Preparedness for a Low Carbon Future – Knowledge Level of Built Environment Students

Abstract

Purpose: The UK government has committed to achieving Net-Zero emissions by 2050, being the first major nation to do so. While laudable, it raises the question, 'are future built environment professionals (BEPs) equipped for this?' Although, studies related to students' perspectives exist, most broadly focus on sustainability-related pedagogical aspects, with limited studies conducted in the built environment (BE). This study makes the case that it is timely to investigate this from an emerging perspective using the term 'Low Carbon Future' (LCF) given that it is germane to achieving Net-Zero emissions and it is at the forefront of academic and practice discourse.
Design/methodology/approach: A systematic scoping study review of published papers related to sustainability in BE curriculum in the UK HEI context.
Findings: The findings reveal that LCF remains at a nascent stage with no study specifically addressing it. It indicates a knowledge gap that could impact the grounding students require to address current and future sustainability challenges.
Originality/value: Beyond contributing to the discourse on sustainability literacy in UK HEI from an emerging concepts perspective, this study would be useful as possibly the first of its kind. Therefore, it fills the theoretical gap and proffers recommendations that would be beneficial for curriculum development.
Research limitations/implications: The review focused on a specific term, which while relevant is very niche. A review of other emerging terms, considering LCF as a theme, and/or empirical data from diverse stakeholders in UK HEIs could enrich the results.
Practical implications: The study provides significant insight into the status of sustainability inclusion in BE curriculum. It would serve as a reference for stakeholders involved in equipping future BEPs with the requisite knowledge and skills to deal with sustainability challenges that will be consequential beyond the UK context. It would also inform future research.
Social implications: Sustainability informed and equipped BEPs will be influential in shaping their immediate surroundings and how people engage with them, which will contribute to developing a more equitable and sustainable society.

Keywords Low carbon future, Education for Sustainable Development, Built Environment, Students' Perspective, Higher Education, Scoping Review

1. Introduction

Sustainable transitions regardless of the motivation, be it for environmental security, resource efficiency, ensuring a strong, healthy, and just society, technological growth, and/or good governance, among others, has been a driving force in all sectors and walks of life, as is evidenced by the United Nations Sustainability Development Goals (UNSDGs) (United Nations, 2017) and the Intergovernmental Panel on Climate change (IPCC) in its numerous assessment reports (IPCC, 2022). Within the construction sector, given the impact of its activities, a key focus is its decarbonisation (Cooper and Hammond, 2018; Weirs and Osborne, 2020). This has led to several interventions, a prominent one being 'circular economy', underpinned by the principles of designing out waste, recycling and reuse, renewable energy, and materials (Ellen MacArthur Foundation, (EMF), n.d.). Ultimately, conservative, restorative, and regenerate by nature which is somewhat the antithesis of the construction industry and its activities (Cooper and Hammond, 2018).

Not known for its conservative and/or considerate approach, the sector is one of the leading waste generators and polluters, as well as resource consumers in the world (World Green Building Council (WorldGBC), 2019). Such that it propelled the establishment of various institutions, initiatives, and standards to address its increasingly negative impact (Ekundayo *et al.*, 2018). While these have contributed towards reforming processes, practices, and activities of the industry at both national and international levels, it is widely acknowledged that there is still much more to be done (United Nations Environment Programme (UNEP), 2021). Indeed, according to UNEP (2021), if urgent and more measures are not taken, achieving the targets of the Paris Agreement would be impossible.

This is particularly significant given the projected doubling of the global building stock by 2060 (UNEP, 2021) which will result in increased carbon emissions and resource use (WorldGBC, n.d.). In addition, it will exacerbate the already challenging human and environmental situation. Accordingly, there is a persistent drive to decarbonise buildings and the construction industry and integral to this is education (Cortese, 2003; Winter *et al*., 2015; Zulu and Muleya, 2017). The likes of Cortese (2003) and Zulu and Muleya (2017) recognise the function of education in ensuring the requisite knowledge base and expertise of students (learners) to address the sustainability challenges of society and the need for this to be reflected in the educational system. The importance of this is particularly evident in the UK context, given the UK's quest and indeed, commitment to a net-zero economy (UNEP, 2021), that will see a transformation of its energy system and will undoubtedly have an impact on buildings and the construction industry (HM Government, 2021). Therefore, having the requisite grounding (training) by such individuals (learners) who will engage in building and construction related activities is essential and apparent to the UK government, construction sector organisations, and allied professional institutions (Chartered Institute of Building (CIOB), 2013; Dawe *et al.*, 2005; Higham and Thomson, 2015). The UK government in its 2005 report on *Securing the future – delivering UK sustainable development strategy*, identified sustainability skills as a core competence for graduates (HM Government, 2005).

This paper builds on this and is concerned with formal education i.e., tertiary level, given that it is the key stage in a learner's development that produces graduates (future built environment professionals) (Kokkarinen and Cotgrave, 2013; Ola, 2019). Furthermore, the evidence suggests higher education institutions (HEIs) are a platform for diversity and inclusivity in engagement, discourse, and thought, that can lead to the development of better societies (Martin and Jucker, 2005; Opoku and Egbu, 2018). As such, HEIs have a sphere of influence not only on the teaching and learning content created and delivered to learners but equally on the learning environment that helps shape their understanding, perspectives, choices, and behaviours.

The need to focus on ensuring that future BEPs who will be responsible for creating and/or maintaining sustainable buildings and the construction industry are adequately equipped to address sustainability challenges cannot be overstated. This is germane to transitioning to a low carbon future. The concept of low carbon future (LCF) has emerged is public discourse across industry, academia, and policymakers due to the transition efforts to a net-zero economy (Sovacool and Griffiths, 2020). A LCF reflects the transition to a society that is reliant on sustainable (renewable) energy and consumption systems to mitigate the effect of climate change (Moroni *et al.*, 2019; O'Sullivan *et al.*, 2020). According to Szulecki (2018, p.21), transitioning to a LCF brings about "energy democracy", which is key to a just society. Therefore, given its significance, the study aimed to assess the knowledge of UK BE students' in HEI specific to the term LCF.

2. Literature Review

Scholars have long since described education as the bedrock of society (Cortese, 2003; Ola, 2019; Oarenren-Osaghae *et al.*, 2019). The significance of which, Oarenren-Osaghae *et al.* (2019) opine is akin to one's background, in that it informs the way one turns out. As such, it influences one's perceptions, knowledge, and attitude, which translates into actions and/or practices. Similarly, Ola (2019) posits that every society and its culture is influenced by its educational systems and indeed the perceptions held associated with them as a basis for its development. Based on the above, it can be reasonably argued that a society with an educational system that enables its people (learners) to "*acquire knowledge, develop skills, and adopt values*" (Ola, 2019, p.75), is poised to succeed because it offers opportunities for economic development, social equality, cultural diversity, and environmental justice. This was brought into focus by the United Nations National Education, Scientific, and Cultural Organisations (UNESCO) in 2005 through its Decade of Education for Sustainable Development (UNESCO, 2003) and more recently through Goal 4 (Quality Education) of the UNSDGs (UN, 2017) which champions sustainability inclusion in education and the emergence of 'Education for Sustainable Development' (ESD) (Higham and Thomson, 2015; Winter *et al.*, 2015).

ESD is about learning for sustainability (LfS) (Opoku and Egbu, 2018) as a facilitator for sustainable development. This according to the UN (n.d.) focuses on "*shaping values that are supportive of sustainable development, and in consolidating sustainable societies.*". In other words, ESD offers the opportunity for informed understanding to influence the decision-making processes that drive lifestyles and behaviours that will play a key role in driving forward the sustainability agenda. Within the context of HEIs, EDS is seen as transformative, key to encouraging critical thinking and changing mindsets, particularly toward a sustainable future (Kelly, 2021). Despite this, Cortese (2003) and Lozano *et al.* (2013) opine that HEIs have fallen short in this task by not prioritising sustainability, which they argue is evidenced by society's current path. The latter is linked to the low level and/or a lack of awareness and understanding of the issues in the built environment and construction industry (see CIOB, 2013; Opoku and Egbu, 2018). Lozano *et al.* (2013) and Sibilla and Kurul (2021) opine that this is due in part to the traditional approach of HEIs which is not suited to dealing with the interdisciplinary and emergent demands of sustainability. Similarly, Zsóka *et al.* (2013), in their study, on greening due environmental education, identified a strong relationship between the intensity of environmental education and the environmental knowledge of students.

Therefore, the more focused and explicit sustainability education is, the better the understanding of students which will shape attitudes. This is key given the concerns about the lack of engagement in formal education by construction professionals, hindering their access to sustainability-related training and consequently, their sustainability literacy (Higham and Thomson, 2015). For instance, in its 2013 report on *Skills in the UK Construction Industry*, the CIOB (2013) identified environmental and sustainability skills as one of the top five most required by the industry. Similarly, Clarke *et al.* (2017) in their study assessing the expertise required for low-energy construction identified a lack of energy literacy across all professions associated with education and training. The authors opine it had the effect of impacting the delivery of low-energy construction in the UK which is germane to achieving a net-zero future. It is therefore not surprising that the UK government in their 2011 *Skills for a Green Economy* report and as part of their 2016-2020 construction strategy stress the need to upskill and retrain BEPs towards transitioning to a low carbon economy (Oliveira *et al.*, 2018). Additionally, regulatory, and professional institutions across built environment disciplines are reviewing accreditation requirements which will have an impact on the courses delivered and/or offered in HEIs. Furthermore, academic unions have joined the efforts, running awareness and

educational campaigns, including offering learning opportunities and resources to their members regardless of their discipline (University College Union (UCU) n.d.). Similarly, students are also taking a stand on the issue of climate change evidenced by the establishment of Students Organising for Sustainability (SOS) UK in 2019.

Consequently, sustainability literacy is at the forefront of academic and industry discourse across different levels, with the aim of embedding climate and sustainability topics into HE curriculum across built environment disciplines (Ekundayo *et al.,* 2018; Olubunmi *et al*., 2016). This is because education is seen as a platform for creating greater awareness of, interest in, and/or concern among graduates (future BEPs) about the consequences of their decisions and behaviours as it relates to sustainability (Warren *et al*., 2014). This will aid in changing mindsets by providing future BEPs with the breadth, depth, and quality of understanding to make decisions that address the future sustainability challenges facing society. UCU and SOS (2023) reinforce this, speaking to the need to use education as a tool; a catalyst to encourage and produce agents for change. Dent and Dalton (2010) however emphasise ensuring that the multi-faceted aspects of sustainability are captured. It is against this backdrop and in furtherance of Dent and Dalton's (2010) position that we recommend the inclusion of emerging sustainability aspects and that this study was necessitated and conducted to explore the awareness and knowledge of BE students as it relates to the specific term low carbon future (LCF).

While research evaluating students' sustainability perceptions is not new, studies have primarily focused on broader sustainability-related pedagogical aspects such as, curriculum design, teaching and learning or have been environ-centric (Kokkarinen and Cotgrave, 2010; Thomas, 2004). This is not surprising, given the concerns about the impact of anthropogenic activities on the environment, which Thomas (2004) notes have led to the historical one-sided focus and development of environmental programmes as it relates to HEIs to enhance environmental literacy. Consequently, hindering the appreciation of a holistic view. Additionally, limited studies have been conducted in the built environment, that considers multiple disciplines in a single study and have primarily been discipline specific (Opoku and Egbu, 2018). That is focusing on a singular discipline such as, quantity surveying. There lacks a study from a multidisciplinary BE perspective which is key to this study given that the delivery of a building is a multidisciplinary endeavour. The construction industry by nature is project based with contributions from multiple disciplines. There is a need however for a multidisciplinary approach. The subject specific studies reinforce the silo mentality and therefore, hinders the inclusive, diverse, and collaborative approach that is inherent in project delivery (Amaratunga *et al.,* 2002; Fellows and Liu, 2015; Ghaffarianhoseini *et al.,* 2016)

3. Method

Scoping studies have been widely used in varied disciplines to uncover and/or clarify what is known or unknown about a subject and field of research by facilitating the mapping of its key concepts (Arksey and O 'Malley, 2005). Safarpour *et al*. (2020) suggest it is best suited to investigate areas that have not been fully explored and/or are new. Given that this was the case with this study, a scoping study was deemed suitable. Additionally, unlike systematic reviews, scoping reviews aid in providing a status overview of a research area or activity and include diverse research designs (Crampton *et al.,* 2016), which was pertinent to this study. The awareness and knowledge of BE students of LCFs is not dependent on how they gained that awareness and knowledge. On the other hand, like systematic reviews, assessing the quality of the studies included in the review was important to this study to contribute to methodological rigour, which is not the standard approach with scoping studies. The study adopted Arksey and

O'Malley's five-stage framework revised by Unuigbe *et al.* (2018) to include a quality assessment stage, making it a six-stage framework consisting of (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) quality assessment, (5) charting the data, (6) collating, summarising and reporting results.

3.1 Scoping Review Process

The study commenced with a guiding question '*what is known by UK BE students specific to Low Carbon Futures?'* which informed the design of a search strategy based on key terms associated with the guiding question to identify relevant studies *(Stage 2)*. The following keywords and/or terms were considered: '*low-carbon futures', 'low-carbon transition', 'sustainable future', 'net-zero future', 'carbon neutrality', 'sustainability literacy', 'education for sustainable development', 'sustainability education', 'built environment', 'construction industry', 'UK', 'students' 'perception', 'awareness', and 'knowledge'*. The search was enhanced by using different combinations and iterations of the keywords and/or terms with the aid of Boolean operators. However, given resource constraints the search terms had to be finite, similarly, we argue the same approach applies to the different data sources consulted. The review was conducted primarily using the electronic database Scopus supported by the Association of Researchers in Construction Management (ARCOM) abstracts database and Google Scholar. In addition, a review of the reference list from the articles identified was conducted. A search criterion was developed based on factors for inclusion and exclusion *(Stage 3)* to effectively manage the process while still ensuring relevant studies were captured as detailed in Table 1.

(Insert Table 1: Inclusion and Exclusion Criteria)

The initial search using keywords and/or terms generated 5576 papers, underscoring the value of imposing limitation through the inclusion and exclusion criteria to delineate the scope of the literature to be reviewed. This was followed by removing the duplicates with the remaining papers undergoing a two-phase eligibility process informed by the inclusion and exclusion criteria as shown in Table 1. This led to the identification of 327 papers (phase 1) and then 17 papers (phase 2). A careful review of the full text of the 17 papers, identified papers still within the exclusion criteria based on population samples such as 'recent graduates' and 'graduate professional'. These were removed and guided the final selection of six papers and subsequent quality assessment *(Stage 4)* using Hawker *et al.*'s (2002) four-point scoring system ranging from 1 (very poor – no evidence/details/indication of criteria) to 4 (good – clear evidence/details/mention of criteria) across nine criteria as shown in Table 2. This meant each paper could attain scores between 9 (the lowest) and 36 (the highest). Table 2 presents the quality assessment score attained by each paper. Only 6 papers were deemed to be of suitable quality, attaining scores ranging from 26 to 32. This meant that they achieved methodological rigour and were considered moderate to high-quality publications because they attained scores above 18 being the average.

(Insert Table 2: Quality assessment score of papers)

In general, all papers presented clear statements of their aims and equally their findings. Interestingly, little or no mention was made or presented in support of ethical consideration in any of the papers. The 6 papers were included in the review as illustrated in the scoping study process (Figure 1) and subsequently recorded *(Stage 5)* based on similar attributes extracted from each paper for standardisation as illustrated in Table 3.

(Insert Figure 1: Scoping study review process)

3. Findings and Discussion

As indicated in the introduction, the study aimed to assess the knowledge of UK BE students' in HEIs specific to the term 'Low Carbon Future' (LCF) using a scoping review guided by the question, '*What is known by UK BE students specific to Low Carbon Futures?* Following the scoping review process, as outlined in Figure 1, a total of 5576 papers were identified from three databases. Informed by inclusion and exclusion criteria this led to a review of 327 abstracts and 17 full-text papers and the final identification of 6 papers included in the study based on Hawker *et al.*'s (2002) four-point scoring system (quality assessment protocol). Table 3 presents a summary of the analysis of the 6 papers *(Stage 6)*. It charts and summaries the papers against 5 parameters to facilitate a standardised framework for comparison, namely, author details, discipline, evidence of LCF, study focus, methods, key findings, and quality score.

Based on the review of the papers, the principal finding in light of the guiding question, as noted above, is that there is currently no study that specifically addresses LCF within the UK BE HEI context. In other words, it remains at a nescient stage which indicates a knowledge gap that could impact the grounding students require to address current and future sustainability challenges. When reviewing the papers to evaluate BE students' knowledge it was clear that generic aspects of sustainable development (SD) and more specifically its environmental dimension were the focus of all the studies. While SD was not the focus of this study, it was deemed useful to review the identified UK HEI BE empirical studies as they provided some insight into the current status.

Firstly, all six papers adopted quantitative research strategies, employing questionnaires as their primary method of data collection, with two using interviews in addition. This was relevant as it spoke to the level of insight and/or detail obtained from the students, which would influence the type of data collected. The studies revealed a familiarity with the terms: sustainability, sustainable development, and environmental sustainability. However, this was associated with basic or limited sustainability knowledge. Additionally, a key observation from the studies was the single discipline focus with most of the studies conducted from a surveying perspective. Only one study (Kagawa, 2007) explored perceptions from multiple disciplines across the HEI under investigation and while it evidenced a positive attitude toward sustainability, it also revealed a gap in social and economic knowledge. This highlights the challenges facing academics and/or educators in holistically embedding SD in the curriculum.

Noteworthily, studies revealed students' interest to gain holistic sustainability knowledge, rating sustainability education highly (Tan *et al.*, 2017; Opoku and Egbu, 2018). They evidence the support and growing significance attributed to creating sustainability literate graduates, by embedding sustainability aspects in the curriculum. For instance, the study by Opoku and Egbu (2018) identified students' dissatisfaction with the level of sustainability inclusion in their programme, linking sustainability knowledge and skills to job competitiveness. It revealed that students believed that the more sustainability literate they were the better their chances of securing a job which speaks to their cognisance of the need for a certain skill set in the industry, with sustainability being one. It reinforced the study by CIOB (2013) which identified sustainability skills as one of the top five in the industry and the push by other institutions such as RIBA and the UK government to meet the current and future challenges facing the construction industry (Clarke *et al*., 2017; Oliveira *et al.*, 2018; RIBA, n.d.). This is noteworthy given the increased concern by students about climate change, their eagerness to learn about sustainability at university, and their willingness to take employment with a sustainably ethical organisation even at the cost of a salary sacrifice (SOS, 2022).

(Insert Table 3: Summary of empirical studies included in the scoping review)

4. Conclusion and Recommendation

Literature is rife with the significance of academia in producing positive contributing members of society; students, due to their sphere of influence in informing, moulding, and/or grounding their perceptions, knowledge, and actions for a sustainable society. It is against this backdrop that this study arose and sought to explore the issue of the preparedness of future BEPs beyond contributing to and/or meeting the requirements for the UK government's Net-Zero goals. It focused on assessing knowledge of the specific term 'Low Carbon Future' (LCF) given that it is germane to achieving Net-Zero emissions.

The study has shown that LCF remains at a nescient stage in the UK as it relates to the HEI BE curriculum which indicates a knowledge gap that could impact the grounding students require to address current and future sustainability challenges. This is pertinent given the need for a paradigm shift from what it was/is to what it should be, and students as future BEPs would be responsible for driving the sustainability agenda which has economic, environmental, and social implications for society. This means they would be key to transitioning efforts and more importantly to ensure the built environment remains resilient. Consequently, having the requisite knowledge and skill sets is essential.

Therefore, holistically embedding the sustainable development dimension including their sub-aspects - regardless of their emerging or established nature - is key to enhancing students' understanding, knowledge, and skill, and indeed vital to creating the change/transitioning HEI curriculum that addresses the concerns of academics and professional bodies and interest of students. This is particularly significant given the rapidly changing and uncertain sustainability-related challenges that BE students as future BEPs will face. As such HEIs as transformative platforms are vital to driving the sustainability agenda given that they produce students who will meet the challenges. While there is no one-size-fits-all approach or even a 'best approach' to enhance students' sustainability literacy, making students' learning and knowledge acquisition can be made more specific, relevant, and/or holistic. Therefore, it is recommended that BE curriculum moves beyond the typical generic sustainability issues and enviro-centric content and transitions to a holistic one, embedding all SD dimensions, energy-related aspects, emerging terminology such as LCF and others as well as designing targeted programmes specific to emerging topics/aspects. As such, the development of content and framework for sustainability inclusion that explicitly addresses its different aspects to support students in their understanding of the relationships, nuances, and terminologies

This study like others is not without its limitations. Firstly, the review focused on the actual term 'Low Carbon Future' which while relevant, is very niche, considering 'Low Carbon Future' as a topic, subject area, or theme could have offered a broader area for review and enhanced the findings. Secondly, only two electronic databases were consulted (Scopus and ARCOM) and while they provide a useful representation of research output within the BE, more data sources could have provided a more comprehensive overview. Thirdly, although useful, collecting empirical data on students' knowledge as opposed to a literature review may have enriched the findings. Additionally, collecting empirical data from academic and industry professionals would be beneficial. Notwithstanding the limitations, the findings originating from the study provide useful insight into what is existing and identify the knowledge gap which future research can address. It is believed that the study would be beneficial to academics, industry professionals, and professional and statutory bodies alike as it would go a long way to addressing the concerns of academics, industry professionals, and professional

bodies to produce graduates with a holistic understanding of sustainability and are ready and prepared to deal with real-world issues and equally the interests of students to be more sustainability literate. In simple terms, all stakeholders advocate a sustainability-literate workforce. Although this study focused on UK BE students, the findings have wider implications beyond the UK as sustainability literacy and transitioning to a Net Zero economy is a global challenge and need. Furthermore, as evidenced by the 2020-21 NUS Sustainability Skills Survey (SOS, 2022), it cuts across different disciplines/sectors. Thus, reinforcing the need for a multidisciplinary BE perspective.

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Table 1. Inclusion and Exclusion Criteria
(Source: Adapted from Unuigbe *et al.*, 2018)

	Criterion	**Inclusion Criteria**	**Exclusion Criteria**
Phase 1	Time period	Between 2000 and 2022	Before 2000
	Language	English	Non-English
	Type of literature	Peer-reviewed journals and conferences proceedings	Books and journals (reviews)
	Geography focus	UK	Non- UK countries
Phase 2	Population sample	Built environment students (undergraduate and postgraduate)	Non-built environment students
	Literature focus	Articles that specifically use the term 'Low Carbon Future'	Articles that do not use the term 'Low Carbon Future'
	Study design	Empirical evidence of perceptions, awareness, and knowledge	Literature-based reviews, subject matter accounts, and/or country accounts

Table 2. Quality assessment score of papers
(Source: Adapted from Unuigbe *et al.*, 2018)

Protocol	Authors Details					
	Cowling, (2007)	Kagawa (2007)	Cotgrave (2011)	Ekundayo (2018)	Opoku (2018)	Oliveira (2018)
Abstract and Title	2	3	3	4	3	4
Introduction and Aims	3	4	3	4	3	4
Method and Data	4	4	4	4	4	4
Sampling	4	3	4	4	4	4
Data Analysis	4	4	4	3	3	4
Ethics and Bias	1	1	1	1	1	1
Findings/Results	4	4	4	4	4	4
Transferability/Generalizability	4	4	4	4	2	4
Implications and Usefulness	3	4	3	3	2	4
Total	30	31	30	32	26	33
	Key: 1 (Very Poor), 2(Poor), 3(Fair), 4(Good)					

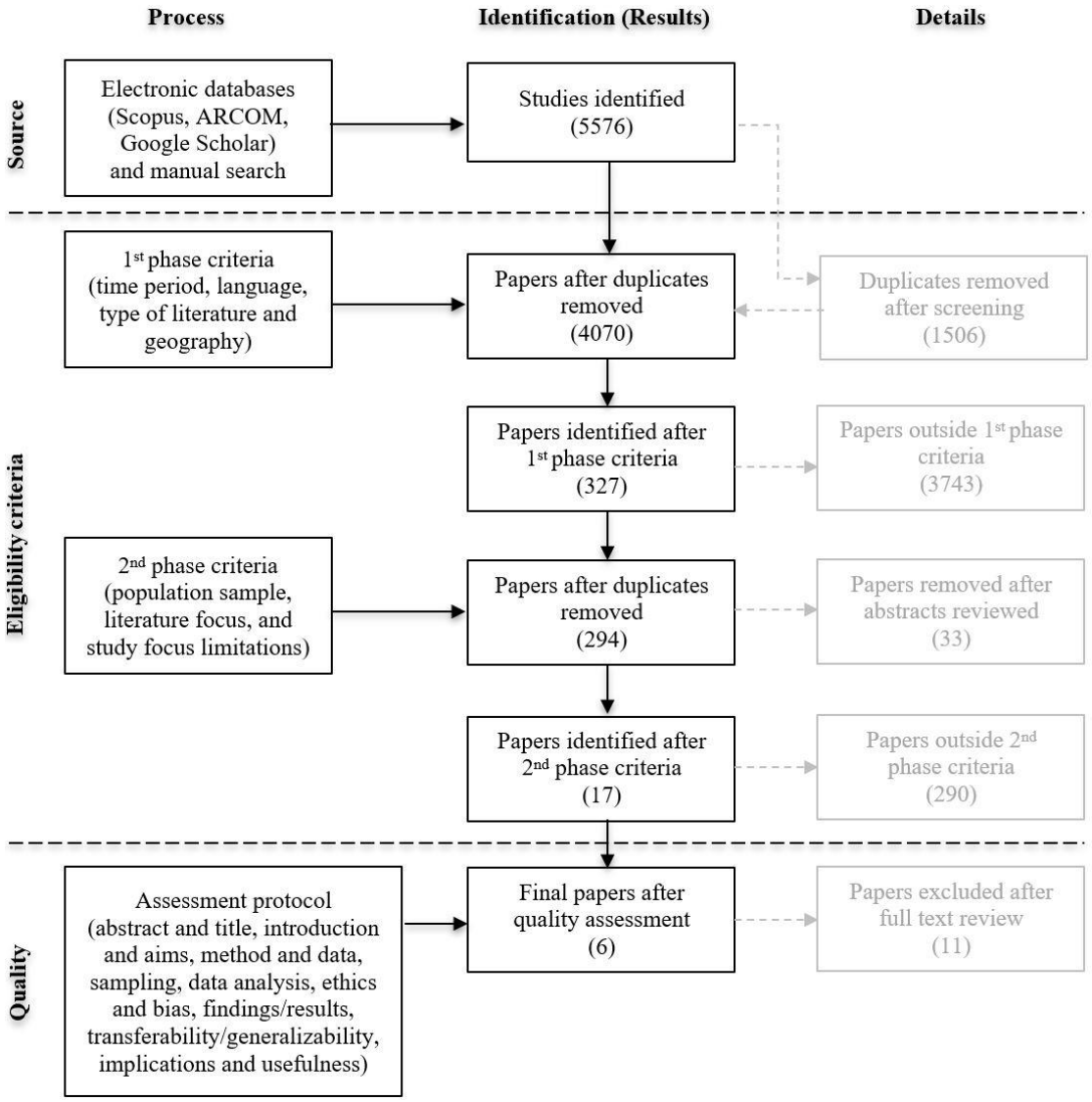

Figure 1. Scoping study review process

Table 3. Summary of six empirical studies included in the scoping review

Author' details	Discipline	Evidence of LFC	Study focus	Methods	Findings	Quality score
Cowling *et al.* (2007)	Surveying Programmes	No	Students' awareness and literacy of SD	Online questionnaire survey	High interest and perceived significance of SD with environmental aspect perceived as most relevant. Sustainability is not translated into lifestyle choices HEIs focus on SD contributes to students' awareness	30
Kagawa (2007)	All faculties	No	Students' perception of SD	Online questionnaire survey	Student's perception reflects a positive attitude toward sustainability, however, this does not directly correlate to the understanding of sustainability Students' associate SD with a singular perspective (environmental), evidencing a gap in social and economic knowledge exists. Identified dissonances between students' perceptions of SD and behaviour	31
Cotgrave and Kokkarinen (2011)	Construction Management	No	Students' perceptions based on the sustainability literacy model	Online questionnaire survey and Interview	Significant increase in priority on environmental issues and awareness of the environmental impact of construction work and buildings	30
Udeaja *et al*. (2017)	Quantity Surveying	No	Students' perception of sustainability curriculum	Online questionnaire survey	Sustainability knowledge level is a little above 'basic/limited knowledge.' Sustainability education was placed highly. SD integration in the curriculum has been successful to a certain extent	32
Opoku and Egbu (2018)	Quantity Surveying	No	Students' perception of sustainability literacy relevance	Literature review, Semi-structured interviews, and Questionnaire survey	Students' value sustainability knowledge and skills and most believe it aids competitiveness in the job market. General understanding of SD concepts but biased towards the environmental dimension Students not satisfied with limited sustainability inclusion, suggest more holistic integration.	26
Oliveira *et al.* (2018)	Architecture	No	Educators' and students' perspectives on energy-related content in teaching	Literature review, Observations, Semi-structured interviews, and Focus groups	Transforming the status quo is perceived as a major obstacle whereby a school design agenda, design studio educators' motivations, and a curriculum only gets added to our shared concerns.	33