

can be related with the SDGs, but more with the environmental sustainability: carbon footprint, circular economy, new sustainable materials, recycling, energy efficiency and sustainable cities. The social dimension of sustainability was not explicitly mentioned.

It can be said that approximately half of the companies considered that their employees know the SDGs, whereas the other half do not know them or only have vague SDG knowledge.

Most respondents consider that the SDGs are becoming more important among corporate and institutional customers (Fig. 52). However, regarding the private customers, they think the SDGs are not an important purchase criterion or are not even applicable.

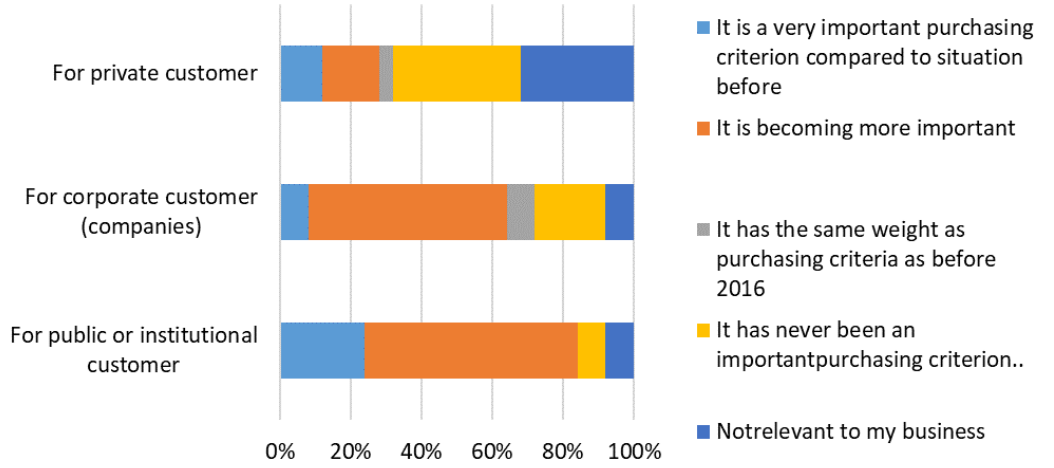


Fig. 54: Customers and the SDGs (how do the customers value the SDGs)

Regarding environmental sustainability, the most important issues for the companies are energy efficiency and the efficient use of materials (**Fig. 55**). However, water efficiency and biodiversity are clearly less important topics.

Climate change	60%
Renewable energy	52%
Energy efficiency	96%
Water efficiency	32%
Biodiversity	16%
Air pollution	56%
Effi cient use of materials	84%
LCA or other certification of sustainability	64%
Not relevant	4%

Fig. 55: Important for companies (Important issues from the point of view of the company)

Most companies have experienced some progress regarding SDG implementation in the last five years (**Fig. 56**). As an average. It can be said that they have made adequate progress. When asked about some examples of what they did in that period, they answered the following:

- Development of low carbon footprint materials.
- Reuse of construction and demolition waste as material for road sub-bases.
- Research projects regarding several topics, such as recycled bituminous mixtures and reflective pavements.

- Monitoring of air quality.
- Taking measures to increase energy efficiency: improvement of climatization, renovation of different typologies of machinery,
- Installation of renewable energy sources (photovoltaic).
- Implementation of new methodologies such as life cycle assessment.
- Gender equality measures.

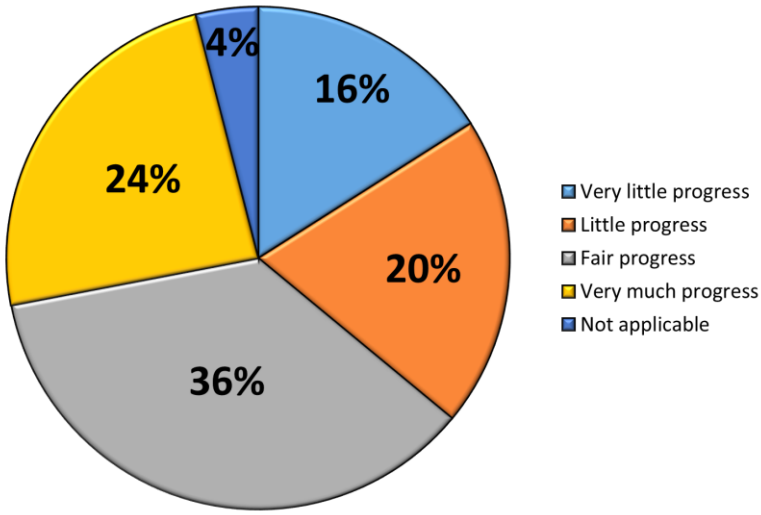


Fig. 56: Companies have promoted sustainable development (how much a company has done during the past five years to promote sustainable development)

Finally, the respondents were asked to evaluate how the architecture and construction branch considered the user and customer orientation in specific named targets of their activities, like neighbourhoods or office buildings. On average, the respondents argued that user and customer orientation had been well considered (**Fig. 57**).

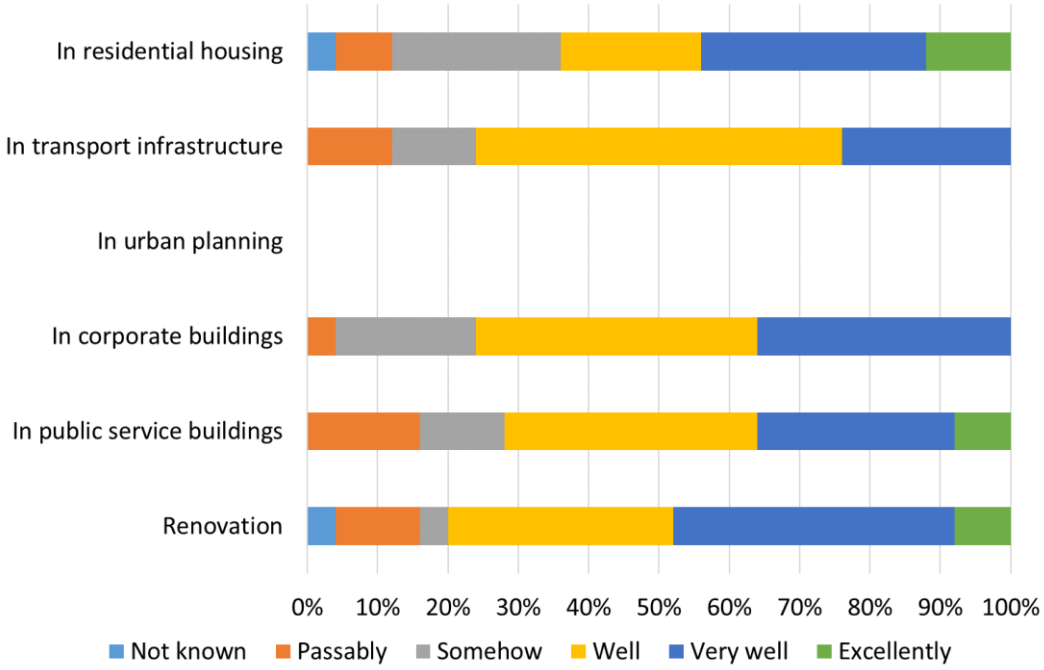


Fig. 57: construction business vs customer orientation (how have the architecture and construction branches considered the customer orientation)

3.6 Results: Public Bodies

3.6.1 Belgium

The public administration group is not big, as only 8 respondents filled in the survey (**Fig. 58**).

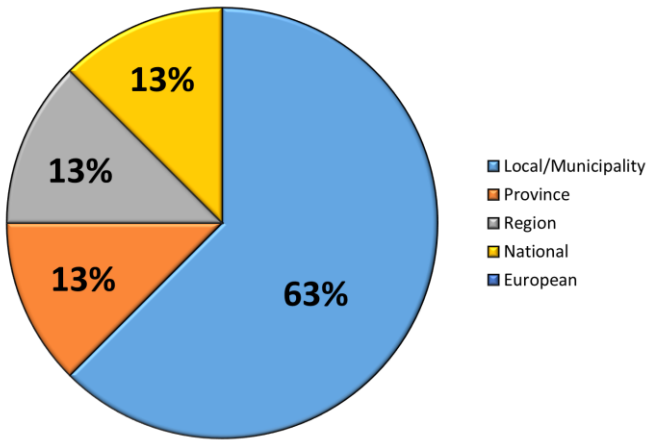


Fig. 58: Geographical scope of action of the public bodies

5 of 8 respondents said that their organization had promoted implementation of SDGs during the past five years. The following promoting activities were mentioned as examples

- Week of sustainable city

- More green management
- Forest compensation programme
- Test projects about energy, water
- Circularity awareness programmes

Most of the respondents evaluated that the level of activities promoting sustainability and responsibility was modest (4 respondents) or high (1 respondent) (**Fig. 59**). One voted for low and one for very high.

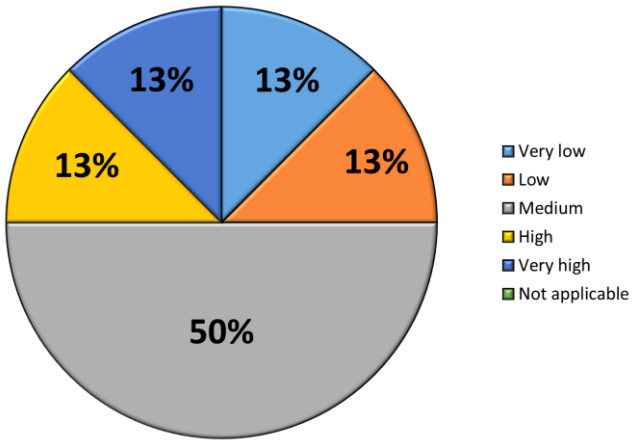


Fig. 59: The level of activities promoting sustainability and responsibility (the level of activities promoting sustainability and responsibility during the past five years)

Respondents were asked to evaluate some tools' usability to reach sustainable development goals. For example, the most usable tools were ‘developing new rules and standards’ and ‘controlling regulatory compliance’ (**Fig. 60**).

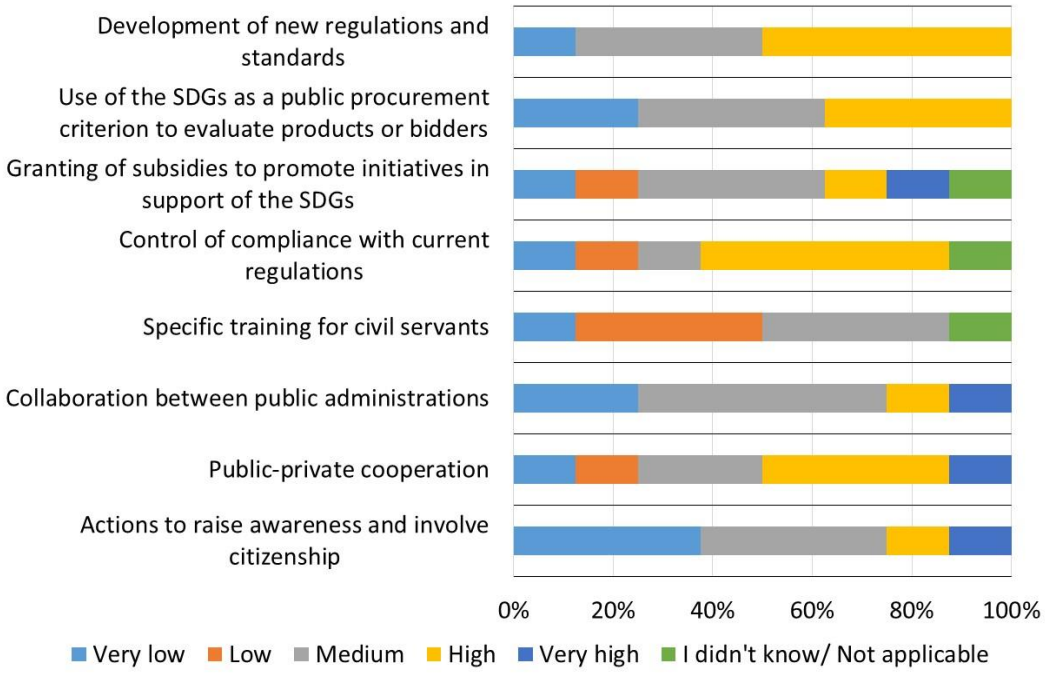


Fig. 60: The usability of tools in reaching the SDGs (evaluate the usability of the following tools in reaching the SDGs in a built environment)

3.6.2 Denmark

In this category, there were 19 responses; 95% were from local municipalities and 5% from national authorities. However, there were no responses from any regional and governmental authorities.

The efforts of public administration to promote the SDGs in the last five years were investigated. Accordingly, 61% of respondents declared that their organisations had made efforts to promote the SDGs, 33% had not, and 6% answered that the SDGs are irrelevant to them (**Fig. 61**). These efforts were evaluated, revealing that 42 % had a medium level of activities promoting the SDGs, 37% had low activities, and 21% had high activities (**Fig. 62**).

Respondents were asked to evaluate the usability of specific tools or actions to implement the SDGs in the built environment, as shown in **Fig. 63**. The most usable tools considered were granting subsidies to promote initiatives supporting the SDGs. Next were the development of new rules and standards, then using the SDGs as a public procurement criterion to evaluate products or bidders, and the collaboration between public administrations and specific training for civil servants. The less usable tool, according to respondents, was controlling regulatory compliance.

Respondents provided some examples of initiatives involving attending courses and seminars, visualising the SDGs at working places and on organisations' web pages, developing a code for sustainable construction, developing a sustainability strategy based on the SDGs, and participating in internal and external events. In addition, examples included establishing natural laboratories in the city, hanging posters for citizens, showing the SDGs in different areas in working places, implementing the SDGs in the municipalities' schools and discussing them in construction projects.

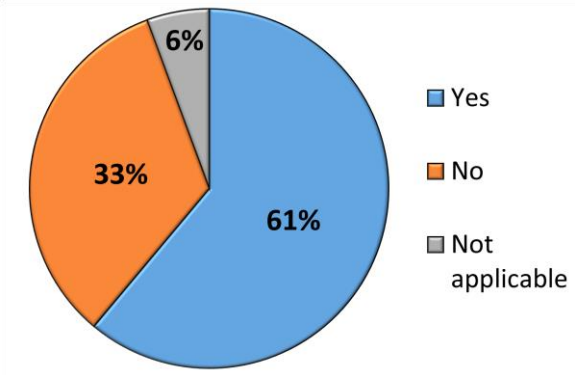


Fig. 61: Efforts in promoting the sustainable development goals in the last five years

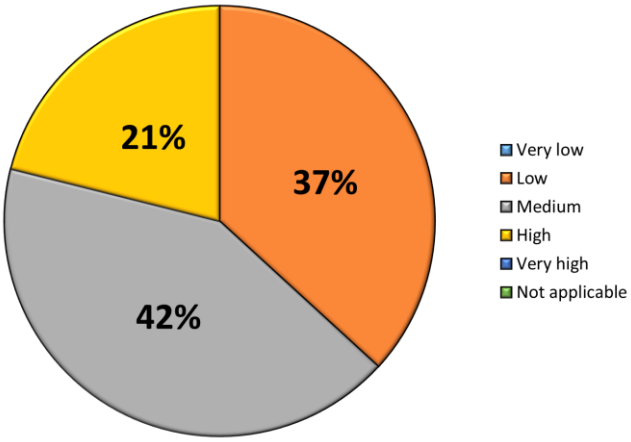


Fig. 62: The level of activities promoting sustainability and responsibility (the level of activities promoting sustainability and responsibility during the past five years)

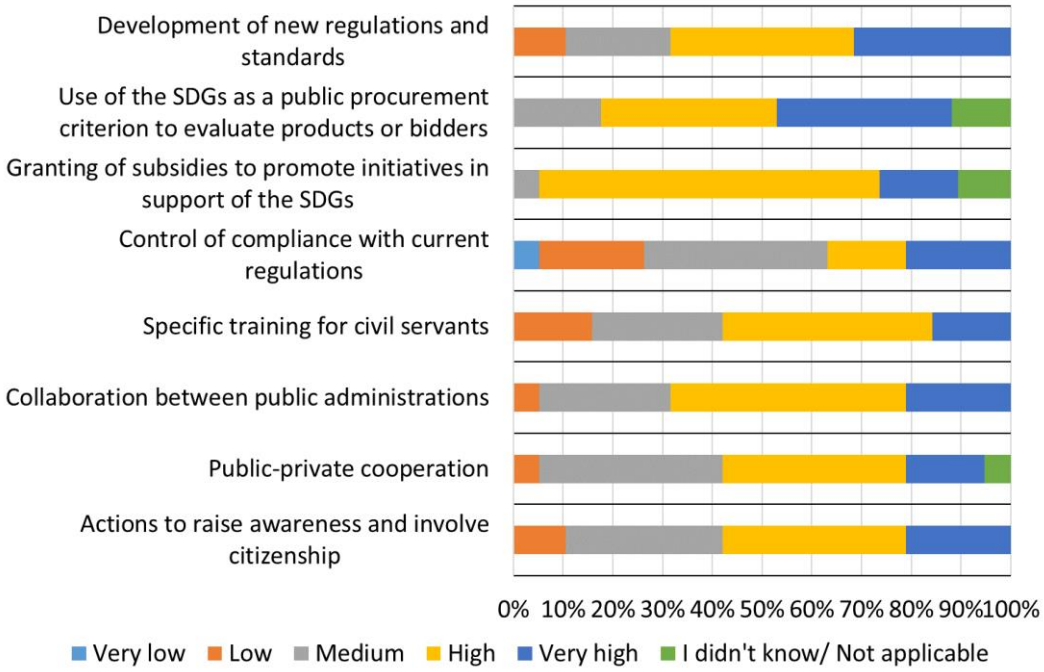


Fig. 63: The usability of tools in reaching the SDGs (evaluate the usability of the following tools in reaching the SDGs in a built environment)

3.6.3 Finland

The group of public administration consisted only of representatives of municipal organizations. It is difficult to know why the regional and governmental authorities did not feel it essential to respond to the survey. One reason might be that the survey was conducted just before the summer season, and the offices were busy training the trainees and deputies.

8 of the 10 respondents said that their organization had promoted reaching SDGs during the past five years. The following promoting activities were mentioned as examples:

- programme to promote sustainable development;
- implementing life cycle thinking of buildings;
- improving energy-efficiency;
- implementing responsibility reporting;
- considering the SDGs in area planning;
- city bike –project;
- enabling on-line working.

The majority of the respondents evaluated that the level of activities promoting sustainability and responsibility was modest (5 respondents) or high (3 respondents) (**Fig. 64**). One voted for low and one for very high. The average of the evaluations is 3.4.

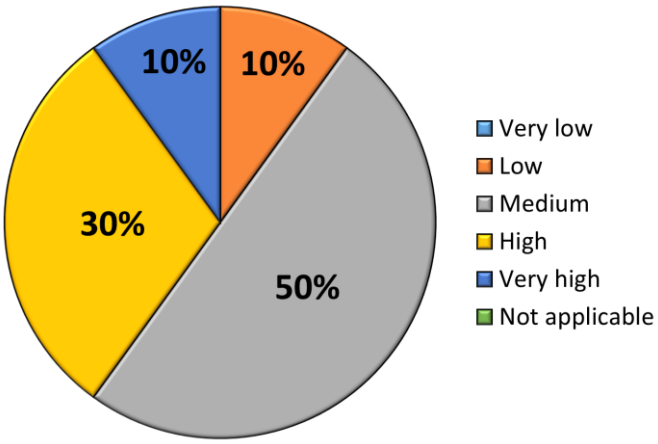


Fig. 64: The level of activities promoting sustainability and responsibility (the level of activities promoting sustainability and responsibility during the past five years)

The respondents were also told to evaluate the usability of some tools to reach the SDGs. The most usable tools were 'Increasing the awareness' and 'Using SDGs as criteria in public procurement' (**Fig. 65**). The less usable tool, according to respondents, was 'Controlling the regulatory compliance'.

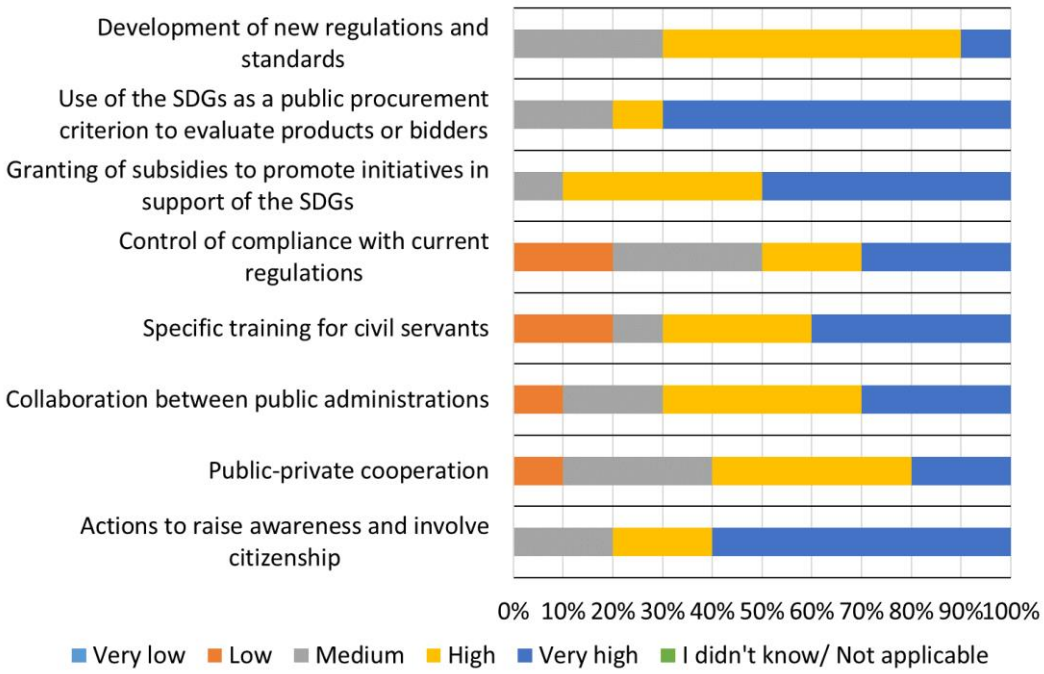


Fig. 65: The usability of tools in reaching the SDGs (evaluate the usability of the following tools in reaching the SDGs in a built environment)

3.6.4 Spain

All respondents from public bodies work in the regional administration, and all of them considered that they had made a high effort in promoting the achievement of the SDGs. Among the specific measures they implemented, the following can be highlighted:

- Incorporation of the SDGs into different strategic plans.
- Organisation of courses.
- Dissemination of related projects through websites.

The respondents were also told to evaluate the usability of some tools according to reaching the SDGs. According to them, the most helpful tool is the development of new regulations and standards (**Fig. 66**), whereas the least valuable tools are the specific training for civil servants and the collaboration between public administrations.

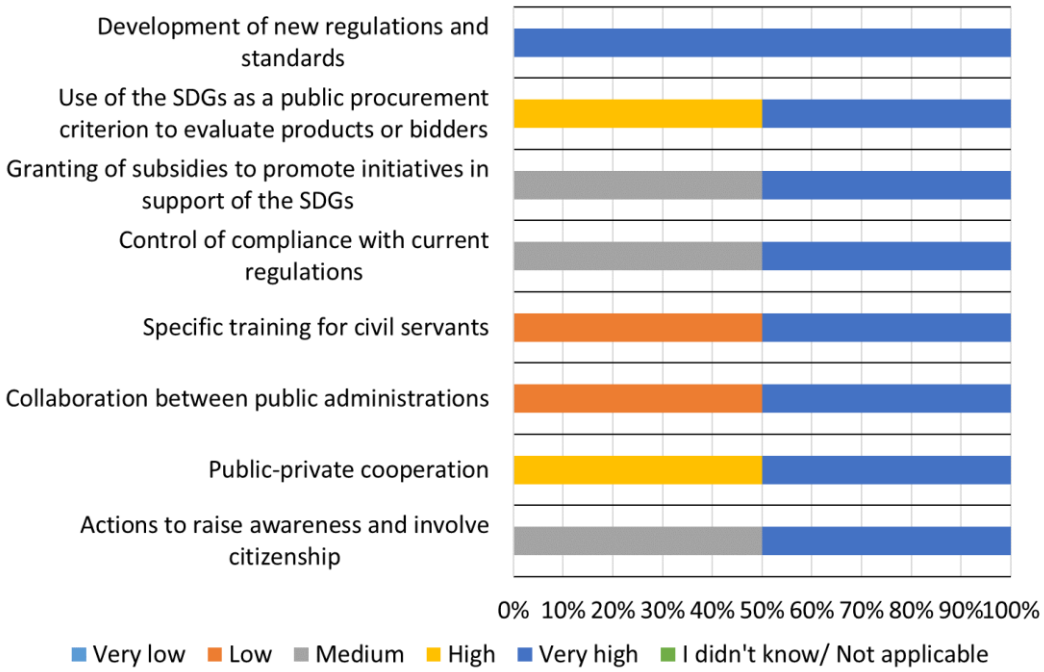


Fig. 66: The usability of tools in reaching the SDGs (evaluate the usability of the following tools in reaching the SDGs in a built environment)

3.7 Results: Citizens

3.7.1 Belgium

The group of ordinary people and members of organizations consisted of 9 males and 5 females. The average of the group was 33 years. The youngest was 19 years old, and the oldest 79-year-old.

12 of the 14 respondents had participated in activities promoting or disseminating information on sustainable development goals. The respondents evaluated the importance of different actors in reaching the SDGs, with a Likert scale from 1 (not important at all) to 5 (very important) (**Fig. 67**). Although the given scores varied slightly, the average scores were the same (4.64) with all given actor types.

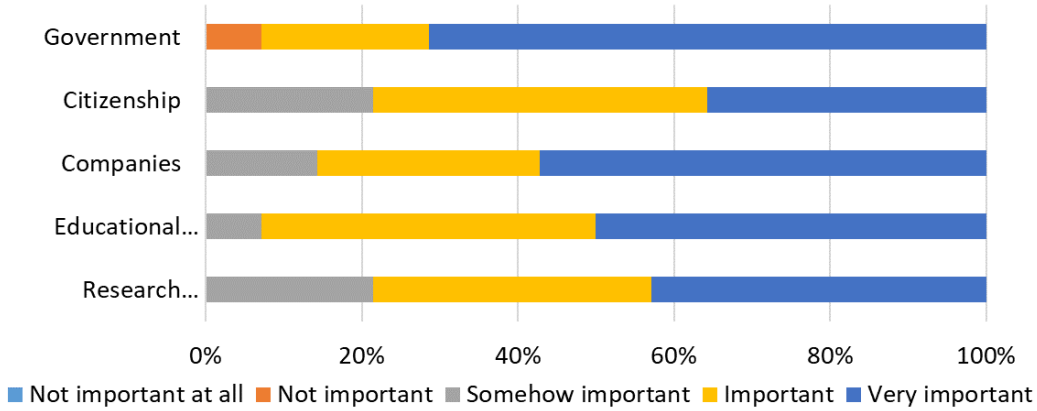


Fig. 67: The importance of actors in reaching the SDGs

The respondents did not believe that reaching SDGs would result in lower taxes or worse public infrastructure (**Fig. 68**). Instead, they believed that reaching the sustainable development goals would improve the quality of life, public infrastructure, protection of nature and reputation of the construction industry. On the other hand, reaching the SDGs could also result in higher taxes, rising living costs and near-located educational opportunities.

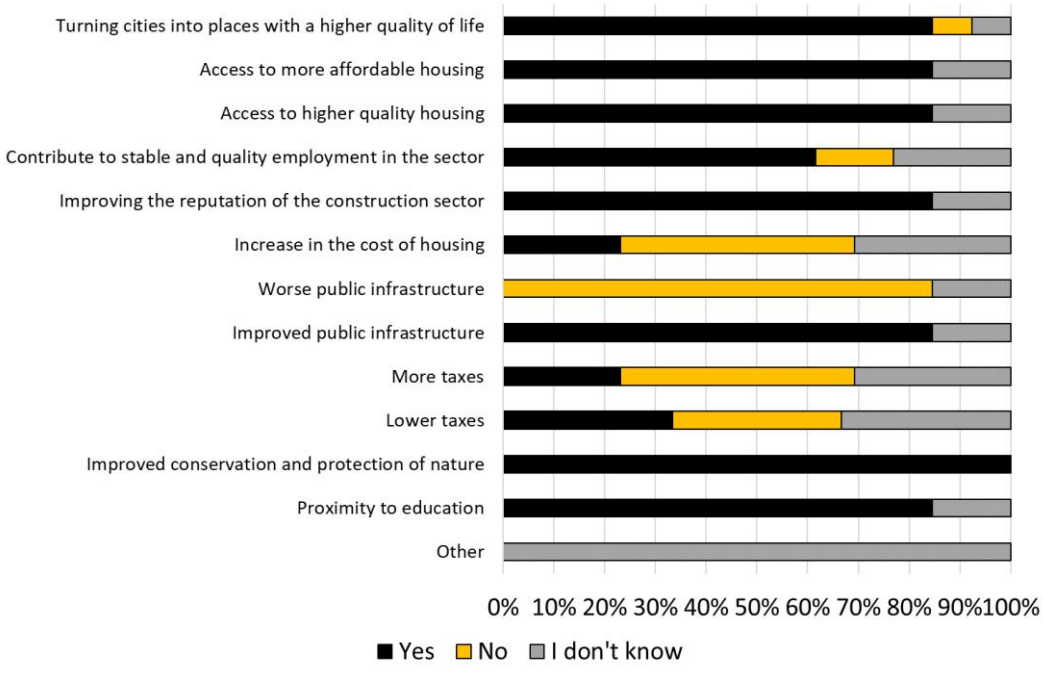


Fig. 68: The consequences of reaching the SDGs (Reaching SDGs would cause the following consequences)

Concerning the rising housing costs, most respondents would not tolerate a rise. Approximately 25% would tolerate a rise from 6 to 10 per cent. However, 25% of the respondents indicated that it is up to the sector to take care of it. The group who claim that they do not accept a rise, agree with a higher SDG awareness if this does not increase prices (**Fig. 69**).

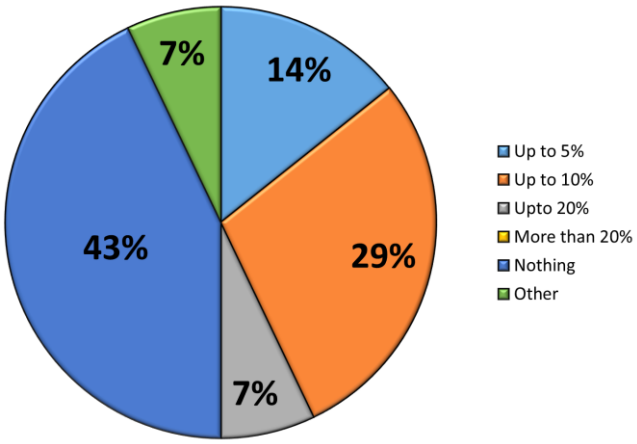


Fig. 69: Rise of costs (How big a rise in housing costs would you be ready to accept if it guaranteed the reaching of SDGs)

The criteria most often used by the respondents when renting or buying real properties were energy efficiency and renewable energy, education and training nearby and proximity and accessibility of green areas (**Fig. 70**).

Energy efficiency/renewable energy	62%
Proximity and access to green areas	69%
The use of more efficient or circular materials in the construction	15%
Equality policies in the selling, leasing or construction company	8%
Healthiness and comfort through materials, installations, activities in the surroundings (noise, pollution...), etc.	39%
Access to an efficient public transportation network in the vicinity	23%
Proximity to education	62%
Public access to the facilities in the building with shared facilities	8%

Fig. 70: Criteria when buying real estate. (Have you used the following criteria while renting or buying real estate properties)

3.7.2 Denmark

The group of ordinary people and members of the organisation consisted of 4 respondents aged between 33 and 67 years, with 3 males and 1 female. All respondents had participated in initiatives aimed at helping to achieve or disseminate the SDGs.

The respondents evaluated the importance of different actors in reaching the SDGs, with a Likert scale from 1 (not important at all) to 5 (very important) (**Fig. 71**). The government has an essential role in achieving the SDGs, followed by research and educational institutes and then companies. However, citizens have less importance. The given scores varied slightly. However, the average scores for all actor types were the same (4).

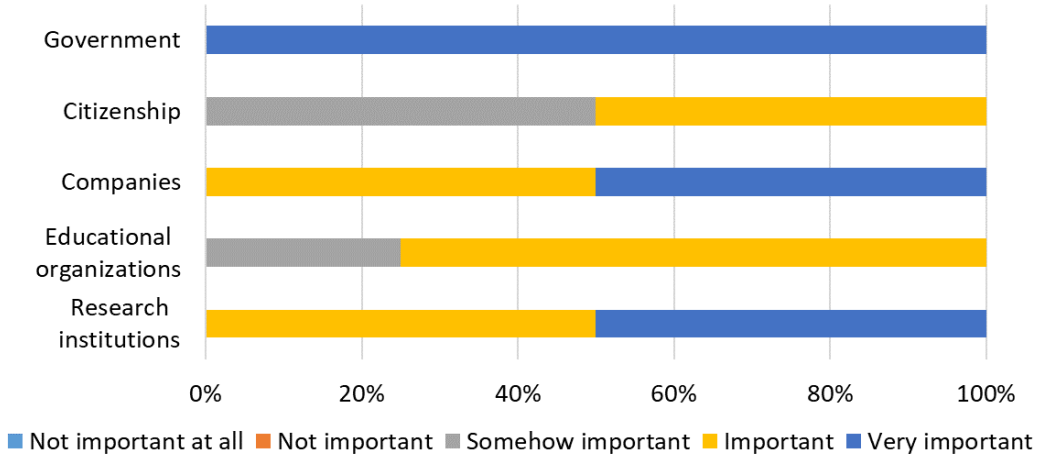


Fig. 71: The importance of actors in reaching the SDGs

All respondents agreed that reaching the SDGs would mainly improve the quality of life, protection of nature and reputation of the construction industry, improve the public infrastructure, and contribute to stable and quality employment. However, they have no consequences with regard to taxes, higher quality housing and more affordable housing (**Fig. 72**). Instead, they believed that the SDGs could increase the cost of housing.

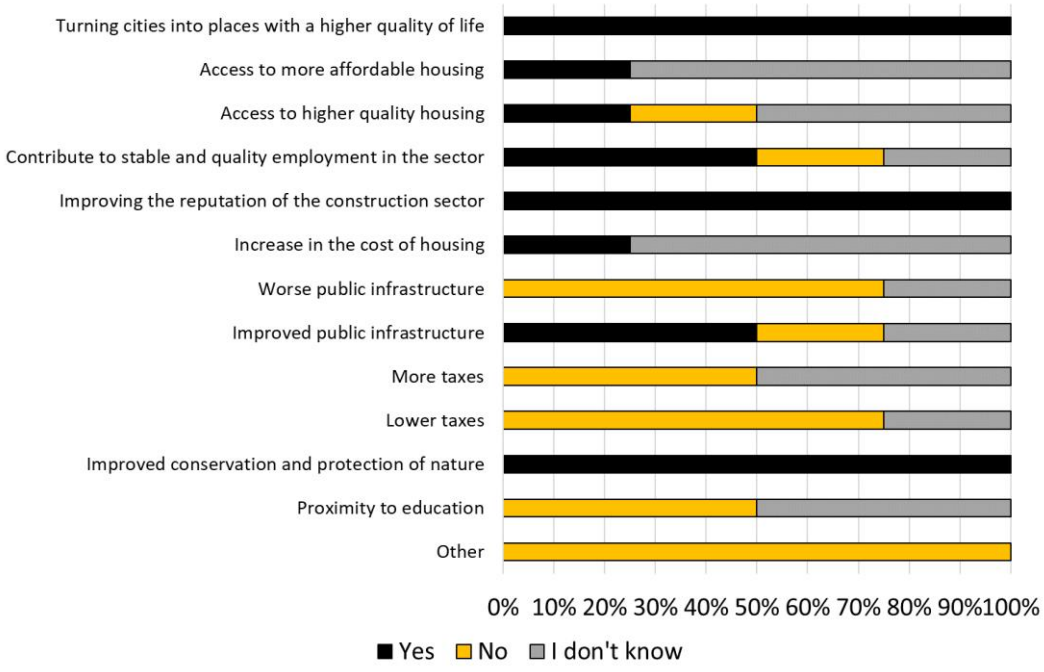


Fig. 72: The consequences of reaching the SDGs (Reaching SDGs would cause the following consequences)

Concerning the rising housing costs, 25% of respondents would tolerate a rise of 5%, and 25% would tolerate a rise of 10%. Thus, 50% would tolerate another rise, which could be smaller than 5% (**Fig. 73**).

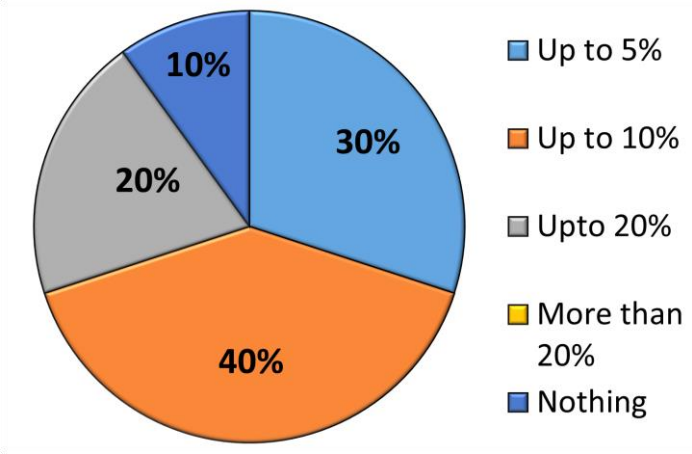


Fig. 73: Rise of costs (How significant a rise in housing costs you would be ready to accept if it guaranteed the reaching of SDGs)

The criteria most often used by the respondents when renting or buying real properties (**Fig. 74**), were proximity and accessibility to green areas, accessibility to public transport, healthiness, energy efficiency and renewable energy and comfort through materials, installations, activities in the surroundings, e.g., noise and pollution. In addition, the following criteria were proximity to education and public access to the facilities in the building with shared facilities. The less essential criteria were distance to work, public institutes and housing price, the use of more efficient or circular materials in the construction and equality policies in the selling, leasing, or construction company.

Energy efficiency/renewable energy	100%
Proximity and access to green areas	100%
The use of more efficient or circular materials in the construction	25%
Equality policies in the selling, leasing or construction company	25%
Healthiness and comfort through materials, installations, activities in the surroundings (noise, pollution...), etc.	100%
Access to an efficient public transportation network in the vicinity	100%
Proximity to education	50%
Public access to the facilities in the building with shared facilities	50%

Fig. 74: Criteria when buying real estate. (Have you used the following criteria while renting or buying real properties)

3.7.3 Finland

The group of ordinary people and members of the organization consisted of 6 males, 4 females, and 1 person who did not want to disclose a specific gender. The group average was 44 years, the youngest was 23 years old, and the oldest 67 years old.

8 of the 11 respondents had participated in activities promoting or disseminating SDG information. The respondents evaluated the importance of different actors in reaching the SDGs, with a Likert scale from 1 (not important at all) to 5 (very important) (**Fig. 75**). Even though the given scores varied slightly, the average scores were the same (4,64) with all given actor types.

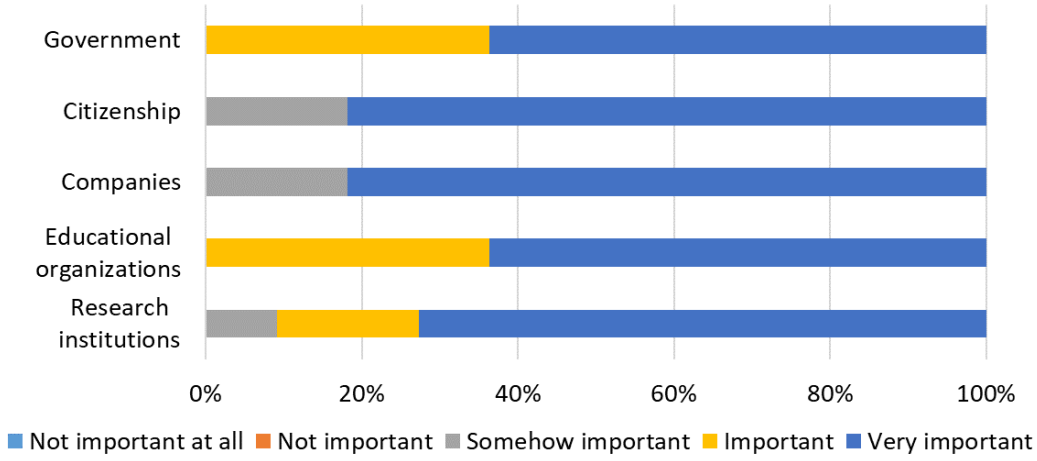


Fig. 75: The importance of actors in reaching the SDGs

The respondents did not believe that reaching SDGs would lower taxes or worse public infrastructure (**Fig. 76**). On the contrary: they believed that reaching the SDGs would improve quality of life, public infrastructure, protection of nature and the construction industry's reputation. On the other hand, reaching the SDGs could also result in higher taxes, rising living costs and near-located educational opportunities.

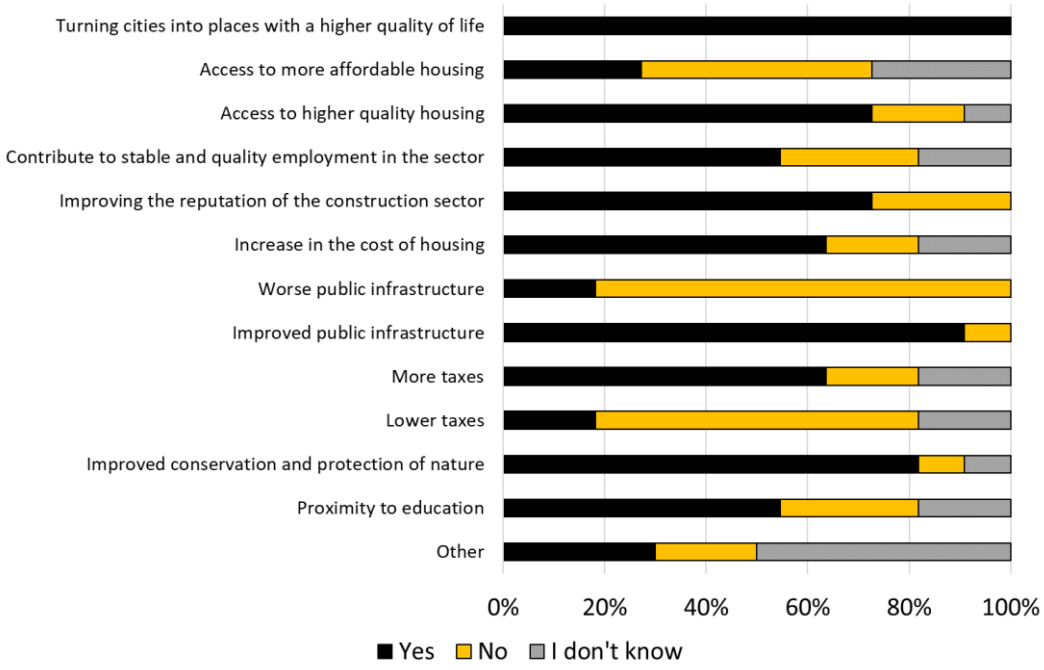


Fig. 76: The consequences of reaching the SDGs (Reaching SDGs would cause the following consequences)

Concerning the rising housing costs, most respondents would tolerate a rise of 5%, approximately 55% would tolerate a rise of 10% and 18%t would tolerate a rise of 20% (**Fig. 77**).

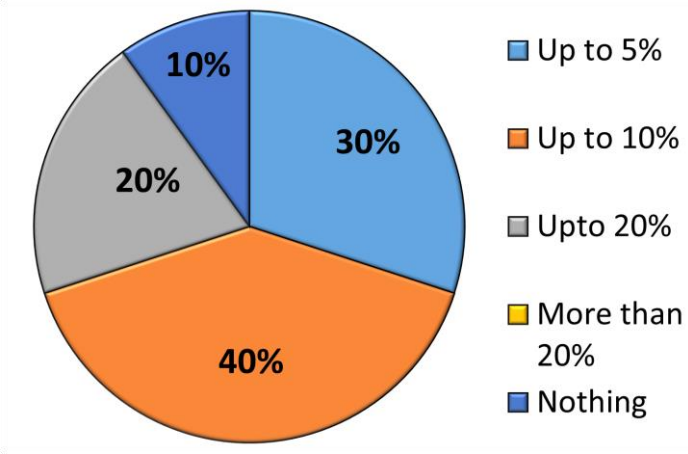


Fig. 77: Rise of costs (How big a rise in housing costs you would be ready to accept if it guaranteed the reaching of SDGs)

The most used criteria the respondents had used when renting or buying real properties were proximity and accessibility of public transport, proximity and accessibility of green areas, and energy efficiency and renewable energy (**Fig. 78**).

Energy efficiency/renewable energy	64%
Proximity and access to green areas	82%
The use of more efficient or circular materials in the construction	0%
Equality policies in the selling, leasing or construction company	27%
Healthiness and comfort through materials, installations, activities in the surroundings (noise, pollution...), etc.	55%
Access to an efficient public transportation network in the vicinity	82%
Proximity to education	55%
Public access to the facilities in the building with shared facilities	18%

Fig. 78: Criteria when buying real estate. (Have you used the following criteria while renting or buying real estate properties)

3.7.4 Spain

The proportion of women in the citizen's group of respondents was only 25%. The average age was 47 years (minimum 25 and maximum 64). Half of the respondents had participated in activities to promote the SDGs. When evaluating the relevance of different stakeholders in achieving the SDGs, the one considered most important is the government, while the least important is the research institutions (**Fig. 79**).

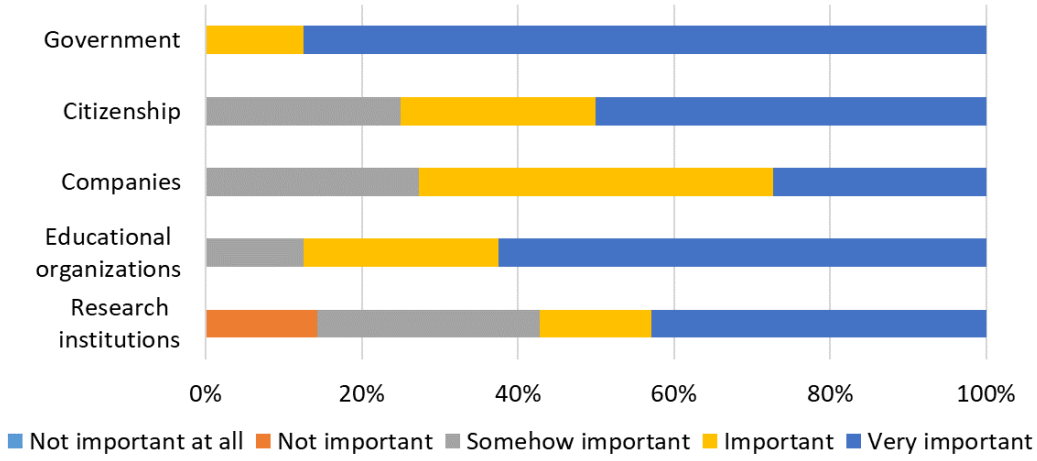


Fig. 79: The importance of actors in reaching the SDGs

The respondents did not believe that reaching SDGs would result in lower taxes or worse public infrastructure (**Fig. 80**). Instead, they believed that reaching the SDGs will improve the quality of life, protection of nature, the reputation of the construction industry, and would promote access to more affordable and higher quality housing. Reaching the SDGs can also result in higher taxes, rising living costs, improved public infrastructure and more stable employment.

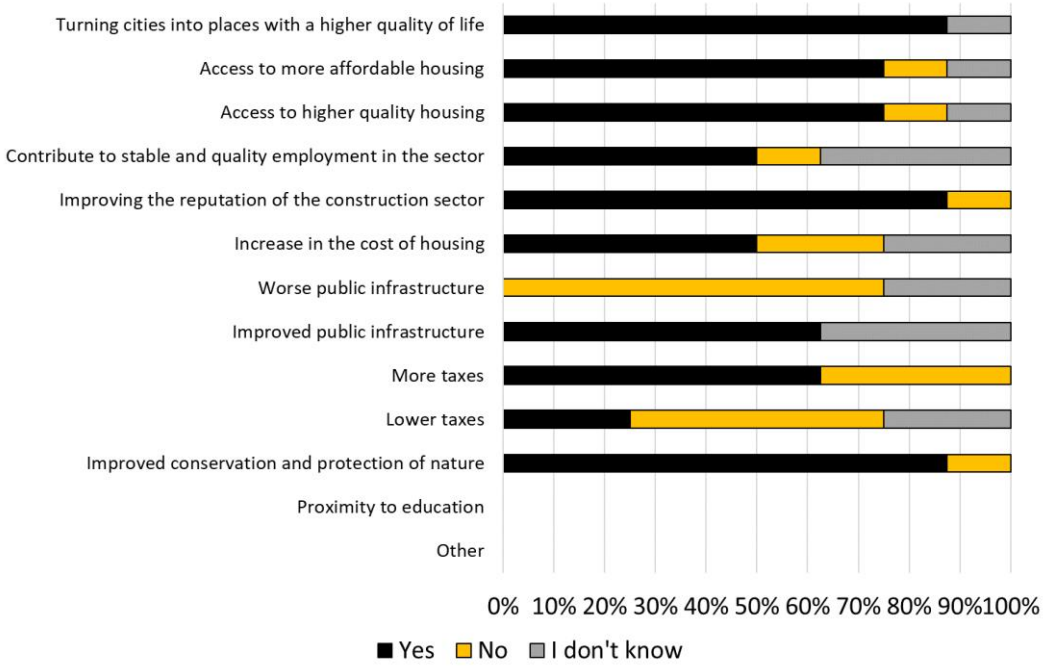


Fig. 80: The consequences of reaching the SDGs (Reaching SDGs would cause the following consequences)

Concerning the rising housing costs, most respondents would tolerate a rise of 5% or 10%, and 25% would not tolerate any increase (**Fig. 81**).

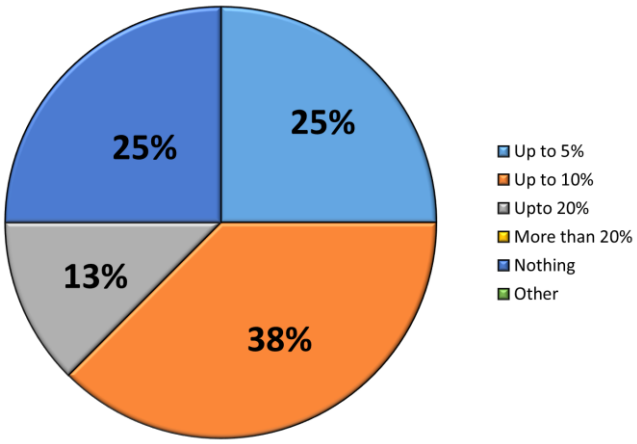


Fig. 81: Rise of costs (How big a rise in housing costs would you be ready to accept if it guaranteed the reaching of SDGs)

When renting or buying a house or flat, the most used criteria were the proximity and access to green areas and the healthiness and comfort through materials, installations, and activities in the surroundings (**Fig. 82**).

Energy efficiency/renewable energy	63%
Proximity and access to green areas	100%
The use of more efficient or circular materials in the construction	25%
Equality policies in the selling, leasing or construction company	0%
Healthiness and comfort through materials, installations, activities in the surroundings (noise, pollution...), etc.	88%
Access to an efficient public transportation network in the vicinity	63%
Proximity to education	38%
Public access to the facilities in the building with shared facilities	25%

Fig. 82: Criteria when buying real estate. (Have you used the following criteria while renting or buying real estate properties)

3.8 Discussion and Conclusions: Common and comparative

This study was conducted to determine how the different stakeholders in the Belgian, Danish, Finnish and Spanish construction businesses **understand** the SDGs, how they have promoted the **implementation** of the SDGs and which SDGs are seen as **necessary** in the construction business.

The survey was sent to four groups of stakeholders, consisting of **companies** (employers and entrepreneurs), **academia** (educational institutions), **public bodies** (public administration and governments), and **citizens** (ordinary people related somehow to the sector). A relatively good number of responses was collected in each country (Section 3.2). However, the response rate was low, which can be related to the time of conducting the survey in May-June, as it was close to summer vacations, which is usually a busy period. Therefore, the survey results cannot be generalised, but it provided a very good indication of the status of implementation of the SDGs in the Belgian, Danish, Finnish and Spanish construction industries because the biggest response rate was found in the group of companies. Moreover, the respondents self-chose to participate in the survey, indicating their interest in the SDGs. The number of invitations was so big that the sample could be considered randomised. Thus, the results are valid and relatively reliable. Furthermore, the survey questions

to the four groups of respondents were different, but although they did not measure the same topics, they indicated well the status of SDG implementation within every group.

The main research question is the following: **How is the connection between the built environment, the concept of sustainability, and the SDGs understood by the stakeholders in the construction industry?** The research aimed to understand the importance of the SDGs for the construction industry, from the point of view of companies, academia, public bodies, and citizens. Also, to identify the goals most directly connected to the sector and to find out the current situation (in 2022), including barriers and opportunities, identifying the opportunities to promote the understanding of the SDGs in the construction industry by training.

In Belgium, Finland, and Spain, around one-half of the respondents know the SDGs and are interested in them. In Denmark, this proportion is even higher (74%). The results indicate that even if respondents are aware of sustainable development, there is a certain lack of knowledge regarding the specific framework of the SDGs. Barriers to implementing the SDGs were mainly related to economic factors reflecting **the need for cost-effective solutions**, followed by political barriers indicating the necessity for further **political support** and developing new legislation. Many organisations already have a sustainability strategy with ambitious goals and those who do not have it, are willing to change their strategies.

3.8.1 Companies

The companies that participated in the survey mostly consider the SDGs **an opportunity** to reduce the environmental impact and a possibility to **improve** the efficiency of their processes or products, as long as they control the costs.

Generally speaking for all the participant countries, the topics related to environmental sustainability that attract the highest interest of the companies are **energy efficiency** and the efficient use of **materials** (**Fig. 83**). The least interesting are water use efficiency, air pollution and biodiversity. Some **discrepancies between the different countries** deserve to be analysed. For instance, the interest in life cycle assessment and sustainability certificates is much lower in Finland than in other countries. Also in this country, air pollution is less important for companies whereas this topic increases in relevance for Spain. Another topic is biodiversity: the importance given to this topic in Denmark triplicates that in Belgium and Spain. Finally, it can be mentioned that, in Finland, some respondents had a fairly cynical approach towards the SDGs and the company's main task (to make a profit).

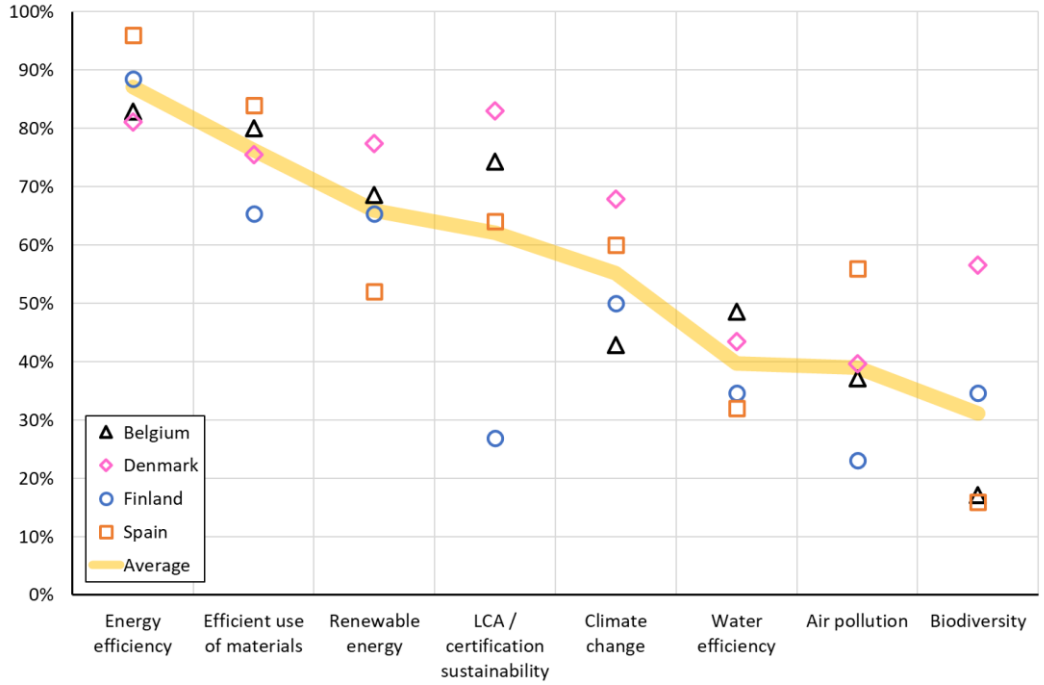


Fig. 83: Interest of companies in topics related to environmental sustainability

Furthermore, most of the respondents provided many good examples and cases of implementing sustainability on small and big scales, reflecting the size of their organisation. In Belgium, Denmark, and Finland, most organisations were aware of customers' thoughts and believed that the SDGs would become important among corporate and institutional customers. In **Spain**, however, they consider that **the SDGs are not a purchase criterion for private clients**. Most **organisations have promoted sustainable development** well during the past five years. Furthermore, there is a **need for more actions towards employees** regarding SDG awareness.

3.8.2 Academia

Regarding academia, professors and teachers from different educational levels participated in the survey. In Finland, all the respondents agreed that the SDGs had been incorporated into their institutions' study plans, although they are not always capable of describing how the goals become visible in the curricula. In Belgium and Spain, this proportion reduces to one-half, and only a few think SDGs are irrelevant to their institutions. However, in Denmark, quite a few respondents (28%) have referred to the SDGs in their education, and most think they are irrelevant.

Although there is generally an increased focus on sustainability in education, it is **not directly linked to the SDGs**. The lack of interest and understanding of the importance of the SDGs from a strategic level are the main problems from the teacher's side. Thus, educational institutes must provide extra efforts in this regard. Positively, an increased number of respondents are willing to make future changes to adopt the SDGs in their education.

The respondents evaluated the training given to students regarding different sustainability aspects (**Fig. 84**). Among the analysed topics, only fighting against inequality and cooperation for development were rated significantly lower than the others (when aggregating the data from the different countries). Furthermore, these topics seem to be much less implemented in the Spanish educational system than in other countries. In Belgium, the training regarding these topics was evaluated the best.

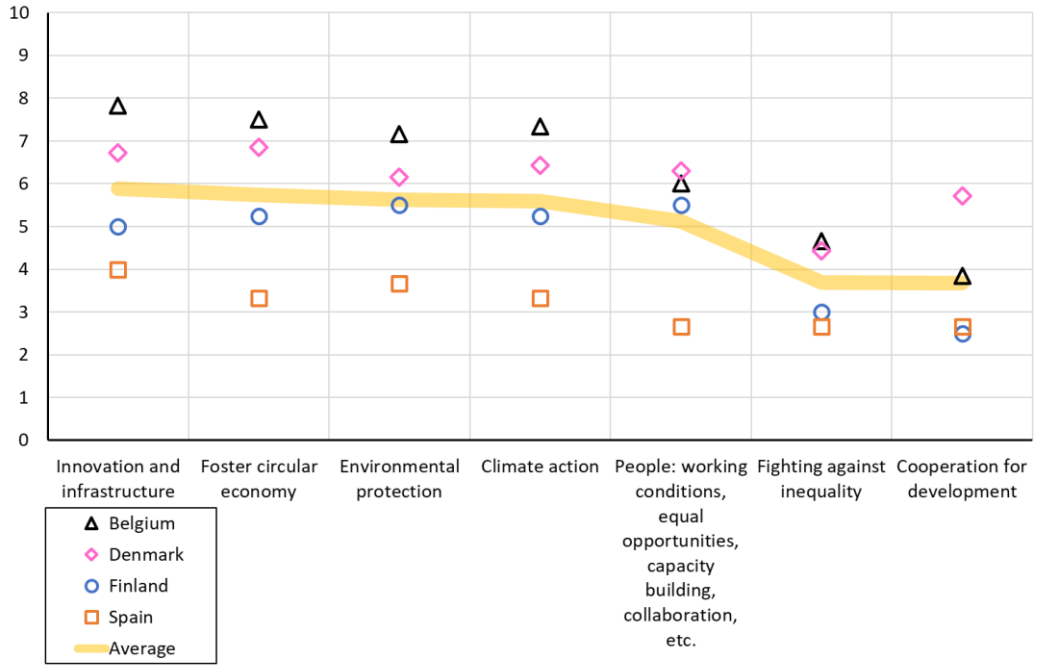


Fig. 84: Rating of the training about sustainability-related topics given to students in the construction industry

3.8.3 Public bodies

In Denmark and Spain, public bodies had many activities promoting sustainability and responsibility during the last five years. In Finland, they rate their performance as modest. However, in Belgium, it seems that the administration has not worked much in this period.

The participants were asked to rate the usefulness of several measures that could be taken by public bodies (**Fig. 85**). When aggregating the data collected in the different countries, all the proposed measures got similar rates, being the development of new regulations and standards the best rated and the specific training for civil servants the worst rated. In general, all the public instruments were rated lower in Belgium than in the other countries.

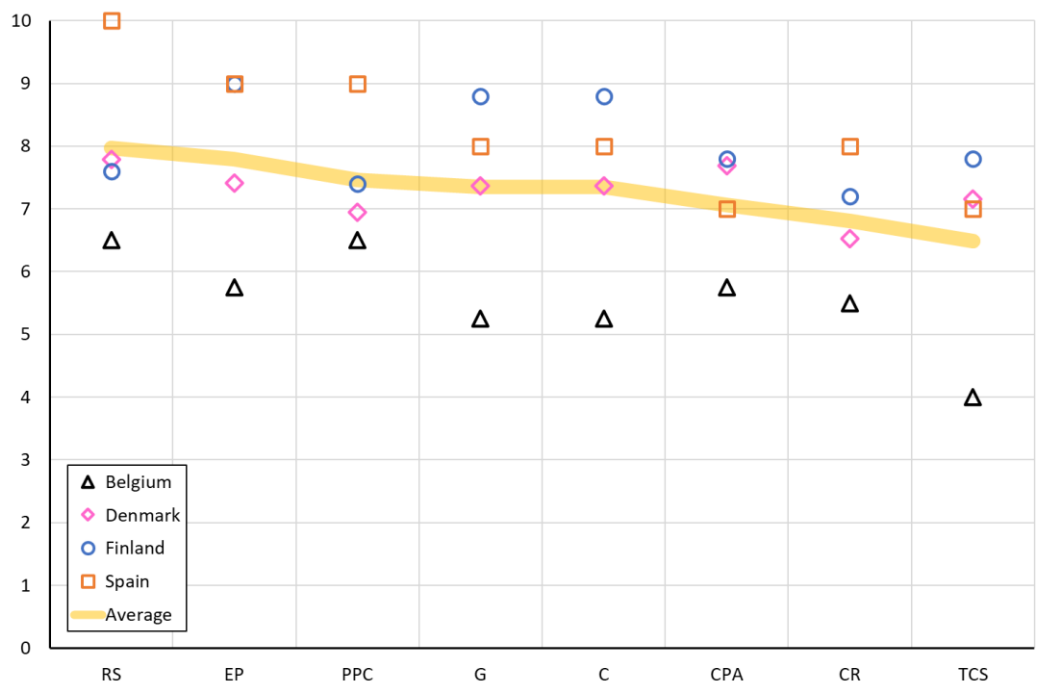


Fig. 85: Usefulness of public instruments to promote the achievement of the SDGs. Caption: RS = Development of new regulations and standards, EP = Use of the SDGs as a public procurement criterion to evaluate products or bidders, PPC = Public-private cooperation, G = Granting of subsidies to promote initiatives in support of the SDGs, C = Actions to raise awareness and involve citizens, CPA = Collaboration between public administrations, CR = Control of compliance with current regulations, and TCS = Specific training for civil servants

3.8.4 Citizens

Regarding the citizens, most of the respondents were males in all the participant countries, indicating that they are more dominant in the construction industry, lacking gender equality.

When asked about the importance of the role of different institutions in the promotion of the SDGs, government was rated most important (**Fig. 86**). However, all the proposed stakeholders were highly rated, meaning that all the institutions must be involved. Some differences between the analysed countries deserve to be commented. For instance, in Denmark, the role of academia and citizens is remarkably lower than that of other institutions. However, in the case of Spain, this anomalous rating goes to companies and research institutions.

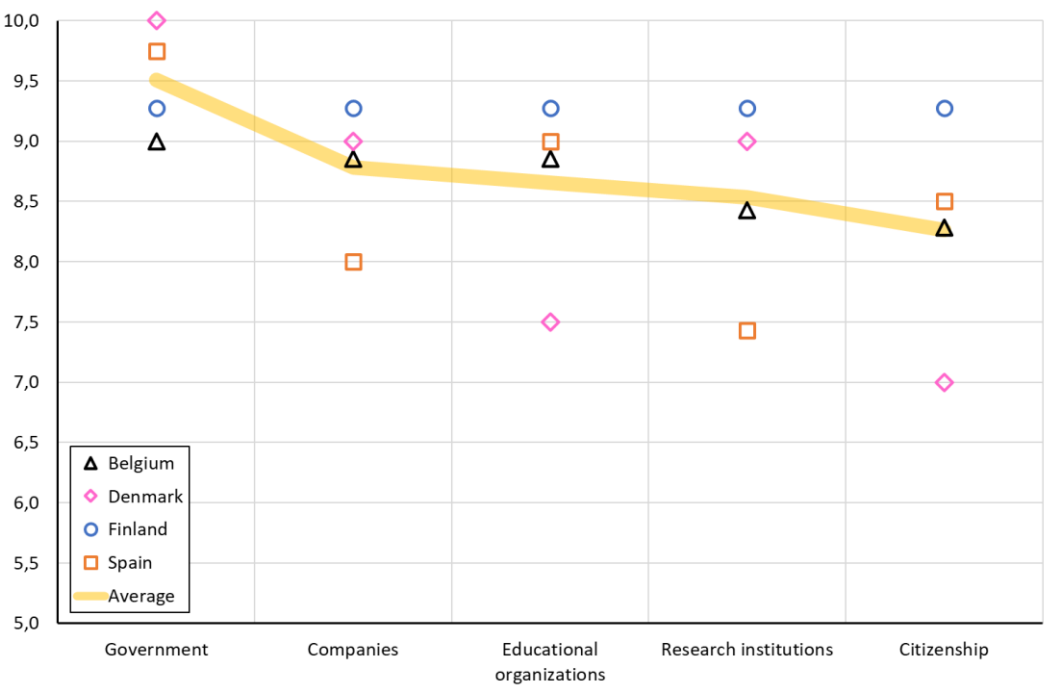


Fig. 86: Rating of the importance of each stakeholder in the achievement of the SDGs

Citizens wish that considering the SDGs will improve the quality of life, protection of nature, and the construction industry's reputation. However, they are worried about rising taxes. Most respondents would tolerate a rise of 5% or 10% in living costs, but 25% would not tolerate any increase.

This group was also asked about their criteria when choosing a dwelling to rent or buy.

- In Belgium, these criteria were the proximity and accessibility of public transport, proximity and accessibility of green areas, and energy efficiency and renewable energy.
- In Denmark, the most important criteria are the equal proximity and accessibility of public transport, proximity and accessibility of green areas, energy efficiency and renewable energy and healthiness and comfort.
- In Finland, the criteria the respondents use most commonly when renting or buying real properties are proximity and accessibility of public transport, proximity and accessibility of green areas, and energy efficiency and renewable energy.
- In Spain, the most used criteria were the proximity to green areas and the healthiness and comfort through materials, installations, activities in the surroundings etc.

3.8.5 Rating of SDGs

This study was conducted to determine how different stakeholders in the construction business understand the SDGs, how they have promoted the reaching of the SDGs and which SDGs are considered as necessary in the construction business.

When rating the relative importance of SDGs by aggregating the data from all the participant countries, three groups can be distinguished (**Fig. 87**):

- Rated higher than 7/10 (SDG 11, 9, 13, 7, 6, 3,12,8 and 15)
- Rated between 5/10 and 7/10 (SDG 17, 4,14,10 and 1)

- Rated below 5/10 (SDG 5, 16 and 2)

In the first group, most SDGs are directly related to environmental sustainability and the performance of buildings and infrastructure. However, in the second group, the SDGs are more linked to social responsibility. The least related group are SDGs with a strong social character. Some data from specific countries deserve to be highlighted. For instance, SDG3 (good health) and SDG 14 (life below water) are less and more considered by Belgium than the other countries. In Denmark, SDG12 (responsible consumption) is better rated than average. Finland gives higher rates to SDG 6 (clean water and sanitation) and SDG 15 (life on land). Finally, Spain gives a remarkably lower rate to SDG17 (partnerships for the goals) and SDG16 (peace and justice).

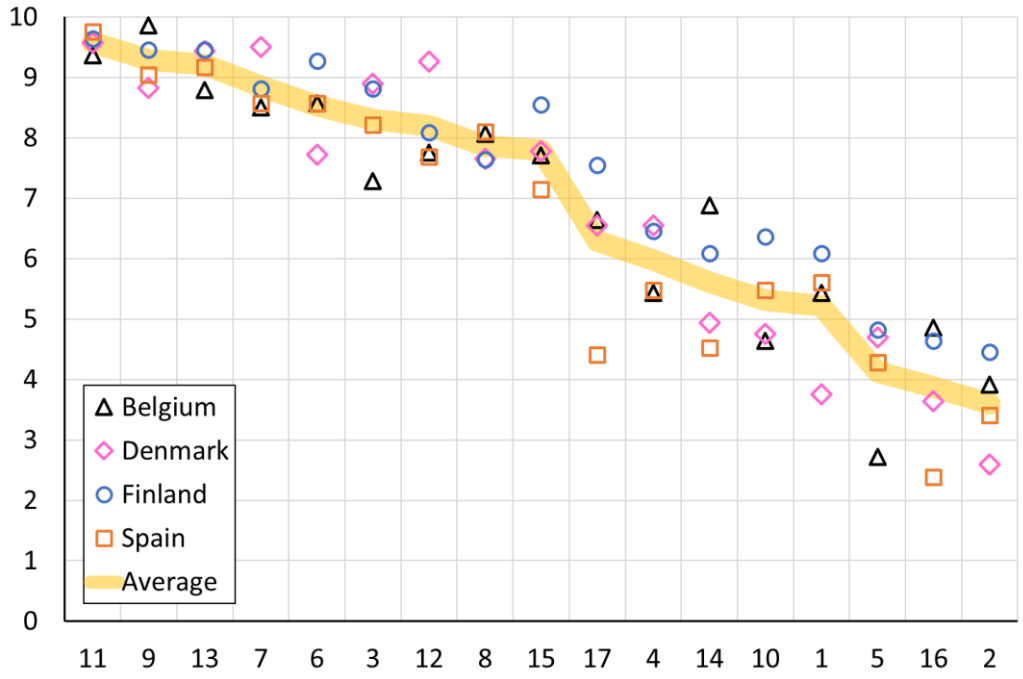


Fig. 87: Degree of connection of the SDGs with the construction industry and the built environment

To conclude, according to the participants in this survey, the three SDGs which are most directly connected to the construction industry are SDG 11 (sustainable cities and communities), SDG 9 (innovation and infrastructure) and SDG 13 (protect the planet). After these, there are others with lower ratings but still on top of the list: SDG 7 (clean energy), SDG6 (clean water and sanitation), SDG 3 (good health), SDG12 (responsible consumption), SDG 8 (good jobs and economic growth) and SDG 15 (life on land). The logos of these main SDGs are shown in **Fig. 87**.

Fig. 88: The most connected SDGs to the construction industry

It also became clear that the holistic nature of SDGs should be highlighted so that the climate issues do not steal all the attention. Considering all the goals equally will increase the interest and awareness of public, professionals and enterprises.

4. Focus group interviews

The focus group workshop aims to elicit the core skills expected from graduates within sustainable construction, contribute to the UN SDGs, and understand what type of best practice is needed to further the SDGs and sustainability in the construction industry. Furthermore, the objective is to collect best practice cases and examples to use in the course design and handbook developed in WP4 in the SUSTAINABUILD project.

4.1 Purpose and methods

The methodology followed in conducting the focus group interviews was similar in the different countries but adapted to specific circumstances, such as the number of participants, their availability (what led to onsite and online focus group interviews) and their background. Nevertheless, the procedures to analyse the obtained data were similar, so parallel discussions and comparable conclusions could be drawn.

4.1.1 Belgium

The purpose of the focus group interview was to know the perception of a few representative people from different fields in the construction industry regarding the SDGs in connection with the construction industry. The interview consisted of the following open questions:

1. Have a look at every SDG and consider how it could be helpful or applicable in construction. Consider also what prohibits the further implementation of SDGs. Indicate which SDGs are easy to apply and considered essential.
2. Which skills do you expect a university college to develop among its students to become SDG proof professionals in construction? Which skills that could contribute to the SDGs should be expected from the professionals working in sustainable construction? What kind of professionals are needed to adapt the construction industry to the current sustainability challenges?

The participants were asked to link their responses to specific SDGs but were not asked to focus on any particular group of SDGs. The information collected from the focus group interview will be used to design the course developed in WP3 (project result 2). The focus group interview was conducted on 2 December 2022.

Table 11: Participants by background

Construction Companies/Industry	6
Academia	4
Architects / Engineering	4
Project developers / Investors	4

The participants were invited to the focus group by telephone. Everyone invited agreed to attend without exception. We deliberately did not send the questions at forehand. The purpose of the focus group was to have a brainstorming session. The people who attended the meeting were the company owners or representatives responsible for the sustainable aspects within the respective companies. From industry, we welcomed the head of the CRH department, a worldwide leading company in concrete that became SDG Champion

last year, and a representative of Tectum, a company active in the field of green architecture (within their roof department). Some major construction companies were invited: Houben, Vanderstraeten, Democo, Jansen Building Group and Marchetta. These are all 100-500 employee companies. It was interesting to have 4 project developers participate in the interview. Project developers can have an important role in determining the sustainable goals for a project, whereas the architects and engineers are very interested in the further development of the SDGs.

The meeting was organized as follows:

- Brief introduction regarding the SDGs, the SUSTAINABUILD project and the focus group interview methodology (15 min).
- Question 1: time for answering 50 min.
- Question 2: time for answering 50 min.
- Brief discussion 20 min.

The participants were divided into three mixed groups of six people (Industry, Academia, Engineering, and Investors). For the second question, the groups were remixed. Each group had a PXL student making notes on the importance of SDGs on a flipover chart. This is indicated in **Table 3**. In each group, a member of PXL Bouw & Industrie research department made notes. The students who attended the meeting were third-year Bachelors of Construction interested in sustainability and who will work on a bachelor thesis about a circularity or sustainability related topic. The answers were noted for each SDG, for each group. The answers were reassembled and analysed afterwards.

4.1.2 Denmark

A workshop was conducted in August 2022 in Aalborg, Denmark. The workshop consisted of two identical focus group interviews conducted in the same room and time, with 6 participants in each group. The explorative study seeks to investigate the following research question: 'Which core competencies are expected of actors in sustainable construction projects to contribute to UN's SDGs?' Furthermore, best practice examples of how the construction industry can contribute to the SDGs were collected.

The workshop was structured into two parts: the first focused on core competencies, and the second was on best practices. The questions were first discussed in each group, and then each part was followed by a knowledge-sharing session between the two groups. The knowledge-sharing sessions summarized the main points discussed by the groups.

Focus group interviews have a perceived informality which helps engage a broader prospect of participants. In addition, focus groups can encourage greater candour (Krueger, 1994). Therefore, the method was chosen to enable discussions between the participants, encourage knowledge sharing, and get a nuanced perspective on the research questions from participants through the whole value chain.

One limitation of using focus group interviews is that several participants competing to tell their individual and detailed stories in a group setting is likely to produce "noise"; that is, data that is hard to obtain and attribute to individual speakers (Barbour, 2007) To minimize the noise produced the main themes of the interviews were maintained by visual stimulus. A large poster showing the SDGs was placed in front of the participants, where they could add notes to the relevant SDGs. In order to maintain the focus during the interview, printed cards showing the discussed interview questions were also placed on each group table, plus the SDG's cubes, including the SDG targets and indicators, as shown in **Fig. 89**.

Fig. 89: Workshop setup

The framework of the focus group interviews was guided using a practical interview protocol. The interview consisted of three sections; (1) a 20-minute briefing introducing the project and the participants, (2) the central theme with 1 hour for each of the two interview questions, and (3) a 10-minute debriefing summarizing the information gathered.

At the beginning of each interview question, the participants were provided 5 minutes to prepare for the question before starting the group discussion. During the 5 minutes, the participants were encouraged to write the main core skills (in the first part of the interview) and notes on best practice examples (in the second part of the interview) on post-it notes and place them on the poster provided. The post-it notes and the recorded and transcribed interviews are the generated data of the focus group interviews (for further details, see Section 9.1.1).

Each focus group consisted of 6 participants from the construction industry. The number of participants was chosen as it encourages more time for each participant to share their experiences and find shared experiences across the groups. The participants were selected using the quadruple helix model of innovation to encourage interactions between academia, industry, and government to study the point of view of each part of the quadruple helix model. The participants included professional clients, architectural and engineering consultants, supplier- and demolition associates, industry/interest associations, researchers, and professors. All participants were chosen based on their knowledge and experience with sustainable construction and were known as ‘knowledgeable agents’.

Further description of the data management (references in Section 9.1.2):

The exploratory, qualitative data analysis followed the method described by Corley and Gioia (2004) and Gioia et al. (2013). In addition, the Gioia method was used to present and theorize from the data effectively. The features of the Gioia methodology that enhance qualitative rigour begin with the approach to analyses, in terms of organizing the data into first and second-order categories to facilitate their later assembly into a more structured form (Gioia et al. 2013).

The interview data were cut into small sections to structure the data, each containing sentences connected by speech and contents. The data were given an identification number with the post-it notes. From the data, several categories emerged. An inductive coding process seeking similarities and differences in the categories reduced the categories to a more manageable number referred to as the 1st Order Concepts according to the Gioia method. Each interview question was categorized into 14 1st Order Concepts. The phrasing of the participants is used in the description of the concepts.

The participants had placed some of the data belonging to SDGs with a post-it on the poster. The concepts were analysed, and the relevant SDG to each was noted with the participants' placement.

After the data were placed into concepts, the data were then given labels or phrasal descriptors (preferably retaining participants' phrasing), called the 2nd Order Themes. When the concepts and themes were developed, a process towards Glaser and Strauss' (1967) term ''theoretical saturation'' was investigated to find whether it is possible to unite the 2nd-order themes into ''aggregate dimensions.'' (Gioia et al. 2013) The Gioia methodology stimulates the combination of informant and researcher-centric data coding structure and provides an inductive and iterative data analysis.

The transition from second-order themes to aggregate dimensions was done for interview question 1 – Which core competencies are expected of actors in sustainable construction projects to contribute to UNs SDGs? - using the list of 18 coding families described in Glaser, B. (1978). The coding families have arranged groups of general sociological concepts organized into connected frameworks, which can foster the theoretical sensitivity of the researcher to support the development of theory from the data. (Vollstedt, M., Rezat, S.,2019)

The *Process family* has given three aggregate dimensions. The *strategy family* supported the formation of the three aggregate dimensions.

4.1.3 Finland

The study was descriptive and aimed to identify contents to be included in the SUSTAINABUILD course. Initially, the survey was meant to be conducted as a face-to-face meeting of the focus group. However, in Finland, the summer is the busiest season in the construction branch, and the meeting would have been difficult or impossible to facilitate. Considering this, online brainstorming was selected as a data-collecting method. Data was collected with the virtual sharing and collaborating tool Padlet. A padlet-sheet was created to collect answers from the focus group and advisory board members. The Sustainable Development and Construction Padlet wall had six brick-like sections:

- Guidelines and background information about the Sustainable project Construction
- Background information about sustainable development goals (SDGs)
- Instruction to answer the two questions. Participants could also approve proposals with a thumbs up gesture.
- First open question: What skills could contribute to the UN Sustainable Development Goals (SDG) do you expect from the graduates of the sustainable construction course?
- Second open question: What do you think / experience are the best practices that can promote sustainable development goals in construction projects? Focus on the most important goals of sustainable development in the construction industry.
- Confidentiality, copyright and other legal issues

The Padlet for the focus group was open between August 19 and August 29, 2022. An e-mail indicating the project information, why responses are essential, and a link to the Padlet was sent to the focus group members on August 19 and a reminder on August 26. The Padlet for the Advisory Board members was open between September 7 and September 15, 2022. They were also informed by a similar e-mail with the link to the Padlet, like the focus group. The Advisory Board was included in the survey to increase its validity. All responses to the two questions and thumbs ups to the notes were given anonymously. The Padlet link was sent to the members of:

- The Focus Group comprises 7 professionals from building contractors, engineering companies, construction companies, the Association of Builders and Engineers, smart city company, the HVAC Association, and the Confederation of Building Contractors.
- The Advisory Board consists of 8 professionals from a construction consultant company, HVAC company, HVAC and energy consulting company, project development and construction company, smart sanitary fittings company, civil engineering division of the city, the Confederation of Building Contractors, and a higher education institute.

4.1.4 Spain

The purpose of the focus group interview was to know the perspective of a few representative people from different fields in the construction industry (quadruple helix: industry, academia, public bodies, and citizens) regarding the SDGs in connection with the construction industry. The interview consisted of the following open questions:

1. What kind of skills that could contribute to the SDGs should be expected from the professionals working in sustainable construction? What kind of professionals are needed to adapt the construction industry to the current sustainability challenges? What skills should professionals have to make the industry more sustainable?
2. Which best practices can be used to promote sustainable development goals in construction projects? How can construction projects contribute to the implementation of the SDGs?

The participants were asked to link their responses to specific SDGs but were not asked to focus on any particular group of SDGs. The information collected from the focus group interview will be used to design the SUSTAINABUILD course to be developed in WP3 (project result 2). The focus group interview was conducted on 13th October 2022. As all the participants could not attend the event physically, they were separated into two groups: a 'physical' attendance group (6 people) and an online group (5 people). Representative people from the different construction industries (quadruple helix: industry, academia, public bodies, and citizens) were present in the two groups (**Table 12**).

Table 12: Participants in each group

	Attendance group	Online group
Industry	2	1
Academia	1	2
Public bodies	2	1
Citizens	1	1

A few days before the meeting, some information regarding the SDGs was sent to all the participants. Both groups were asked the same questions. The attendance group wrote their answers on post-its and posted them on the specific SDGs they thought were most related to the answers. The online group wrote their answers in a collaborative online document, relating them to specific SDGs. The agenda of the meeting was identical for the attendance and the online group and was organized as follows:

- Brief introduction regarding the SDGs, the SUSTAINABUILD project and the focus group interview methodology (15 min).
- Question 1: time for answering 50 min.
- Question 2: time for answering 50 min.
- Sharing final remarks between the two groups (attendance and online, 20 min).

After the meeting, the comments of both groups were analyzed together (no distinctive feedback is expected from the attendance and the online groups). As a first step, the answers were collected, and only a few were corrected, eliminated, or assigned to different SDGs for better comprehension. This first phase was done in the Spanish language to stick as much as possible to the original expressions used by the respondents. As a second step, the responses that were indeed similar were merged to get fewer responses without losing any information. Finally, in this phase, the responses were translated into English.

4.2 Core competencies

4.2.1 Belgium

The list of responses to question 2, related to the SDGs, is shown in **Table 13**. The answers are from the 16 participants of the focus group who responded. We received over 70 answers. The answers in green are soft skill related. It is important to mention that 40 of the 73 answers are skills that concern soft skills.

Table 13: Skills (soft in green)

1	A mindset to increase the impact
2	Order of lessons well coordinated
3	People's knowledge and communication
4	Thinking out of the box
5	Solution-oriented thinking
6	Knowledge of circular materials
7	BIM and digitalisation
8	Definitions of sustainability
9	Definitions of circularity
10	Soft skills
11	Lifelong learning
12	Measuring tools
13	Legislation and standardisation
14	Insight into cost price on LT
15	LCA
16	Critical mind human interactions
17	Mindset : small effort has big effect
18	Common sense
19	Learning to the end of life
20	Promote public transport

21	Inclusive education: design/AR, matching techniques, stability and greenery
22	Entrepreneurship in function of sustainability
23	Sustainable construction starts with sustainable design
24	Critical view on sustainability
25	Choices LCA not always unambiguous
26	Functions can change (e.g. youth movement single weekend, school only week)
27	Learn to determine/assess a problem quickly
28	Learning to work together
29	Module-based fields of interest exploring instead of 1 dental curriculum
30	Out of comfort zone, e.g. Erasmus
31	Connect
32	English instead of French and German
33	Mathematics applied on site
34	Long-term internships
35	Free public transport
36	Stimulating children to do what they are good at (shaping your talents)
37	Stop overloading with useless knowledge
38	Working in teams
39	Study abroad Erasmus
40	Taking people out of their comfort zone
41	Financial arithmetic, learning financial awareness
42	Values and norms
43	Critical view on production
44	Critical view on longevity
45	Working together to achieve goals together
46	Learning to raise awareness
47	Questioning things
48	Stimulate curiosity
49	Open mind
50	Accountability
51	Encourage intuition
52	Choose courses appropriately
53	Sparking interest in the subjects
54	Open mind
55	Innovative thinking
56	Trigger to look further
57	Total picture thinking
58	Learning to work together

59	Desire to think further
60	Taking your own responsibility
61	What can I do about sustainability myself ?
62	Economically conscious thinking
63	What are the economic consequences of my choices?
64	Searching for balances
65	Waking ownership of actions/positions
66	Ownership
67	Tolerating feedback and learning to give
68	Learning to improve
69	Knowledge of ecological materials
70	Understanding ecology (should not be a goal in itself)
71	Learning insights into modularity
72	Respect for the planet
73	Learning how to use less energy

The relative importance of the various SDGs with regard to future professionals' core competencies is presented in **Fig. 90**.

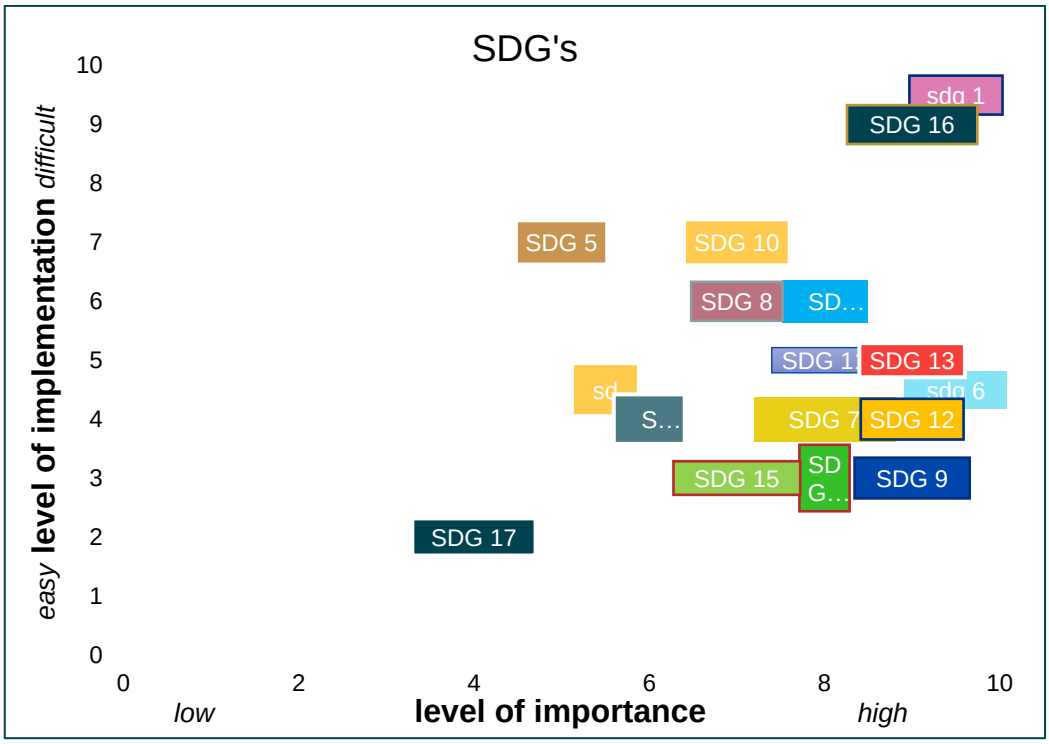


Fig. 90: Graphic of importance and implementation of SDG

4.2.2 Denmark

The interviews were cut into small sections and given an identification number. Each post-it note was also given an identification number. The categories emerged from the data from similarities and differences and were reduced into the 1st Order Concepts shown in **Table 14:** The participants placed some data belonging to specific SDGs with a post-it on the poster. The unidentified concepts were analysed, and if a specific SDG matched the concepts, they were added to the data shown in the table.

Table 14: Competences. Data Sources – Results from the coding process

1st order concepts and SDGs	
	• Knowledge of applied construction methods. • Constructing with simpler materials that can be taken apart after use.
	• Material properties • CO_2, Life Cycle Assessment (LCA), and Environmental Product Declaration (EPD) • Material sustainability
	• Timber-construction application and execution • More experts on wood structures
	• Build the same way we used to build • Using simpler constructions • Local supplies
	• New craftsmanship • Learn how to construct and not just mount
	• Holistic approach • Economical, sustainable, and social justice
	• Cooperation and partnership • Multidisciplinarity through the whole value chain
-	• Open mindset • Trust in the process • Creativity
	• Knowledge of the SDGs • Best practice using the SDGs

	• Professional competences • Translation of knowledge
	• Competences in creating a good indoor climate • Climate adaptation -> how should we design/adapt/construct our buildings
	• Use the economic situation to become more sustainable (corona, lack of material deliveries, and energy crisis)
	• Developers (clients) decide what is being built • The client must set the proper requirements correctly • Political and strategic client
	• Human community - Remember our social responsibility

The most referred to SDG is SDG

Using the Gioia method, the developed coding process is illustrated in **Fig. 91** from the first-order concepts to second-order themes and aggregate dimensions. The three aggregate dimensions that emerged from the data were 'Knowledge of construction, materials, and sustainability', 'Skills in construction practice and sustainable adaptation', and 'Competences in social qualities and strategic processes', as shown in **Fig. 91**.

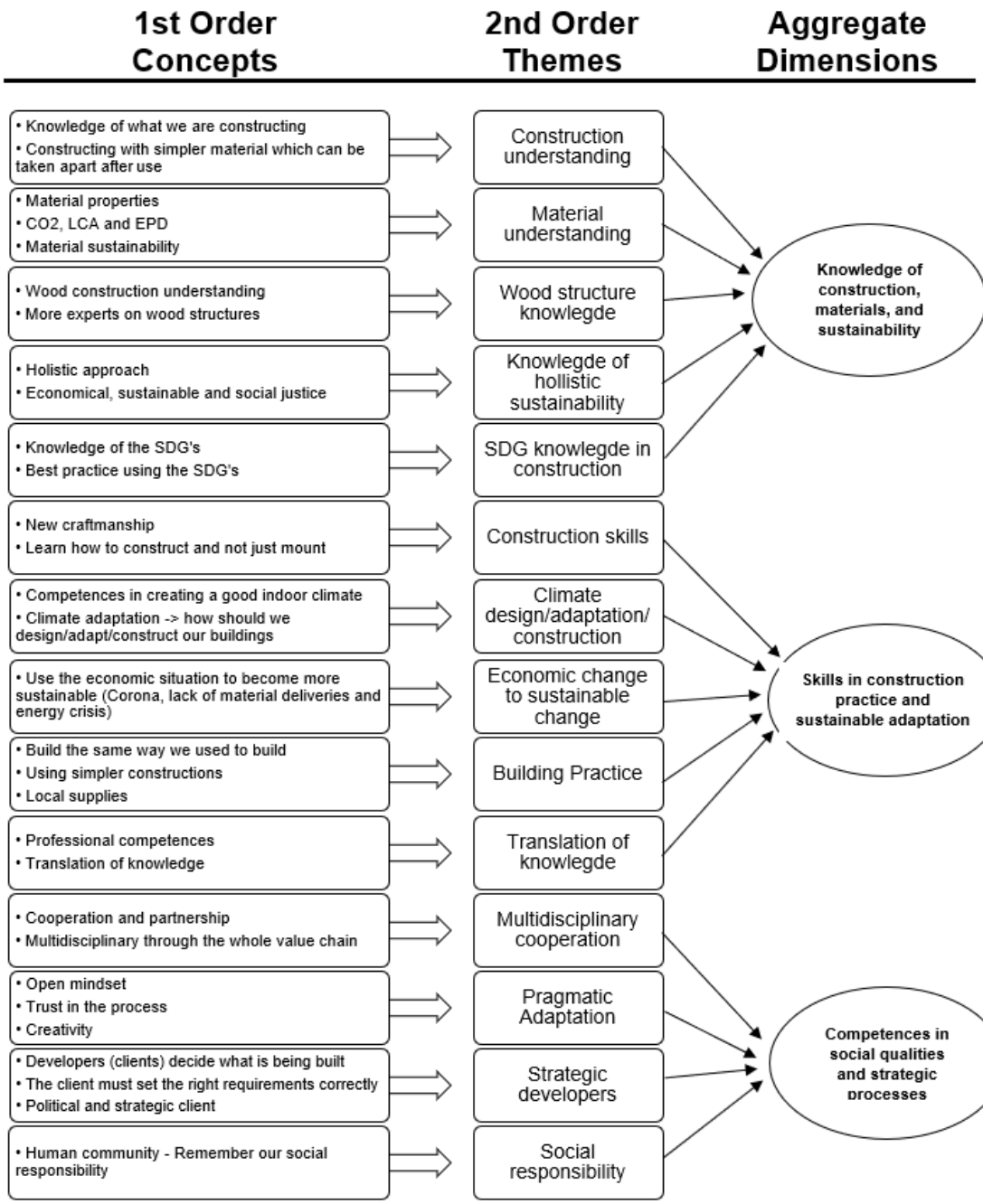


Fig. 91: Data structure - core competencies. Reproduced from Corley & Gioia (2004)

Knowledge covers knowledge and understanding of a subject. *Skill* covers what a person can do or accomplish, and *competence* is about responsibility, autonomy, and the ability to apply knowledge and skills in a work situation. (Danish Ministry of Higher Education and Science, 2022) The results show what general knowledge of construction, materials, and sustainability is needed for all actors in sustainable construction projects to contribute to the UN's SDGs. The focus is first to understand what is constructed to enable the possible

change in construction. The data shows; with the increased demands for sustainable solutions in the construction industry, the necessary skillset of the clients, consultants, suppliers, and contractors also change. There will be a necessity for skills in construction practice and adaptation. Lastly, the participants express a need for responsibility and autonomy to apply the knowledge and skills of social qualities and strategic processes to sustainable construction projects to contribute to the UN's SDGs.

4.2.3 Finland

What kind of skills could contribute to the UN Sustainable Development Goals (SDGs) and do you expect from the graduates of the SUSTAINABUILD course?

In common, understanding how the construction branch and the SDGs are connected was found important. Students should know all the different points of view related to the topic and how responsibility can be considered in the different phases of the construction project, e.g.

- Why talk about responsibility?
- Which goals have been set by Finland, and which by the EU?
- What are the worst sources of emissions, and how can they be affected?
- What is life cycle assessment?

It was also worth highlighting that it is unnecessary to do everything, as it has been done before and that it is acceptable to challenge and question current operating models. Furthermore, it was said that enterprises are missing information on where to find reliable information and facts. Some respondents were also missing industry standards or guidelines that would support taking responsibility into account. One of the respondents mentioned 2.5 hour long free course published by Rateko: Raki training for construction and circular economy.

One of the respondents found it essential for employees to have the basic skills to perform a carbon footprint calculation, so that they would have the ability to compare different structures with each other from a carbon footprint perspective. This calculation essentially involves using models, which should also be a competence to some extent.

4.2.4 Spain

The condensed list of responses to question 1, related to the SDGs, is shown in **Table 15**. It must be noted that some general comments were made by most of the respondents in relation to most of the answers. On the one hand, they state that future professionals should have both knowledge and awareness; without awareness, knowledge is useless. On the other hand, future professionals should not only be able to implement different solutions but also assess their environmental, economic, and social impact.

Table 15: Responses to question 1

	Absence of gender bias
	Ability to understand and apply equality plans

Knowledge needed to use water more efficiently and sustainably (less consumption, reuse)

Knowledge needed to enhance the energy efficiency of buildings along their whole life cycle

Knowledge regarding renewable energy sources, including self-consumption systems

Focus on innovation and ability to provide innovative solutions along the whole life cycle of buildings, using innovative tools (IT included), assessing their environmental impact and bearing in mind the needs of the industry, academia and end-users.

Adaptability to possible changes

Knowledge and awareness regarding accessibility

Ability to apply urban and regional scale solutions related to transport and green areas (nature-based solutions included)

Ability to apply and assess sustainable solutions with the following characteristics: reused, reusable, recycled, recyclable, durable, easy-to-repair. Focus on circularity and quality.

Leadership and multidisciplinary teamwork skills

Ability to consider the social dimension of the construction industry

Focus on sustainability and climate change

4.3 Best practice

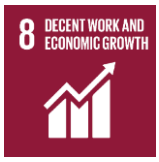
4.3.1 Belgium

The condensed list of responses to question 1, related to the SDGs, is shown in **Table 16**. It was remarkable that during the discussion in each group, respondents took enough time for each SDG and did not only focus on SDGs which would easily be related to the construction field, such as SDGs 7, 9, 11 or 12. The approach of the focus groups was holistic, which is evident from the many remarks they made for each SDG.

Table 16: Remarks on SDGs

	compensation for labour in line with the market
	no undeclared work
	subsidized housing
	affordable housing
	business code of conduct
	check the chain of subcontractors
	compulsory investment of pension fund
	leasehold instead of buying
	apply all over the world
	new formulas of renting – buying
	meal vouchers
	pay foreigners sufficiently according to Belgian standards
	check the chain of subcontractors and suppliers
	difficult in construction
	healthy working conditions
	PPE safety
	team building activities
	exoskeleton
	anti-stress coaching
	avoid burn-outs
	comfort in construction equipment
	climate ceilings
	prevention advisors
	enough space
	safety

	healthy indoor climate
	tension design vs health
	let comfort take precedence over aesthetics
	better trained architects
	technically well thought-out designs
	master drawing program better
	technical, but also social skills
	training internal staff (Tectum University)
	coaching e.g. mindfulness, healthy food
	fixed training hours provided for each staff member
	workplace learning
	healthy classrooms
	lifelong learning, continuous learning
	construction confederation: expanded package
	necessary
	life is one big education/training
	equality on the management level
	should no longer be an issue
	exoskeletons
	no real gender balance yet
	still too few women in the construction industry
	childcare in companies
	collectively from the sector
	more women in construction training programmes
	reuse of rainwater
	reduce consumption
	return well drainage
	grey water recovery
	water recovery on construction sites
	green roofs, green architecture
	purify water and reuse it in concrete
	shift towards more closed systems
	avoiding hard surfaces and pavements
	removing hard surfaces and pavements
	solar panels on production sites and offices
	charging stations
	wind turbines
	optimisation batteries
	produce your own energy
	energy management systems
	heat pumps
	collective solutions

	geothermal energy
	hot topic
	green roofs, together with solar panels
	installing solar panels on construction sites
	heat network
	infrastructure to be provided by the government
	long existence by doing a good job
	standardisation
	industrialisation
	monitoring profitability
	correct and safe working conditions
	supervision of construction works
	business code of conduct
	obvious
	context
	sustainable growth
	transition
	safety on site
	modularity
	digital twin
	BIM
	how to think differently
	circular thinking
	finding sustainable solutions
	be aware of impact
	be aware of your waste and minimize it
	system-oriented design
	robots to cope with shortages of people
	D-print
	prefab
	financial innovation, who is going to pay for it?
	more factory output to limit weather influences
	different nationalities
	adapt to each other
	support new people
	companies with a social dimension
	know different tasks
	educate
	learning from each other
	unfair competition
	social security
	check the chain of subcontractors and suppliers

	neighbourhood feeling in new projects
	nature-inclusive building
	centralize
	creating a social mix
	sustainable modular construction
	green roofs / green architecture
	social cohesion
	legislative framework is a bottleneck
	role of the government now is rather obstructive
	technology is there
	co housing/co living spaces
	awareness is changing rapidly
	willingness to integrate
	still much possible
	reception of refugees
	good preparation
	waste reduction
	reduce material use
	circularity
	search for new systems
	modularity
	reuse of rainwater
	thermal ceiling as a service
	most circular option is sometimes demolishing buildings
	ROTOR (circular expert, what is reusable on site ?)
	do we need the new building?
	balancing act towards the most sustainable solutions
	still too many restrictions
	improved production (sometimes relatively simple)
	C- and E-levels
	greening fleet / carpark
	heat pumps
	solar panels on production sites and offices
	encouraging building owners to build green
	avoid exotic products
	local products
	lower the heating
	removing lamps
	closing doors
	breaking habits
	money holds us back
	it's about our planet

	reducing CO_2 emissions
	awareness is there
	standardisation
	no groundwater pollution
	infiltration wells / wadi
	softening surfaces
	water permeable materials
	microplastics
	waste / discharge
	softening surfaces
	waste sorting
	green roofs
	landscaping
	insect hotels
	looking at / green architecture
	BREEAM, LEED and other certification
	still a lot to do
	hands on heart
	defining values that companies propagate
	business code of conduct
	compliance
	don't bribe anyone
	too many governments
	too little support from the government
	legislator plays a major role
	imposing with reason and sense
	be applicable
	online energy auditor
	collaborating with PXL, universities of applied sciences
	sustainable partnerships
	social companies
	subcontractors: working and learning from each other
	working together to increase quality
	see which suppliers work innovatively and sustainably
	supervising master's and bachelor's theses
	attracting good students through internships
	collaboration is key
	transparency between parties
	is difficult, even in your own organisations

4.3.2 Denmark

The resulting first-order concepts for the interview from the coding process are shown in **Table 17**.

Table 17: Best practice. Data Sources – Results from the coding process

1st order concepts and SDGs	
	• Certifications show best practices (DGNB, Swan label, BREEAM, LEED)
	• Garbage sorting
	• Resource mapping during demolition • Recycling portal (e.g. Titan)
	• Climate protection • LCA • CO_2 benchmark
	• Innovative thinking/curiosity regarding the use of materials (e.g. Lendager)
	• Need for best practice examples (public, private, scalable, buildable, and knowledge sharing)
	• Changing contracts • Partnerships • Thinking about sustainability from the start
	• Teaching on construction sites
	• Requires a front runner (e.g. Tesla/electric car) • Possibility of a test fund, so the individual company does not run all the risk
	• Broad involvement (e.g. for public housing) and collaborations
	• Sustainability in several facets (think green and social and economic sustainability together)
	• It must be documentable in relation to local plans, fire safety, insurance, and financing.

	• What can we do with the current framework?
	• Concerning social sustainability, it makes a difference if we know the history behind a building, which makes recycling attractive
	• Making sustainability a business case. • Use the interest in recycling in the population and the construction industry.

referred to

The *strategy family* supported the formation of the three aggregate dimensions presented in **Fig. 92**.

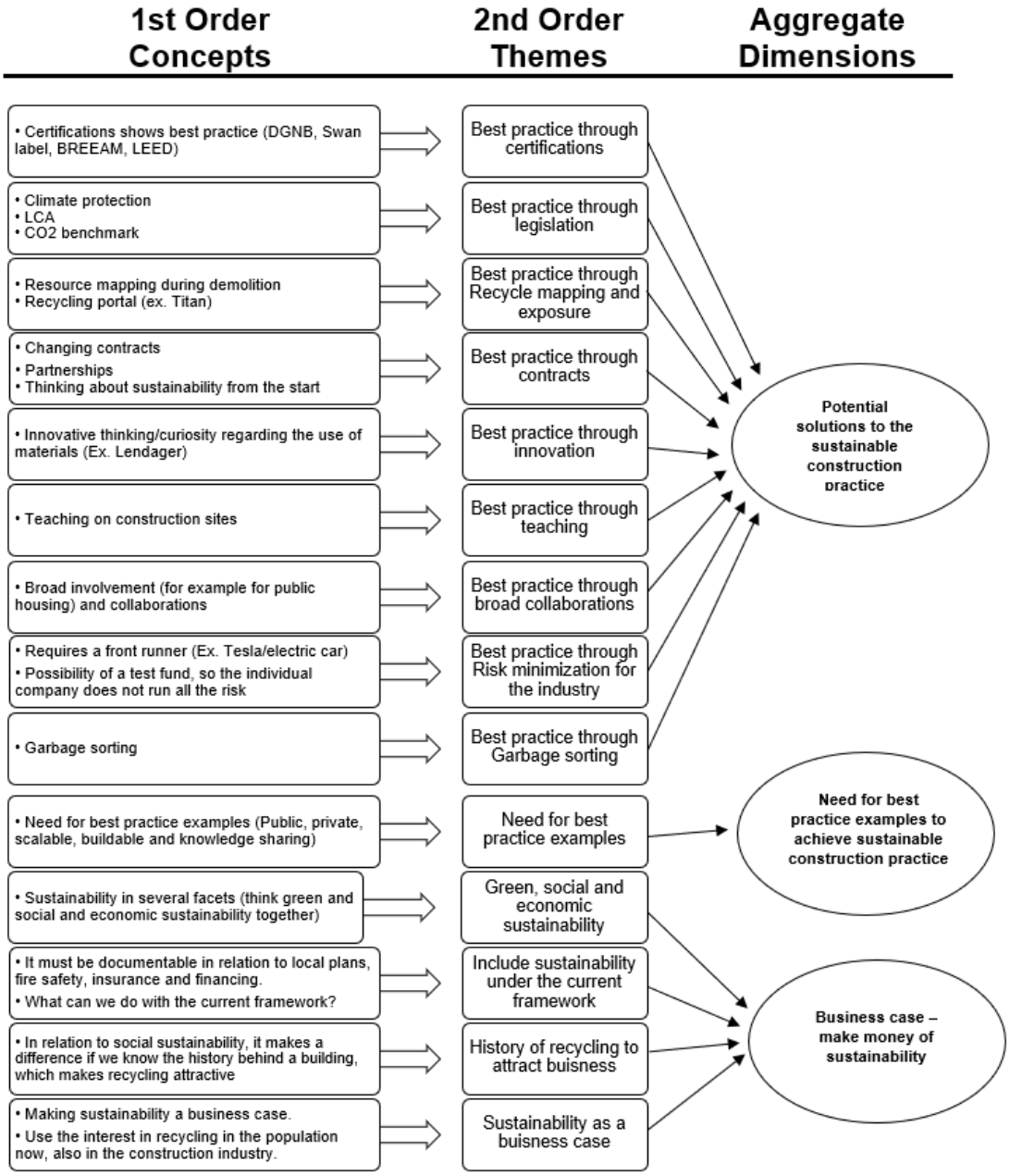


Fig. 92: Data structure – best practice. Reproduced from Corley & Gioia (2004)

The interview question about best practice examples from the construction industry first shows a great demand for examples contributing to UN's SDGs. The data showed urgency for best practice examples as new Danish construction legislation applicable from 1st January 2023 includes demands of reaching climate goals, hereunder LCA calculations.

The results also reveal potential solutions to sustainable construction practices. The solutions provided by the participants were through legislation, certifications, contract changes, recycling, innovation, teaching, collaboration, and risk minimization. Besides the mentioned potential solutions, economic sustainability was a significant focus area. An important focus

in the industry is to find ways to include social and environmental sustainability without losing the economic prospect of the clients. Specific examples of sustainable construction projects emerging from the data are gathered in the following list to use in the course design and Handbook developed in WP3 in the SUSTAINABUILD project.

1. Intro course on sustainability at vocational schools
2. Apprentices and social work (Råt og Godt)
3. Titan orangery
4. Climate alliance with Aalborg municipality and Aalborg Supply
5. Sheds in recycled wood
6. Circle House from lejerbo
7. Rainwater collection Karakter architects (Integrate collections in sheds etc.)
8. Green Hub House - Collaboration with We Build Denmark on a manifesto for the construction of multi-storey buildings of the future.
9. UN17 Village
10. Lenager-group projects in Ørestaden (Recycling of materials)
11. CCO Arkitekter - Rethinking design. For example, security
12. PFA collegiate (DGNB requirements for waste sorting meant recycling several old materials in the landscape project)
13. NBE's (Network for Sustainable Business Development in Northern Denmark) business model
14. Climate projects at Østerbro
15. WeBuildDenmark fire project
16. AAU experiments with recycled materials, detailing, aesthetics etc.

All the examples are sustainable projects in the Danish construction industry that have worked towards the SDG as a shared blueprint.

4.3.3 Finland

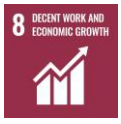
According to your opinion/in your experience, what best practices can be used to promote sustainable development goals in construction projects? Focus on the most important sustainable development goals for the construction industry. That was the basic question the respondents were asked to answer.

The respondents named circular economy practices and sustainable material choices, considering the end user's needs in plans and cooperation between different actors to avoid wrong material choices or a needless dismantling of what has already been built. Furthermore, they also emphasised that each project partner's opportunities to impact on the project should be focused on. One of the respondents said that during this year, FIGBC had organized in-depth low-carbon training for various parties. Within this training, quick guides for each project partner were created. Taking a large sample of guest lecturers for the course was also mentioned as a good practice, such as the best practices assessment of the project's carbon footprint and handprint. In this topic, life cycle assessment was mentioned as an example that can help in decision-making and indicate the magnitude of the effects. An enterprise could focus on energy consumption and materials based on the evaluation. A guide to low-carbon construction made by A-Insinöörit (ains.fi) was named as a practical example of materials. With the help of the low-carbon construction guide, an enterprise can sustainably control the carbon footprint of its construction projects from project to project.

4.3.4 Spain

The condensed list of responses to question 2, related to the SDGs, is shown in **Table 18**. It must be noted that most respondents made general comments concerning most of the answers. On the one hand, they state that most of the best practices and contributions to the most technical SDGs (6 to 12) must be innovative to some extent. On the other hand, they insist on applying all the proposed solutions along the whole life cycle of buildings or infrastructures under concern.

Table 18: Responses to question 2

	Collaborating with educational institutions to increase teaching regarding sustainability
	Disseminating the knowledge regarding the SDGs
	Disseminating best practices in the construction industry regarding gender equality
	Adapting the construction projects to their surrounding hydric conditions
	Avoiding the use of fossil fuels for machinery and transport and sharing these means to reduce the consumption of energy
	Generating energy for self-consumption
	Improving working conditions: schedule flexibility, family conciliation, work-life balance, teleworking.
	Promoting research, development, and innovation
	Implementing new digital tools

Implementing solutions in the cities to enhance their resilience against adverse climate events: drainage systems, and green roofs.

Applying circularity at an urban scale. For instance, renovating the built environment (with the support of the public bodies)

Implementing solutions with the following characteristics: sustainable, efficient (industrialized), low-carbon, durable, circular, pollution-reducing, and biodiversity-protecting.

Decreasing the use of containers

Carrying out projects to enhance the living conditions of vulnerable groups

Promoting corporate social responsibility

4.4 Discussion and conclusions

After **condensing** the responses given by the focus groups to the proposed questions, some common conclusions could be drawn regarding the core competencies of future professionals and best practices to be applied in construction projects.

- A wide range of **core competencies** was mentioned, including **hard and soft** skills.
- It was remarked that new **core competencies** and **best practices** should address not only **environmental** aspects but **social ones** too.

As the methodology followed by each country was slightly different, the conclusions obtained by each partner in relation to the most addressed SDGs are presented in the following sections.

4.4.1 Belgium

It was remarkable that in one group, they considered all SDGs equally important, which pleads for the holistic view of the SDGs. It was also remarkable to see how many remarks were given for almost every SDG. The SDGs specifically indicated as SDGs related to construction surprisingly concerned 8 SDGs (**Fig. 93**).

Fig. 93: The most concerned SDGs in relation to construction

4.4.2 Denmark

The focus group workshop aimed to investigate the core skills expected from graduates within sustainable construction, contribute to the UN SDGs, and understand what type of best practice is needed to further the SDGs and sustainability in the Danish construction industry.

The core skills discussed have been condensed into three aggregate dimensions:

- Knowledge of construction, materials, and sustainability
- Skills in construction practice and sustainable adaptation
- Competences in social qualities and strategic processes

The best practice approach has been condensed into three aggregate dimensions:

- Potential solutions to the sustainable construction practice
- Need for best practice examples to achieve sustainable construction practice
- Business cases – make money from sustainability

Furthermore, the object was to collect best practice cases/examples to use in the handbook developed in WP4 in the SUSTAINABUILD project. The 16 specific projects were listed in section 4.3.2.

The most tagged SDGs in both interview questions are SDG 4, quality education, SDG 12, responsible consumption and production,

Fig. 94

Fig. 94: Most frequently highlighted SDGs

4.4.3 Finland

This study was conducted to determine what kind of knowledge and skills concerning the SDGs the focus group and advisory board believe will be needed in the construction business and which practices they found to be best in promoting SDGs in the construction business. In the answers of both groups, the hard goals like SDG 6 (Clean water and sanitation), SDG 7 (Affordable and clean energy), SDG 8 (Decent work and growth), SDG 11 (Sustainable cities and communities), SDG 12 (Responsible consumption and production) and SDG 13 (Climate actions) became highlighted (**Fig. 95**).

Fig. 95: Most frequently mentioned hard goals

However, also the soft goals, such as SDG 1 (No poverty), SDG 2 (Zero hunger), SDG 3 (Good health and well-being), SDG 4 (Quality education) and SDG 5 (Gender equality) became mentioned in one way or another, but less prominently (**Fig. 96**).

Fig. 96: Most frequently mentioned soft goals

4.4.4 Spain

The focus group interviews aimed to know how the SDGs are linked to construction from the perspective of a few representative people from the sector. In order to get that information, questions regarding the formation of future construction professionals and ways to promote the implementation of the SDGs were asked. As a result, some general statements were obtained, pointing to the need for higher knowledge and awareness of environmental and social sustainability. Furthermore, specific responses were linked to almost all the SDGs, although SDG 2 (zero hunger) and SDG 3 (good health) were never mentioned. On the contrary, the most tagged SDGs are shown in **Fig. 97**:

Fig. 97: Most frequently tagged SDGs

5. Conclusions

This report is the starting point for defining the course contents (WP3), and handbook (WP4) proposed in the SUSTAINABUILD project. Several conclusions can be drawn based on a literature review and the analysis of surveys and focus group interviews where a quadruple helix (industry, academia, public bodies, and citizens) took part. From those conclusions, some recommendations can be given regarding the curriculum contents and the best learning goals for the students and practitioners. Among the conclusions, the following are highlighted:

- A wide variety of documents already **deal with the SDGs** related to environmental sustainability in the construction industry, although **not explicitly**. However, **educational and dissemination materials are lacking**. Further information regarding the academic literature review will be available in a paper published in the *Journal of Building Engineering*.
- From the literature review, it was concluded that any action regarding the implementation of the SDGs in the construction industry should be approached from both **European Union and national points of view**, considering the EU regulation and national legislation in each country.
- The knowledge regarding sustainable development is generalized among the participants in the **survey**. However, knowledge regarding the specific framework of the SDGs is scarce, and some barriers hinder their implementation. Among those barriers, economic and legislative obstacles are the most noteworthy. Therefore, it is concluded that implementing the SDGs should always be **cost-effective and backed up by political support.**
    - **Industry**: In general, companies consider the implementation of the SDGs as an **opportunity** to reduce the environmental impact and improve the efficiency of their processes. Furthermore, in general, they consider the efficient use of energy and materials the most interesting topic related to the SDGs. However, remarkable discrepancies exist between the countries regarding the topics of most interest.
    - **Academia**: There is not a strong presence of the SDGs in the **curricula** of higher education institutions, despite the spread of content regarding **environmental sustainability**. However, professors and teachers are committed, and most are willing to make future changes to include SDGs linked to the construction industry.
    - **Public bodies**: There are strong **differences between** the analysed **countries** regarding implementing the SDGs in the construction industry from the public bodies. Denmark and Spain seem to be making a great effort, whereas Belgium seems less committed to this matter.
    - **Citizens**: People not belonging to the industry, academia, or public bodies but related to the construction industry somehow consider that the government is the institution that should be involved most in implementing the SDGs in the construction industry. Furthermore, they think that considering the SDGs in the construction industry would **improve** the quality of life, protection of nature, and the sector's reputation, although it may raise **taxes**.
- The **focus group interviews** (both on-site and online) are a very useful tool to understand the state of implementation of the SDGs in the construction industry.

Therefore, a careful selection of the participants should be carried out with a structured methodology, not only for the interview itself but also for analysing the collected data. A systematic condensation of the qualitative information provided by the respondents (**inductive coding process**) was a successful way to manage the data and draw conclusions. Furthermore, it was a great opportunity for different stakeholders belonging to the **quadruple helix** (industry, academia, public bodies, and citizens), to interact by sharing their knowledge and opinions regarding the SDGs in the construction industry.

- As a general conclusion from the collected impressions in the focus group interviews, it can be said that many organisations already have a sustainability strategy with **ambitious** objectives (best practices) and those who do not are willing to change their strategies.
- Also, during the focus group interviews and concerning the course and handbook to be developed in WP3 and WP4 (core competencies), it was emphasised that, in addition to **knowledge** and **hard skills**, the **awareness** regarding the implementation of the SDGs and the **soft skills** is a very important aspect to be addressed in both **educational and dissemination projects**. This aligns with the conclusions obtained and developed in other projects with a broader scope, such as the Inner Development Goals.

In addition to the conclusions previously presented, some important remarks can be given regarding the contents to be addressed in the **course** (WP3) and **handbook** (WP4). For instance, the following **topics** were considered as important after reviewing the literature:

- Sustainability and life cycle assessment methods.
- Digitalization to promote sustainability.
- Energy efficiency and low carbon footprint.
- Circular construction.
- Social sustainability.

Furthermore, the surveys and focus group interviews showed relevant information regarding the most referred **SDGs** when dealing with the construction industry (**Fig. 98**). However, the most important remark from this analytical framework is that most of the stakeholders address the SDGs from a holistic point of view. Then, most participants in the survey or the focus group interviews stated that all the SDGs should have the same importance or could assign inputs to all of them. Therefore, the course and handbook to be developed in WP3 and WP4 should follow a **holistic approach**, considering the implications of as many SDGs as possible.

Survey		Focus group interview				
Most important	Second order	Belgium	Denmark	Finland		Spain
				Hard	Soft	
						

Fig. 98: SDGs that were addressed at the most during the surveys and focus group interviews

6. Appendix 1: Other bibliographic resources

A great number of valuable documents were collected for the literature review. Not all of them were referred to in the corresponding section, but a selection was made. Other bibliographic resources are shown in the following subsections:

6.1 From Denmark:

Title	Author	Publication year	Publication type	Summary
Denmark without waste. Danmark uden affald II	Ministry of environment	2015	Report	The national strategy to reduce waste
Handlingsplan for FN's verdens-	Regeringen, Udenrigsministeriet	2017	Report	Denmark's governmental follow-up of the UN's global goals for sustainable development
KL- Indspil til regeringens arbejde	KL- kommunerne	2020	Contribution	Contribute to the government's work on an action plan for the UN World Goals
Frivilig bæredygtighedsklasse	Ministry of housing	2005	Report	The sustainability class aims to define and offer an easily accessible and consistent basis for building sustainable construction.
KL's action plan for the UN's World Goals	KL- kommunerne	2018	Report	KL supports that the Danish government has committed Denmark to the 17 World Goals in the UN. Therefore, with the financial agreement between KL and the government for 2018 and again in 2019, KL has entered into a binding effort to contribute to raising the UN's World Goals in Denmark.

https://www.kl.dk/tema/verdensmaal/inspirationskatalog-	KL- kommunerne		Online Catalogue	Inspiration in the municipalities 'work with the World Goals and the municipalities' work with social, climate and environmental and economic sustainability, as well as partnerships.
KL Undersøgelse om FN's Verdensmål i	KL- kommunerne	2021	Report	KL has surveyed Municipalities on their efforts with the UN's World Goals. The investigation has been completed via a questionnaire sent to all 98 municipalities. In 2020, 77 municipalities submitted responses.
Gør verdensmål til vores mål	KL- kommunerne	2020	Report	197 Danish measurement points for a more sustainable world
Kommunerne og verdens-	KL- kommunerne	2020	Note	KL's survey on the municipalities' work with the UN's World Goals
Kommunernes arbejde med	KL- kommunerne	2019	Ph.D	PhD-plan. Problem area and work questions. Jannik Egelund
Erhvervslivet og verdensmålene	Danmarks Statistik	2020	Report	Collection of inspiration from UNCTAD, which has converted the SDGs into indicators of sustainability on which enterprises should report individually – information that investors are demanding more than before and also offers an overview specifying which sustainability aspects are most important to focus on for the various industries.
Pilot survey 2019	Danmarks Statistik	2019	Survey results	In 2019, Statistics Denmark asked Danish companies with more than 250 employees about their work with the World Goals, including the sub-goals committee.

MAKE GLOBAL GOALS OUR GOALS (same as 8)	Statistics Denmark and the 2030-Panel	2020	Report, English	The report contains 197 suggested Danish indicators related to the 17 SDGs. The indicators supplement the UN indicators for measuring sustainable development, thus contributing to measuring the progress of sustainable development in Denmark following the UN's 17 SDGs.
Statistical follow-up on the 2030 AgendaDenmark	Statistics Denmark	2017	Report, English	Data on selected indicators showing the development from 2005-2015. The report presents a statistical snapshot of the situation in Denmark concerning the SDGs that can serve as a starting point for public debate. Given the relatively limited time for its production, we have mainly concentrated on data already available in Statistics Demark.
AN ARCHITECTURE GUIDE to the UN 17 Sustainable	Institute of Architecture and Technology, KADK The Danish Associ-	2018	Book, English	The guide provides an architecture guide to the Goals. The 17 chapters present how each Goal is defined by the UN, outline how it interacts with the built environment and gives examples of realized projects that illustrate architectural contributions.
Baseline for the Global Goals in Denmark - Goal 11: Sustainable Cities and Communities	Danish Architecture Center, Ramboll Management Consulting, Local Government Denmark	2019	Report, English	The report forms a baseline for one of the SDGs, Goal 11, which concerns sustainable cities and communities

THE CAPITAL OF SUSTAINABLE DEVELOPMENT	The City of Copenhagen Department of Finance		Report	Contains a mapping of the city's current contribution to the realization of the UN's world goals and a plan for the city's strategic anchoring of SDGs in the management's forward-looking work. A contribution to the global conversation on the operationalization of the SDGs in the cities' work with social, economic and environmental sustainability as well as the first sting in the city's long-term work with the goals
SPOTLIGHT REPORT CHALLENGES FOR DENMARK ON THE WAY TO ACHIEVING THE SDGS – IN	Danish 92 Group og Global Focus	2020	Report, English	To highlight the challenges Denmark faces regarding fully implementing the SDGs in Denmark and making a maximum contribution at the global level as well as highlighting individual challenges, the report recommends how political action can be leveraged to solve these challenges.
SPOTLIGHT REPORT	Danish 92 Group og Global Focus	2019	Report, English	Denmark's challenges in achieving the SDGs english summary
Sustainable Development Ac-	Nordic Council of Ministers	2017	Report, English	Implementation of the Global 2030 Agenda for Sustainable Development in Nordic Cooperation
Danmarks udviklingssamarbejde	UDENRIGS MINISTERIET- DANIDA	2017	Report	A concrete and visible contribution to the co-responsibility that Denmark assumes for the development of the world. Development cooperation is fully integrated into Denmark's foreign and security policy and is aimed at making the world a safer, free, prosperous, sustainable and fair place to grow up for future generations.

DE 17VERDENSMÅL– SÅDAN KOMMER II GANG!	Danske Arkitektvirksomheder	2020	Instructions	Guide to implementing the world goals in your companies and projects so that the world goals can become your springboard to rethink your business, exploit cracks and open windows, cultivate new business areas and be at the forefront of the bus in terms of taking advantage of the changes in the market that will shape the future.
UN17 village			Website	UN17 Village is the first building in the world, created based on a complete method to address and incorporate the UN's 17 world goals into one complete solution. This approach to the construction of the future challenges the present in a holistic project that meets the highest standards in social, environmental and economic sustainability.
Afgangsprojekter med fokus på	Det Kongelige Akademi		Website	Graduation projects focusing on the UN's world goals
Visit SOLUTIONS 2021	Det Kongelige Akademi		Website	More than 200 solutions to major sustainable challenges
FN's 17 verdensmål - værdi for	Milestone pro		Workshop	
FN's 17 verdensmaalene-Det vigti-	Steen Hildebrandt, KLS Pureprint	2018	Book	

Generationernes Hus	Fredensborg Kommune	2021	Report	Generationernes Hus in Nivå city center is the municipality's largest construction project to date with the opportunity to work with sustainability at all levels in a completely new city center. With this sustainability strategy, Fredensborg Municipality shows the way they work with sustainability at the social, economic and environmental levels.
The UN's 17 World Goals-from ambition to marked	GTS, Godkendt Teknologisk Service	2018	Report	In this publication, we have collected eight cases that show how the Danish GTS institutes work closely with Danish companies and public actors to develop new solutions that can contribute to the 17 world goals.
WhatmeansUN 17world goalsaboutsustainable-developmentforthe	PER TYBJERG ALDRICH, NIRAS A/S	2018	Workshop	The objective is that the participants: Gain knowledge of those of the UN's world goals that are related to the work environment, shares experiences and perspectives on the use of the UN's world goals in the work environment, Be inspired to use the UN's world goals in work environment work 3
Virksomhedernes arbejde med FNs ver-	IDA	2018	Report	IDA asked members how they assess world goals and how to describe users in their work. A total of 617 members of IDA responded to the questionnaire.
Region Hovedstadens arbejde	Meeting of the Advisory Panelfor		Report	Examples of priorities in the action plan for the UNworld goals within the Danish Environment.
KLIMAPÅ VIRKNINGERBÆREDY-	RAMBØLL	2018	Presentation	

6.2 From Finland:

Title	Author	Publication date	Publication type	Summary

Maanrakennus- ja rakentamislaki (132/1999) (Land Use and Building	Ministry of the Environment	1999	Legislation	The Land Use and Construction Act is one of the most important laws concerning our living environment. It contains the basic provisions for land use planning, zoning and construction. Regulation affects every municipality, contractor, landowner and resident.
Maankäyttö- ja rakentamisasetus (895/1999) (Land Use and Building	Ministry of the Environment	1999	Legislation	The Land Use and Building Decree regulate in more detail the design and construction of a building, as well as the construction permit requirements and permit procedure. It also sets out obligations regarding arrangements for the execution of construction projects.
Maankäyttö- ja rakennuslaki uudistuu	Ministry of the Environment		Legislation (under reform)	
Energiatehokkuuslaki (1429/2014) (Energy Efficiceny ACt	Parliament of Finland	2014	Legislation	The Energy Efficiency Act obligates large enterprises to conduct an energy audit every four years. Energy audits are used to produce knowledge of a company's existing energy consumption profile or all the units in a group, identifying energy savings opportunities.
Laki rakennuksen energiatodistuksesta (50/2013) (The	Parliament of Finland	2013	Legislation	The purpose of this law is, in particular, to increase the possibilities for comparing the energy performance of buildings by promoting the energy performance of buildings and promoting the use of renewable energy in buildings.

Ympäristöministeriön asetus uuden rakennuksen energiatehokkuudesta (Decree of the Ministry of the Environment on	Ministry of the Environment	2017	Legislation	This Regulation concerns the design and construction of a new energy-efficient building with a covered wall structure to maintain the indoor climate. The regulation also applies to the extension of the building and the addition of space to the floor area. The regulation applies to the extension of a building with a floor area of less than 50 square meters only to the extent that the building with its extensions exceeds 50 square meters.
Jätelaki (646/2011) (Waste Act (646/2011)	Parliament of Finland	2011	Legislation	The purpose of this Act is to prevent the hazard and harm to human health and the environment posed by waste and waste management, to reduce the amount and harmfulness of waste, to promote the sustainable use of natural resources, to ensure functioning waste management, and to prevent littering.
Valtioneuvoston asetus jätteistä	Finnish Government	2021	Legislation	
Kohti kestävää arkkitehtuuria : Suomen arkkitehtuuripoliittinen ohjelma 2022–2035 (Towards Sus-	Finnish Government	2022	Policy programme	Towards Sustainable Architecture is Finland's new national architectural policy programme. The ecological, social, economic and cultural sustainability of the built environment is at the heart of the new architectural policy programme. The programme offers a comprehensive perspective on the goal-oriented development of Finland's built environment.
Kestävän rakentamisen	CEN		European standards	

The National Building Code of Finland	Ministry of the Environment		Several codes	Further provisions and guidelines to the Land Use and Building ACT (132/1999) concerning building are issued in the National Building Code of Finland.
Environment, Indoor Air and Health	Rakennustieto (The Building Information Foundation RTS ry)		Several certifications	The environmental and health impacts of building and buildings are versatile and complex to evaluate. The Building Information Foundation provides certification and classification services related to environment, indoor air and health issues. We try to create possibilities for construction professionals to make sustainable choices.
RALa Rakentamisen laatu (RALA Construction quality)	Rakentamisen Laatu RALA ry (The Construction Quality Associa-		Several certificates	The services provided by RALA include RALA Certificate of Competence, RALA Certification and RALA Project Feedback. Over one thousand contractors and construction companies avail themselves of these services.
Pitkän aikavälin korjausrakentami-	Motiva Oy, VTT Oy, Tampere Uni-	2021	Strategy & Roadmap	
Ilmasto ja energiastrategia (Energy	TEM		Strategy, several links	Finland's long-term goal is a carbon-neutral society.
Energiatodistuspas 2018: Rakennu-		2018	Guide book	Energy Certificate Guide 2018: Building Energy Certificate and E-Number Determination

Kiertotalouden edistäminen kuntien hankinnoissa (Circular procurement in municipal tenders)	Green Building Council Finland ry.	2022	Report/Guide	The circular economy market review for real estate and construction industry answers the questions: How can the circular economy in construction be promoted in different regions by the combined efforts of the public and private sectors? How could the circular economy be most profitably supported by a public purchaser in different urban areas? The report serves as a guide for municipalities to circular procurement and to act as a driver of circular economy change in their area.
Purkaa vai korjata? Hiilijalanjälki-vaikutukset, elinkaarikustannukset ja ohjauskeinot (To demolish or to	Ministry of the Environment	2021	Book	The reform of the legislation on building and construction also prepares for a transition towards low-carbon building. In the future carbon reduction must be taken into account in the whole life cycle of a building, i.e. in new building and renovation and in demolition. This report summarises the carbon footprint and life cycle impacts of the renovation and development of buildings compared to demolition followed by new building.
Purkutyöt - opas tekijöille ja teettäjille (Demolition work – a guide for operators and contractors)	Ministry of the Environment	2019	Guidebook	The utilisation of demolition materials is one of the key objectives in the circular economy of construction. Through the EU Waste Directive, Finland has committed to utilising at least 70 per cent of the construction and demolition waste generated in the country as material by next year (2020). The guide has been drafted as an instructive tool for the high-quality implementation of demolition projects. The aim is to improve and develop the planning, contracting and commissioning practices related to demolition projects, as well as the carrying out of the demolition work itself.

Purkukartoitus – opas laatijalle (Pre-demolition Audit – A Guide for Authors)	Ministry of the Environment	2019	Guidebook	The utilisation of demolition materials is at the core of the circular economy of construction. Audits are a new, voluntary measure for mapping out the materials and hazardous substances in buildings to be demolished. The purpose of the surveys is to create good conditions for the appropriate use of demolition materials while preventing environmental and health risks and ensuring a high-quality demolition process in all demolition projects.
Kierto-talous julkisissa pur-	Ministry of the Environment	2019	Guidebook	
Carbon Footprint Limits for Common Building Types	Ministry of the Environment	2021	Report	This report was commissioned by the Ministry of the Environment from Bionova Ltd (better known under brand One Click LCA) to support the development of carbon footprint limit values for buildings – referred to in this report as building carbon footprints. This report is written for a subject matter expert audience and does not include introduction or definitions.
Method for the whole life carbon assessment of buildings	Ministry of the Environment	2019	Book / Publication	This publication describes the first version of a method employed in Finland for the whole life carbon assessment of buildings. The method is based on the European Commission's Level(s) method and European Standards. A low-carbon building has a low carbon footprint and a big carbon handprint. A carbon footprint analysis covers a building's entire life cycle. It includes the manufacture and transportation of the products used in a construction project, the worksite, the use and maintenance of the building, its demolition, and recycling.

Kiinteistön hiilineutraali energiankäyttö (Carbon neutral energy use in buildings)	Green Building Council Finland	2021	Guide	What carbon-neutral energy use really means, how it is calculated and what are the key principles in moving towards a carbon-neutral real estate business. The Carbon Neutral Energy Use in Buildings is a guide for evaluating your own operations and making a carbon neutrality claim. The main goal of the publication is to provide guidance to those seeking carbon-neutral energy use on what aspects to consider and how to communicate carbon neutrality openly and transparently.
Kestävän purkamisen green deal -sopimus	Ministry of the Environment & Rakli ry	2020	Commitment	The Green Deel Agreement is a voluntary agreement to promote material efficiency in demolition. The main goal is to increase the reuse and recycling of demolition materials by encouraging property owners/developers to carry out demolition surveys at least for demolition and large-scale renovation projects of entire buildings.
Vapaaehtoiset kompensaatiot kiinteistö- ja rakennusalalla	Green Building Council Finland	2022	Guidebook	The purpose of this guide is to gather up-to-date information on the voluntary emissions compensation market and its development in Finland and around the world and to provide concrete tools and tips for obtaining high-quality and responsibly produced voluntary emission offsets. In addition, the aim is to share experiences and good practices from those players in the real estate and construction industry who have already offset their emissions as part of their carbon neutrality work.

Työkaluja KIRA-alan hiilineutraaliuteen ja kiertotalouteen (Tools for carbon neutrality and the circular economy in the real estate and construction indus-	Green Building Council Finland	2021	Guidebook	Contractors, investors and end-users require a built environment that is sustainable, and this is also driven by ever-tightening legislation. One of the most significant factors is the gradually expanding and tightening steering effect of EU taxonomy. The purpose of the legislation is to harmonize the criteria for green funding and thus guide low-cost green funding to projects that contribute to at least one of the six identified sustainability objectives - without compromising others.
Infrarakentamisen päästölaskentatyökalut ja referenssikohteet Suomessa (Emission calculation tools and refer-	Green Building Council Finland	2021	Book / Review	An overview of the ready-made carbon footprint calculation tools currently available in Finland to support infrastructure construction, as well as pilot sites and projects where assessment tools have been used in recent years. Infrastructure construction has a huge potential for reducing greenhouse gas emissions. In the future, all projects must pay attention to emissions throughout the project life cycle.
Kiertotalouskriteerit infrahankkeelle (Circular economy criteria for the infrastructure projrct)	Tampereen kaupunki – KIEPPI -hanke	2021	Project report / Criteria	The circular economy criteria for the infrastructure project were developed in the KIEPPI project and piloted in the construction contract on Yliopistonkatu in the city of Tampere. For the first time in Finland, the KIEPPI project developed procurement criteria and procedures for infrastructure in accordance with the circular economy. The circular economy criteria were functional and the most ambitious and economically advantageous service provider in terms of circular economy was selected to implement the procurement.

Kestävä infra -määritelmä (Definition for the sustainable infra)	Green Building Council Finland	2021	Report / Definition	The definition of sustainable infrastructure promotes thinking where sustainability is understood as the sustainability of the entire infrastructure life cycle and value chain. Sustainability is holistic - considering the ecological, social and economic aspects. The definition provides support for managing the sustainability of the infrastructure sector. It serves as a tool to take sustainable development into account at all stages of the infrastructure's life cycle in the best possible way
MADASTER-materiaalipassin testaus rakennuksissa (Testing of the MADASTER material passport in buildings)	Ministry of the Environment	2020	Project report	The Ministry of the Environment's project tested the so-called Madaster material passport already on the market, developed in the Netherlands by the construction industry. The testing in Finland was related to the ongoing comprehensive reform of the Land Use and Construction Act (MRL), the Ministry of the Environment's Built Environment Information System RYHTI project and the plastic road map.
Kunnan ilmastosuunnitelman toteuttamisvaihtoehdot ilmastolaissa (Alternative ways to implement ...	Ministry of the Environment	2022	Report / Review	This report discusses alternative ways to include the obligation for municipalities to draw up climate change plans in the Climate Change Act. The report evaluates the current state of climate change plans in Finland and examines the requirements concerning municipal climate change plans in the legislation of certain other countries.

Asuntotuotannon laatumuutokset 2005–2020 Korkeampaa, tiiviimpää, energiatehokkaampaa (Quality	Ministry of the Environment	2021	Report / Review	Technical changes in residential buildings and apartments have increased the building costs, but savings achieved with space design solutions have compensated for this. However, in big cities, the selling prices and rents of new apartments have increased due to factors associated with the location and the supply and demand situation.
Kiertotalous vähähiilisyyden edistäjänä ja luonnon monimuotoisuuden turvaajana (A circular econ-	Ministry of the Environment	2021	Report	The purpose of the study was to collect information on how a circular economy can reduce greenhouse gas emissions and protect biodiversity. The study explores the impacts of different circular economy measures in the building, metal and forest industries, food and transport systems, plastic, electronics and textile sectors.
Pehmeä kaupunki — Hyvän kaupunkielämän perusteet (Soft City : Wellbe-	Rakennustieto	2022 (forthcoming)	Book	The soft city offers ideas, guidance and inspiration to anyone interested in urban planning. The book is illustrated with design ideas that could make the city more efficient, more comfortable and more strongly connected to its environment.
Kiertotalous rakennetussa ympäristössä (Circular Economy in Built Envi-	Rakennustieto	2021	Book	Everyone is now talking about the circular economy, but what does it mean in practice in the construction industry? The circular economy in the built environment brings together current research and experience data on the circular economy of construction between one deck.

Ekologisesti kestävä pientalo (Ecologically sustainable detached house)	Rakennustieto	2022 (forthcoming)	Book	The book opens up the relationship between the environmental crisis, rising energy prices and housing. It shows how climate-wise, low-carbon living is possible in both new and older houses. There are many routes to ecologically sustainable living, from which the reader can find his or her own with the help of the book's rich examples without compromising on living standards and comfort.
Katsaus kiinteistö- ja rakennusalan ilmastokestävyyden nykytilaan (Current	Green Building Council Finland	2021	Book / Review	Energi # BuildingLife is a joint project of ten European Green Building Councils to reduce material-related emissions, a key climate goal for the EU, Member States and businesses. The project will publish two studies, the first of which will be published
Building 2030 mittarit (Building 2030 metrics)	Building 2030	2021	Slide set	Building 2030 has defined a vision with five themes: reliability, user orientation, sustainability, productivity, and inspiration. Each theme has goals but initially did not have numerical metrics, except for sustainability. In 2030, CO_2 emissions should be down 50% from the level in 2018.
Building 2030 -teemoihin liittyviä tutki-	Building 2030	2020-	Several reports	
Ympäristöministeriö / Vähähiilin	Ministry of the Environment		Webpage with several reports	
Rakentaminen ja maankäyttö (Builfing	Ministry of the Environment		Webpages with several themes and links	

Rakentaminen / Jousenmerkki &	Ympäristömerkintä Suomi		Webpages with several themes and links	
Rakennusteollisuus / Energia ja	Rakennusteollisuus RT ry		Webpages with several themes and links	
Rakennetun omaisuuden tila	Ministry of the Environment	2021	Report	Status of built assets ROTI is an impartial expert assessment of the status of built assets.
Rakennusmateriaalien kasvihuonekaasupäästöjen ohjaukseen käytettävät järjestelmät ja sääntely (Sys-	Bionova Oy	2015	Report /Review	The study assesses the effectiveness, usability and acceptability of the selected control instruments that are already in use and considered appropriate. Other potential control measures include the mandatory maximum level of life cycle emissions in Finland, taxation of product emissions, extended producer responsibility and control linked to financing.
Carbon handprint guide V. 2.0 Applicable for environmental handprint	VTT Technical Research Centre of Finland	2021	Guide	VTT Technical Research Centre of Finland Ltd and LUT University have developed an approach for quantifying the environmental handprint based on standardized methods. Therefore, determining a quantification procedure for a carbon handprint was a logical start to aim for a systematic and grounded approach.
Päästöttömien työmaiden seurantajärjestelmä: Green deal -sopimuksen päästöseurannan toteutus	VTT Technical Research Centre of Finland	2021	Report	The green deal agreement between cities and the state on emission-free construction sites requires the establishment of environmental criteria for construction machinery and transport used on construction sites. The agreement sets progressively tightening requirements for emissions from work machines and trucks, as well as for the propulsion of propulsion and energy on site.

The environmental handprint approach	VTT Technical Research Centre of	2021	Report	The framework for the environmental handprint and case studies of the development work are presented in this final report.
Review of the European Legislative and Policy Framework Affecting the Recycling of Hazardous Plastics from ELV, WEEE and C&DW	VTT Technical Research Centre of Finland	2021	Report	In the NONTOX project, the focus is on the recycling of plastics contained in three specific waste streams, namely ELV, WEEE and C&DW, and especially on the recycling of plastic waste with heritage hazardous compounds, such as brominated flame retardants. For the recovery of such materials, the treatment processes need to be adapted to safely remove the compounds of concern in order to produce recovered material that is safe to use in new products
Vihreä julkinen rakentaminen	Ministry of the Environment	2017	Guidebook	This guide presents recommendations to implement in green public building procurement. An adequate amount of time and expertise must be reserved for the preparation of green public procurement. The procurement units must be supported by a strategic mandate to ensure that their entire organisation approves of the consideration of environmental perspectives and the required resources.
Vähähiilisen rakentamisen hankintakriteerit	Ministry of the Environment	2017	Guidebook	This guide presents recommendations for Green Public Procurement (GPP) criteria to be applied on a voluntary basis in order to reduce the carbon footprint of building projects implemented by means of public funds under the Act on Public Procurement and Concession Contracts. Particular focus is placed on lifecycle thinking, which should be applied starting from the planning stage of buildings with calculations of the building lifecycle carbon footprint.

Summary of sectoral low-carbon road maps	Ministry of Economic Affairs and Employmen	2021	Summary / Report	Both the Government Programmes of Prime Minister Antti Rinne and Prime Minister Sanna Marin stated that sector-specific low-carbon roadmaps would be developed in cooperation with operators in each sector. The roadmaps' purpose was to provide a more accurate picture of the scale, costs and conditions of the measures needed to move to a carbon neutral Finland.
Valtioneuvoston selonteko kestävän kehityksen globaalista toimintaohjelmasta	Finnish Government	2020	Policy paper	This report describes the current state of Finland's implementation of the 2030 Agenda, the actions taken by the Government to promote the SDGs, the policy principles guiding their implementation at the national level and the organisation, monitoring and evaluation of the implementation.
Vastustuskykyinen kaupunki. Kaupunkisuunnittelu pandemioiden ennaltaehkäisyn välineenä (RECIPE) Tilannekuvaraportti 2021	Academy of Finland	2021	Strategic Research Report	The control of infectious diseases is not taken into account in current urban planning, although global urbanization continues and many past and present pandemics have originated and spread to cities. Resistant city. Urban planning for pandemics as a tool for prevention (Resistant Cities. Urban Planning as Means of The Pandemic Prevention RECIPE project explores urban environments role and potential of urban planning in infectious diseases prevention and thus the fight against pandemics.
Kestävän rakentamisen prosessit	VTT Technical Research Centre of Finland	2011	Research report	The research project Sustainable Building Processes aimed at adopting new processes for ecoefficient building and sustainable built environment. The objectives were to 1) understand barriers and impacts, 2) develop new working processes, 3) develop new business models and 4) develop effective steering mechanisms for sustainable building (SB).

Puukerrostalojen rakentamisen esteet ja mahdollisuudet: Keskeisten suomalaisten ra-	Technical university of Tampere	2013	Doctoral Thesis	Enabling wooden multi-story construction requires challenges related to the construction method to be discussed openly, with a simultaneous attempt to demonstrate the strengths that generate markets for rental apartments, and later for resident-owned apartments and apartments bought as investments.
Kehikosta vesikattoon -vanhan hirsitalon siirto	Rakennustieto	2020	Book	The book goes through the stages of the transfer of a log house: the purchase of a house and site, dismantling of the trunk, transportation and intermediate storage, applying for a building permit, as well as erection of the frame. The process and stages of work are described until the old log frame has been reassembled and a water roof has been obtained on top of it.
Kohti vähähiilistä rakentamista - opas arviointiin ja suunnitteluun	Rakennustieto	2020	Book	Towards low carbon construction is a planners handbook that contains basic information about the low carbon nature of the building, its evaluation and consideration at various stages of planning. In addition, the book provides advanced information on life cycle assessment, eco-labels, service life planning, circular economy, and energy and material efficiency.
Vihreä mökki — Kestävää lomaasumista	Rakennustieto	2021	Book	The book tells us how we can make cottages while saving the environment. The vacation home is built, renovated, energy is needed and you also have to travel there. All of this is releasing carbon dioxide into the atmosphere.

Infrarakentajan ympäristöopas	Rakennustieto	2015	Book	The book details key issues regarding infra-sector legislation as well as corporate environmental responsibility. In addition, the prevention and compensation of environmental damage, the company's environmental plan and risk management, and sanctions for environmental violations are also undertaken. Finally, the environmental authorities and their tasks are presented.
Rakennusten elinkaari, energia ja kunto	Rakennustieto	2019	Book	The book describes the lifecycle responsibility of a building, improving energy efficiency and maintenance, and provides example calculations how to influence the life cycle, energy and maintenance costs of a building.
Korjausrakentamisen kustannuksia 2022 (Costs for building components in renovation projects 2022)	Rakennustieto	2022	Guidebook	The manual, which contains basic information on renovation costs, complements the annual Building Parts Costs book. In addition to basic information, the book includes information on scaffolding, moulds, and protective equipment, various models for improving energy efficiency, energy repair calculations, and winter construction information.
Energiatehokkuuden oheishyöd	Motiva	2019	Summary/report	Motiva investigated the ancillary benefits of energy efficiency measures for municipalities implementing them.
Energiatehokas ilmanvaihto te-	Motiva	2018	Guidebook	Practical guidelines explain how to implement industrial ventilation in an energy-efficient manner
Aurinkosähkön turvallisuusopas	Motiva	2020	Guidebook	The Photovoltaic Safety Guide provides information and tips on how to improve the fire safety of a photovoltaic system during the design and operation stages.

Informaatio-ohjauksen vaikutukset kotitalouksien sähkönkulutukseen – Oppeja satunnaiskokeiluista	Motiva	2020	Report	Incentive energy saving advice and household consumption information help to reduce electricity consumption, especially during the winter months when electricity consumption is at its highest. The issue was investigated in an information guidance pilot project, the results of which have been compiled in this report published in 2020.
Kestävä veden käyttö – vedenkäyttöselvitys	Motiva & TTS Työtehoseura	2020	Case study	This study has been carried out as part of the Sustainable Water Use project coordinated by Motiva. The study examined household water use in three ways — measurement data, water use survey, and household water use monitoring.
Säätöjen ja käyttötapojen vaikutus energiankulutukseen - Asuinkerrostalot	Motiva	2017	Summary/Guidebook	What effect do the right regulations and usage changes have on energy consumption? In real estate, savings in energy costs can be obtained through both energy savings and reduced unit costs of energy. Users' housing and water use habits, building envelope, air exchange, and heating system timeliness, for example, have a decisive impact on energy use. The material is aimed at both property administrators and residents.
ESCO-hankintaohje – ESCO-hankintaohje julkisiin hankintoihin	Motiva	2012	Report	This report discusses the specifics of ESCO procurement in large public procurement for multiple construction sites. The customer may choose to combine other needs in addition to improving energy efficiency, including renewal and repair of energy engineering systems. In particular, the report deals with the tendering of large ESCO acquisitions and the steps involved.

Taloudellisten kannusteiden käyttö	Ministry of the Environment	2020	Project report	This study assesses the impact of four economic instruments in promoting low-carbon construction.
Rakennusmateriaalien ympäristövaikutukset: Selvitys rakennusmateriaalien vaikutuksesta rakentamisen kasvihuon-	Ministry of the Environment	2013	Summary report	By order of the Ministry of the Environment, VTT and Syke investigated the significance of the environmental impact of building materials in terms of construction guidance. The significance was assessed by calculating the proportion of materials to greenhouse gas emissions during the life cycle of an apartment building (50 and 100 years) and estimating the emission range limits. The report summarizes the survey.
Tyhjät tilat	Ministry of the Environment	2014	Report / Guidebook	The Ministry of the Environment's Empty Spaces Project examined the problems of vacant spaces and buildings and new operating models to make available spaces better available. This publication is directed as an inspiration, a source of information and a practical guide for anyone interested in continuing to use and reuse buildings — both practitioners and public authorities.
Nordic guide to sustainable materials	Ramboll/ Green Building Council Finland	2016	Guidebook	WP4:Guide to Sustainable materials [this report discusses sustainable materials on a building, material and product level. This report also gives an overview of the whole project and includes summaries from the other work packages.
Circular economy in the built environ-	Green Building Council Finland &	2018	Objectives paper	Seven objectives

Muovit rakentamisessa (Plastics in construction)	Pro Rakentamisen muovit yhteenliittymä	Webpage with several links	Plastic is a highly versatile and durable material in countless construction applications: it can be used to implement low-carbon, resource-efficient and long-lasting solutions in all types of construction - both new and refurbished. Furthermore, the various plastics' unique material properties enable flexible implementations, are easy to maintain and are well-preserved.
LCA, LCC, EPD, Circularity, and Green Building Certifi-	One Click LCA Ltd.	Webpage with several e-books, guides and articles with links	
Säädökset, oppaat ja neuvontapalve-	Sulvi	Webpage with several regulations, guides and services	
Elinkaariarviointi, jalanjäljet ja panos-	Ministry of the Environment	Webpage with several documents and tools	
Rakennuksen sisäilmasto (In-	Ministry of the Environment	Webpage with several links	

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8. Appendix 2: Survey

The connection between the Agenda 2030 and the built environment. Questionnaire

1. 1. Did you know about the SDGs of the 2030 Agenda? If so, please rate your level of interest in it

   Marca solo un óvalo.

   - ◯ I hadn´t information about SDG
   - ◯ I had information but I am not interested in SDG
   - ◯ I had information and I am a little interested in SDG
   - ◯ I had information and I am quite interested in this topic

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2. 2. From the full list of SDGs, please check those that have a direct and notable connection to the construction sector and the built environment, those whose connection is indirect or weak and those totally disconnected.

Marca solo un óvalo por fila.

	Direct Connection	Indirect or weak connection	Totally disconnected
1.No poverty	◯	◯	◯
2. Zero hunger	◯	◯	◯
3. Good health and well-being	◯	◯	◯
4. Quality education	◯	◯	◯
5. Gender equality	◯	◯	◯
6. Clean water and sanitation	◯	◯	◯
7. Affordable and clean energy	◯	◯	◯
8. Decent work and economic growth	◯	◯	◯
9. Industry, innovation and infraestructure	◯	◯	◯
10. Reduced inequalities	◯	◯	◯
11. Sustainable cities and communities	◯	◯	◯
12. Responsible consumption and production	◯	◯	◯
13. Climate action	◯	◯	◯
14. Life below water	◯	◯	◯

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15. Life on land			
16. Peace, justice and strong institutions			
17. Partnership for the goals			

3. 3. For each of the following SDGs, indicate what BARRIERS you believe exist and hinder their adoption by the construction industry

Selecciona todos los que correspondan.

	Economic barriers/of investment	Political or regulatory barriers	Limited skills or capacities	Citizen awarness	Cultural barriers	Others
11.Sustainable Cities and Communities	☐	☐	☐	☐	☐	☐
13.Climate Action	☐	☐	☐	☐	☐	☐
12.Responsible consumption and production	☐	☐	☐	☐	☐	☐
9.Industry, Innovation and Infrastructure	☐	☐	☐	☐	☐	☐
8.Decent work and economic growth	☐	☐	☐	☐	☐	☐
5.Gender equality	☐	☐	☐	☐	☐	☐
7.Clean and affordable energy	☐	☐	☐	☐	☐	☐
6.Clean water and sanitation	☐	☐	☐	☐	☐	☐
3.Good health and well-being	☐	☐	☐	☐	☐	☐

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4. 4. If you marked "other/s" in the question above, could you please indicate it/them

5. 5. What is your main relationship with the construction sector?

Marca solo un óvalo.

- ◯ I am a employee/entrepreneur of a building business or association of companies.
- ◯ I am a teacher/researcher
- ◯ I am a public officer or public authorithy
- ◯ I am a citizen interested in this subject or member of a civil organization (association of profesionals, consumers, neighbours)

BLOCK II: Companies

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6. 6. Which of the following activities best reflects your company's business? (Please select a maximum of 2)

Selecciona todos los que correspondan.

- [ ] Real state business
- [ ] Contractor Company
- [ ] Architecture, Landscaping and/or Urban planing
- [ ] Engineering (Industrial, Civil, Mining, etc) or quantity surveyors
- [ ] Environmental consultancy
- [ ] Manufacturing and or sell of construction products and materials
- [ ] Extraction and commercialization of construction minerals
- [ ] Services for the construction industry (Geotechnics, Topography, etc.)
- [ ] Quality Control and/or Certifification
- [ ] Demolition works
- [ ] Management and treatment of Construction and Demolition waste
- [ ] Product or interior design
- [ ] Installer (Electricity, plumbing, air conditioning, fire protection, home automation, etc.)
- [ ] Otro: _____

7. 7. Please check the option(s) that express what the SDGs mean for your company or industry:

Selecciona todos los que correspondan.

- [ ] An opportunity to be more efficient or productive.
- [ ] An opportunity to improve the quality of our products or processes.
- [ ] An opportunity to reduce our environmental impact.
- [ ] A trend that is embodied in legal or regulatory obligations.
- [ ] An opportunity to better connect with our customers.
- [ ] An opportunity to differentiate from our competitors.
- [ ] An imposition that reduces our competitiveness.
- [ ] A trend that increases our costs or reduces our productivity.
- [ ] An opportunity to reduce inequalities.
- [ ] A trend that creates inequality between companies based on their size, location, etc.
- [ ] A political or social trend that is difficult to implement in practice in companies.
- [ ] An initiative with little capacity for real positive impact.
- [ ] Otro: _____

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8. 8. What are your company's sustainability objectives? Do you think that the company's employees are generally aware of these objectives?

9. 9. Since 2016, when the targets were published, please assess the evolution of the importance that your customers give to the topics of SDGs, as a purchasing criteria.

Marca solo un óvalo por fila.

	It is a very important purchasing criterion compared to situation before	It is becoming more important	It has the same weight as purchasing criteria as before 2016	It has never been an important purchasing criterion..	Not relevant to my business
For private customer	◯	◯	◯	◯	◯
For corporate customer (companies)	◯	◯	◯	◯	◯
For public or institutional customer	◯	◯	◯	◯	◯

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SUSTAINABUILD

10. 10. Regarding environmental sustainability, you can mark the issues that are of interest to your company

Selecciona todos los que correspondan.

- [ ] Climate change
- [ ] Renewable energy
- [ ] Energy efficiency
- [ ] Water efficiency
- [ ] Biodiversity
- [ ] Air pollution
- [ ] Efficient use of materials
- [ ] Life Cycle Assessment or other certification of sustainability
- [ ] Not relevant
- [ ] Otro: _____

11. 11. To what extent has your organization made progess in the last 5 years in the development of initiatives or projects whose main purpose is to enhance the achievement of SDG through of the results or processes?

Marca solo un óvalo.

- ◯ Very little progress
- ◯ Little progress
- ◯ Fair progress
- ◯ Very much progress
- ◯ Not applicable

12. 12. Could you describe any particularly relevant project carried out in your company in the last 5 years that is related to one or more of the 17 SDGs?

_____

_____

_____

_____

_____

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13. 13. Regarding the social dimension of the SDGs, do you think that in the last 5 years, the construction and architecture industry has increased its concern to put the user at the center, or to make buildings more livable? Please rate from 0 to 5

Marca solo un óvalo por fila.

	0	1	2	3	4	5
In residential housing	◯	◯	◯	◯	◯	◯
In transport infrastructure	◯	◯	◯	◯	◯	◯
In urban planning	◯	◯	◯	◯	◯	◯
In corporate buildings	◯	◯	◯	◯	◯	◯
In public service buildings (libraries, schools, sports facilities...)	◯	◯	◯	◯	◯	◯
Renovation	◯	◯	◯	◯	◯	◯

14. 14. What is the size of your company?

Marca solo un óvalo.

- ◯ <5 employees
- ◯ 6-10 employees
- ◯ 11-20 employees
- ◯ 20-50 employees
- ◯ 50-250 employees
- ◯ >250 employees
- ◯ Opción 7

BLOCK III: Academia

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SUSTAINABUILD

15. 6. What type of educational institution do you belong to?

Marca solo un óvalo.

- ◯ University
- ◯ Vocational Education and Training
- ◯ Secondary or High School
- ◯ Primary School
- ◯ University of Applied Sciences

16. 7. What is the name of the courses that you teach and/or the Department to whom you belong?

_____

17. 8 a. To the best of your knowledge, have the SGDs been incorporated into the training curriculum of any subject taught at your university or educational institution?

Marca solo un óvalo.

- ◯ Yes
- ◯ No
- ◯ Not applicable

18. 8b.If you answered yes to the above topic, could you please indicate the name or topic of the subject(s) where the SDGs have been included?

_____

19. 8c. If you anwsered no, what do you think is the reason?

_____

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20. 9.Do you know of any formal or informal initiative of your university or educational institution that includes making the SDGs known to the student body (teaching days or fairs, lectures, talks, etc.)?

Marca solo un óvalo.

- ◯ Yes
- ◯ No
- ◯ Not applicable

21. 10.Do you already apply the use of SDG's or sustainabilty in your courses? If so, which SDG or sustainability topic do you refer to

_____

22. 10b. If you answered yes to the previous question, could you explain what this initiative consists of?

_____

_____

_____

_____

_____

23. 11. Is it planned to do in the future any action related to SDG?

Marca solo un óvalo.

- ◯ Yes
- ◯ No
- ◯ Not applicable

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SUSTAINABUILD

24. 12. Please rate the training given to students in the AEC (Architecture, Engineering and Construction) sector in aspects related to sustainability.

Marca solo un óvalo por fila.

	Very poor	Poor	Fair	Good	Very good	Not relevant for my organization
Climate action	◯	◯	◯	◯	◯	◯
Cooperation for development	◯	◯	◯	◯	◯	◯
Fighting against inequality	◯	◯	◯	◯	◯	◯
Foster circular economy	◯	◯	◯	◯	◯	◯
Protection/ Improvement of the environment	◯	◯	◯	◯	◯	◯
People : working conditions, equal opportunities, capacity building, collaboration, etc.	◯	◯	◯	◯	◯	◯
Innovation and infrastructure	◯	◯	◯	◯	◯	◯

BLOCK IV: Public administration

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SUSTAINABUILD

25. 6. Please indicate the scope of action of the public administration to which you belong.

Marca solo un óvalo.

- ◯ Local/Municipality
- ◯ Province
- ◯ Region
- ◯ National
- ◯ European

26. 7. Please rate the effort made in past 5 years by your administration to promote the achievement of the SDGs, within its competencies and scope of action.

Marca solo un óvalo.

- ◯ Very low
- ◯ Low
- ◯ Medium
- ◯ High
- ◯ Very high
- ◯ Not applicable

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SUSTAINABUILD

27. 8. Please rate the usefulness of each of the following public instruments in the achievement of the SDGs and sustainabuility in the built environment:

Marca solo un óvalo por fila.

	Very low	Low	Medium	High	Very High	I don´t know/ Not applicable
Development of new regulations and standards						
Use of the SDGs as a public procurement criterion to evaluate products or bidders.						
Granting of subsidies to promote initiatives in support of the SDGs.						
Control of compliance with current regulations.						
Specific training for civil servants						
Collaboration between public administrations						
Public-private cooperation						
Actions to raise awareness and involve citizenship						

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SUSTAINABUILD

28. 9. Has your administration organized any action to promote the SDGs, aimed at the public or at the administration's own employees in the last 5 years?

Marca solo un óvalo.

- ◯ Yes
- ◯ No
- ◯ Not applicable

29. 10. If you have answered yes to the previous question, could you briefly describe it/them?

BLOCK 5: Citizenship / Civil associations

30. 6.What is your age?

31. 7. What is your gender?

Marca solo un óvalo.

- ◯ Femenine
- ◯ Masculine
- ◯ I prefer not to say
- ◯ Other

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SUSTAINABUILD

32. 8. Have you participated in any initiative aimed at helping to achieve or disseminate the SDGs?

Marca solo un óvalo.

- ◯ Yes
- ◯ No

33. 9. Could tou rate from 1 to 5 (being 1 the minimum importance and 5 the maximum) the importance that you think each player has in the achievement of SDG

Marca solo un óvalo por fila.

	1	2	3	4	5
Government	◯	◯	◯	◯	◯
Citizenship	◯	◯	◯	◯	◯
Companies	◯	◯	◯	◯	◯
Educational organizations	◯	◯	◯	◯	◯
Research institutions	◯	◯	◯	◯	◯

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SUSTAINABUILD

34. 10. Do you believe that progress in achieving the SDGs within the urban development and construction sector would lead to?

Marca solo un óvalo por fila.

	Yes	No	I don´t know
Turning cities into places with a higher quality of life	◯	◯	◯
Access to more affordable housing	◯	◯	◯
Access to higher quality housing	◯	◯	◯
Contribute to stable and quality employment in the sector.	◯	◯	◯
Improving the reputation of the construction sector	◯	◯	◯
Increase in the cost of housing	◯	◯	◯
Worse public infrastructure	◯	◯	◯
Improved public infrastructure	◯	◯	◯
More taxes	◯	◯	◯
Lower taxes	◯	◯	◯
Improved conservation and protection of nature	◯	◯	◯
Other	◯	◯	◯
Proximity to education	◯	◯	◯

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SUSTAINABUILD

35. 11. As a citizen, what increase in the cost of housing would you admit if it guaranteed a real and effective effort to achieve the SDGs by the sector?

Marca solo un óvalo.

- ◯ Up to 5%
- ◯ Up to 10%
- ◯ Upto 20%
- ◯ More than 20%
- ◯ Nothing, because the SDGs should be pursued as long as they do not entail higher costs.
- ◯ Other
- ◯ Otro: _____

36. 12. When buying or renting real estate, have you considered any of the following criteria?

Selecciona todos los que correspondan.

- ☐ Energy efficiency/renewable energy
- ☐ Proximity and access to green areas
- ☐ The use of more efficient or circular materials in the construction
- ☐ Equality policies in the selling, leasing or construction company
- ☐ Healthiness and comfort through materials, installations, activities in the surroundings (noise, pollution...), etc.
- ☐ Access to an efficient public transportation network in the vicinity
- ☐ Proximity to education
- ☐ Public access to the facilities in the building with shared facilities
- ☐ Otro: _____

9. Appendix 3: Focus group

9.1 Denmark

9.1.1 Results transcriptions

Del 1 – Kernekompetencer - Opsamling

Gruppe 1

1c1 Jeg har haft lidt svært ved at sætte dem lige på verdensmål fordi det er blevet sådan mere end en generel snak om at det er selvfølgelig kræver noget oplysthed. Sådan generelt set og også sådan helt menneskeligt med at vi skal forstå at det her det hænger sammen og det er det her samfundssind og samfundets ansvar vi har.

1c2 Det er ikke bare et en politisk beslutning og løftet pegefinger og det er jo en proces der nok også tager nogle generationer.

1c3 Så har vi vidensopbygning omkring materiale kendskab og verdensmål og bæredygtighed og den tredelte bundlinje. Vi skal selvfølgelig kende til den og respektere den og det er ikke kun i byggebranchen, det er også bankrådgivere der skal give lån til om man skal bygge om eller man skal bygge nyt og det er politisk set og det er rigtig mange steder henne. Så vi kan ikke bare se på bæredygtighed bare i bæredygtigt byggeri altså vi er nødt til at få mange andre brancher med.

1c4 Vi snakker om byggeskikke, altså så måske lige få skruet vores byggetekniske viden 50-100 år tilbage og så se hvordan gjorde vi egentlig tidligere både i forhold til at kunne skille ting ad og kunne bruge det igen. Og den her låne mentalitet at vi låner materialerne for en tid og så bliver de flyttet et andet sted hen og bliver til noget andet. Og den her renovering og transformations tankegang og respekt for det der er enten i dens nuværende form eller den kan laves om til noget andet og få lov at få et videre liv.

1c5 Og vi snakker også meget om, det fint nok at sige nu skal vi have så skal vi bare bygge med træ fordi det har et lavt CO2 ”impact” men der er jo ikke træ nok lige nu og vi kan ikke lige få det fra Rusland og vi kan ikke lige købe det de steder vi måske plejer i forhold til den sociale bæredygtighed og hvad er det for nogle forhold det er er blevet ”sourced” under. Så vi skal tænke det ind i det. Det betyder ikke at vi ikke skal gøre det, men det betyder heller ikke at vi blindt bare skal bygge i træ. Vi skal bruge træ til det, det er godt til og vi skal bruge beton til det, det er godt til.

1c6 Men det kræver måske at vi kommer væk fra den her industrialiserede bygge- og opførelses proces hvor at vi siger, okay nu kører vi bare samme løsning hele vejen op og hele vejen hen fordi det er billigere. Det bliver nødt til at være lidt mere nuanceret. For eksempel etagebyggerier; de øverste etager behøver ikke den samme styrke som de nederste, og vi kan nuancere det i forhold til hvad der måske findes af eksistere materialer der kan bruges i noget af byggeriet man ikke i den anden ende af det. Så det stiller nogle helt andre krav til de udførende altså, håndværkerne som faktisk skal til at være håndværkere igen i stedet for at bare kunne montere og tage en ny bygningsdel, og så smide det der ikke lige passede væk. Det kræver også at man ikke bruger så meget, altså der ikke skal være så meget spild i de ressourcer vi så låner og bruger.

1c7 Men vi har rigtig mange (Post-its) som ikke helt kunne sættes på plads (ét verdensmål) fordi det var sådan mere den holistiske tankegang og det passer mange steder hen. Og åbenheden omkring og se de her krav som et kærkomment benspænd, i stedet for at se det som ærgerligt at nu må vi ikke bygge så meget efter 2023 som bruger en hel masse energi. Vi skal tænke nyt.

1c8 Også der hvor du sagde at håndværkerne skulle til at tænke på en anden måde, det kunne faktisk også godt løfte ryet omkring håndværkerne. Så ikke for at sige at de ikke gør det godt, men det kunne faktisk være at håndværker blev et mere respekteret fag/erhvervet end hvad det er i dag.

1c9 Når man gerne vil genbruge materialer, så er der hele det dilemma man står i nu, om man i virkeligheden kan få lov fordi det ikke har en mærkning eller vi ikke kan regne på det på samme måde som vi kan med nye materialer. Altså hvordan får vi løftet den hvis vi vil over at bruge endnu flere genbrugsmaterialer. Så der er en barriere lige nu. Den skal man ligesom ud over og finde løsningen på det.

Gruppe 2

1c10 Vi har sagt nogle af de samme ting. Jeg vil prøve at tage tre ting op fra vores snak. Den første omhandler også det holistiske. At have en forståelse for hvordan de enkelte verdensmål har en påvirkning på hinanden. Man kan sjældent arbejde med den ene uden at påvirke nogle af de andre. Når vi snakker byggeri, så er det vigtigt at have en holistisk viden omkring bæredygtigt byggeri, altså alle de elementer eller kriterier eller emner eller ordninger omkring bæredygtigt byggeri. Der er mange facetter, som er indbyrdes afhængige. Viden omkring det er enormt vigtigt når man arbejder med det her.

1c11 Den næste pind er det med at kunne omsætte den her viden. Det er ikke nok at vi bare har viden, men vi skal også kunne omsætte det til færdighed og kompetencer eller konkrete løsninger. Det er uanset hvor man er i værdikæden så skal man kunne omsætte det til noget konkret. Der kommer vi selvfølgelig også ind og diskutere nogle af de udfordringer og barrierer der er. Bl.a. økonomi. Kan det betale sig at gå ned til Titan og finde nogle vinduer eller er det bare nemmere og mere bekvemmeligt, lige at købe det nede i byggemarkedet. Der er nogle markedskræfter og nogle mekanismer men også at man rent faktisk ved hvordan man skal arbejde med det rent konkret. Så er der også samarbejde og partnerskaber. Det har vi længe snakke om, men måske er det blevet endnu mere vigtigt og indgå nogle samarbejder. Man skal ikke bare klare det her alene, man er nødt til at gå sammen og løse det her. Der har vi selvfølgelig fået allerede nogle pilotprojekter hvor man arbejder rigtig godt sammen det skal vi også til at gøre måske i større skala.

1c12 Så har vi værdikæden, hvor vi skal tænke på alle, også håndværkere. Konstruktøren, ingeniøren og arkitekterne er måske ved at være godt med, men der mangler vi også nogle af dem der faktisk møder hr og fru Danmark hver dag. Langt de fleste går til en håndværker før de går til en rådgiver, hvis de nogensinde møder en rådgiver. Så vi skal have klædt tømrermesteren på, til når han går ud og møder kunden. Vi skal have afmystificeret det her med at finde nogle brugt gipsplader. Det er langt hen ad vejen bygherren der bestemmer hvad der skal bygges, og de vil hellere have det spritnye også fordi det er billigere og mere bekvemt. Der har vi nogle udfordringer.

1c13 Vi snakkede om at man ikke kan alene. Man er nødt til at samarbejde, for man kan ikke have al viden om bæredygtighed. Vi kan både bruge generalister, men vi kan også bruge specialisternes kompetencer. Vi talte også om forskellen på de kompetencer det kræver for at bygge nyt kontra det at renovere/transformere. Det er nogle forskellige kompetencer det kræver at bygge med genbrugt materiale eller standard løsninger. Det kunne være en ide hvis håndværkerne der gik nede på teknisk skole, skulle ud til Titan og bruge de byggematerialer til deres næste skoleprojekt, så de vænner sig til at være håndværkere i stedet for bare at være en montør.

1c14 Det er jo meget skægt vi hos Titan, får nogle gange en henvendelse fra en typisk arkitekt, som siger hun skal bruge 4 betonelementer og de skal være 4,5 cm tyk, 360 høje og 120 bredde – hvad koster de? Jeg siger det må være den modsatte vej, de må se hvad

der findes der ude på lageret og spørge sig selv hvad kan vi få ud af det. Det er også det man skal udfordre håndværkeren på, på teknisk skole. Hvad kan man få ud af det her.

1c15 Men man skal bare vente 6 måneder ved kommunen plus at man skal have en rådgiver der skal sidde og tegne. Jeg kan jo ikke få fat i de der betonelementer jeg skal i hvert fald være sikker på at bygherre gerne vil betale for dem på forhånd, så jeg kan købe dem ved Titan før jeg kan tegne det. Det tager simpelthen for lang tid altså. Der går for lang tid fra at vi ved hvad det er vi skal tegne til at det egentlig står ude på byggepladsen. Så kræver det i hvert fald et lager hvor de købte materialer står der og er klar.

Del 2 – Best practice - Opsamling

Gruppe 2

2c1 Vi har haft en meget bred snak og er alle sammen enige om at Best Practice det har vi brug for. Vi har brug for best practice som er transformerbart og som er bygbart og skalerbart for andre også. Så vi ikke kun har de her fyrtårnsprojekter, men man faktisk som andre bygherrer og aktører kan sætte sig ind den practice, hvor man ikke lige har 200 millioner.

2c2 Det skal også være dokumenterbart, og der har vi stort set været forbi alle de benspænd som der er i lokalplaner, brandsikkerhed, forsikringer og finansiering i forhold til dokumenterbarhed.

2c3 Så har man den tekniske/sociale bæredygtighed når vi bygger - hvad gør det ved os, at vi kan se de gamle flotte mursten. Jeg elsker synet af gamle mursten. Det er noget helt andet end en kold, hvid beton facade som selvfølgelig også kan noget men i en anden kontekst. Så bare det vi nogle gange kender historien bag et byggeri - hvor kommer materialet fra?

2c4 Et godt eksempel er Lindholm Brygge. Hvis man ser Lindholm Brygge i dag - sikke en transformation og genial brug af materialer og genbrug af materialer.

2c5 Så det vi egentlig tænker er at vi har virkelig brug for et sted hvor vi har adgang til best practice – vi er der ikke endnu.

Gruppe 1

2c6 Vi talte også meget om hvordan man går fra fyrtårnsprojekter - de er vigtige at have selvfølgelig for at inspirere, men også til at det bliver skalerbart så det bliver den måde vi bare bygger på fremadrettet, og at det er bæredygtigt.

2c7 Himmerland boligforening kigger på hvad kan vi gøre nu og her ud for de rammer vi har, så vi ikke hele tiden lader os begrænse, og siger det kan bare ikke økonomisk lade sig gøre og det er altid dyrere at bo bæredygtigt.

2c8 Vi bliver nødt til at arbejde skridt for skridt hen imod at nå de nye bæredygtige tiltag, og der er også eksempler på det. Vi talte om at bygge skure, altså man ikke tager de bærende bygningskonstruktioner, men for eksempel skure i genbrugstræ. Det er knapt så slemt hvis det er der det går galt. Så kan man lettere at udskifte. Det ved jeg Enemærke og Petersen har gjort. Så der er nogen der prøver det af med forskellige tilgange til at få det til at fungere.

2c9 Det (forsøg) skal vi have meget mere af samt videndeling omkring det.

2c10 Lendager har i Ørestaden, lavet en del projekter som ressourcerækkerne hvor de genbruger mursten. Man kunne ikke skille murstenen ad, så har de skåret dem ud i store elementer og sat dem op som puslespil eller patchwork nærmere. Men det giver jo også en historie det giver også noget andet til den bygning.

2c11 Upcycle studios har rækkehuse der er bygget derovre, hvor de siger det faktisk er dem de har nemmest ved at leje ud og leje i længst tid, og er mest tilfredse. Så der er altså også en business case ud af det her.

2c12 Det er også vigtigt at få frem, at der er en interesse, og vi tror der er noget at bygge på nu i forhold til det fokus der er på at vi skal købe genbrugstøj og så videre. Vi skal selvfølgelig også få det frem i byggebranchen fremadrettet.

2c13 Der var også nogle eksempler, nemlig klimaprojekter på Østerbro, som viser at man skal bygge det ind og tænke det ind fra starten af. Det betyder noget for æstetikken, når man tænker det ind fra starten af.

2c14 Hvordan designer man byrum til kvinder, og hvordan laver man parkeringspladserne med belysning, så de ikke føles utrygge. At tage alle disse snakke, gør jo faktisk at man er nødt til at dykke ned i verdensmålene fra starten af, og snakke om hvad kan vi gøre for at understøtte mål 5 om ligestilling. Der er nogle ting som man måske kommer til at tænke på tidligere i et byggeprojekt hvis man får taget den her snak rundt om bordet.

2c15 Der er også den sociale bæredygtighed - at stille krav til lærlinge og social beskæftigelse. Det kan du faktisk også bygge ind. Vi er jo nødt til at have uddannet nogle til at lave fremtidens byggerier. At stille krav til at der skal være lærlinge på ens byggeprojekter, er i hvert fald en vigtig del, og få det sat i stand både som bygherre og entreprenør.

2c16 Det er et samarbejde på tværs af branchen der skal til for at vi lykkes.

2c17 Der ved vi også at, for eksempel Enemærke og Pedersen, har meget på dagsorden i forbindelse med social beskæftigelse. De arbejder sammen med nogle der hedder Frak i København. Hos dem er der unge, der har brug for et fritidsjob, som kommer fra familier hvor forældrene måske ikke har været i job. Der har de brugt dem ude på byggepladserne, hvor de så har kommet med en ide om at genbruge alt overskudstræ til at bygge gangbroer på byggepladserne.

2c18 At samtænke den grønne og den sociale dagsorden er der også et stort potentiale i. Jeg talte også med Building Green, der var et godt sted at få vidensdelt det der foregår, fordi vi netop har brug for at vidensdele det der foregår, og hvordan vi kan lære af hinanden, så vi ikke bare bliver ved med at gøre det vi plejer.

2c19 Er det er fair at det er det enkelte projekt der skal bære risikoen? Er der ikke en interesse i at den enkelte virksomhed også skal bære en barsel, for eksempel barselsfond. Men man kunne måske også have en byggerifond, eller en testfond, der gør at det ikke er det enkelte projekt der skal bære risikoen i forhold til forsikring, tiden og processen, eller tid til at inddrage til en dialog.

Kernekompetencer - gruppe 1		
Verdenmål		Kompetencer
Mål 4: Sikre alle lige adgang til kvalitetsuddannelse og muligheder for livslang læring.	1	Kompetencer i at skabe et godt indeklima
	2	Oplyst, viden og dannelse
	3	Videnbegæring – have lyst til at gøre noget vi ikke plejer
	4	Konstruktionsforståelse
	5	Klimatilpasning -> hvordan skal vi udforme/tilpasse/konstruere vores byggerier
	6	Kendskab til byggeskik i relation til renoveringsopgaver
	7	Kreativitet – Viljen til at se muligheder og få dem til at lykkes
Mål 12: Sikre bæredygtige forbrugs- og produktionsformer.	8	Materiale egenskaber og CO2 aftryk
	9	Respekt for håndværket
	10	At sætte sig ind i og være interesseret i, hvilke materialer der bidrager med hvad
	11	Anlæg vs. Drift vender
	12	Materialer for transformation
	13	LCA krav fra 2023 -> Første skridt til paradigmeskifte
	14	Data og EPD'er
	15	Viden om bæredygtige byggematerialer
	16	Materiale kendskab (også i forhold til genbrug)
	17	Viden om CO2 reducering i alle faser
Mål 17: Styrke det globale partnerskab for handling og øg midlerne til at nå målene.	18	Tværfaglighed og samarbejde
	19	Partnerskaber
	20	Samarbejde på tværs af værdikæden
Ikke tilhørende et specifikt verdensmål	21	Åbent mindset
	22	Redskaber til at vurdere positivt og negativ impact på verdensmålene
	23	Holistisk tilgang til byggeriet (den tredobbelte bundlinje)
	24	Grundlæggende viden/information
	25	Kærkomment benspænd – manglende materiale leverancer (Gylden mulighed lige nu til grønne investeringer, da der er godt gang i byggeriet.
	26	Holistiske mål – Kræver holistisk tilgang, forståelse og ansvar

Kernekompetencer - gruppe 2		
Verdenmål		Kompetencer
Ikke tilhørende et specifikt verdensmål	27	Kreativitet, nysgerrighed, mod og vedholdenhed
	28	Nybyggeri ift. eksisterende
	29	Praktisk oversættelse af de verdensmål som er relevante for brancen, evt. via certificeringsystemer
	30	Specifikke fagkompetencer som før det muligt at forstå hvorledes enkelte tiltag i et byggeri kan understøtte enkelte eller flere verdensmål
	31	Baggrund/Grundlæggende forståelse for bæredygtighed og verdensmål
	32	Indsigt i Cirkulær økonomi og FNs verdensmål
	33	Holistisk forståelse for alle verdensmålene sådledes man kan forstå sammenhæng, muligheder og begrænsninger
	34	Bygherre skal stille de rigtige krav rigtigt.
	35	Evnen til at omsætte viden om bæredygtigtigt byggeri til færdigheder og kompetencer
	36	Samarbejde/Partnerskab
	37	Bred tværfaglig viden (holistisk)
	38	Viden om; FNs verdensmål, DGNB, Svanemærket m.fl.
	39	Viden om de mange elementer af bæredygtigt byggeri, og deres indbyrdes afhængighed
	40	Kendskab til bæredygtige materialer
	41	Dokumentation – væres bæredygtighed skal dokumenteres med stolthed
	42	Mestre dialogen modsat diskussionen
	43	Vilje/motivation til at samarbejde
	44	Evnen/forståelse/insigt i at omsætte det til praksis (implementering/skalering)
	45	Konkrete cases/eksempler som en del ad opbygningen af kompetencer
	46	Kende CO2 belastningen for materialer/ydelser osv.
	47	Politisk og strategisk bygherre
	48	Indsigt i værdien af; Netværk, videndeling, partnerskaber. Det kan ikke løses af en aktør/virksomhed

Best Practice - gruppe 1		
Verdenmål		Best practice
Ikke tilhørende et specifikt verdensmål	49	Introforløb om bæredygtighed på erhvervsskoler
	50	Lærlinge og socialbeskæftigelse (Råt og Godt (VM4+8)
	51	Affaldsortering
	52	Certificeringer (Svanemærket og DGNB)
	53	Præfabrikeret (eks scandibyg)
	54	Titan orangeri
	55	Nysgerrighed (Brug dem vi stoler/tror på)
	56	Kritisk blik (brug ikke alt hvad du finder,men overvej om det virker logisk) - (Kernekompetencer)
	57	Kontrakter hvor håndværksmesteren forpligtes via social klausul
	58	Bred involvering i almene bolig områder
	59	Undervisning på byggepladsen af folkeskolelever
	60	Konkret mål for energi forbrug (2030) for hele boligmassen
	61	Klimaalliance med Aalborg kommune og Forsyning
	62	Klimaindsats LCA ->CO2 bench mark (VM13)
	63	Klimasikring -> Smukke og funktionelle pladser/gader/parker (VM13)
	64	Partnerskaber med forsyning om lavtemperaturløsninger (fjernvarme)
	65	Eventuelt slægge på nogle indeklimakrav. Vi bruger "Sort" energi til at producere materialer, for at spare på "grøn" energi (VM7+11)
	66	Lendagers nytænkning ift. brug af materialer
	67	Tillid - tro på at der er nogen der holder håndenunder dig når du tager chancer (Kernekompetencer)
	68	Frontrunner - som el-bilen er der nogen der skal turde at gå forrest, for så tør andre at gå med
	69	Skure i genbrugstræ
	70	Circle House fra lejerbo
	71	Regnvandsopsamling Karakter ariktektur (Integrer opsamlinger i skure mm.
	72	Green Hub House - Samarbejde med We Build Denmark om manifest for byggeri af fremtidens etageboliger.
	73	UN17 Village
	74	At gøre noget er bedre end slet ikke at prøve (Angst for Green Washing) (Kernekompetencer)
	75	Lenager-group projekter i ørestaden (Genbrug af materialer)
	76	Gode boligforhold for mennesker med de laveste indkomster (renovering af almene boliger)
	77	CCO Arkitekter - Gentænkning af design. F.eks.tryghed.
	78	Klima projekter på bla Østerbro
	79	Bæredygtighedscertificeringer, DGNB, BREEAM, LEED, svanemærke

Best Practice - gruppe 2		
Verdenmål		Best practice
Ikke tilhørende et specifikt verdensmål	80	Ressource kortlægning ved nedbrydning
	81	Bygherre leverancer på genbrugsmaterialer (Risiko/Ansvar)
	82	Bæredygtig logistik og transport
	83	Fyrtårns projekter skal kunne skaleres
	84	Best practices skal videndeles
	85	Der er behov for best practice
	86	"Billigt" byggeri skal også være bæredygtig. (Sundhed, materialer, økonomi)
	87	Upcykling Orangeri (Titan)
	88	Eksempler på genanvendelse af "udtjente bygninger" -> Adskillelse og genopførsel
	89	PFA kollegiet (DGNB krav til sortering af affald betød genbrug af flere gamle materialer i landskabsprojektet)
	90	Eksempler fra offtentligt byggeri og privat byggeri. Både stort som småt.
	91	Genbrug af byggematerialer plus dokumentation af holdbarhed
	92	Titan genbrug
	93	Materiale portal
	94	NBE (Netværk for Bæredygtig Erhvervsudvikling i NordDanmark)s forretningsmodel
	95	We Build Denmark spireprojekt/brand (Test+Viden)
	96	Best practice er: Transformation, Bygbart, Skalerbart og dokumentationsbart (VM3+11+12)
	97	AAU eksperiment med genbrugsmaterialer, detaljering, æstetik mm.

9.1.2 References

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9.2 Spain

Table 19: Reponses to question 1

Adapted and sorted		Condensed (first step)	
	Fijar los objetivos empresariales sin basarse únicamente en el beneficio económico y más en el social Formación económica más responsable socialmente		Capacidad de valorar las implicaciones sociales de la actividad empresarial en el sector
	Compatibilizar trabajo y resto de vida fijando metas a largo plazo		Capacidad para conciliar
	Profesionales que apuesten por la calidad siendo recompensado de algún modo esa iniciativa		Orientación a la calidad
	Profesionales formados en su capacitación Profesional donde esté incluido la formación y concienciación medioambiental		Conocimientos y concienciación sobre sostenibilidad medioambiental
	Trabajo en equipo		Capacidad de trabajo en equipo sin prejuicios de género

	Profesionales que trabajen bajo un plan de igualdad		Cumplimiento de los planes de igualdad
	Mayor conocimiento del ciclo del agua. Formación práctica con talleres para conocer de primera mano el estado de nuestros recursos hídricos Reutilización de aguas grises Eficiencia hídrica Reutilización de agua Sensibilidad social		Conocimientos para hacer un uso más eficiente y sostenible del agua (reducción del consumo, reutilización…)
	Eficiencia energética en procesos de construcción. Eficiencia energética en edificación. Imaginación para desarrollar nuevos procesos constructivos Rehabilitación energética. Instalaciones más eficientes. Tecnificación del desarrollo		Conocimientos para mejorar la eficiencia energética en los edificios en todo su ciclo de vida.
	Energías renovables. Integración de energías renovables. Priorizar el autoconsumo.		Conocimientos sobre energías renovables (incluido autoconsumo)

	Concienciación del uso de soluciones innovadoras		Orientación a la innovación
	Re-sensibilización social al clima		Sensibilidad hacia el cambio climático
	Fomento de nuevas formas de pensamiento. Herramientas que favorezcan la innovación: Fomentar el design thinking Capacidad de resolución de problemas. Lean startup Competencia en nuevos procesos de gestión y ejecución Se necesitan profesionales más conectados con la industria, la empresa y la universidad. Experiencia del usuario. Es muy importante analizar la forma de cómo llegar al usuario final para que sea el que demande estos cambios y nuevas soluciones.		Capacidad para encontrar soluciones innovadoras (en todo el ciclo de vida de los edificios) utilizando nuevas herramientas, teniendo en cuenta las necesidades de la industria, la empresa, la universidad y el usuario.
	Resiliencia y capacidad de adaptación a la transformación que experimentará el sector.		Capacidad de adaptación al cambio

	Fomentar la empatía, la sensibilización y la concienciación. Trabajo en equipo Multidisciplinar Pensamiento crítico y conexión entre las distintas áreas Liderazgo Coordinación de equipos Escucha activa Visión global		Capacidad de liderazgo y trabajo en equipos multidisciplinares.
	Accesibilidad		Concienciación y conocimientos sobre accesibilidad
	Nuevos materiales. Nuevos procesos constructivos. Construcción industrializada. Evaluación de la huella de carbono durante la toda la vida útil de la construcción. Desde la extracción de materias primas, fabricación de productos, etc. hasta la fase de demolición y reciclado. Infraestructuras. Respeto al entorno natural		Capacidad para aplicar soluciones innovadoras y evaluar su impacto ambiental

	Formación en nuevas habilidades digitales Modelo BIM Digitalización Transformación digital del sector. Nuevas tecnologías aplicadas al sector. Herramientas digitales.		Capacidad para aplicar las nuevas tecnologías digitales
	Equipos interdisciplinares coordinados por expertos en ordenación del territorio, urbanismo y arquitectura. Conocimiento de planificación y gestión de sistemas de transporte y su incidencia en el medio ambiente Peatonalización. Cultura de grupo, de país y de mundo. Construir con consciencia. Pensar de forma global. Renaturalización de la ciudad. Fomento de sombras. Sistemas pasivos Sistemas urbanos de drenaje sostenible. Sensibilidad de las demandas Fomentar cursos básicos de medio ambiente.		Capacidad para aplicar soluciones a escala urbana y regional (transporte, zonas verdes…)

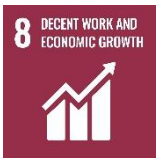
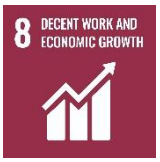
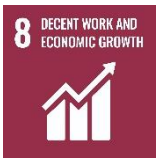
	Rehabilitación Ecodiseño Elaboración de catálogos Cálculo de la huella de carbono.		
	Conciencia de buena calidad constructiva significa mayor ahorro de recursos Aumento de la durabilidad de estructuras. Fomentar el mantenimiento: Reutilización y reparación.		Capacidad para aplicar soluciones garantizando su durabilidad, posibilidad de reutilización y facilidad de reparación
	Economía circular Demoliciones selectivas de edificios. Gestión sostenible de RCD Aprovechamiento de residuos. Reutilizar materias primas.		Capacidad para aplicar la circularidad
	Materiales de baja huella de carbono. Materiales de construcción sostenibles. Declaraciones ambientales de productos. Análisis de ciclo de vida		Capacidad para evaluar y utilizar productos de bajo impacto ambiental

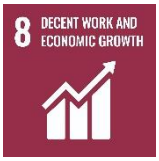
	Soluciones basadas en la naturaleza (SBN).		Capacidad para aplicar soluciones basadas en la naturaleza
	Diseño: Orientación climática.		Concienciación por el cambio climático
POSTED AS DISCONECTED TO ANY SDG			
	Motivación para afrontar nuevos retos		Capacidad para adaptarse al cambio
	Capacidad de gestión de equipos.		Capacidad para trabajar en equipo
	Tener la capacidad de reunir e interpretar datos relevantes en esta área de estudio, para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social o científica sobre la sostenibilidad. Haber desarrollado aquellas habilidades de aprendizaje necesarias en cualquiera de los títulos de ingeniería, máster u otros relacionados con el medio ambiente y la sostenibilidad.		Concienciación sobre la sostenibilidad

	Saber aplicar los conocimientos a su trabajo o vocación de una forma profesional por medio de la elaboración y defensa de argumentos y resolución de problemas		
	Poder transmitir información, ideas, problemas y solución de problemas relacionados con la sostenibilidad a un público tanto especializado como no.		Capacidad de trabajo en equipo

Table 20: Reponses to question 2

Adapted and sorted		Condensed (first step)	
	Líneas de trabajo o proyecto social para gente vulnerable		Proyectos enfocados a mejorar las condiciones de colectivos vulnerables
	Proyectos educativos concretos de la mano de instituciones Educación en concienciación ambiental Educación en sostenibilidad		Colaboración con instituciones de enseñanza para aumentar la educación sobre sostenibilidad
	Difusión de buenos ejemplos		Difusión de ejemplos de buenas prácticas en relación con la igual de género

	Adaptabilidad al entorno		Proyectos que adaptan su diseño a las condiciones hídricas del entorno
	Economía colaborativa, transporte, compartir medios de producción Proyectos relevantes que premien esa iniciativa o algún tipo de bonificación		Compartir medios de transporte y producción para ahorrar energía
	Potenciar y premiar la responsabilidad social corporativa Buena Gobernanza corporativa		Potenciar la responsabilidad social corporativa
	Conciliación familiar Flexibilidad de horario Teletrabajo		Mejores condiciones laborales: conciliación familiar, flexibilidad de horarios, teletrabajo…
	Promoción del I+D+i		Promoción del I+D+i
	Construcción industrializada Uso de procesos industriales y materiales prefabricados		Favorecer la construcción industrializada

	Flexibilización de los espacios de trabajo		Favorecer la flexibilidad de los espacios de trabajo
	Aumento del porcentaje de reciclaje Uso de materiales que respeten la biodiversidad Elaboración de guías, arboles, medio urbano Financiación verde de entidades que se sumen a las cuestiones de sostenibilidad. Uso de materiales que permitan aumentar la vida útil Materiales km0 Reducción de logística		Implantar soluciones que favorezcan la economía circular, la reducción de emisiones contaminantes, la preservación de la biodiversidad y la sostenibilidad en general
	Digitalización Monitorización y medición		Utilización de nuevas herramientas digitales
	Uso de materiales de baja huella de carbono Materiales eficientes Uso de materiales absorbentes de contaminantes $C0_2$ NO_x		Utilización de materiales de bajo impacto ambiental y reductores la contaminación ambiental
	Fomento de la rehabilitación		Rehabilitar el espacio ya construido

	Nuevas soluciones de transporte Sistemas de reutilización de aguas grises Proyectos de ciudades resilientes Proyectos de edificios autoabastecidos e inteligentes		Aplicación de soluciones resilientes y economía circular a escala urbana
	La administración como motor y guía del cambio: Difusión Intercambio Conocimiento Enlace de consulta Acciones		Colaboración con la administración pública para realizar proyectos a escala urbana
	Optimizar el consumo de recursos (canteras, transporte, medios materiales) Minimizar el consumo de corto plazo Mejores materiales para mayor durabilidad Planes de reutilización de RCD´s Uso de materiales reciclados. Mejora normativa para permitir el uso de materiales reciclados en todos los ámbitos de la construcción		Uso eficiente de recursos y aplicación de soluciones durables y circulares

	Descarbonización de la movilidad		Descarbonización de la movilidad
	Autoconsumo		Generación de energía para autoconsumo
	SUDs Asfaltos drenantes.		Sistemas resilientes a eventos climáticos adversos
	Participación en acciones formativas divulgativas.		Colaboración con instituciones educativas Realización de actos de divulgación
	Fomentar la reducción de combustible Coche eléctrico en las flotas de empresa Reuniones telemáticas en lugar de presenciales. Renovación de maquinaria obsoleta.		Descarbonización del transporte y la maquinaria
	SUDs Potencial de mejora con cubiertas vegetales. Fomento de subvenciones a municipios. Espacio público urbano.		Aplicación de soluciones para la resiliencia de ciudades (sistemas de drenaje, cubiertas verdes…)

	Procesos constructivos de menos emisiones (mezclas semicalientes, betunes sintéticos) Utilización de madera Cálculo de la huella de carbono Reusabilidad de infraes-tructuras. Experiencias piloto Experiencia piloto estudio Auditoria de demolición previa.		Aplicación y evaluación de soluciones de bajo impacto ambiental y circulares
	Reducción de los plásti-cos en envases de cons-trucción, promover el uso de materiales a granel		Reducción en el uso de en-vases