Sustainability Practices at Higher Education Institutions in Asia

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Abstract

Purpose
It is still unclear how Asian universities incorporate the theory or practice of sustainable development (SD) in their research and education programs. To address this gap, the current work reports on a study that has examined how universities in Asian countries handle and address matters related to SD.

Design/methodology/approach
The study employed a bibliometric analysis and an online survey-method. The online survey data were analysed through descriptive analysis and one sample Student's *t*-test.

Findings
The study indicates that there is considerable variation among the Asian countries regarding sustainability practices in higher education institutions (HEIs). The HEIs in far eastern countries such as Indonesia, Malaysia and Thailand are perceived to demonstrate more sustainability practices.

Research limitations/implications
Even though a substantial number of participants participated in the survey, it did not cover all Asian countries. The online survey was carried out over a limited period of time, and not all HEIs in the field may have received information about the study.

Practical implications
Asia is the largest continent facing a number of sustainability challenges. In this context, the contribution of HEIs is very important. The findings of the current study may serve as a baseline for Asian HEIs to take more initiatives towards sustainable development goals (SDGs) since HEIs are responsible for the education and training of hundreds of thousands of students who will be occupying key positions in industry, government or education in the coming years.

Originality/value
The study contributes to the existing literature in two distinct ways. First, it was possible to develop a comprehensive instrument to measure sustainability practices in HEIs. Secondly, this study has filled the gap of the scarcity of studies regarding sustainability practices in HEIs in Asia.

Keywords: sustainability; higher education institutions; education for sustainable development; challenges; drivers.

1. Introduction

Due to the fragile and vulnerable ecosystem in Central Asia, climate change in this region has advanced more intensely and quickly than in other parts of the world (Asadullah et al., 2020).

It is thus extremely important to undertake critical sustainable development (SD) measures and actions to improve the situation that is engulfing Asia (Czvetkó et al., 2021). The transition towards diversification in energy sources and clean energy generation will enable Asia to reduce its dependence on fossil fuels, thereby minimising the associated negative environmental impacts and responding to one of the biggest challenges of SD in the region (Roslan, 2021).

Realizing the critical role of higher education in advancing the agenda of SD, different universities have taken varied initiatives. In their survey of 642 business schools Wu et al. (2010) noted that many universities had included sustainability courses in different academic programmes. As a response to the United Nations (UN) Agenda 21 for education of sustainable development (ESD), universities from different countries have signed Talloires Declaration to promote higher education for sustainable development (HESD) at political and policy levels (Michelsen, 2015). SD has advanced at an evolutionary pace in Asia, in tandem with the sustainable development goals (SDGs). Sustainability practices within higher education institutions (HEIs) in Asia have also followed suit since the Johannesburg Summit in 2002, which focused on the special role of education systems in facilitating, envisioning, and leading change towards sustainability. The Kyoto declaration made in 1993 for campus sustainability through the efficient use of water, energy, awareness, and conservation in HEIs has also brought about much sustainability awareness and action amongst institutions of higher learning in the region (Faghihi et al., 2015).
In conceptualising sustainability practices within HEIs, the research conducted by Heinen (1994), Lozano García et al. (2006) and Leal Filho et al. (2017) revealed that many of these practices have been adopted within theoretical, evolutionary and reformative dimensions, providing support to widespread discussions and dissemination of ideas for promoting SD at HEIs. In the recent years, sustainability challenges have also been emphasized in all sectors as predominant social practices across the educational sector (Calder and Clugston, 2003, Lozano, 2006, Franco et al., 2018).
Environmental sustainability, operational resources such as water, waste, and energy consumption, and unsustainable human behaviours continue to constitute concerns in HEIs and are identified as thematic questions (Tierney et al., 2015). In ensuring ESD, it remains critical within this context to identify its barriers and solutions, design courses and research materials, and plan and allocate finances to balance its importance and urgency, and these actions have become great challenges for many countries (Dlouhá et al., 2017). The launch of the SDGs has ensured that education for sustainability becomes critical to the sustainability agenda (Beynaghi et al., 2016, Vásquez et al., 2015).
Literature indicates that a range of initiatives have been carried out at Asian universities to contribute towards SDGs (Blanco, 2021, Liu and Gao, 2021, Okubo et al., 2021, Su and Chang, 2010, Chang, 2013, Xiong and Mok, 2020). Despite the rapid progress in the field of SD in Asia, there is a lack of studies on the extent to which sustainability is implemented at HEIs in the region, where a review of the literature combined with a survey, allow to identify and document the diversity of initiatives undertaken today in this context. There is also a scarcity of comprehensive instruments measuring sustainability practices in HEIs and the developed survey instrument in the light of the study framework will contribute to address that gap. In particular, this study focuses on understanding current sustainability practices and trends in research, teaching and institutional commitments in Asian HEIs. The findings of this study will be instrumental in assisting HEIs in Asia to formulate institutional sustainability policies and guidelines in key areas such as institutional strategy, teaching and research.

The study employed bibliometric analysis and an online survey to understand:

1. The commitment of Asian HEIs to sustainability,
2. The practices of Asian HEIs as teaching organisations, responsible for the education of students as knowledge multipliers for SD,

3. The practices of HEIs as places for research and as think tanks for a sustainable society.

2. Sustainable Development and Higher Education Institutions in Asia

Sustainability at universities plays an integral role in shaping present and future sustainable societies.

Asian universities are currently adopting strategies to ensure sustainability. Members of the Asian Universities Alliance have implemented sustainability in four main domains that include substantial course delivery, research aligned with the sustainability agenda, innovative green campuses, and community engagement and partnership in implementing the sustainability agenda (Liu and Kitamura, 2019).Asian universities aim to pursue sustainability, as illustrated below.

Historically, Malaysia started implementing sustainability through the goal established in public policy documents that sought to eradicate hunger in the country (Economic Planning Unit, 2017). For the 17 SDGs to be achieved based on systematic and measurable progress, a favourable environment was created from several global symposia involving multiple stakeholders and participatory governance (United Nations, 2020). Malaysia has also invested in the promotion of renewable sources of energy, with the intention of meeting the growing demand for this resource, explained by the population growth and technological development in the region (Shaikh et al., 2017).

In India, a developing South Asian country, sustainability science is slowly being introduced to universities and is being implemented in an attempt to progress toward the UN SDGs. Universities are trying to reshape their curriculum to include SD within their current setup. The emphasis is placed on sustainability education to allow India to move towards achieving total sustainability (Priyadarshini and Abhilash, 2020). The Indian School of Business, for instance, encourages the development of competitive projects and strategies based on sustainable management, which will have a positive impact on both universities and society to increase their legitimacy (Miotto et al., 2020). Interestingly, the study of Albareda-Tiana et al. (2018) found that Indian campuses are focused on a few academic parameters (Jain et al., 2013). They lack a contextual assessment system for SD and require adequate indicators, especially for those focused on administrative management, research, and extension, generating an absence of holistic SD.

According to Nousheen et al. (2020), Pakistan is one of the first countries to adopt the UN 2030 Agenda for SD, and from 2017 onwards it has implemented for the first time an educational policy aimed at ESD. Parvez and Agrawal (2019) argued that HEIs act within mechanisms that have their own governance and economic and cultural systems. Though not legally designated as such, ESD may be seen taking place in a developing country like Bangladesh through different pathways of learning.

In Bangladesh, on the other hand, the mandate of education as a way of educating people for economic success has been exceeded. Bangladeshi universities lack both formal and informal governance to address the issue of sustainability. The limited efforts include a simpler orientation programme about sustainability that targets teachers, staff and students equally (Hossain and Mohammad, 2015). While this effort seems a theoretical one, the practice of it remains more difficult to implement. As Alam et al. (2021) argued, the mushrooming in the private university sector has resulted in a sustainability crisis, even though both public and private sector universities do not emphasise it. In this context, and in order to meet the global benchmark in Bangladesh, a formal education policy on sustainability is recommended (Hoque et al., 2017).

In Cambodia, urban planning measures and policies aimed at sustainably managing land use are being implemented, ensuring that the rapid population growth in urban areas occurs in a way that does not cause negative environmental impacts (Lord, 2020). Through more participatory governance, the Philippines seeks to implement sustainability on research in HEIs, as it understands that the HEIs act as living labs and thus contribute to the creation of

more sustainable forms of management, which will positively impact the entire environment around them (Blanco, 2021).

Conversely, in more developed Asian countries, sustainability is well implemented. A study in Hong Kong found that the universities integrated resources and efforts to ensure sustainability at their campuses. Eight university grant-funded institutions signed the Hong Kong Declaration to recognise the importance of HEIs in the path towards sustainability. The declaration aimed to incorporate sustainability into the learning and teaching processes and the curriculum. Furthermore, it promoted the green operations of universities, such as decreasing water usage, waste, energy and greenhouse gas (GHG) emissions. Additionally, it provided a method for universities to be held accountable for their actions (Xiong and Mok, 2020).

Chinese universities have placed emphasis on SD. Most universities have employed a phased plan to move towards sustainability. The multi-step approach was adapted as the sustainability needs of the world changed. Phase 1 occurred early in 1993-2005 to prepare universities. Phase 2 promoted conservation-oriented campus construction. Lastly, Phase 3 moved onto green campuses. These initiatives were supported by the Chinese government and other organisations (Liu and Gao, 2021).

Taiwan's government has also taken initiatives by allocating resources to the HEIs (Su and Chang, 2010, Chang, 2013). Okubo et al. (2021) reported that the Japanese government is poised to build a new educational curriculum that allows participants to learn practices and develop skills that contribute to a sustainable society (Onuki and Mino, 2009). It also hosted the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Conference on Education for Sustainability in Nagoya 2014 (Fredriksson et al., 2020).

As evidenced by the studies presented above and also illustrated in Table 1, Asian HEIs place a strong emphasis on SD. This study's review of studies on sustainability innovations in Asian HEIs found that ongoing research and development has not only focused on curricula and pedagogical novelties, but has also been a core feature of research and development work, campus estate management, and institutional practices. The cases highlighted in Table 1 showcase some of the established sustainability practices of HEIs in Asia that have been documented within the literature. This extensive collection of data reveals the focus and impacts of pursued initiatives in various domains of knowledge, showing that Asia is in fact advancing towards SD.

In the context of Asian HEIs, this review shows some gaps in the literature, e.g., i) lack of coherence/connection between the various SD efforts being pursued in HEIs, ii) thematic gaps with some subjects being more focused than others, iii) some countries are better represented regarding SD research than others. At the same time, this study highlights the scarcity of articles specifically focusing on sustainability at HEIs in Asia. All this illustrates the need to invest in additional SD studies in Asian countries. Additionally, this study reports on a survey that serves the purpose of better understanding sustainability practices and identifying current trends in Asian HEIs. In the authors' opinion, this study is innovative, since it includes the development of a comprehensive instrument to measure sustainability practices, addressing a sample from a significant number of Asian countries. The questions included in the survey assist in clarifying the SD engagement in Asian HEIs.

Table 1. Case studies on sustainability practices at Higher Education Institutions in Asia

N.	Case Title	Case Focus	Case Impact	Reference
1	Sustainability education and a new Master's degree: The Master of Sustainability Science: the Graduate Program in Sustainability Science (GPSS) at the University of Tokyo	The set-up of a new Master's degree at the University of Tokyo, in Japan, the Master of Sustainability Science, linking up academic stakeholders interested on sustainable development research	Experiential learning and skills oriented practical courses, which are key in developing the skill set and sensibility required of upcoming leaders	Onuki and Mino (2009)
2	Sustainability, blended learning and the undergraduate communication skills classroom: Negotiating engineering undergraduates' expectations and perceptions	Exploring the perceptions and expectations of undergraduate engineering students at Universiti Teknologi PETRONAS, Malaysia, on the potential of using the blended learning approach to incorporate sustainability within the Professional Communication Skills (PCS) module	Increased learner awareness in environmental, social and cultural dimensions of sustainability, development of sustainability literacy and capacity for self-directed learning	Sivapalan (2017)
3	Engineering Education for Sustainable Development in Malaysia: Student Stakeholders Perspectives on the Integration of Holistic Sustainability Competences Within Undergraduate Engineering Programs	Gauging Universiti Teknologi PETRONAS, Malaysia final year engineering students views on the development of engineering education for sustainable development competence indicators for inclusion within undergraduate engineering program module learning outcomes	The voices of student stakeholders are critical in developing sustainability focused graduate learning outcomes. It also suggests that students view sustainability as an important competence to acquire in preparing them to enter the engineering workforce in Malaysia	Sivapalan (2016)
4	Inquiry into sustainability issues by preservice teachers: A pedagogy to enhance sustainability consciousness	The integration of sustainability education in the 'Research Methods in Education' course for preservice teachers using an inquiry-based learning approach at the Lahore College for Women University in Pakistan	There is much potential for teacher education programs to employ inquiry-based learning as a vehicle to enhance sustainability consciousness	Kalsoom and Khanam (2017)
5	From piecemeal to holistic: Introducing sustainability science in Indian Universities to attain UN-Sustainable Development Goals	The infusion of sustainability within Indian institutions of higher learning has been found to be holistic in nature. Innovative models of integration are seen as a way forward	The infusion and diffusion models proposed in this work is projected to assist Indian higher education institutions to accelerate the inclusion of sustainability within course offerings, further promoting progress in achieving the UN SDGs.	Priyadarshini and Abhilash (2020)
6	Understanding Gender Differences in Students' Perceptions of Competency Certification for Enhancing Sustainability in Higher Education	Exploring differences between male and female students from K University in Korea on their perception of competency certification programs to enhance sustainability of Korean higher education	For Korean institutions of higher education to be sustainable, the universities should look into developing systematic competency certification policies that address the needs of the students as well as of society, besides bridging the workforce gender gap.	Lim et al. (2020)
7	Fostering sustainability through education, research and practice: a case study of TERI University	The development of the Environmental Studies and Resource Management postgraduate program at TERI University, India, using blended learning pedagogy	The use of blended learning pedagogy and an interdisciplinary approach has paved the way for curriculum innovation for sustainable development integration	Jain et al. (2013)
8	Greening of a campus through waste management initiatives	Effects of 3R waste management initiatives on the AIT campus community in Thailand	While 3R can bring about positive effects on attitudes towards waste management, volunteerism, coupled with regulatory and incentive approaches brings about better behavioral changes towards waste management practices	Tangwanichagapong et al. (2017)

N.	Case Title	Case Focus	Case Impact	Reference
9	A critical assessment of the Higher Education for Sustainable Development from students' perspectives–a Chinese study	An investigation of the awareness of students from Shandong University, China, on sustainability and their views on Higher Education for Sustainable Development (HESI)	Key HESI priorities of students were mostly environmentally focused, with social aspects such as campus security and disability access also found to be important	Yuan and Zuo (2013)
10	Sustainable development concept in the chemistry curriculum: An exploration of foundation students' perspective	Investigation of the knowledge, attitude and behaviors of foundation (pre-university) chemistry students in a local university in Selangor, Malaysia on the concept of sustainable development	Innovation is required within teaching and learning practices at the pre-university level, taking into account learner perspectives and needs	Kanapathy et al. (2019)
11	Environmental management accounting in the Taiwanese higher education sector: Issues and opportunities	Management of environmental costs associated with the usage of water, electricity and paper within the Taiwanese higher education context	Environmental performance management from an accounting perspective has been limited within the Taiwan university context. Factoring such a practice in would enable better management of the environmental costs borne by universities.	Chang (2013)
12	Contributing to Sustainability Education of East Asian University Students through a Field Trip Experience: A Social-Ecological Perspective	The use of field trips to advance education for sustainable development within an east Asian university context in Korea	Field trips, coupled with a social-ecology approach has the potential to promote education for sustainable development and environmental education	Yoon et al. (2016)
13	Sustainability initiative for a Malaysian university campus: living laboratories and the reduction of greenhouse gas emissions	GHG emissions within urban universities are present, but under researched in developing countries such as Malaysia	Campus operations and research activities within urban university campuses are possible sources of GHG emissions, and reduction methods should thus be approached accordingly	Yusoff et al. (2021)
14	Green Campus initiative and its impacts on quality of life of stakeholders in Green and Non-Green Campus universities	Differentiating sustainability practices and observed quality of life perspectives of stakeholders of green and non-green campuses in Thailand	The adoption of UI GreenMetric World University Ranking within campuses in Thailand could boost sustainability practices and improve quality of life	Tiyarattana chai and Hollmann (2016)
15	Strategic Options for Campus Sustainability: Cluster Analysis on Higher Education Institutions in Japan	10-year evaluation of campus sustainability initiatives of universities in Japan	While the implementation of sustainability is largely lacking, asset management or networking are areas with potential for campus sustainability implementation, particularly for small institutions	Ikegami and Neuts (2020)
16	Does GATS' Influence on Private University Sector's Growth Ensure ESD or Develop City 'Sustainability Crisis'—Policy Framework to Respond COP21	In response to COP21, a 'carbon neutrality' policy framework for the sector has been proposed as a means of addressing the sustainability challenge.	While the greenery index has decreased dramatically, the night light and heat indices have unexpectedly increased, which is associated with the growth and expansion of the private university sector.	Alam et al. (2021)

3. Methodology

3.1 Approach Used in the Bibliometric Analysis

Bibliometric analysis techniques are increasingly used to understand the knowledge structure and trends in academic fields. Among other things, they can show what topics have received more attention in the literature. Different software tools such as CiteSpace and SciMAT have been developed for this purpose, which mainly focus on the thematic evolution of scientific fields. VOSviewer was used in this study because it allows for the identification of major thematic focus areas and their interlinkages. In addition, the interface of the software and its outputs are user friendly (van Eck and Waltman, 2010). The objects of analysis are the bibliographic data of publications indexed in the Web of Science (WoS), a well-known scientific database for archiving peer-reviewed academic literature. To select relevant studies for inclusion in the analysis, the authors first designed a broad-based search string that covers terms related to sustainability education and research in Asia. This search string is presented in Table 2. The literature analysis was undertaken on February 28, 2021 and returned 1,648 publications. The search included all research indexed in the WoS between 1900-2021. Titles and abstracts of these articles were screened to select those related to the scope of this study. In the end, 1,158 articles were selected for analysis through VOSviewer. Of the different bibliometric analyses offered by VOSviewer, the term co-occurrence analysis was selected, as it provides information about the thematic focus of a research area (Callon et al., 1983). The output of this analysis is a network of nodes and links, where node size and link width are proportional to the frequency of occurrence of terms and the strength of connection between two terms, respectively. Terms that are close to each other form clusters that represent thematic focus areas (van Eck and Waltman, 2010).

Table 2. Search string for the bibliometric analysis

(TS= (("sustainab*") and ("universit*" OR "higher education institut*" OR "college*") and ("asia*" OR "Bangladesh*" OR "Bhutan*" OR "Brunei*" OR "Cambodia*" OR "Chin*" OR "India" OR "Indonesia*" OR "Japan*" OR "Lao*" OR "Malaysia*" OR "Maldives" OR "Mongolia*" OR "Myanmar*" OR "Nepal*" OR "Korea*" OR "Pakistan*" OR "Philippin*" OR "Singapor*" OR "Sri Lanka*" OR "Taiwan*" OR "Thai*" OR "Timor*" OR "Vietnam*" OR “Kazakhstan*” OR “Russia*” OR “Tajikistan*” OR “Turkmenistan*” OR “Uzbekistan*” OR “Afghanistan*”))) AND LANGUAGE: (English)	Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=1900-2021

3.2 Online Survey

For the exploratory component, an online survey was applied to establish how HEIs in Asia address sustainability. The invitation to contribute to the survey was open, and only persons interested on the topic took part. Based on previous extensive literature review, as well as knowledge from researchers working in this area and region, the questionnaire was developed to comprise 12 questions and 4 main sections, aiming at simplicity:

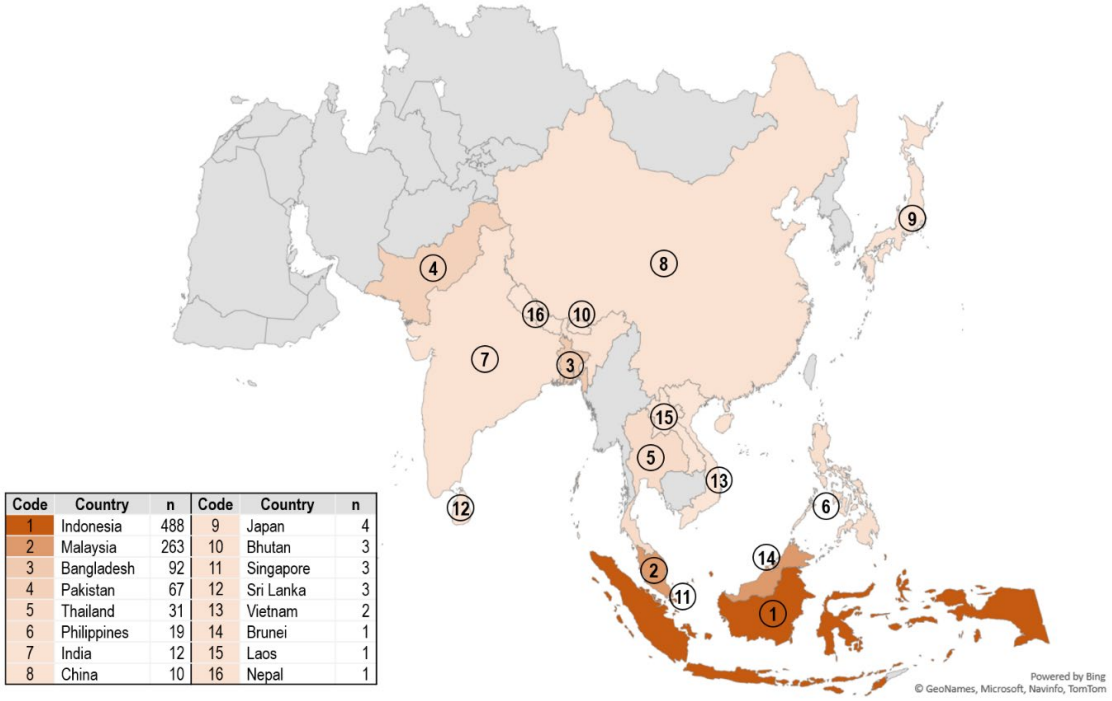
Part 1 - The commitment of HEIs to sustainability
Commitment towards a sustainable use of resources
Commitment towards a sustainable organisation

Part 2 - HEIs as teaching organisations, responsible for the education of students as knowledge multipliers for SD

Part 3 - HEIs as places for research and as think tanks for a sustainable society

Part 4 - Challenges and drivers of the implementation of sustainability-related initiatives at Asian universities

The questionnaire was validated by a group of sustainability researchers and then shared with several networks of universities, such as the Inter-University Sustainable Development Research Programme (IUSDRP, https://www.haw-hamburg.de/en/ftz-nk/programmes/iusdrp/), and the Promotion of Sustainability in Postgraduate Education and Research (ProSPER.Net, https://prospernet.ias.unu.edu/), which when combined they cover more than 70 universities in Asia. The study followed a convenience sampling methodology, as the researchers shared the survey with their networks and contacts.
The questionnaire remained active between March and April 2021 and collected 1,000 responses from 16 countries after data clean-up, as shown in Figure 1, removing countries not in the area of study.



Code	Country	n	Code	Country	n
1	Indonesia	488	9	Japan	4
2	Malaysia	263	10	Bhutan	3
3	Bangladesh	92	11	Singapore	3
4	Pakistan	67	12	Sri Lanka	3
5	Thailand	31	13	Vietnam	2
6	Philippines	19	14	Brunei	1
7	India	12	15	Laos	1
8	China	10	16	Nepal	1

Figure 1. Participating countries and number of respondents (*n*) per country

Indonesia and Malaysia rank among the highest responses to the survey, representing about 75% of the total responses. This is followed by Bangladesh, Pakistan, Thailand, the Philippines, India and China. Japan registered four responses, while Bhutan, Singapore and Sri Lanka provided three responses each. Vietnam registered two responses, while Brunei, Laos and Nepal registered one response each. It is very encouraging to see responses from as many as 16 Asian countries, considering the fact that this study was conducted under extraordinary circumstances during the COVID-19 pandemic. The 1000 responses received had indeed exceeded the expectations of the research team.
The sample has an average age of 42 years and is rather balanced in terms of gender, i.e., 54 % female, 45 % male, 0.1 % other, 1 % prefer not to say. Half of the respondents listed post-graduation as the highest educational level, followed by 40 % with tertiary education and 10 % with secondary school or lower. Regarding their primary position at the university, almost three quarters of the respondents are students, followed by 15 % of lecturers/professors, 5 % of administrative staff and 5 % researchers. Other indicated positions are staff workers at the institution.
To determine the HEIs' commitment towards the sustainable use of resources as sustainable organisations, as places of knowledge multipliers for SD, and as places for research and think tanks for a sustainable society, one sample Student's *t*-test was employed. A mean score of '3.5' (μ_0 = 3.5) was set as the minimum score indicator of commitment, knowledge multiplier

and as a think tank. In addition to the analysis of the overall data set, the data from the individual countries, with 30 or more responses, was also analysed, aiming to trace country-based differences in the responses.

4. Results

The results of both the bibliometric analysis and survey are presented in this section of the paper and are subsequently discussed in Section 5.

4.1 Bibliometric Analysis

The term co-occurrence analysis shows that, in addition to the search terms (e.g., sustainability, universities, and education), other terms such as China, behaviour, climate change, performance, management, knowledge, model, systems, perceptions, innovation, policy, challenges, environmental sustainability, technology, and GHG emissions have occurred more frequently. In addition to the dominance of China in this area (Niu et al., 2010, Yuan and Zuo, 2013, Wang et al., 2020), this indicates that sustainability practices at HEIs in Asia have a special focus on issues related to climate change (Perkins et al., 2018, Scholz et al., 2021), perception and behaviour (Janmaimool and Khajohnmanee, 2019, Yu et al., 2017, Sivapalan, 2016, Sivapalan, 2017, Ariffin and Ng, 2020, Kanapathy et al., 2019), knowledge management and knowledge economy (Parveen et al., 2021, Sutrisno and Pillay, 2015), technologies and innovation (Lee, 2012, Uwasu et al., 2009, Yoon et al., 2016), and challenges and barriers to ESD (Mian et al., 2020, Sekhar, 2020).

As for thematic clusters, three major clusters can be identified. The red cluster at the bottom of Figure 2 shows that there has been major emphasis on issues related to the efficient management of water and energy resources and on developing innovative scientific solutions that can contribute to climate change mitigation efforts (Ishak et al., 2016, Kuehr, 2007). This includes focus on issues such as knowledge creation, mainstreaming sustainable resource consumption at universities (Anwar et al., 2020, Ishak et al., 2016), promoting collaboration for fostering innovative research (Cai et al., 2019, Yao and Steemers, 2009), measuring and tracking performance using models and indicator frameworks (Ding et al., 2019, Jauhar et al., 2018), and investment in campus sustainability programmes, discussed under the green cluster.

Closely linked with the previous cluster, the right side of the green cluster shows that special attention has been paid to environmental sustainability initiatives such as campus sustainability programmes (Anthony Jnr, 2020, Tan et al., 2014, Yusoff et al., 2021, Tiyarattanachai and Hollmann, 2016, Ikegami and Neuts, 2020). Such campus sustainability and living lab initiatives can also provide societal benefits and promote sustainability by engaging different community stakeholders and enhancing community knowledge and awareness (Tiyarattanachai and Hollmann, 2016, Zhu et al., 2020). Terms on the left side of the cluster indicate that behaviour change and awareness-raising benefits of sustainability and environmental education (EE) are also widely recognised. In fact, it is likely that the enhanced environmental awareness will lead to pro-environmental behaviour (Janmaimool and Khajohnmanee, 2019, Yu et al., 2017).

Finally, the blue cluster, which includes less frequently occurring terms, is mainly focused on challenges and barriers to the adoption and implementation of ESD programmes. One noteworthy challenge is a paradigm shift towards a multi- and trans-disciplinary curriculum that is aligned with the sustainability agenda and requires a balanced coverage of different issues (Down, 2006, Qu et al., 2020). Other potential barriers could be budget limitations for curriculum reform and teacher training, lack of previous experiences and limited real world examples, limited mechanisms for experience sharing, and also students' preference for traditional disciplinary courses (Aleixo et al., 2018, Down, 2006, Rampasso et al., 2019, Weiss

and Barth, 2019). Finally, evidence shows that Asian universities are not appropriately oriented towards corporate social sustainability principles, and this may have negative effects on efforts aimed at integrating sustainability education into university programmes (Rehman et al., 2019).

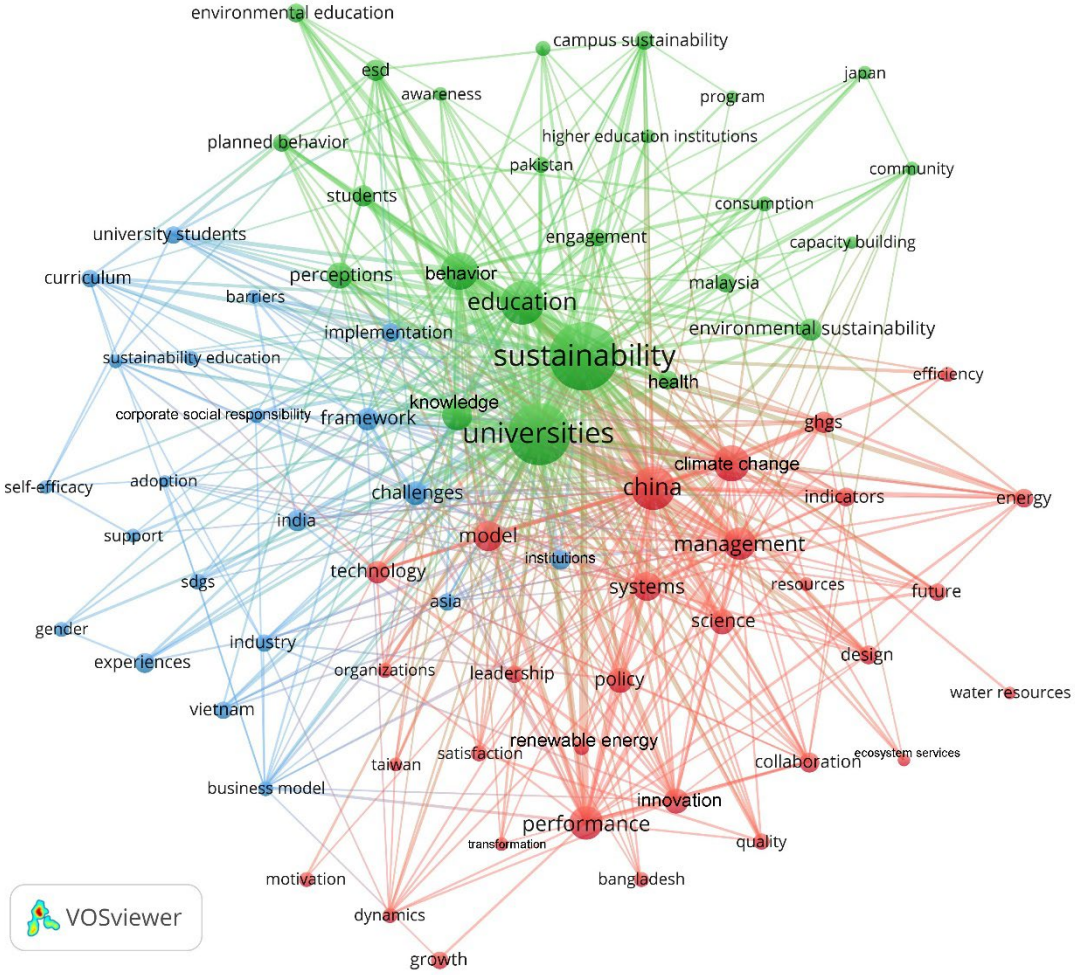


Figure 2. Bibliometric clusters for co-occurrence term

4.2 Survey

In addition to the bibliometric analysis, an empirical survey with the stakeholders from universities in Asia was carried out. The survey's goal was to gather stakeholder perspectives on Asian HEIs' commitment to sustainability, their role as knowledge multipliers for SD, their role in advocating research and development and critically thinking about sustainability, and the various challenges that Asian HEIs face. The survey data was analysed in accordance with the study parameters described in the introductory section of the results, and later, in the discussion. The survey analysis was conducted to determine the following:

1. Sustainability Initiatives in Asian HEIs
2. Commitment towards a sustainable use of resources
3. Commitment towards a sustainable organisation
4. HEIs as knowledge multipliers for SD
5. HEIs as places for research and as think tanks for a sustainable society
6. Perceived challenges to the efforts of implementing sustainability-related initiatives in HEIs

7. Perceived drivers for the implementation of sustainability-related initiatives at HEIs

The results of the survey analysis are presented below and discussed in the following section, at the light of the relevant literature on the subject.

4.2.1 Sustainability Initiatives in Asian Higher Education Institutions

The data analysis (Table 3 and Figure 3) indicate that the study respondents strongly perceive that HEIs in Asia have implemented sustainability initiatives with reference to having a SD policy, a sustainability office, sustainable campus programme, and to publishing about sustainability, supporting SDGs, advancing sustainability, and participating in sustainability rankings.

Table 3. Sustainability initiatives at Asian Higher Education Institutions (%)

Item	Yes	No
My university has a Sustainable Development Policy	89.7	10.3
My university has a Green/Sustainability office	80.9	19.1
My university has a Campus Greening/Sustainable Campus Program	89.6	10.4
My university has Sustainability/Environmental Education Programs	87.1	12.9
My university periodically publishes Sustainability Reports	76.5	23.5
My university supports the Sustainable Development Goals (SDGs)	94.0	6.0
My university has taken measures to pursue sustainability in procurement	86.4	13.6
My university participates in Green/Sustainability rankings	86.4	13.6
Overall	86.32	13.68

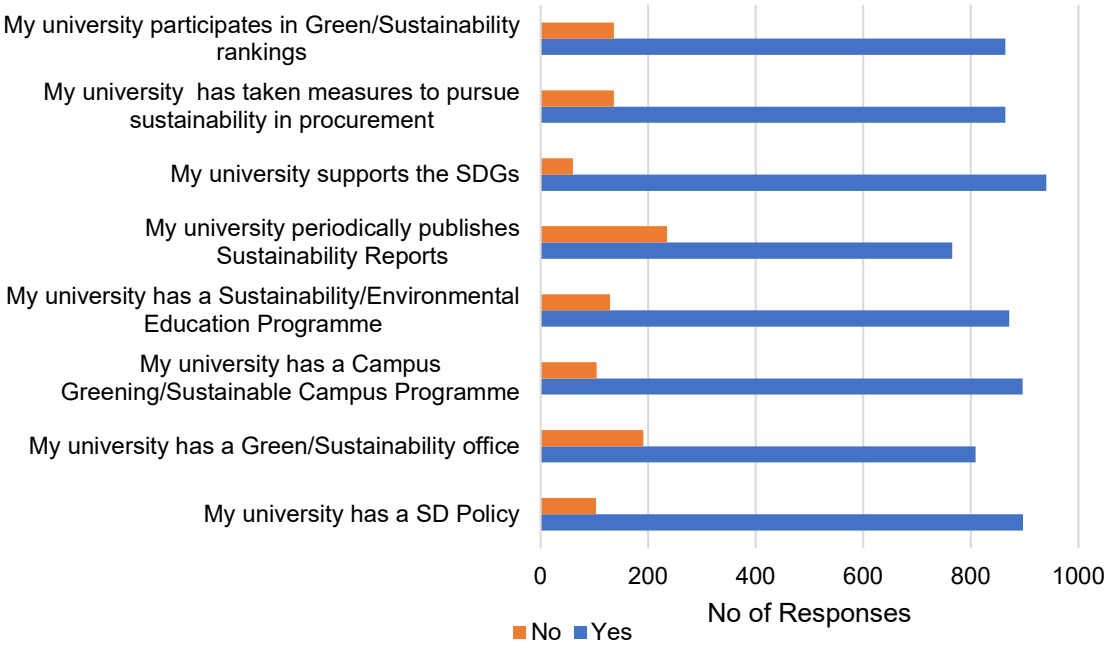


Figure 3. Sustainability initiatives in Asian Higher Education Institutions

Although the overall responses (86.32 %) suggest that HEIs in Asia have taken on sustainability initiatives, responses from Bangladesh and Pakistan do not suggest the same. The country-specific data indicate that only 56.79 % respondents from Bangladesh and 54 % respondents from Pakistan perceive that their universities have taken on initiatives for sustainability. Moreover, only 36 % respondents from Bangladesh and 45 % from Pakistan maintained that their HEIs publish sustainability reports.

4.2.2 Commitment Towards a Sustainable Use of Resources

The data analysis in Table 4 indicates that the perceived commitment of Asian HEIs towards a sustainable use of resources is less than the expectations. However, the country-specific analysis in the same Table 4 indicates that HEIs in Indonesia, Malaysia and Thailand are perceived as being committed towards the sustainable use of resources. The situation is different in Bangladesh and Pakistan, where HEIs are not perceived as committed towards the sustainable use of resources.

Table 4. Commitment towards a sustainable use of resources in Higher Education Institutions (HEIs)

Country		**Mean Score, *t*-test value and interpretation**
Asian Countries	Mean Score	$\mu_1 = 3.39$
	t-test value	$t\ (999) = 3.168$
	Interpretation	Perceived commitment of HEIs towards sustainable use of resources is LESS than the expectations.
Bangladesh	Mean Score	$\mu_1 = 2.15$
	t-test value	$t\ (91) = 12.966$
	Interpretation	Perceived commitment of HEIs towards sustainable use of resources is LESS than the expectations.
Indonesia	Mean Score	$\mu_1 = 3.64$
	t-test value	$t\ (487) = 3.056$
	Interpretation	Perceived commitment of HEIs towards sustainable use of resources is HIGHER than the expectations.
Malaysia	Mean Score	$\mu_1 = 3.47$

	t-test value	*t* (262*)* = 0.462
	Interpretation	Perceived commitment of HEIs towards sustainable use of resources is HIGHER than the expectations.
Pakistan	Mean Score	μ_1 = 2.6
	t-test value	*t* (66) = 6.02
	Interpretation	Perceived commitment of HEIs towards sustainable use of resources is LESS than the expectations.
Thailand	Mean Score	μ_1 = 4.18
	t-test value	*t* (30) = 5.2
	Interpretation	Perceived commitment of HEIs towards sustainable use of resources is HIGHER than the expectations.

4.2.3 Commitment Towards a Sustainable Organisation

The data analysis in Table 5 indicates that the perceived commitment of Asian HEIs towards a sustainable organisation is above the expectations. However, the country-based analysis in the same Table 5 indicates that HEIs in Pakistan are not perceived as being committed towards a sustainable organisation.

Table 5. Perceived commitment of Higher Education Institutions (HEIs) towards a sustainable organisation

Country	**Mean Score, *t*-test value and interpretation**	
Asian Countries	Mean Score	μ_1 = 3.996
	t-test value	*t* (999) = 18.04
	Interpretation	Perceived commitment of HEIs towards a sustainable organization is ABOVE the expectations.
Bangladesh	Mean Score	μ_1 = 3.32
	t-test value	*t* (91) = 1.85
	Interpretation	Perceived commitment of HEIs towards a sustainable organization is UP to the expectations.
Indonesia	Mean Score	μ_1 = 4.21
	t-test value	*t* (487) = 21.58
	Interpretation	Perceived commitment of HEIs towards a sustainable organization is ABOVE the expectations.
Malaysia	Mean Score	μ_1 = 3.996
	t-test value	*t* (262) = 9.24
	Interpretation	Perceived commitment of HEIs towards a sustainable organization is ABOVE the expectations.
Pakistan	Mean Score	μ_1 = 3.243
	t-test value	*t* (66*)* = 2.12
	Interpretation	Perceived commitment of HEIs towards a sustainable organization is NOT UP to the expectations.
Thailand	Mean Score	μ_1 = 4.37
	t-test value	*t* (30) = 8.78
	Interpretation	Perceived commitment of HEIs towards a sustainable organization is ABOVE the expectations.

4.2.4 Higher Education Institutions as Knowledge Multipliers for Sustainable Development

The data analysis in Table 6 indicates that HEIs in Asia are perceived as knowledge multipliers for SD. However, country-specific analysis in Table 6 indicates that HEIs in Bangladesh and Pakistan are not perceived as knowledge multipliers for SD.

Table 6. Higher Education Institutions (HEIs) as knowledge multipliers for sustainable development (SD)

Country	Mean Score, *t*-test value and interpretation	
Asian Countries	Mean Score	$\mu_1 = 3.75$
	t-test value	$t\ (999) = 8.77$
	Interpretation	HEIs are HIGHLY perceived as knowledge multipliers for SD.
Bangladesh	Mean Score	$\mu_1 = 3.07$
	t-test value	$t\ (91) = 4.14$
	Interpretation	HEIs are NOT knowledge multipliers for SD.
Indonesia	Mean Score	$\mu_1 = 3.92$
	t-test value	$t\ (487) = 11.36$
	Interpretation	HEIs are HIGHLY perceived as knowledge multipliers for SD.
Malaysia	Mean Score	$\mu_1 = 3.797$
	t-test value	$t\ (262) = 5.78$
	Interpretation	HEIs are HIGHLY perceived as knowledge multipliers for SD.
Pakistan	Mean Score	$\mu_1 = 3.02$
	t-test value	$t\ (66) = 3.81$
	Interpretation	HEIs are NOT knowledge multipliers for SD.
Thailand	Mean Score	$\mu_1 = 4.42$
	t-test value	$t\ (30) = 8.42$
	Interpretation	HEIs are HIGHLY perceived as knowledge multipliers for SD.

4.2.5 Higher Education Institutions as Places for Research and as Think Tanks for a Sustainable Society

The data analysis in Table 7 indicates that HEIs in Asia are perceived as places for research and as think tanks for a sustainable society. The country-specific analysis in Table 7 indicates that respondents from Bangladesh and Pakistan do not perceive their universities as places for research and as think tanks for a sustainable society.

Table 7. Higher Education Institutions (HEIs) as places for research and as think tanks for a sustainable society

Country	Mean Score, *t*-test value and interpretation	
Asian Countries	Mean Score	$\mu_1 = 3.86$
	t-test value	$t\ (999) = 11.76$
	Interpretation	HEIs are HIGHLY perceived as places for research and think tanks for a sustainable society.
Bangladesh	Mean Score	$\mu_1 = 3.07$
	t-test value	$t\ (91) = 4.046$
	Interpretation	HEIs are NOT perceived as places for research and think tanks for a sustainable society.
Indonesia	Mean Score	$\mu_1 = 4.13$
	t-test value	$t\ (487) = 17.25$
	Interpretation	HEIs are HIGHLY perceived as places for research and think tanks for a sustainable society.
Malaysia	Mean Score	$\mu_1 = 3.84$
	t-test value	$t\ (262) = 6.37$

	Interpretation	HEIs are HIGHLY perceived as places for research and think tanks for a sustainable society.
Pakistan	Mean Score	$\mu_1 = 2.887$
	t-test value	$t\,(66) = 4.45$
	Interpretation	HEIs are NOT perceived as places for research and think tanks for a sustainable society.
Thailand	Mean Score	$\mu_1 = 4.53$
	t-test value	$t\,(30) = 9.56$
	Interpretation	HEIs are HIGHLY perceived as places for research and think tanks for a sustainable society.

4.2.6 Perceived Challenges to the Efforts of Implementing Sustainability-related Initiatives in Higher Education Institutions

The data analysis (Figure 4) indicates that the lack of funding is perceived as a major challenge to implementing sustainability-related initiatives in Asian universities. The second most common challenge identified by the respondents is the lack of interest from students, followed by the lack of resources. Lack of support from the administration appeared to be the least identified challenge.

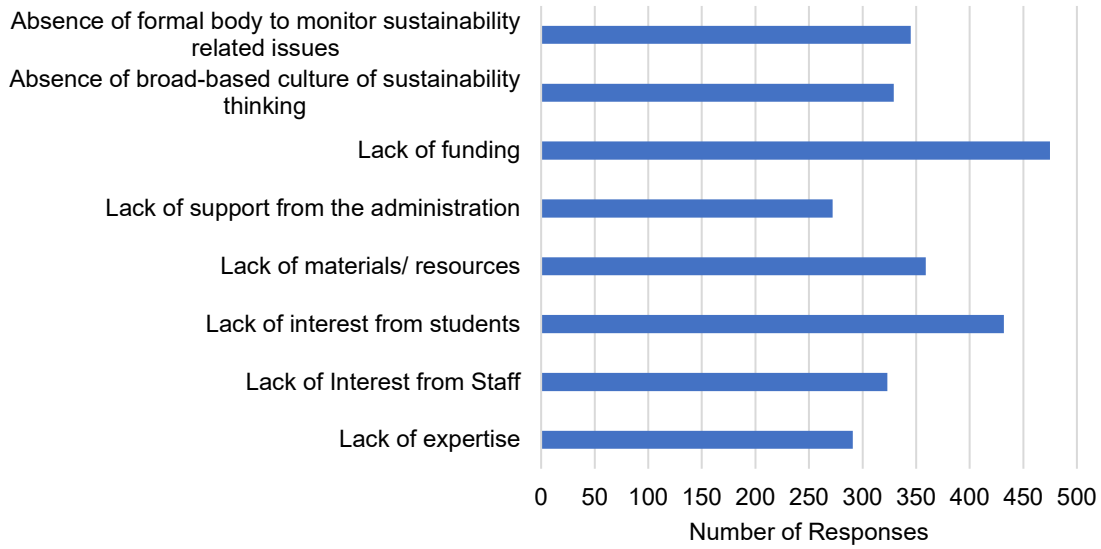


Figure 4. Challenges for implementing sustainability in Higher Education Institutions in Asia

The country-based analysis (Figure 5) indicates that 7 of the 8 mentioned challenges received maximum responses from Bangladesh, indicating that the implementation of SD at HEIs in Bangladesh is very challenging. It is also interesting to note that a relatively small percentage of respondents from Thailand highlighted different challenges.

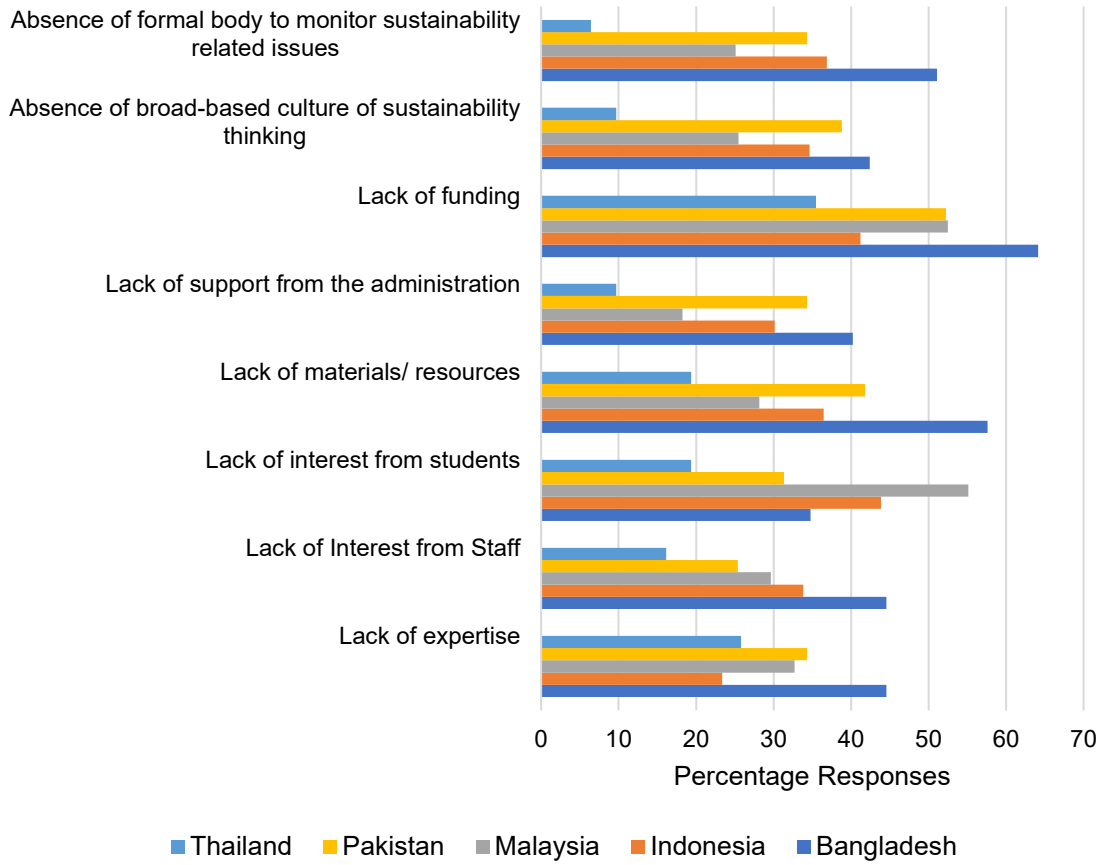


Figure 5. Challenges for Implementing sustainability in Higher Education Institutions in Bangladesh, Indonesia, Malaysia, Pakistan and Thailand

4.2.7 Perceived Drivers for the Implementation of Sustainability-related Initiatives at Higher Education Institutions

Figure 6 indicates that the most important driver for implementing sustainability initiatives in Asian universities is the increased attractiveness to students, followed by sustainability culture among stakeholders and the possibilities to reduce costs. Favourable legislation was the least identified driver in the complete data set. However, it turned out to be the second most important perceived driver among Pakistani respondents (Figure 7). The respondents from Bangladesh (Figure 7) named ‘benefits to the organisation' as the most important driver, followed by ‘cost-cutting opportunities’. The respondents from Indonesia (Figure 7) perceived ‘sustainability culture among stakeholders’ as the major driver for implementing sustainability in their universities.

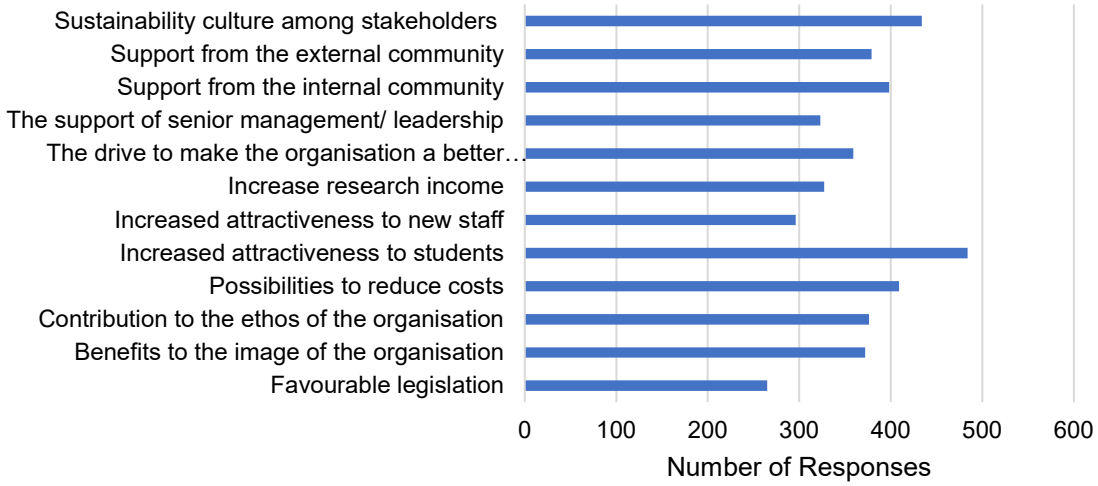


Figure 6. Drivers for implementing sustainability in Higher Education Institutions in Asia

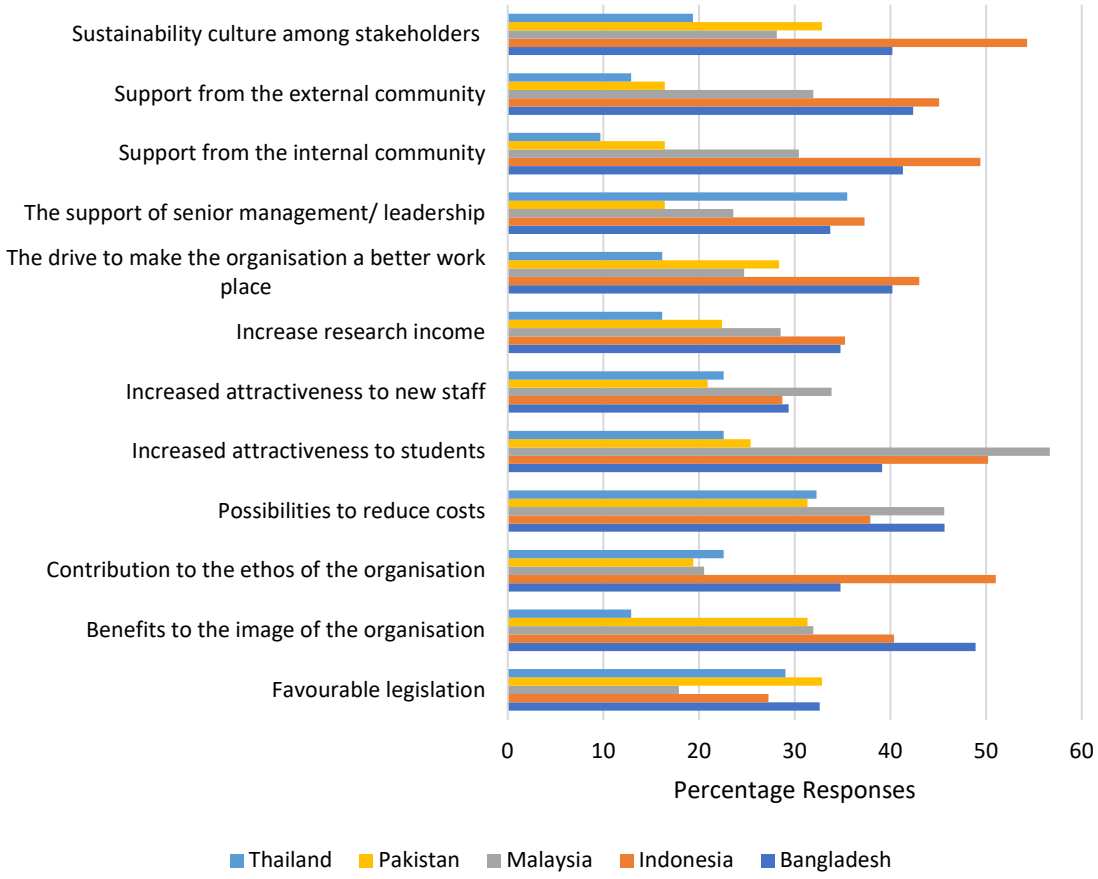


Figure 7. Drivers for implementing sustainability in Higher Education Institutions in Bangladesh, Indonesia, Malaysia, Pakistan and Thailand

5. Discussion

The results of the bibliometric analysis showed that sustainability at HEIs in Asia are dominated by issues related to climate change and efficient management of resources for climate adaptation and mitigation (Perkins et al., 2018, Scholz et al., 2021, Ishak et al., 2016, Kuehr, 2007). This indicates that universities in the region have made good contributions to training experts and policy makers that can lead efforts towards developing and implementing climate action plans. In terms of multiple sustainability dimensions, it was found that more attention has been paid to the environmental dimension and social, economic, and institutional dimensions have received relatively less attention. While environmentally-focused programs such as green campus initiatives, and living labs (Anthony Jnr, 2020, Tan et al., 2014, Yusoff et al., 2021, Tiyarattanachai and Hollmann, 2016, Ikegami and Neuts, 2020) are important for achieving sustainability (Tiyarattanachai and Hollmann, 2016, Zhu et al., 2020), the other dimensions are also important and deserve more attention. In fact, simultaneous consideration of socio-economic and institutional dimensions is critical for maximizing the benefits of environmentally-focused programs and to ensure that they could be scaled up. The bibliometric analysis also highlighted major barriers towards integrating sustainability paradigms into HEIs in Asia. Noteworthy barriers are dominance of disciplinary programs, lack of budget for curriculum reform, and students' preference for traditional disciplinary courses (Aleixo et al., 2018, Down, 2006, Rampasso et al., 2019, Weiss and Barth, 2019). While paradigm shifts at the level of university level are essential for addressing such barriers, it is clear that universities alone would not be capable of addressing all issues involved in SD. Institutional support and market reforms are also needed and should be prioritized.

The results of the survey indicate that there is considerable variation among the Asian countries regarding sustainability practices in HEIs. The HEIs in far eastern countries such as Indonesia, Malaysia and Thailand are perceived to demonstrate more sustainability practices. The mean scores of the responses from these countries were higher than the expectations, i.e., a mean score of 3.5. This indicates that HEIs in these countries have a commitment towards a sustainable use of resources and a commitment towards a sustainable organisation, act as knowledge multipliers for SD, and serve as places for research and as think tanks for a sustainable society. These findings augur well with the notion of HEIs as catalysts for the advancement of SD and ESD, and they support previous research conducted in Malaysia, Indonesia, and Thailand (Tangwanichagapong et al., 2017, Tiyarattanachai and Hollmann, 2016). On the contrary, the mean scores of responses from Pakistan were lower than the expectations in the above-mentioned aspects. Similarly, the mean scores are lower in three out of four aspects in Bangladesh.

The high mean scores in Indonesia and Malaysia in particular may be explained in light of existing literature by Nomura (2009) and Shaikh et al. (2017). Focus on EE in Indonesian education dates back to 1996 when an EE network was established in Indonesia. In 1998, forty-five organisations made a strategy and action plan to promote EE in Indonesia. As of 2009, there were 200 organisations working for EE (Nomura, 2009). A strong focus on EE in Indonesia might have influenced the higher education sector to take initiatives towards sustainability, especially when participating in the UN's decade of ESD, which meant that the entire HEIs' curricula would be adapted to contemplate EE with a focus on the needs of society, environment, economy and culture (Parker, 2017).

In Malaysia, sustainability-related initiatives can be witnessed at the governmental level as well as within the higher education sector. Foo (2013) highlighted that Malaysian universities (e.g., USM, Universiti Putra Malaysia, Universiti Malaysia Pahang, Monash University, Malaysia) are committed towards sustainability. The same author states that USM has mechanisms to protect the multiple ecosystems and conserve resources. In addition, the universities are committed to including sustainability elements in their courses, and there is an increase in university publications regarding sustainability and climate change (Foo, 2013). The findings from the current study also confirm that HEIs in Malaysia are committed to sustainability practices, mainly by making issues about sustainability more attractive to their students. This is further supported by previous studies conducted in both public and

private HEIs in Malaysia (Sivapalan, 2016, Sivapalan, 2017, Kanapathy et al., 2019, Yusoff et al., 2021).
Thailand has a national roadmap on sustainable consumption and production and has implemented green product procurement through governmental organisations and universities. In addition, compulsory EE in schools is a part of the 20-year National Strategy of Thailand (Mungkung et al., 2021). It is also important to note that this implementation process could be faster if the region had greater financial support, since the lack of it was mentioned as one of the biggest challenges. National level policies related to green consumption and production and education could be the reasons for sustainability practices at HEIs in Thailand, as shown in the current study.
Contrary to Indonesia, Malaysia and Thailand, sustainability education or EE have not been emphasised at the policy level in Pakistan (Kalsoom et al., 2017). As a result, there is little evidence of sustainability practices with reference to sustainability-focused curricula, research, stakeholder's engagement, and governance (Habib et al., 2021). The results of the current study are in line with the findings of Habib et al. (2021) and Zahid et al. (2020). It is also important to note that although there are fragmented efforts regarding the incorporation of sustainability-focused pedagogical interventions in HEIs in Pakistan (Kalsoom and Qureshi, 2021, Nousheen et al., 2020, Kalsoom and Khanam, 2017), the findings from the current study indicate that these interventions are scarce and not enough to shape the HEIs as places for research and as think tanks for a sustainable society. One of the practices used is the adaptation of curricula with the aim of making students more participatory, the same measure that is being taken in other countries, as previously mentioned in the case of Indonesia. Recent studies indicate that private universities in the country are more likely to offer education focused on sustainability due to the financial support they receive, the infrastructure, the ability to make decisions in a shorter period, and the ease of promoting changes, reforms, or restructuring, unlike public universities that depend only on the support of public policies (Zahid et al., 2020).
This study's findings further support earlier research in the context of Bangladesh (Hoque et al., 2017). The researchers found that environmental sustainability practices were very limited in institutions of Bangladesh. Green practices are used by a small fraction of universities to enhance sustainability. The present study's findings also reveal a lack of sustainability strategies in Bangladesh's HEIs. The study's findings thus indicate that the respondents from Bangladesh identified maximum challenges regarding the implementation of SD initiatives in HEIs. This explains the reasons for the lower mean score values of Bangladesh in the different aspects of sustainability (Tables 4 to 7). As a result, a new national higher education policy framework is urgently needed, one that is backed up by cross-ministerial collaboration on SDGs and ESD. Given the importance of the SDGs' and ESD's aims, a redesigned national higher education policy framework should address topics like the sustainability issues, the role of innovation, and the policy framework for the green revolution as soon as possible (Alam et al., 2021).
This study, which focuses on sustainability practices in Asian HEIs, provides a number of lessons for higher education advancement for SD in the global and Asian contexts.
Firstly, the empirical evidence shows a substantial degree of involvement by Asian universities in this fundamentally important area of scholarship. This evidence goes further to suggest the increasing need for Asian perspectives and voices to be heard and recognised in international dialogues and platforms on ESD within the global higher education landscape. The results of this study also suggest that there are varying degrees of acceptance and advancement of sustainability practices within the Asian higher education system.

6. Conclusions

This study represents an attempt to foster a better understanding of how sustainability issues are perceived and considered by HEIs in Asia. This research has allowed to identify the fact

that various degrees of emphasis are attached to sustainability, with quite high levels of responses about the degree to which universities are active in this area.
Regarding the perceived commitment towards SD, the country-based analysis involving Bangladesh, Indonesia, Malaysia, Pakistan and Thailand shows that countries such as Indonesia, Malaysia and Thailand are very active in this respect, whereas in Bangladesh and Pakistan the HEIs do not seem to have shown substantial engagement in this area. Such a negative trend is also seen in regard to how HEIs in Bangladesh and Pakistan perceive their roles as knowledge multipliers on SD. In all of the countries, a lack of funding seems to be a common problem that should be addressed.
The research has some limitations. One of them is the fact that it did not cover all Asian countries, even though it collected a significant number of responses from participants. A further limitation of the study is that there is a variation in the number of respondents between countries, possibly due to a wider promotion of the study in specific areas of knowledge. Also, the online survey was carried out over a specific period of time, and it is possible that some universities that are active in the field did not receive information about the study.
The originality of this study resides on the comprehensive instrument developed to assess the SD engagement observed in Asian HEIs currently, particularly relevant when considering this specific region with a scarcity of studies on the subject. To the best of the authors' knowledge, the information on the commitment of HEIs towards a sustainable use of resources, a sustainable organisation and whether HEIs see themselves as knowledge multipliers for SD are issues not tackled in previous studies in an integrated way. Additionally, the study did not only identify the problems and barriers to sustainability among HEIs in Asia, but also the drivers.
The implications of this paper are threefold. Firstly, it provides a comprehensive overview of how SD is seen and perceived among HEIs in Asia. Secondly, it illustrates the diversity of initiatives that are currently undertaken by universities in the region. Moreover, the study shows some of the constraints universities experience when pursuing SD-related initiatives.
Despite these constraints, the study succeeded in collecting information from 1,000 respondents from 16 Asian countries, a very significant and representative rate of responses. The research therefore provides a welcome addition to the literature, since it documents and promotes experiences on SD in Asian HEIs, identifying the differences seen between the addressed countries. It is suggested that further research in the region be advanced with specific cases, which may analyse specific related aspects such as curriculum innovation and campus greening.
In terms of implications for policy and practice, the study has identified some areas which need attention. For instance, while acknowledged that individual institutions should have their own strategic priorities and trajectories, sustainability should be a fundamental thought process and core component of all decision-making processes, institutional policies and practices. Although the findings of this research show that certain countries within the region have a slight advantage over others in terms of executing and advancing sustainability practices within its higher education system, ongoing work within countries that are not as well organised must not dismissed.
In terms of recommendations, one key component is that partnerships for sustainability education and capacity building in the region should be intensified. Also, as advocated by Shiel et al. (2016), efforts are recommended to facilitate a more inclusive participation of HEIs in sustainability efforts in Asia. In addition, cross-country activities aimed at enhancing resource access, professional development and knowledge sharing are also highly recommended. As a result of this research, it can be seen that Asian universities already play an important role in advancing SD and the Agenda 2030 goals. To enhance the impact of these initiatives, concerted and sustainably coordinated efforts amongst key stakeholders are required at all levels.

Competing Interests statement

The authors declare no competing interests.

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[some only relate Table 1: Lim et al. (2020)]

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