



Campus Sustainability Framework: Bibliometric Literature Review Analysis

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Abstract

Based on a systematic literature review, this study investigates the application of the campus sustainability framework developed by Alshuwaikhat and Abubakar (2008). Scholarly work on campus sustainability has directed a lot of attention and, therefore, this framework must be verified for practical use at university. Using the Google Scholar and Scopus databases, a rigorous search of articles with specific criteria has been conducted. After going through the prescribed quality screening and setting, a total of 26 published articles from 2010-2020 were identified. These articles applied the proposed campus sustainability framework by Alshuwaikhat and Abubakar. A total of three main components are selected as the criteria in this study, namely University Environmental Management Systems (EMS), Public Participation and Social Responsibility, as well as Sustainability Teaching and Research. The most dominant variable/component, which is applied in the field of campus sustainability is EMS. More than 80% of the articles have used EMS as the main framework in campus sustainability management. This is significant with the management planning of each organization that triggered the campus sustainability initiative at the top level, including the setting of relevant policies.

Disciplinary: Education, Sustainability in Higher Education, Sustainable Cities and Society.

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1 Introduction

The phrase 'campus sustainability' has become increasingly popular with the discovery of more than 7490 exploration results on the Google Scholar database. This tendency of increasing search has proven that studies about campus sustainability have recently directed considerable attention. According to the sustainable development concept, which has been adopted by most

countries all over the world, universities are required to be role models to educate society in practicing campus sustainability. The university is seen as a unique institution, which can address the challenges of implementing environmental, economic, and social sustainability (Leal Filho, 2011). Various appropriate initiatives need to be framed to integrate the concept of sustainable development, mainly in management, as well as the development of university education. Universities serve as small towns with a variety of daily activities. These activities inevitably affect the environment (Saadatian et al., 2013). Activities inside a university like transportation, sewage, use of energy resources, including electricity and water, and even learning activities on campus all exert an impact on environmental sustainability. This eventually requires a systematic and proactive approach from all parties to ensure that campus sustainability is seriously considered by those who are responsible.

Such conceptual frameworks have been previously pioneered by scholars to measure the level of campus sustainability practices. These include Alshuwaikhat and Abubakar's (2008) framework of sustainability assessment at universities, GASU - Graphical Assessment of Sustainability at Universities (Lozano et al., 2015), AISHE - Auditing Instrument for Sustainability in Higher Education and CSAF - Campus Sustainability Assessment Framework (Saadatian et al., 2013) to name a few. Although there are many references and studies on the campus sustainability notion, Alshuwaikhat and Abubakar's (2008) proposal has received the highest number of citations (Lozano et al., 2015). A search string of "Alshuwaikhat AND campus sustainability" on the Google Scholar database found a total of 44 related articles. Also, Alshuwaikhat and Abubakar's (2008) article about campus sustainability has been cited by 827 scholarly articles in the field of sustainability and the environment. Alshuwaikhat and Abubakar's (2008) proposed framework comprises three major components, namely University Environmental Management Systems (EMS), i.e., Public Participation, and Social Responsibility, in addition to Sustainability Teaching and Research.

2 Conceptual Background

2.1 University EMS

The main introduced framework is University EMS, which involves the university's policy stipulation and management on campus sustainability issues. Alshuwaikhat and Abubakar (2008) have initiated two core elements in the University EMS, namely 'Environmental Management and Improvement', as well as 'Green Campus'. All the initiatives that are mentioned in the University EMS are the ongoing planning of the management, aiming at campus sustainability (Agdas et al., 2015). Various activities on campus, e.g., the arrival of university staff in the morning, the design of vehicle routes, the utilization of energy resources, the construction of recreational parks at university, waste collection, setting the temperature in lecture halls, etc. all require careful planning (Alawin et al., 2016).

Peak hours on campus usually occur when staff members arrive at university early in the morning and when they leave university at the end of their working hours. At this point, the entrances and exits of the campus are very congested with vehicles. Thus, some universities practice flexible working hours to reduce the risk of air pollution (Agdas et al., 2015). Carpooling is strongly encouraged (Desha & Hargroves, 2010) among university staff members, and the use of public transport on campus, e.g., shuttle buses contribute to a better ecosystem. Therefore, the campus management needs to apply the best practices in this University EMS known as Environmental Management and Improvement to ensure that campus conservation is effectively guaranteed. All initiatives aim to minimize the daily operations' adverse effects on campus. According to Castro and Jabbour (2013), activities, which are listed as Environmental Management and Improvement, include 1) minimizing adverse effects of campus operations, 2) preventing pollution, 3) efficient use of energy, 4) conserving resources, 5) improving the environment, 6) reducing waste, together with 7) reutilizing (recycling). The second major element of the University EMS is the 'Green Campus' initiative, which encompasses related activities of green transportation, green buildings, and campus conservation (Castro & Jabbour, 2013).

2.2 Sustainability Teaching and Research

Another component of Alshuwaikhat and Abubakar's (2008) proposed framework is sustainability teaching, as well as research. Such university activities can negatively affect environmental sustainability. Activities conducted, such as seminars, workshops, curriculum, and courses, should be given more attention by the management. The use of paper, stationery, disposable materials, research substance, laboratory activities, and various learning equipment has an impact on the environment. Therefore, research and development (R&D), especially in the field of renewable energy, climate change, and environmental protection need to be effectively emphasized.

Castro and Jabbour (2013) have summarized the activities carried out at university in conformity with Alshuwaikhat and Abubakar's (2008) framework as illustrated in Table 1.

This study aims to systematically examine the components of Alshuwaikhat and Abubakar's (2008) framework, which are applied by universities in conserving the environment. The findings of this study can be used as a reference to researchers in the field of campus sustainability. Besides, relevant parties, which are directly involved in the university management system can benefit from the results of this study. Moreover, important criteria have been provided regarding the rigorous article search and screening to ensure that the manuscript is of good quality. This systematic literature review primarily aims to provide an overview of the research conducted by Alshuwaikhat and Abubakar (2008) about campus sustainability. The following research questions are addressed:

1. To what extent has the framework of campus sustainability by Alshuwaikhat and Abubakar (2008) been applied in universities?
2. What is the trend of previous empirical studies about campus sustainability from 2010 through 2020?

3. Is the research output of documents on Alshuwaikhat and Abubakar's (2008) campus sustainability framework based on a comprehensive thematic analysis?

Table 1: Description of main activities of campus sustainability.

Framework for evaluating campus sustainability	Description of the main activities	Examples of activities
Universiti EMS	Environmental management & Improvement Green Campus	Minimize negative impacts of operations Pollution prevention Energy efficiency Resources conservation Environmental improvement Waste reduction Recycling Green building Green transportation Campus preservation
Public participation & social responsibility	Public participation Community services Social justice	Campus community Alumni Partnership Public lectures & awareness Community projects Other services Equity Care for disability
Sustainability teaching & research	Conferences, seminars & workshop Curriculum & courses Research & development (R&D)	Conferences, seminars & workshops, etc Sustainability Health and safety Livable settlements Renewable energy Environmental protection Climate change

3 Methodology

The methodology of this study is based on three main procedures as follows:

1. Conduct systematic literature review (SLR) protocol.
2. Perform data management and descriptive analysis of related articles.
3. Classify articles based on themes within the conceptual framework proposed by Alshuwaikhat and Abubakar (2008).

3.1 SLR Protocol

SLR is one of the literature review (LR) methods used to identify, select, and evaluate articles/documents included in the review process to answer specific research questions (Dewey & Drahota, 2016). The main difference between the most practiced SLR and LR approaches involves the implementation of a more rigorous methodology. SLR requires a structured process that refers to specific sources in the formation of SLR, the formation of research questions, systematic search, article quality assessment, as well as data analysis. Consequently, the researcher has set some important protocols in conducting this study as follows:

1. Selection of database as article search source. Only articles from the Google Scholar and Scopus databases are selected for the analysis. The reason behind using these databases is because these databases can be accessed online, and they contain many citation articles. Also, the selected databases are constantly updated (Cothran, 2011).
2. Only articles published between 2010 and 2020 are considered.
3. Setting the search strings that are “campus sustainability” AND “universit*” as the main keywords of the conducted search. To delve into the most detailed scope of Alshuwaikhat’s campus sustainability framework, a combination of these words “EMS” “Public Participation” “Social Responsibility” “Sustainable Teaching and Research” are used. Table 2 shows the setting of search strings, which are used as a protocol in this study.

Table 2: Search string setting for SLR

Search string 1	“campus sustainability” (title/abstract/keywords) AND “universit*” AND “framework” (title/abstract/keywords)
Search string 2	"EMS" OR "Public Participation" OR "Social Responsibility" "Sustainable Teaching and Research"
Search string 3	“Alshuwaikhat” (abstract/reference)

4. This study exclusively involves scholarly articles published by indexed journals. Books, conference papers, concept papers, and working papers are not accepted as search criteria. However, doctoral and master’s dissertation manuscripts are included as the university follows strict rules, and it stipulates high-quality research requirements.
5. Only research papers in English are accepted. Therefore, studies written in languages other than English are not included in the selection criteria. The article selection criteria are comprehensively described in Table 3.

Table 3: Inclusion and exclusion criterion for SLR.

Criterion	Inclusion	Exclusion
Time frame	2010 - 2020	articles published before 2010 are not taken into account
Language	English only	Any other languages
Type of publication	1) Indexed journals only 2) Dissertation	1) Books 2) Concept papers 3) Conference papers 4) Working papers

3.2 Data Management and Descriptive Analysis

To store data in a systematic and secure approach, the researchers selected the Google Drive site. This selection has been made to achieve more effective functionality and security of data. Google Drive is similar to Microsoft Excel in its utilization of apps, such as Google Sheets, which systematically store data (sorting, as well as filtering functions) beyond limits. Also, this service is free. Moreover, Google Drive is extremely practical due to its use of data storage via the cloud, in

which, users do not have to worry about loss of local storage. Besides, users can access the data anytime.

Descriptive analysis has been performed for all the screened articles collected on the Google Drive website. The conducted analysis comprises six categories, including the year of the study, the researchers' names, the study title, the journal's title, the country, where the study is originated, and the number of citations of the study. By using an Excel spreadsheet on Google Drive, all the articles were subject to screening, as well as filtering according to specified categories.

3.3 Articles Classification according to Campus Sustainability Framework by Alshuwaikhat and Abubakar (2008)

Articles, which are obtained from the screening process, have been analyzed following Alshuwaikhat and Abubakar's (2008) campus sustainability framework. The variables involved are the EMS, public participation, and social responsibility, in addition to sustainability teaching and research. To ensure the quality of article classification, all the selected articles have been read rigorously by the researchers. Each phrase related to the campus sustainability framework is marked and included in the classification table. After classifying the themes, a second-round review has been conducted to ensure that the analysis process adheres to the agreed stipulations.

4 Results and Discussion

4.1 SLR and Descriptive Analysis

Figure 1 shows the SLR process. The search began with the setting of string number 1 (refer to Table 2). This search resulted in 3570 articles, which are associated with campus sustainability. Then, article screening has been carried out with the setting of search string number 2, which resulted in a total of 383 articles. Finally, the search refinement using string number 3 has been applied and the number of articles obtained at this stage is 167 articles. Based on the inclusion criteria that have been determined in the early stages of the SLR, all articles, which are not produced within (2010-2020) have been removed. Only articles in English are accepted, as well as the articles, which are published in indexed journals, in addition to M.A. and Ph.D. dissertations. All relevant articles are reviewed by a group of researchers based on the article quality assessment. The quality setting, which has been agreed upon, is that every article must cite Alshuwaikhat's framework of campus sustainability and must have consistency in the methodology, the sampling method, data analysis, and valid results. Conclusively, a total of 26 articles have been successfully collected and will be analyzed.

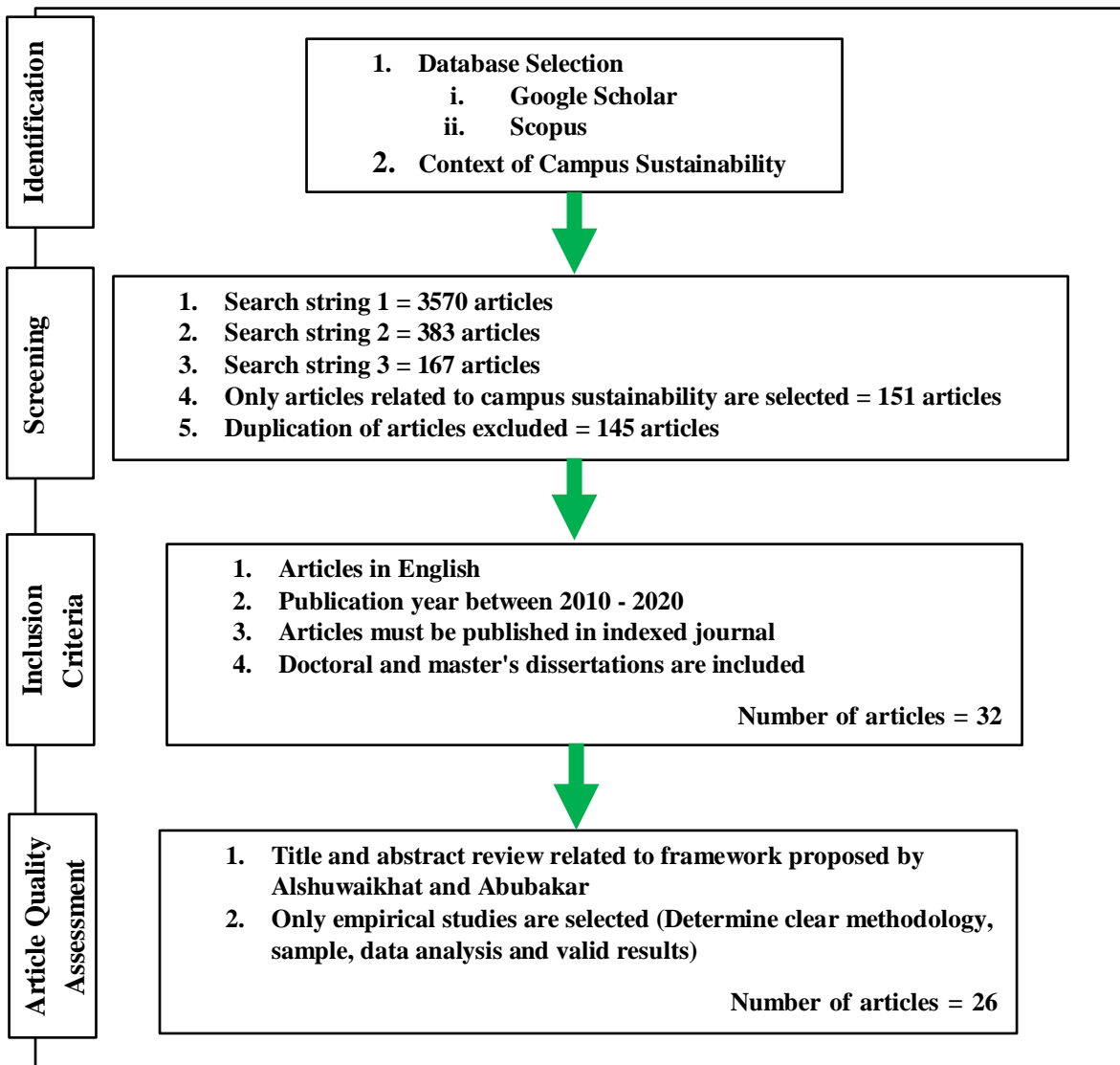


Figure 1: The flow of the SLR process for this study.

A total of 26 analyzed articles were published in 12 different journals. However, the main journal that published studies related to campus sustainability is the “Journal of Cleaner Production” with 6 articles, representing 23% of the total number of articles published from 2010 to 2020. This journal has been indexed Q1 by Scopus. Moreover, journals on sustainability and the environment, e.g., “*International Journal of Sustainability in Higher Education*”, as well as “*Sustainability*” published two of the articles each. The “*Journal of Environmental Studies*” has only published one article, supporting the framework of Alshuwaikhat and Abubakar over the past decade. Other journals are not in the field of the environment; these journals published only one article each as shown in Figure 2. However, the SLR results showed that there is a significant growing interest in research related to the proposed framework by Alshuwaikhat and Abubakar (2008). A total of eight post-graduate studies were conducted from 2010 until 2020, which contributed to 31% of the total number of articles.

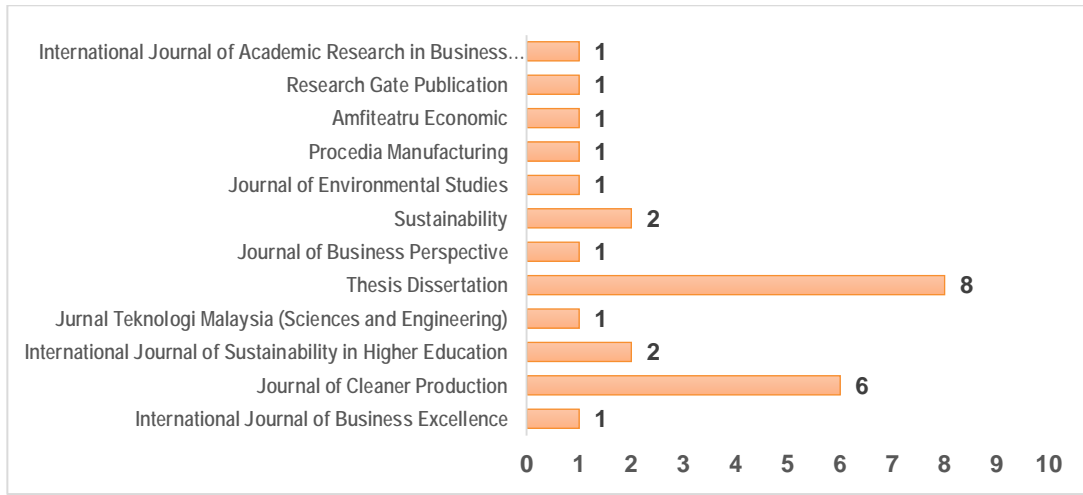


Figure 2: Number of studies per journal.

There are 15 countries involved with the selected studies. However, the origin of only two articles is unknown. Surprisingly, the campus sustainability framework by Alshuwaikhat and Abubakar had been practiced mostly in developing countries, including Malaysia, Indonesia, India, and Brazil. Figure 3 shows the country, where the articles are produced. The results showed that the following countries from the Asian continent, including China with 1 article, India with 2 articles, Indonesia with 3, Malaysia with 5, KSA with 1, and Syria with only 1 article are increasingly adopting the Alshuwaikhat's framework with 50% of the studies produced in Asian countries, followed by studies produced in the European continent at 15 percent (Lithuania = 1, Portugal = 1, Romania = 1, Spain = 1), South America 11% (Brazil = 3), North America 8% (USA = 2), followed by studies that were produced in Africa (Nigeria = 1) and Oceania 4% (New Zealand = 1), respectively as shown in Figure 4.

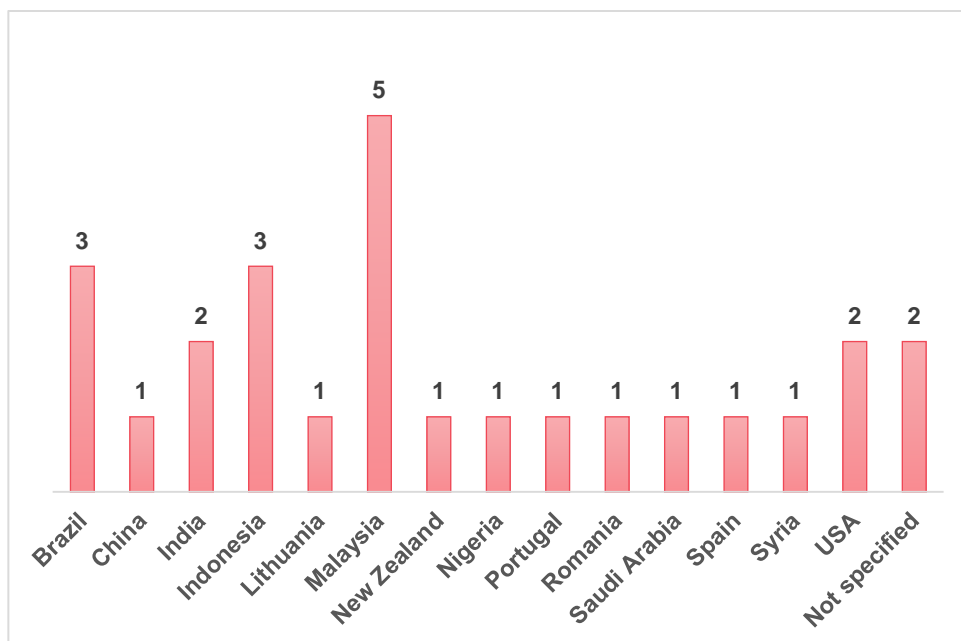


Figure 3: Number of studies by country

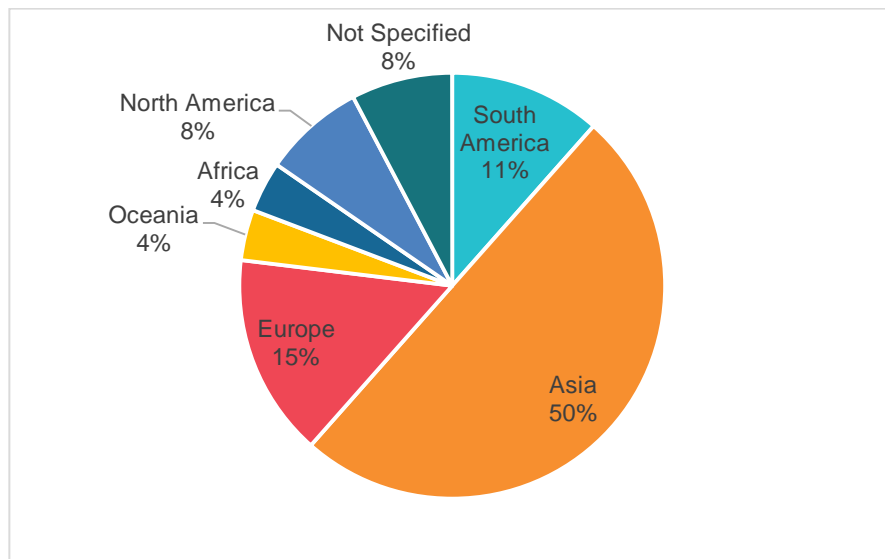


Figure 4: Number of studies by continent.

No related articles were published in 2010 and 2012 as shown in Figure 5. Most articles were published in 2017, i.e., (6 articles), followed by the year 2015 with (4 articles). The results showed that there is not any significant and clear trend in the publication of articles based on the year of publication. The reason might be the availability of other environmental sustainability frameworks preferred by researchers (Kolokotsa et al., 2016) instead of Alshuwaikhat and Abubakar’s (2008) framework. However, the data obtained in this SLR study still supports the growing interest in the campus sustainability framework based on the distribution of relevant empirical studies over the past decade.

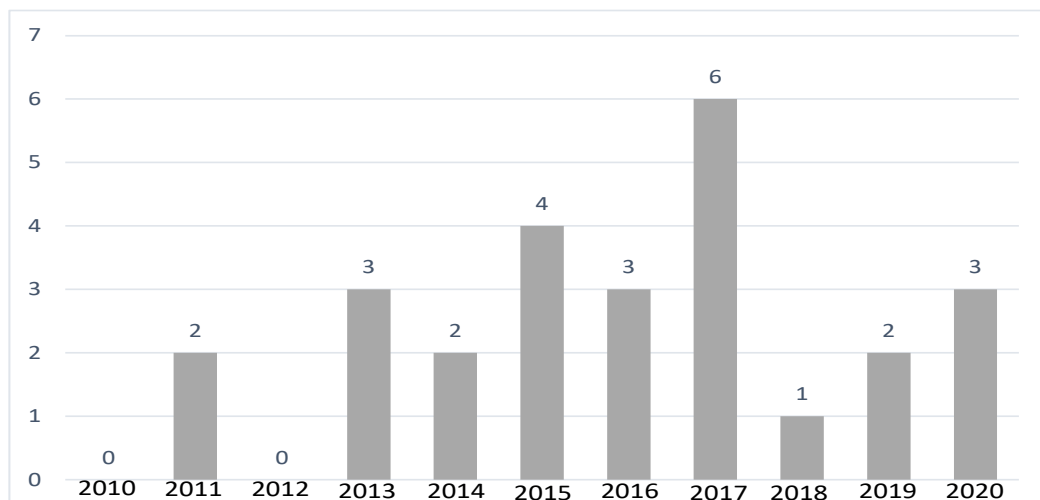


Figure 5: Number of studies per year

4.2 Thematic Analysis and Article Classification

All 26 articles were analyzed thematically according to the campus sustainability framework by Alshuwaikhat and Abubakar, which consists of three major components, including University EMS, public participation, and social responsibility, in addition to sustainability teaching and research. The selected articles have been scrutinized by a group of researchers.

After being thematically analyzed, the previous studies, which used the proposed campus sustainability framework by Alshuwaikhat and Abubakar (2008), are illustrated in Table 4. A total of

4 articles have used the three main components of Alshuwaikhat's framework. However, 5 articles only have applied EMS variables and public participation and social responsibility. On the other hand, a total of 6 articles have applied the EMS component and sustainability teaching and research, whereas 6 articles only used the EMS framework exclusively. Also, 4 articles only have entirely used sustainability teaching and research and only 1 article applied the components of public participation and social responsibility.

Table 4: The number of articles, which employed the component in Alshuwaikhat's framework.

Variable used in articles that relevant to Alshuwaikhat's Campus Sustainability Framework	Number of articles implemented the component in the framework
EMS + public participation & social responsibility + sustainability teaching & research	4
EMS + public participation & social responsibility	5
EMS + sustainability teaching & research	6
Public participation & social responsibility + sustainability teaching & research	0
EMS only	6
Public participation & social responsibility only	1
Sustainability teaching & research only	4

The most dominant variable is the EMS variable as 21 articles (80.77%) from a total of 26 applied this variable. This shows that university management has begun to focus on planning towards achieving campus sustainability goals (Aris & Bhaskoro, 2014). However, the public participation and the social responsibility variable were not used. In other words, ten articles only (38.46%) used the above-mentioned variable. Universities listed in these studies have prioritized sustainability teaching and research in the process of implementing campus sustainability. This can be justified by the existence of 14 articles (53.85%), in which this variable is applied.

5 Conclusion

Conducting a comprehensively systematic review is the focus of this study. The selected articles about campus sustainability include the framework, which has been developed by Alshuwaikhat (2008). The main findings of this study are as follows:

- The developed sustainability framework by Alshuwaikhat and Abubakar (2008) has been used in various universities. The framework has been mainly applied in developing countries in the Asian region, including China, India, Indonesia, and Malaysia.
- There are 26 articles on the campus sustainability framework by Alshuwaikhat and Abubakar. This framework has been applied in previous studies in a number of universities between 2010 and 2020. However, the results showed that there is not a significant publication trend during this period.
- The most dominant variable/component, which is applied in the field of campus sustainability is EMS. More than 80% of the articles have used EMS as the main framework in campus sustainability management. This is significant with the

management planning of each organization that triggered the campus sustainability initiative at the top level, including the setting of relevant policies.

Based on the analysis of a total of 26 articles, it was found that the campus sustainability framework application proposed by Alshuwaikhat and Abubakar can still be improved practically by the university. The framework's components, particularly public participation and social responsibility are still not fully emphasized. The university should diversify activities, involving the community, alumni, and NGOs in raising awareness of the environment. Furthermore, the welfare and practicality of facilities at university should be prioritized, especially for the handicapped. Overall, the concept of campus sustainability not only sustains the environment but also achieves equity and equality in all aspects.

6 Availability of Data And Material

Data can be made available by contacting the corresponding authors.

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