Fecha de presentación: marzo, 2022, **Fecha de Aceptación**: junio, 2022, **Fecha de publicación**: septiembre, 2022

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SUSTAINABILITY FRAMEWORK FOR ONLINE AND DISTANCE EDUCATION

MARCO DE SOSTENIBILIDAD PARA LA EDUCACIÓN EN LÍNEA Y A DISTANCIA

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Suggested citation (APA, seventh edition)

Harizan, S. H. M., & Shah, S. A. (2022). Sustainability framework for online and distance educa-tion. ***Revista Conrado, 18(88)***, 116-124.

ABSTRACT

The recent Covid-19 pandemic has drastically changed the higher education landscape and its future of achieving sustainability. There has been a surge in enrolment in online courses, and people have expressed greater enthusiasm for online-only options. While a few studies have looked at the impact of online and distance education on sustainability elements, little attention has been paid to the criteria of distance education that are economically, environmentally, and socially sustainable. This study considers the question of "How does online and distance education relate to sustainability?" and attempts to identify the criteria of online and distance education that are related to sustainability. Based on the Triple Bottom Line approach, this study employed a qualitative method by engaging several selected experts in Malaysia in a series of focus group discussions. The results extracted nine, seven, and fifteen criteria for online and distance education that can be categorized into the economic, environmental, and social pillars of sustainability, respectively. Social sustainability seemed to be the most prominent pillar in online and distance education. Future studies may further expand the applicability and operationally of the newly developed framework.

Keywords:

Distance education, ODL, online education, SDG, Triple Bottom Line.

RESUMEN

La reciente pandemia de Covid-19 ha cambiado drásticamente el panorama de la educación superior y su futuro para lograr la sostenibilidad. Ha habido un aumento en la inscripción en cursos en línea y la gente ha expresado un mayor entusiasmo por las opciones solo en línea. Si bien algunos estudios han analizado el impacto de la educación en línea y a distancia en los elementos de sostenibilidad, se ha prestado poca atención a los criterios de educación a distancia que son económica, ambiental y socialmente sostenibles. Este estudio considera la pregunta "¿Cómo se relaciona la educación en línea y a distancia con la sostenibilidad?" e intenta identificar los criterios de la educación en línea ya distancia que se relacionan con la sostenibilidad. Basado en el enfoque Triple Bottom Line, este estudio empleó un método cualitativo al involucrar a varios expertos seleccionados en Malasia en una serie de discusiones de grupos focales. Los resultados extrajeron nueve, siete y quince criterios para la educación en línea y a distancia que se pueden clasificar en los pilares económico, ambiental y social de la sostenibilidad, respectivamente. La sostenibilidad social parecía ser el pilar más destacado en la educación en línea ya distancia. Los estudios futuros pueden ampliar aún más la aplicabilidad y la operatividad del marco recientemente desarrollado.

Palabras clave:

Educación a distancia, ODL, educación en línea, SDG, Triple Bottom Line

INTRODUCTION

Distance education programmes have been proven to meet the needs of learners, particularly lifelong learners, and these programmes have reported a steady increase in enrolment throughout the years (Ministry of Education, Malaysia, 2015). Besides providing a competitive advantage for its providers, distance education also creates various learning opportunities that are not available through conventional learning, either locally or internationally. The recent Covid-19 pandemic has further intensified the emergence of online learning and will have a long-term impact on the higher educational landscape. Travel restrictions and mandates to stay at home for safety have created a conducive environment for online and distance learning for learners. A surge in enrolment in online courses since March 2020 has been recorded (Impey, 2020), whereby people aged 25 to 49 expressed greater enthusiasm for online-only options than people aged 18 to 24 or 50 and older (McKenzie, 2020).

In the current situation, the frequent use of the internet has created a great opportunity for higher education providers to use online and distance education platforms. As of April 2022, there were 5 billion internet users worldwide, which is 63 percent of the global population, 4.65 billion of which were social media users (Johnson, 2022). The percentage of Malaysia's population using the internet increased by 5.4, from 84.2 in 2019 to 89.6 in 2020. The same trend was recorded for computer use, as individuals using computers increased by 7.9 percent, from 72.1 percent in 2019 to 80.0 percent in 2020; the percentage of individuals using mobile phones was recorded at 98.2 in 2020 (Department of Statistics Malaysia, 2021), which is almost a 100 percent penetration rate.

Together with the growing public participation in lifelong learning (Malaysia. Ministry of Higher Education, 2011), the contributions of developing communication technologies and the increasing demand for online and distance education due to changing lifestyles have created an educational niche opportunity to implement distance education as a supplementary rather than a distinctive solution. Online and distance education meets the needs of this digital generation, so it is undeniable that the essence of online and distance education nurtures sustainability. In this context, sustainability refers to a way of life that balances the immediate needs for commerce, living, habitation, food, transportation, energy, and entertainment with future needs for these resources.

Past studies have largely focused on the effectiveness of distance education in delivering lessons related to sustainable development (Bacelar-Nicolau et al., 2009; Azeiteiro et al., 2015). A few attempts have studied the impact of online and distance education on elements of sustainability, yet little attention has been given to the criteria or characteristics of distance education itself (Herring & Roy, 2002; Roy et al., 2008). The connection between sustainability and distance education can be further explored (Md Harizan & Hilmi, 2019, 2021). While past studies have largely focused on the characteristics of online and distance education in terms of its environmental dimension (Aleixo et al., 2018; Md Harizan et al., 2017), more work needs to be done to address other sustainability perspectives related to the online and distance education mode, particularly the economic and social pillars derived from the Triple Bottom Line approach (Elkington, 1994). Thus, this study considers the question of "How does online and distance education relate to sustainable development?" with the objective of identifying the attributes of online and distance education that can be related to the social, economic, and environmental pillars of sustainability.

Following the Brundtland Report, which was published by the World Commission on Environment and Development in 1987, the term "sustainable development" has come into the mainstream global agenda and formed important economic, social, and political aspects in the world today. Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Developmen, 1987). It requires a concerted effort by all nations to strike a balance between development and preserving global resources.

In 2015, the United Nations adopted its Sustainable Development Goals (SDGs) as part of an international initiative to stop poverty, protect the environment, and ensure peace and prosperity for everyone by 2030 (United Nations Development Programme, 2022). There are 17 SDGs: SDG1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well Being), SDG 4 (Quality Education), SDG 5 (Gender Equality), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 10 (Reduced Inequalities), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (Life Below Water), SDG 15 (Life on Land), SDG 16 (Peace, Justice and Strong Institutions), and SDG 17 (Partnerships for the Goals). Action in one area of the SDGs affects other areas' outcomes, which makes the SDGs integrated, and development is also integrated in the sense that

social, economic, and environmental sustainability must be balanced. In 2015, Malaysia, along with 193 other countries, expressed its commitment to supporting and implementing the 2030 Agenda and the SDGs at the United Nations General Assembly (UNGA 2015).

Sustainable development has also been an integral agenda in the Malaysia Education Development Plan (2001 – 2010) and continues to be part of the national commitment towards combating climate change for years to come. While distance education was found to be an important tool for achieving environmental preservation and sustainability (Campbell & Campbell, 2011; Md Harizan et al., 2017), the appeal of achieving sustainable development depends on the extent to which its implementation can address the shortcoming of past research that overlooked the economic and social aspects of online distance education settings, as its environmental aspects have received immense attention (Md Harizan et al., 2017). Thus, the notion of sustainable development within online and distance education settings should be further explored.

Distance education has a history that spans almost two centuries and has caused significant changes in the way learning occurs and is communicated. It is difficult to replace learning and teaching process and teachers' living word with any form of online teaching (Slovaček & Matkovič, 2020). Due to the advancement of information and communication technology (ICT), however; the lesson delivery and learning process can be facilitated with the aid of technology that makes learning easy via online education. Online and distance education was found to be an important tool that enables the achievement of environmental preservation and sustainability (Campbell & Campbell, 2011; Md Harizan et al., 2017). Online and distance education also serves as a platform on which the enculturation of lifelong learning can be achieved through the Blueprint on Enculturation of Lifelong Learning for Malaysia, 2011-2020 (Malaysia. Ministry of Education, 2015). The blueprint seeks to provide lifelong learning stakeholders with a road map to promote lifelong learning in Malaysia. Lifelong learning constitutes all learning activities undertaken throughout life with the aim of improving knowledge, skills, and competences within a personal, civic, social, and/or employment-related perspective (Gvaramadze, 2007). Lifelong learning is usually pursued by everyone aged 15 and above, except for professional students who are enrolled full-time in a school, college, or university to acquire academic qualifications or skills (Malaysia. Ministry of Higher Education, 2011). This segment forms the target group, also known as adult learners, who seek to improve their knowledge and socioeconomic status through online and distance education programmes.

Distance education forms the root from which open and distance learning (ODL) stems. ODL reflects both the fact that all or most teaching is conducted by someone removed in time and space from the learner and that its mission aims to include greater dimensions of openness and flexibility, whether in terms of access, curriculum, or other elements of structure. In ODL, the following characteristics are observed: the separation of teacher and learner in time and place; institutional accreditation; the use of mixed-media courseware involving two-way communication; the possibility of face-to-face meetings; and the use of industrialised processes. In the earliest form of distance education, the mediating technology was print- and mail-based, while more recent technology includes audio teleconferencing, video conferencing, computer-mediated conferencing (Saleh, 2018), and online-based platforms. To look into this evolution while preserving context, the term "online or distance education" will be used throughout this study.

Globally, the earliest distance education institutions include the University of South Africa (Unisa) and Anadolu University in Turkey, followed by the United Kingdom Open University (UKOU), England, Athabasca University (AU) in Alberta, Canada, Korea National Open University (KNOU), South Korea, the National University of Distance Education (UNED), Spain, the Allama Iqbal Open University (AIOU), Pakistan, and, later, the Open University of Sri Lanka (OUSL), the Open University of Japan (OUJ), National Open University, Taiwan, Universidade Aberta (UAb), Portugal, the Open Polytechnic of New Zealand (OPNZ), New Zealand, Al-Quds Open University (QOU), Palestine, the Open University of Hong Kong (OUHK), China, and the Arab Open University (AOU) (Saleh, 2018). Notable distance education providers in Southeast Asia include Sukhothai Thammathirat Open University (STOU), Thailand, Universitas Terbuka (UT), Indonesia, the University of Distance Education, Yangon (UDEY), Myanmar, Ho Chi Minh City Open University (HCMCOU), Vietnam, the University of Philippines Open University (UPOU), Philippines, and the School of Distance Education (SDE) at Universiti Sains Malaysia (USM), Malaysia.

In Malaysia, distance education dates back to 1971, when USM launched its first off-campus programmes by offering bachelor's degrees in both the arts and social sciences, which was later followed by programmes for bachelor's degrees in science (in 1973) and management (in 1997) (Saleh, 2018). At that time, USM was the only public university in Malaysia mandated by the Ministry of Education, Malaysia to offer distance education

programmes. Students were provided with printed lecture notes on campus and required to attend tutorials and practical sessions at regional centres specified by the Ministry of Education, Malaysia. The university hired tutors and instructors on a part-time basis, and students were required to reside on campus for approximately three intensive weeks in every year of their candidature. During these intensive weeks, students were required to attend face-to-face lectures, take continuous examinations, undergo practical sessions and consultations, and participate in other teaching and learning activities. In the early years, students were required to complete their final year of studies on campus. However, this practice is no longer in place, since students are no longer required to stay on campus for their final year, which has given them more flexibility in completing their studies.

In 1990, Universiti Teknologi MARA (UiTM) started its distance education programmes at the diploma and bachelor's degree levels. UiTM was followed by Universiti Kebangsaan Malaysia (UKM) in 1993, University Putra Malaysia (UPM) in 1995, Universiti Tun Abdul Razak (UNIRAZAK) in 1997, and Universiti Utara Malaysia (UUM) and Multimedia University (MMU) in 1998 (Saleh, 2018). The peak of distance education expansion was the launch of Universiti Terbuka Malaysia, or UNITEM, which was later known as Open University Malaysia or OUM, in 2000. The establishment of UNITEM/OUM was agreed upon by all the vice-chancellors and rectors of the eleven Malaysian public universities, namely, USM, Universiti Malaya (UM), Universiti Teknologi Malaysia (UTM), Universiti Islam Antarabangsa Malaysia (UIAM), Universiti Malaysia Sabah (UMS), UPM, UKM, UiTM, and Universiti Pendidikan Sultan Idris (UPSI), as a private consortium that coordinates the distance education programmes offered by every public university before UNITEM/OUM introduced its own programmes in 2001. Other private institutions that started to offer distance education programmes include the International Centre for Education in Islamic Finance (INCEIF) in 2005, Wawasan Open University (WOU) in 2006, the Al-Madinah International University (MEDIU) in 2006, and Asia e-University (AeU) in 2007.

In the democratisation of higher learning, distance education programmes in USM and UiTM are to remain as the government's social responsibility to its people (Saleh, 2018). Other public universities are essentially profit-oriented and charge tuition fees based on credits (Saleh, 2018). All academic programmes offered by distance education institutions are required to obtain accreditation from the Malaysian Qualification Agency (MQA), a body that governs the quality assurance of the higher learning institution system in Malaysia.

Distance education has been acknowledged in previous studies as a mechanism through which sustainable development can be achieved (Azeiteiro et al., 2015; Ramos et al., 2015). Nevertheless, studies that address the extent of the sustainability of online and distance education courses or programmes have been scarce. In past studies, a large amount of effort has been focused on the effectiveness of distance education in delivering education in terms of sustainable development (Bacelar-Nicolau et al., 2009; Azeiteiro et al., 2015; Md Harizan & Hilmi, 2019, 2021). Bacelar-Nicolau et al. (2009), evaluated the extent to which Master's programmes, comprising environmental and social sciences content, succeed in expanding students' awareness and knowledge through e-learning, while Azeiteiro et al. (2015), using a case study approach, conducted a descriptive analysis to assess the effectiveness of e-learning in delivering education in terms of sustainable development. The assessment of the programmes' sustainability remained complex and opened issues (Md Harizan & Hilmi, 2019). Moreover, insufficient attention has been given to the criteria or characteristics of online and distance education settings (Herring & Roy, 2002; Roy et al., 2008), so the relationship between sustainability and the operational assessment of online and distance education can be further understood (Md Harizan & Hilmi, 2019). The environmental perspective of sustainability has been overemphasized in attempts to conceptualise sustainability elements in online and distance education (Md Harizan et al., 2017), leaving avenues to define the other main sustainability pillars in these settings. Thus, it is important to further investigate the sustainability criteria that consist of social, economic, and environmental aspects within the settings of online and distance education.

Various sustainability models have been proposed, but it is common practice to 'model' or operationalise and understand sustainable development though its main pillars (Waas et al., 2011). The Triple Bottom Line approach outlines the three main pillars of sustainability, namely, the economic, environmental, and social pillars. The economic pillar deals with economic growth as an engine for long-term welfare creation to satisfy the essential needs for employment, income, food, energy, water, sanitation, social security, and consumption opportunities. The environmental pillar stresses environmental protection to conserve and enhance natural resources to keep them within the Earth's limits for the long term. The social pillar focuses on social justice to achieve an equal distribution of welfare, equal access to natural resources, and equal opportunities for people. The underlying criteria for online and distance education are expected to correspond with each sustainability pillar mentioned in the study.

The evaluation of online and distance education programmes is usually based on the quality assessment framework that looks into the elements that define its ideal criteria, such as teaching and learning support, infrastructure, educational technology, eLearning environment, instructors, students' expectations, learning style, course assessment, external stakeholders, and the reputation of the institution in addition to the motivation, satisfaction, versatility, and efficiency of its operation (Pinto de Moura, et al., 2010). In Malaysia, the quality of the assessed ODL programmes and courses is based on the Code of Practice for Programme Accreditation: Open and Distance Learning (COPPA-ODL) by the MQA (Malaysian Qualification Agency, 2019). The MQA looks into seven areas: programme development and delivery; assessment of student learning; student selection and support services; academic staff; educational resources; programme management; and programme monitoring, review, and continual quality improvement. Since online and distance education has much to do with electronic learning, the Malaysian National e-Learning Policy (DePAN) is relevant. To enable the implementation of e-learning initiatives, the DePAN outlines several criteria to assess the quality of e-learning, such as infrastructure, the structure of the organisation, curriculum and content, professional development, and enculturation.

In terms of sustainable development, past studies have incorporated sustainability criteria within their quality evaluation frameworks for higher educational institutions (Stephens et al., 2008; Figueiró & Raufflet, 2015; Wessel et al., 2019) but few focus on online and distance education settings (Md Harizan & Hilmi, 2021). Since the quality assessment of electronic learning settings is crucial in attaining the sustainable development goals of online and distance education, the DePAN's evaluation criteria were referred to in order to build an initial framework that outlines the criteria that can assess the sustainability level for online and distance education programmes. This framework suggested comprehensive elements to evaluate the criteria for online and distance education: infrastructure, the structure of the organisation, curriculum and content, professional development, and enculturation. As a valuable element added to the current practice of assessing the quality of education delivered electronically, enculturation emphasises the process that teaches individuals their society's accepted cultural norms and values (Malaysia. Ministry of Higher Education, 2011). Thus, based on the previously mentioned pillars and frameworks, this study attempts to generate and propose sustainability criteria for each attribute of online and distance education.

MATERIALS AND METHODS

This study employed a qualitative method to elicit criteria for distance education that can be related to the sustainability pillars. A discussion guide comprised of semi-structured questions was developed based on the main operational aspects of distance education and the three pillars of sustainability. The discussion guide's face validity was done by consulting with team member experts.

In the next stage, fifteen field experts who handle online and distance education programmes in their respective public universities which are prominent in online and distance education, namely, the University of Malaya Centre for Continuing Education (UMCCED), the Institute of Continuing Education & Professional Studies (iCEPS), and the SDE, were selected to be interviewed in separate online focus group discussion (FGD) sessions. The selection of participant is based on the purposive sampling. The lists of experts were acquired from the administrative office in their respective universities. Inclusion criteria for the participants in order to qualify as the field experts are academician, attached to or employed in their current universities, and have good track records in teaching and publication or leadership in the online and distance education field. The first FGD session was performed with participants from UMCCED in November 2021, followed by participants from the iCEPS in February 2022 and the SDE in April 2022. The video recordings of the FGDs were later transcribed and examined using thematic analysis.

Deductive coding was employed during the data analysis. It is a top-down approach whereby a codebook was created based on the initial set of codes which were developed based on the three main sustainability pillars; economic, environmental and social and attributes as outlined in the National e-Learning policy (DePAN). The data derived from FGDs' transcripts were analysed and the excerpts were assigned to codes. The process was repeated until there are no new excerpts that can be assigned to codes. Feedback from other researchers was obtained to validate the emerging items and themes that later newly formed the criteria for the sustainability of online and distance education.

RESULTS AND DICUSSION

The study's results suggested a set of themes that adhere to criteria for distance education that relate to each pillar of sustainability. The themes were formed as criteria that fulfilled the framework for assessing the deployment of e-learning in terms of the three pillars of sustainability. The results extracted nine, seven, and fifteen criteria for online and distance education that can be categorised into the economic, environmental, and social pillars of sustainability, respectively (Table 1).

Table 1. Grouping of online and distance education criteria into economic, environmental, and social dimensions of sustainability.

Sustainability Pillars	Criteria for distance education
Economic	1. Reasonable and efficient cost to installing, maintaining, and upgrading bandwidth. 2. Availability of sustainability-related start-ups, training in online or distance learning, credit given in service-learning activities that involve students in community service activities and applying the experience to personal and academic development taking place outside the higher educational institution. 3. University budget for the sustainability effort via distance education settings. 4. Research funding related to sustainability in distance education. 5. Availability and reasonable budget allocation for the e-learning unit/team which provides institutional support for learning design. 6. Cost reduction associated with travelling to the classroom (staff and students). 7. Lower break-even point for institutional finances. 8. Higher income or socioeconomic status after student graduation. 9. Graduate employability is satisfactorily.
Environmental	1. Energy conservation policies and implementation. 2. The availability of interoperability, for example: (a) external open sites (e.g., social media, DropBox, Google Drive); (b) learning management systems; (c) exchange of information and teaching/learning materials (e.g., SCORM); (d) single sign-on access control. 3. Green ICT implementation. 4. Utilisation of energy-efficient infrastructure/appliances. 5. Implementing smart building. 6. Greenhouse gas emission reduction due to less travel required to the classroom. 7. Paperless policy and its implementation.
Social	1. Bandwidth speed capacity, bandwidth access, and e-learning platform utilisation are satisfactory for users. 2. Security and safety features of e-learning platforms and data. 3. E-learning platform utilisation is satisfactory. 4. The availability of original e-content and e-assessment deployment is satisfactory. 5. Student satisfaction regarding the adequacy of the pedagogical approaches adopted for the learning objectives. 6. Student satisfaction regarding learning materials. 7. Student and teacher satisfaction regarding performance reports. 8. Student satisfaction regarding interactions with teachers and tutors. 9. E-learning activities and practice are evident; e-learning enculturation and recognition mechanism is satisfactory. 10. Impactful e-learning activities for students. 11. The resulting ICT skills and literacy are satisfactory. 12. University-run sustainability website/social media availability. 13. Flexible professional development for staff. 14. Flexible learning environment. 15. Equal education opportunities for all.

Because of the extensive focus on the effectiveness of distance education in delivering lessons related to sustainable development and the few attempts to define the essence of sustainability elements within the criteria of distance education, this study aims to identify criteria for online and distance education that can be related to the economic, environmental, and social pillars of sustainable development. Looking into past studies which hardly merged between these notions, the findings provided an integrative perspective in which the landscape of higher education institution can be further defined by having sustainability elements 'weaved' into the effectiveness criteria for open and distance education. From sustainability viewpoints, the study has further outlined the relevant areas as highlighted by Stephens et al. (2008), for higher education institutions to be the change agents for sustainability namely financing, organisational structure, accessibility, and transparency in obtaining higher education, communication and information dissemination situation from high-level strategic level concerns and decisions to mid-level tactical decisions, and to more detailed operational-level planning.

Online and distance education exhibited several criteria that contributed towards economic sustainability, such as requiring a reasonable and efficient infrastructural cost of infrastructure to operate programmes, encouraging the availability of sustainability-related start-ups, training in online or distance learning, giving credits in service-learning activities, and exhibiting the allocation of the university budget for sustainability efforts via distance education settings. The reasonable budget allocation for the e-learning unit/team, which provides institutional support for learning or pedagogical design is also an important attribute that contributes to sustainability in online and distance education settings, while instructors and students' costs associated with travelling to the classroom (such as fuel, vehicle maintenance, and

other travelling expenses) can be reduced substantially. In some cases, such cost reductions may help students pay their tuition fees and make it unnecessary for students to postpone their studies due to financial constraints. For the institution, a lower break-even point for its finances may be achievable. Economic sustainability also considers student outcomes, such as their employability after graduation and socioeconomic prospects with their upgraded skills and knowledge gained from these programmes. The findings have somehow expanded the elements of required financing criteria for higher education institution to be the change agent as highlighted by Stephen et al. (2008). Indeed, economic sustainability should be present in order for a higher educational institution which is also the online and distance education provider to be financially fit and able to sustain its operations in the coming future.

The experts in this study agreed that environmental sustainability is significant to the operationalisation of the online and distance education modes. Indeed, online and distance education programmes require less travelling to physical classrooms and reduce the need for instructors and students to stay on campus. Thus, distance education programmes make greenhouse gas emission reduction efforts achievable while enhancing energy conservation, since less electricity is required to power physical classrooms than to operate e-learning servers. Advancements in technology, such as cloud computing, enable the interoperability of e-learning platforms through external open sites, exchange between learning management systems, and other tools and mechanisms that facilitate teaching and learning operations between various applications and systems. Single sign-on access control adds to the efficiency of operationalising online and distance education programmes while maximising student capacity. These criteria may support energy conservation policies and the implementation of green ICT. The utilisation of energy-efficient infrastructure and appliances is another avenue that online and distance education programme providers should consider, as this utilisation works in line with green ICT. In other words, green ICT can be achieved in online and distance education operations by reducing the consumption of electricity resources and greenhouse gas emissions while eliminating excessive waste. Together with the implementation of green ICT and technological advancement, it is believed that smart building implementation will be fully realised soon. The operationalisation of online and distance education also requires less paper to be printed than conventional practices, so these programmes have contributed tremendously to paperless policies that support the preservation of forests. The findings have further detailed the general environmental sustainability criteria in the context of campus sustainability through teaching and learning (Wessel et al., 2019). Besides, the findings have further elaborated the criteria which entails environmental sustainability of distance education in addition to those suggested by Herring & Roy (2002); Roy et al. (2008); Md Harizan & Hilmi (2019); and Md Harizan & Hilmi (2021), such elaborations have thus supported the constant attachment between online and distance learning environment with environmental sustainability as highlighted by past studies.

Social sustainability seemed to be the most prominent pillar in online and distance education, as the highest number of criteria related to it was extracted. Since students are important stakeholders in online and distance education settings, their satisfaction level with learning formed the most important criteria for sustainability in online and distance education programmes. Bandwidth speed capacity, bandwidth access, and e-learning platform utilisation are among students' largest concerns, besides the e-learning platform, data security, and safety features. Overall, students' e-learning platform utilisation should be satisfactory; the availability of original e-content, e-assessment deployment, the adequacy of the adopted pedagogical approaches to the learning objectives, learning materials, performance reports, and interactions between students, instructors, and/or tutors are also important. The findings have further elaborated the breadth and depths of elements addressed by Wessel et al. (2019), on blended approaches and sustainability learning pedagogy, and perceptions of students towards lecturers in teaching and learning. Satisfaction in learning especially in the interaction between students and instructors is integral to students as asserted by Bacelar-Nicolau et al. (2009); and Azeiteiro et al. (2015), within e-learning milieu.

The outcome criteria should also be considered where e-learning activities and practices are evident, while e-learning enculturation and a recognition mechanism are in place. It is also important to emphasise impactful e-learning activities to students that will result in them equipping them with the required ICT and literacy skills. Furthermore, the institutionally run sustainability website and social media should also be made available to everyone. Flexible professional development for staff and a learning environment for students also contribute to the list of social sustainability criteria underlying online and distance education. Institutions that operate via online and distance education modes need to ensure equal opportunities to education for all without discrimination. This is in line with the assertion by Stephens et al. (2008), whereby one of the opportunities for higher education institutions to be the change agents for sustainability is to ensure accessibility

and transparency in obtaining higher education. Besides, the concern raised by Figueiró & Raufflet (2015), in terms of connecting sustainability with the design of a course or a program has also been addressed. Being able to grasp competency in a sustainable manner through online and distance education is also one of the important criteria to be achieved among learners which was emphasized by Azeiteiro et al. (2015).

In relation to the SDGs, the resulting sustainability criteria for online and distance education provided the most support for quality education (SDG 4) by ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. These sustainability criteria reduce inequalities in SDG 10 and help achieve gender equality by empowering women via using ICT to gain access to education. The resulting criteria also contributed towards achieving SDG 9, which builds resilient infrastructure, promotes inclusive and sustainable industrialisation, and fosters innovation. By adhering to the environmental dimension of sustainability, the study's proposed criteria attempt to fulfil SDG 11 by making cities and human settlements inclusive, safe, resilient, and sustainable. The resulting criteria reflected SDG 12 by ensuring sustainable consumption and production patterns while supporting the urgent action taken to mitigate climate change and its impact, as stipulated in SDG 13 through online and distance education operations. The operations and outcomes of online and distance education also provided the clear efforts required to attain SDG 8, which promotes the sustained and inclusive economic growth that occurs when graduating students enter the labour force and enjoy decent work. The resulting criteria may indirectly contribute to attaining the other SDGs when the previously mentioned SDGs are achieved since they are integrated. Last, but not least, the suggested criteria, overall, create a concerted effort that supports the achievement of SDG 17, which involves strengthening the means of implementation and revitalising global partnerships for sustainable development. This SDG may comprise the continuous development, transfer, dissemination, and diffusion of environmentally sound technologies and practices to residents in developing countries, including Malaysia. In turn, achieving this SDG enables continuous capacity building in support of national plans to implement all SDGs while enhancing coherence of policies for sustainable development; not to mention, SDG 17 also enables the building of existing initiatives that develop methods to measure the progress of sustainable development that complement gross domestic product and support statistical capacity building by 2030.

Theoretically, this study further explained the criteria for online and distance education settings by applying the economic, environmental, and social pillars to the Triple Bottom Line approach. This study is also expected to provide different perspective that associates the attributes and characteristics of online and distance education with the SDGs. This perspective will provide the basis on which the extent of attaining sustainability development goals for online and distance education can be gauged. The new perspectives gained from analysing the online and distance education contexts can further add to the theoretical aspects of green ICT. In practice, the newly generated criteria may form the basis for further developing quantifiable indicators that measure the extent of sustainability in online and distance education settings, including their programmes and other curricular activities. These findings may correspond to the National Higher Education Strategic Plan, 2007-2020, and the Blueprint on the Enculturation of Lifelong Learning for Malaysia, 2011-2020, by strengthening learners' learning capacity, supporting the National e-Learning Policy (DePAN 2.0), emphasising the quality and innovation in education, branding Malaysian education, reducing the cost of delivery, bringing Malaysia's expertise and skills to a global level, and cultivating lifelong learning among its people.

CONCLUSIONS

Realising that online and distance education has paved an alternative way in this revolutionary era of education, the goal of this study is to identify the attributes of online and distance education that can be related to the social, economic, and environmental pillars of sustainability. Due to the limitations of this study, the current findings may only reveal criteria for online and distance education that adhere to the economic, environmental, and social dimensions of sustainability. Future studies may further enhance the criteria's comprehensiveness by expanding the dimensions used to define the elements of sustainability within online and distance education settings.

ETHICAL APPROVAL

The questionnaire and methodology for this study was approved by the Human Research Ethics committee of Universiti Sains Malaysia (Ethical approval number: USM/JEPeM/20120626).

ACKNOWLEDGEMENT

We would like to thank the Ministry of Higher Education Malaysia for Fundamental Research Grant Scheme with Project Code: FRGS/1/2020/SSI0/USM/02/3.

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