SUSTAINABLE DEVELOPMENT GOALS IN CONSTRUCTION ENGINEERING EDUCATION: COMPARISON OF CURRENT CURRICULA IN DENMARK, FINLAND, AND BELGIUM

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The construction industry plays an essential role in achieving the Sustainable Development Goals (SDGs) targeted in the 2030 Agenda. However, limited research exists on how sustainability is implemented in higher education in construction programs. This study aims to map and compare the SDGs and their targets in the curricula of three construction engineering programs at bachelor level in Denmark, Belgium, and Finland. This was done by sorting the learning objectives of the curricula according to their contribution to the SDGs and targets. The learning objectives in the three curricula were then discussed concerning their contribution to the SDGs. The results show that the SDGs were addressed in all three curricula. Furthermore, all three sustainability dimensions were identified in the curricula. The results provide insights into the sustainable knowledge, skills, and competencies that higher education students are expected to obtain to tackle the sustainability challenges of the Northern European construction industry.

Keywords: education; sustainability dimension; Northern Europe; SDG; development

INTRODUCTION

The construction industry accounts for around 40% of the world's energy usage and 33% of the world's CO2 emissions (Gade and Opoku 2020). This underpins the urgency of addressing the environmental challenges while not comprising the social and economic dimensions of sustainable development (SD). In 2015, the 17 Sustainable Development Goals (SDGs) were agreed upon by 193 member countries of The United Nations as an ambitious, universal framework for SD towards 2030 (United Nations 2015). The SDGs consist of 169 targets and 231 indicators, equally encompassing environmental, economic, and social dimensions of sustainability

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(United Nations 2015). For the construction industry, the 2030 Agenda provides a common ground for SD and a global and stable definition of sustainability (Goubran and Cucuzzella 2019).

The educational institutions are critical stakeholders for SD and can be changemakers when their institutional capacities align with worldwide efforts to achieve the SDGs (Wright *et al.,* 2021). Therefore, it is also necessary for the educational sector to evolve, adapt and reflect present and future needs. With the SDGs, institutions equip future professionals with capabilities to manage and respond to complex challenges in sustainability in their careers (Sandri *et al.,* 2016; Bangay 2016). For construction engineering educational programs, the SDGs equip future graduates with increased knowledge, skills, and awareness to tackle the sustainability challenges met by the construction industry (Opoku and Guthrie 2018).

LITERATURE REVIEW

In recent years the global context of education has focused on policies and practices to incorporate SD. Research has shown an increased interest in assessing higher educational institutions' role in SD (Becker *et al.,* 2017; Chandran 2017). Investigations into universities and their policies reveal the importance of reflections on sustainability being part of all aspects of education (Almeida *et al.,* 2018). However, studies of higher educational programs' content uncover a low presence of sustainability in curricula addressing primarily sub-topic issues (Etse and Ingley 2015). Another investigation of postgraduates' sustainability skills compared workplace expectations to graduates' learning outcomes and curricula development (Sandri *et al.,* 2018).

The study concluded a gap between the learning outcomes regarding SD and the need for sustainable professionals due to a lack of skills in sustainability. El-Adaway *et al.,* (2015) examined engineering education learning by focusing on enhancing engineering undergraduates' skill sets in designing, constructing, and operating infrastructure systems using problem-based learning. The study revealed that students' performance increased despite of more complex SD activities the students solved. As shown above, only limited research concerning the implementation of SD in higher education exists, even though researchers have pointed out that institutions and programs play an essential role in SD. (Wright *et al.,* 2021). Scholars also argue that curricula and their links to SDGs and SD need to be studied as it gives students a new vision to adopt responsibility for creating a sustainable future (Braun Wanke 2017; Wamsler 2020; Etse and Ingley 2015).

This study aims to compare how the SDGs are considered in the curricula of three construction engineering programs at bachelor level higher education (EQF level 6) in Denmark, Belgium, and Finland. The results provide valuable insights into which sustainable skills, knowledge and competences are understood to be central in construction engineering programs from a Northern European perspective and serve as a first step to research this topic further, e.g., on a broader geographical scale. Furthermore, the results provide educational institutions and educators with a baseline for SDG implementation in the construction industry.

METHOD

This study focuses on mapping the SDGs and targets in three construction engineering programs across Northern Europe at a bachelor level (EQF level 6). The research question is how the curricula in the three higher education institutes differ from each

other the SDGs addressed. The selected programs were Architectural Technology and Construction Management at University College of Northern Denmark (UCN 2021), Construction and Municipal Engineering at Satakunta University of Applied Sciences in Finland (SAMK 2022), and Bachelor of Construction at PXL University of Applied Sciences and Arts in Belgium (PXL 2022). These programs were selected to provide a Northern European perspective on how construction programs currently include the SDGs and targets in their curricula. All three institutions emphasize a practical perspective with solid links to the respective countries' national and regional construction branches.

Researchers from the respective institutions mapped the links between learning goals and SDGs. They all had a thorough knowledge of the study programs, curricula, learning objectives, and actual teaching activities, including the SDGs and related targets. The curricula were written in local languages and had different structures; thus, local researchers did the initial mapping of which learning goals contributed to which SDGs and targets. If clarifications were needed, feedback was requested from the relevant teachers. This was especially important as the links to the SDGs and targets were not explicit but had to be interpreted by the researchers. After this, the curricula were translated and aligned with the mapping results from the other two institutions.

The primary limitation of the study is that only curricula from three educational institutes were analysed. Therefore, the results are not providing the complete picture across Northern Europe. However, the study forms a foundation for further studies, where more programs from other countries could be studied to get a more accurate picture of the current state of SDGs in the European construction programs.

FINDINGS

This section presents the results of the mapping of the Danish, Finnish, and Belgian construction engineering curricula. Results focus on the dimensions of social, environmental, and economic sustainability, and implicit incorporation of the SDGs and targets into the topics and learning goals of courses in the curricula.

The authors define the division into the social, environmental, and economic sustainability dimensions inspired by a model created by Albareda-Tiana (2018). In relation to the SDGs, the social dimension focuses on two overall topics: human wellbeing (SDGs 1, 2, 3, 4, 5, 8, 16, and 17), and infrastructure that supports human health and the ability to live a dignified life (SDGs 6 and 7) (Agenda 2030; Hildebrandt 2016). The first social topic is essential for economic SDGs too, while the second social topic is essential for the environmental dimension (Agenda 2030; Hildebrandt 2016).

The economic dimension (SDGs 8, 9, and 17) focuses on minimizing tensions between material welfare and environmental values (Hildebrandt 2016). It includes economic growth, resilient infrastructure, decent work for all, promoting inclusive, sustainable industrialisation, and fostering innovation (United Nations 2015; Hildebrandt 2016). SDG 17 differs from the others by only being a central instrument for the other SDGs, and its main purpose is to encourage collaboration between countries. The environmental dimension is defined by SDGs 7, 9, 11, 12, 13, 14, and 15, focusing on stopping the ecosystem's overload and creating sustainable societies (Agenda 2030; Hildebrandt 2016).

The rate of inclusion of SDGs and their targets into curricula was determined by addressing each topic and calculating the percentage of the respective SDG(s) covered. For example, if 3 out of 12 targets related to one SDG are included, the SDG is 25% covered. Table 1 shows which SDGs have been identified in the three curricula for each sustainable dimension, based on the division by Albareda-Tiana (2018).

Table 1: SDGs in the Danish, Finnish, and Belgian curricula, along with the related sustainability dimensions

	Social dimension SDGs	Economic dimension SDGs	Environmental dimension SDGs
Danish curriculum	SDGs 4, 7, 8, 16, 17	SDGs 8, 9, 17	SDGs 7, 9, 11, 12, 13
Finnish curriculum	SDGs 4, 6, 7, 8, 17	SDGs 8, 9	SDGs 7, 9, 11, 12, 13
Belgian curriculum	SDGs 3, 4, 6, 7, 8, 17	SDGs 8, 9, 17	SDGs 7, 9, 12, 13

SDGs and Targets in the Danish Curriculum

To realize the social, economic, and environmental sustainability goals, several SDGs from each dimension are incorporated into the Danish curriculum, consisting of a national and institutional curriculum. The overall topics include single-family house construction, constructing buildings up to 2 ½ floors, profession, and prefabrication, multi-story building over three floors, building renovation, elective elements, digital design, internship, and study trips. The overall goal is to broaden students' knowledge, skills, and competences in sustainability to be applied in practice.

The targets 4.4 - 4.7 of SDG 4 are useful in moving education toward sustainability and focusing the students' understanding of sustainable principles, theories, methods, and skills. 25% of SDG 8 is included, incorporating targets 8.3; 8.4; 8.5. SDG 8 is a part of the social and economic sustainability dimensions and used to address humans' wellbeing. Furthermore, SDG 8 is used in the educational elements' theories and practices, focusing on social aspects for the practitioners, such as laws, contract management, equal salaries, and rights, and promoting development-oriented policies.

It supports productive, innovative activities and resource efficiencies (Agenda 2030). The goal also addresses sustainable construction principles, design, production, technical installations, and entrepreneurship. SDG 7, as part of the social and environmental dimension, is the only goal that is 100 % covered in the curriculum. It is used in the learning goals focusing on clean energy in relation to the learning of energy and infrastructure, optimizing concepts in theory, materials, and practices. SDGs 16 and 17, which are 31,6% included in the curriculum, focus on international cooperation across different cultures, using various partnerships to enhance sharing of science, technologies, and innovations (Agenda 2030).

SDG 9 targets 9.3 and 9.4 are part of the environmental and economic dimensions. Together with SDGs 8 and 11, it addresses the curriculum's elements focusing on sustainable upgrading and construction using efficient and clean resources, environmentally sound technologies, and industrial processes - including digital tools to minimize resource waste and experiment with innovative solutions - and economic practices and value chains. It is also used to reflect on knowledge development and energy optimizing renovation concepts and current building renovation practices.

The curriculum incorporates the environmental dimension through SDGs 11, 12, and 13. Besides SDGs 7 and 9, that are also used for the social and economic dimension. SDG 11 and 12 - 63,6% included in the curriculum - address practices and materials

through sustainable urbanisation, focusing on building design planning and management, including digital design. Additionally, focusing on construction principles, solutions, materials, production processes, and recycling of natural resources. SDG 13 target 13.3 is addressed by improving awareness of climate changes for housing construction, maths, and building principles to make them more environmentally friendly.

SDGs and Targets in the Finnish Curriculum

In the curriculum, SDGs from the social, economic, and environmental dimensions are incorporated into the following elements of the program: Basic Studies, Common Studies of Construction and HVAC - Engineering, Common Studies of Construction Engineering, Professional Building Production Studies, Studies of HVAC-Engineering, Studies of Mathematics and Natural Science, Basic Studies of Construction and Municipal Engineering, Practical Training. They shall ensure students achieve sustainability knowledge relevant to professional construction engineers, infrastructures, and industrialisation besides sustainable practices.

For the social dimension, SDGs 4, 6, 7, and 8 are included between 15-30% in the curriculum. SDG 4 targets 4.3, 4.4, and 4.7 are used as a frame for the curriculum for students to achieve sustainable education and education in sustainability. Together with SDG 8 targets 8.3 and 8.8, they are included in curricula elements to learn about safe and secure conduction and environment at a site. Additionally, they are used to understand professional engineers' labour rights, treatment, contracts, and salary. Other elements are used to understand sustainable economic growth, productive activities, and innovation.

The other part of the social dimension focusing on a dignified life is also covered by using SDGs 6 and 7 to address sanitation and clean, modern energy in the curriculum elements for infrastructure. Following topics from the curricula: water systems (designs, materials, and process, fluid technologies), heat systems and production, renovation, air conditioning and ventilation. Thus, supporting the human right to a dignified life (Agenda 2030). This indicates SDGs cover social and economic perspectives.

The economic dimension in the curriculum utilizes SDGs 8 and 9 to focus on construction engineering, entrepreneurship, project and contract management, and practical training. SDG 9 target 9.4 focuses on sustainable infrastructure and the use of clean and environmentally sound technologies in the curriculum's elements: upgrading/renovating infrastructure, building materials to be used, geotechnical engineering, foundation structures, building residential houses and their infrastructure (including fire protection) and heating systems (including production and transfer) and heat pumps (Agenda 2030).

The environmental dimensions, i.e., SDG 7, 9, 11, and 13, are tackled in the curriculum. SDGs 7 and 9 are targeted and cover the social, economic, and environmental dimensions focusing on sustainable infrastructure and industrialisation (Agenda 2030). SDG 11 target 11.3 is included in the curriculum to address climate awareness and limit and reduce its impacts on infrastructure and construction engineering such as materials, technologies, and practices (Agenda 2030). SDG 12 target 12.4 is part of the curriculum focusing on environmentally sound management of waste, including chemicals, throughout their life cycle (Agenda 2030), by addressing the following elements: a sustainable perspective of technical parts, materials, and practices for indoor climate, energy-efficient building materials,

technical maintenance and renovation of buildings, heat and air conditioning, ventilation, contract management and tasks onsite (Agenda 2030). SDG 13 target 13.1 is used to address HVAC engineering and building materials to be more resilient against climate hazards.

SDGs in the Belgian *C*urriculum

The curriculum includes SDGs from all three dimensions to focus on students' competencies. It covers competencies that make the students capable of organizing a building project, understanding the materials, managing, and supervising the building project, and understanding the building project in a bigger context. This ensures that students possess sustainable, technical competencies, including analysis of sustainable and innovative solutions and practices (Agenda 2030).

For the social dimension, the curriculum uses SDG 3, 4, 6, 7, 8, and 17. This curriculum is the only one addressing SDG 3, which is incorporated 15,3%. It includes targets 3.6 and 3.9, focusing on traffic infrastructure and handling and analysing materials; contaminated one and hazardous chemicals and air, water, and soil pollution (Agenda 2030). SDG 4 targets 4.4 and 4.7 ensure that all learners will acquire sustainable knowledge, vocational skills, and technical and analytical competencies.

Students are educated in sustainable development and lifestyle, including cultural diversities, promoting sustainable development (Agenda 2030). SDGs 8's and 17's target 8.8 and 17.17 are included in the curriculum to focus on economic growth, secure working environments, rights, and cooperation, considering multicultural differences in international teams. SDGs 6 and 7 are 40% part of the curriculum focusing on technical aspects of a building project, an analysis of construction and innovative solutions to address improvement of water quality, to reuse water and reduce untreated wastewater next to increasing the share of renewable energy (globally) and improving the efficiency (Agenda 2030).

The curriculum's economic dimension incorporates SDGs 8, 9, and 17. SDG 9 targets 9.4 and 9.5 are used to address sustainable infrastructure upgrading, enhancing scientific research, and upgrading technological capabilities of industrial sectors through the curriculum elements. This is done by analysing building projects and development, focusing on innovative materials, techniques, and practices - and learning innovative solutions (Agenda 2030).

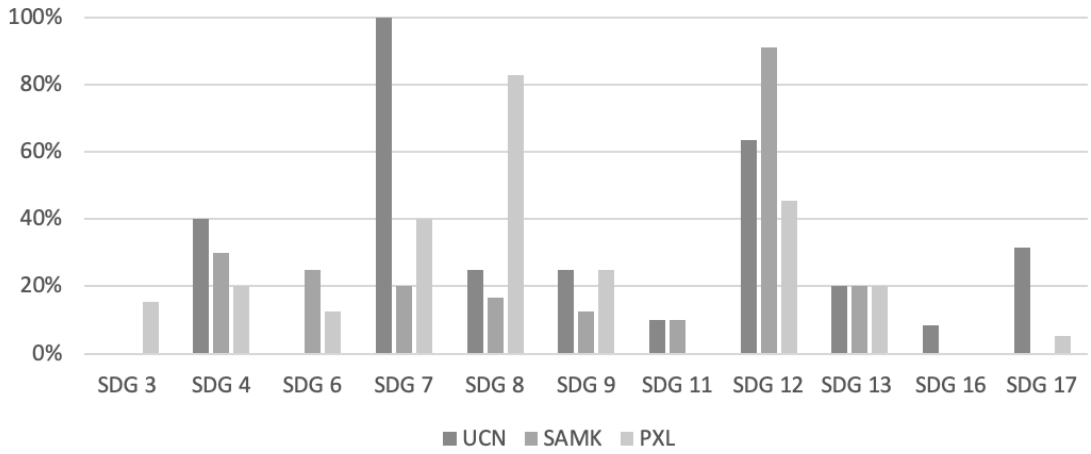
The environmental dimension includes SDGs 7, 9, 12, and 13. SDGs 7 and 9 are both part of the social, economic, and environmental dimensions, focusing on the curriculum covering energy efficiency, sustainable infrastructure, and industrialisation (Agenda 2030). SDGs 7, 9, and 12 are the SDGs incorporated most into the curriculum. SDG 12 uses the targets 12.2, 12.4, 12.5, 12.6, and 12.8 to address material recycling, to analyse innovative materials and development, optimize practical problem(s) and create a responsible professional building engineer. Therefore, they are used for sustainable sound management and efficient use of natural resources and waste products, including polluting chemicals. SDG 13.1, like the Finnish curriculum, focuses on improving climate awareness in the most current sustainable practices and developments.

Education of SD is a concept evolving with emerging sustainability issues, and it is a necessity for construction engineering programs to be considered. Furthermore, SDGs can be used to identify priorities and dimensions relevant to educational programs

(Albareda-Tiana 2018; Goubran 2019). This paper reports, how the three compared engineering programs utilize the SDGs and targets to ensure that students achieve SD knowledge, skills, and competencies. Despite the differences in the design and elements of the curricula, the results show that all three curricula support students in achieving sustainable knowledge, skills, and competencies related to several SDGs. These SDGs focus primarily on sustainable and efficient practices, materials, and design. The topics and approaches of the programs to SD are similar, differing slightly in which SDGs and targets are addressed in the three curricula.

Previous research has highlighted SDGs that directly and indirectly contribute to the built environment (Goubran 2019). Opoku and Guthrie (2018) argue that SDGs 7, 9, 11, 13, and 15 are the most relevant to be applied in the built environment. Other scholars state that the SDGs 6, 7, 12, 13, and 15 are the ones that the construction sector can directly contribute to (Gade *et al.,* 2021; Goubran 2019). The results of this study indicate similarities and differences in all three curricula. Figure 1 shows the level of implementation of each SDG in the three curricula from the point of view of social, environmental, and economic sustainability. The X-axis shows which SDGs are covered in the curricula, while the Y-axis shows the SDGs' level of implementation.

Figure 1: Diagram of the level of SDGs in the three curricula



The Danish curriculum includes five, the Finnish four and the Belgian six of the SDGs related to the social dimension, consisting of ten SDGs. The economic dimension consists of SDGs 8, 9, and 17, and both the Danish and Belgian curriculum address all three of these while the Finnish curriculum includes 8 and 9. For the environmental dimension of sustainability that consists of SDGs 7, 9, 11, 12, 13, 14, and 15, the Danish and Finnish curricula use SDGs 7, 9, 11, 12, and 13, while the Belgian utilizes SDGs 7, 9, 12 and 13.

All the three curricula use SDGs 4, 7, and 8 from the social dimension, differing in how many targets are being used. Only one or two curricula use SDGs 3, 6, 16, and 17. As shown in Figure 1, SDGs 8 and 9 from the economic dimension are used, while SDG 17 is part of both the Danish and Belgian curriculum. For the environmental dimension, SDGs 7, 9, 12, and 13 are part of all three curricula, SDG 7 being included 100% in the Danish curriculum, and the Danish and Finnish include 10% of SDG 11. SDG 14 and 15, on the other hand, are excluded from all three programs. However, only the Danish curriculum uses one SDG 100%, and SDG 15 is not used. Only two programs address SDG 11 (target 11.3). Of the commonly used

SDGs 7, 12, and 13 for building projects (Gade *et al.,* 2021), SDG 12 is used more than 60% in two curricula, and SDG 13 is used 20%. SDGs 6, 7, and 15 are directly dependent on construction activities (Gade *et al.,* 2021). Results reveal that SDG 6 is used in two curricula and incorporate over 20% of it.

CONCLUSIONS

This study compared the state and use of SDGs in the curricula of three construction engineering programs at bachelor level (EQF level 6) in Denmark, Belgium, and Finland. The paper also provides information on which knowledge, skills, and competencies students are expected to achieve across Northern Europe. A comparative analysis was conducted for the three curricula. Although the programs were not directly comparable due to the differences in professions and programs, the results reveal that the SDGs and targets utilized for the professions in the national building sectors are similar for all three curricula, with minor alterations. The results show that all three curricula implicitly and explicitly address sustainable construction, providing graduates with sustainable knowledge, skills, and competencies.

The SDGs 4 (quality education), 7 (affordable and clean energy), 8 (decent work and economic growth), 9 (industry, innovation, and infrastructure), 12 (responsible consumption and production), and 13 (climate action) were implicitly addressed in all three curricula. In addition to this, all three curricula use the social, economic, and environmental dimensions to address sustainability and include similar SDGs and targets. Only SDG 7 (Affordable and clean energy) has all its targets addressed, though only in the Danish curriculum. Previous research has shown that the SDGs 6 (clean water and sanitation), 7 (affordable and clean energy), 9 (industry, innovation, and infrastructure), 11 (sustainable cities and communities), 12 (responsible consumption and production), 13 (climate action), and 15 (life on land) are directly connected to the construction sector.

These SDGs were used in the three curricula, except SDG 15 (Life on Land). The number of included SDGs differs slightly in the three educational programs, indicating different focus and approaches to sustainable construction. Furthermore, some of the SDGs were included in more than one curriculum but used different targets. These minor exceptions highlight differences in sustainable practices, methods, and techniques across the three countries.

The results contribute to understanding the current situation with regard to SD and SDGs in higher education, in construction engineering programs in three European countries as a foundation for assessing graduates' sustainability knowledge, skills, and competencies. The results show despite all three curricula being different they still use similar SDGs for SD.

The paper fills a gap in the current research by mapping the links between the learning goals and the SDGs, in the context of the social, environmental, and economic sustainability dimensions. The authors propose future research to include a broader investigation of the links between construction engineering curricula, SD and the SDGS in Europa and worldwide, along with assessment of the actual learning outcomes of the students.

REFERENCES

Almeida, P, Lopes, A, Oliveira, B (2018) Sustainability in university campuses and environmental education policy: Complementary governances toward consciousness structure in carbon emissions reductions, *In*: W L Filho, F Frankenberger, P Iglecias, R C K Mülfarth (Eds) *Towards Green Campus Operations*, Cham: Springer, 197-204.

Albareda-Tiana, S, Vidal-Raméntol, S, Fernandez-Morilla, M (2018) Implementing the sustainable development goals at university level, *International Journal of Sustainability in Higher Education*, **19**(3).

Bangay, C (2016) Protecting the future: The role of school education in sustainable development - an Indian case study, *International Journal of Development Education and Global Learning*, **8**(1), 5-19.

Becker, D, de Campos, S, da Silva, T (2017) A brazilian university facing challenge of education for sustainable development, *In*: W L Filho, C Skanavis, A do Paço, J Rogers, O Kuznetsova and P Castro (Eds) *Handbook of Theory and Practice of Sustainable Development in Higher Education*, Cham: Springer, 223-244.

Braun-Wanke, K (2017) Learning and teaching for a sustainable future, *In*: *Handbook of Theory and Practice of Sustainable Development in Higher Education*, Cham: Springer, 15-29.

Chandran, N (2017) Sustainability awareness in Singapore's higher education sector, *In:* T Issa, P Isaias, T Issa (Eds) *Sustainability, Green IT and Education Strategies in the Twenty-first Century. Green Energy and Technology,* Springer: Cham*,* 283-305.

El-Adaway, I, Pierrakos, O and Truax, D (2015) Sustainable construction education using problem-based learning and service-learning pedagogies. *Journal of Professional Issues in Engineering Education and Practice*, **141**(1), 05014002.

Etse, D and Ingley, C (2016) Higher education curriculum for sustainability: Course contents analyses of purchasing and supply management programme in Ghana, *International Journal of Sustainability in Higher Education*, **17**(2), 269-280.

Gade, A N, Larsen, T S and Selman, A D (2021) leaving no one behind: A glimpse into the state of adoption of the sustainable development goals in the Danish construction industry. *In:* Scott, L and Neilson, C J (Eds.), *Proceedings 37th Annual ARCOM Conference*, 6-7 September 2021, UK, Association of Researchers in Construction Management, 654-663.

Gade, A N and Opoku, A (2020) challenges for implementing the sustainable development goals in the Danish construction industry: Building owners' perspective. *In:* Scott, L and Neilson, C J (Eds.), *Proceedings 36th Annual ARCOM Conference*, 7-8 September 2020, UK, Association of Researchers in Construction Management, 615-624.

Goubran, S and Cucuzella, C (2019) integrating the sustainable development goals in building projects, *Journal of Sustainable Research*, **1**, 1-43.

Goubran, S (2019) On the role of construction in achieving the SDGs, *Journal of Sustainable Research*, **1**(2).

Hildebrandt, S (2016) Bæredygtig Global Udvikling Jurist og Økonomiforlag.

Harris, Z, Moynahan, H, Vickery H, Henriksen, H, Morello, E and Kasemir, B (2017) *Higher Education Strategic Planning for Sustainable Development: A Global Perspective*, Cham: Springer International Publishing.

Lans, T, Blok, V and Wesselink, R (2014) Learning apart and together: Towards an integrated competence framework for sustainable entrepreneurship in higher education, *Journal of Cleaner Production*, **62**, 37-47.

Opoku, A and Guthrie, P (2018) Education for sustainable development in the built environment, *International Journal of Construction Education and Research*, **14**(1).

PXL (2022) Belgian Curriculum, Available from: https://www.pxl.be/bouw [Accessed 5 April 2022].

Sandri, O, Holdsworth, S and Thomas, I (2016) Assessing graduate sustainability capability post-degree completion: Why is it important and what are the challenges? *International Journal of Sustainability in Higher Education*, **19**(1), 2-14.

SAMK (2022) *Finnish Curriculum – Etenemissuunnitelma*, Available from: https://samk.opinto-opas.fi/curricula/degreeprogrammes/groups/plan?groupId=51779&planId=68908 [Accessed 5 April 2022].

United Nations (2015) *Transforming Our World: The World 2030 Agenda for Sustainable Development*, New York: United Nations.

UCN Professionshøjskolen (2021) Institutionel studieordning for Bygningskonstruktøruddannelsen og byggeteknikuddannelsen.

UCN Professionshøjskolen (2020) National Studieordning 2020 for Bygningskonstruktøruddannelsen.

United Nations (2015) Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development, New York: United Nations.

Wamsler, C (2020) Education for sustainability: Fostering a more conscious society and transformation towards sustainability, *International Journal of Sustainability in Higher Education*, **21**(1), 112-130.

Wright, C, Ritter, L and Conzales, C (2022) Cultivating a collaborative culture for ensuring sustainable development goals in higher education: An integrative case study, *Sustainability*, **14**(3), 1273.