

# DEFINING SUSTAINABLE E-LEARNING: A META-SYNTHESIS

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**ABSTRACT:** In previous work, sustainable e-Learning has largely been defined in economic terms, based on the cost associated with the initial development and later deployment and on-going operation of online learning programs. Although the definition of sustainable development has been broadened in other disciplines to include non-economic dimensions, this has largely not been considered in the context of sustainable e-Learning. This paper addresses this limitation by providing new definitions of sustainable e-Learning that are based on the triple bottom line cost accounting framework. The triple bottom line recognizes that sustainability is based on the inter-relationship of factors that include societal and environmental dimensions in addition to economic considerations. This paper provides new definitions of sustainable e-Learning, derived following a scoping analysis that categorized existing literature based on the triple bottom line framework. To derive the new definitions, this analysis identified societal, environmental and economic factors of e-Learning as found in the existing literature, but recast these in the context of triple bottom line sustainability concepts and nomenclature. For example, e-Learning that develops lifelong learning skills can be considered a national renewable resource when aggregated across learners and institutions. This has the potential for broad societal and economic impact when considered on a national level. The potential for managing and auditing sustainable e-Learning based on the new definitions is considered in the context of a developing country such as Malaysia.

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**KEYWORDS:** *Sustainable e-learning, sustainable development, lifelong learning, the triple bottom line.*

## 1. INTRODUCTION

The COVID-19 pandemic has forced universities to migrate their education methods to online platforms. E-learning has been widely used in higher education institutions as it offers flexible, accessible, cross-platform, cost-saving, and collaborative learning. Many strategies and initiatives were taken to enhance e-learning features to maximize the education quality. In order to sustain education during this pandemic, sustainable development is considered as part of the initiative to ensure e-learning deliver learning resources that meets learners' present and future needs while implementing green technology as infrastructure and reusable learning resources.

The literature shows that e-learning and sustainable development offer many benefits to people. Therefore, the sustainability of e-learning is important to promote a lifelong learning as it allows reusable of learning resources such as learner skills and knowledge. However, the lack of definition for the term sustainable e-learning

causes e-learning stakeholder to have different understanding on sustainable e-learning and then design the e-learning in a less sustainable way.

Thus, this paper focus on defining sustainable e-learning through examining current literature to identify the key terms that were used. This paper is organized in seven sections: introduction, background on sustainable development, e-learning and sustainable e-learning, research methods, data analysis and results, discussion, and conclusion.

## 2. BACKGROUND ON SUSTAINABLE DEVELOPMENT, E-LEARNING AND LIFELONG LEARNING

### 2.1. Sustainable development

In 1987, sustainable development was defined in the Brundtland report as “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs ” The term “sustainability” is used to support a long-term innovation processes that benefits the triple bottom line; people, environment, and economy(Weaver et al. 2000). The concept of sustainable development is often addressing the triple bottom line; people, environment, and economy.

In 2002, the UN World Summit on Sustainable Development was held in Johannesburg with aim to establish and build on the progress on Agenda 21 in 1992. One of the outcomes was the WSSD Plan of Implementation that promotes the overriding of the triple bottom line.

Later in December 2012, the latest UN Conference on Sustainable Development was held in Brazil. There are two themes which are the ‘green economy’ and institutional framework for sustainable development. The outcome of this conference was a document called “The Future We Want” which outlined the sustainable development goals. In 2015, the 17 Sustainable Development Goals (SDG) were introduced by the United Nations as part of the 2030 Agenda for sustainable development (United Nations, 2015). According to SDG Report 2020, the COVID-19 pandemic has shaken the 2030 Agenda in which it brings threat to food systems, healthcare, school closure, increase in global inner poverty, and world economic recession (United Nations, 2020). Nowadays, Sustainable development has been applied in various contexts as shown in Table 1.

Table 1: Classification of contexts in sustainable development

| Context     | Sub-topics   |
|-------------|--|
| Environment | Natural resources, air quality, water quality, solid and hazardous waste, biodiversity, agriculture, forestry, carbon emission, ecosystem, and ecological footprint. |
| Economy     | Cost-effective, green economy, and environmental economics.  |
| Education   | Sustainable education, sustainability of education, education for sustainability, and sustainable e-learning.  |
| Engineering | Green building, green technologies, transportation, and energy saving devices.   |

Furthermore, sustainability in higher education is sustainable university that refers to the effort of transforming universities into more sustainable institutions needs by reconsidering the four keys university functional and interlinked constituencies; Curriculum, teaching, and learning, research and development, administrative procedures, and partnerships (Makrakis 2011).

## **2.2. E-learning**

In the 1980s and 1990s, online learning was introduced as a distance learning education. The unique characteristics of online learning is that the communication occurs through internet connections that allow students and teachers to communicate in different place. This will ensure physical distancing between learners and teachers in order to minimize the dissemination of the coronavirus. The unique characteristics of online learning is that the communication occurs through internet connections that allow students and teachers to communicate in different place. During the pandemic, (Hodges et al. 2020) refers online education as “emergency remote teaching” in response to crisis. In late 1990s, the term e-learning or online learning was introduced to describe a richer learning environment (Dringus and Terrell, 1999). For few decades, e-learning has been defined in different ways (Brown, Charlier and Pierotti 2012). The definitions are mostly to express the technologies evolution which can be used to deliver learning through the Internet.

## **2.3. Lifelong learning**

The term “lifelong learning” has been used in wide selection of context. Still, the definition of lifelong learning is not fixed as different perspectives were applied in its phrase. Furthermore, there is a few discussion about “lifelong education” in the educational philosophy literature (Aspin and Chapman 2007) which represents lack of understanding the elements that satisfy a lifelong learning. The term ‘maximalist position’ was called by (Cropley 1979) that represent the particular programmatic use of term which was developed by the UNESCO Lifelong Education Unit. However, Bagnall argue that ‘Maximalist’ position is illiberal and introduced four semantic interpretations of ‘lifelong education’ (Bagnall 1990). Aspin added that to secure access ‘learning throughout life’, it is important to consider reassessment of education establishment, aims, and resourcing. Based on (Walters 2007), the meaning of lifelong learning term has close relationships with theories and socio-economic development.

## **2.4. Sustainable e-learning**

Even though e-learning acts as an emergency remote teaching during the pandemic, however, at least 500 million students are not able to access e-learning (United Nations, 2020). Along with sustainable development initiatives, e-learning as a wide learning system need to be sustainable to ensure its long-term usefulness, especially promoting a lifelong learning. Extensive debates and research on the link between sustainable development and technology was done to identify the new technology challenges and how it can re-form education towards learning to develop sustainable practice. The integration of sustainable management is needed as part of technology transformation in higher education (Abad-Segura et al. 2020). Thus, sustainable e-learning is necessary to ensure higher education to be able to adapt to new technologies or crisis. Therefore, there is still a lack of definition of sustainable e-learning in the literature.

### **3. RESEARCH METHODOLOGY**

In order to define sustainable e-learning, a systematic literature review was constructed to collect an empirical data about sustainable development, e-learning, and lifelong learning. A meta synthesis was done after the literature review process to identify the terms used to define sustainable development, e-learning, sustainable e-learning, and lifelong learning. After obtaining the relevant database, these articles were recorded through EndNote for a systematic record.

#### **3.1. Scope of the literature review**

The scope of this study is Information Systems. Search study was developed to perform effective search activities. The selection of main themes through titles, abstract, and keywords such as sustainable development, sustainable e-learning, green initiatives, sustainable education, open education resources, e-learning, distance learning, and lifelong learning were used. Online database such as Emerald, ScienceDirect, ProQuest, Curtin library catalogue, IIUM library catalogue, and SpringerLink were used as they wide coverage of Information Systems top publications.

#### **3.2. Filtering process**

In order to obtain the most relevant articles, the articles searched from the online database were filtered into two stages which are 1) overview of topic, abstract and keywords and 2) review of full article. The articles that discuss on sustainable development, e-learning, and lifelong learning in the context of education sector were considered. After the filtering process, then the articles will be recorded using EndNote.

#### **3.3. Classification scheme**

In respect to the triple bottom line (TBL), the definitions were classified into three sub- themes which are people, environment, and economy. Sustainable people involve an agreement between communities and nature that meets present and future needs. Sustainable environment refers to natural resources are protected and restored. Sustainable economy refers to practices that allow access to resources and opportunities to minimize environmental impact while save cost and improve return of investment.

### **4. DATA ANALYSIS AND RESULTS**

The recorded literature was 32 records on sustainable development, 89 records on e-learning, and 22 record on lifelong learning, which were filtered by education context. Based on this literature review, a summary of definitions of sustainable development, e-learning, lifelong learning, and sustainable e-learning are provided as shown in Table 2, Table 3, Table 4, and Table 5 below.

#### 4.1 Literature review in sustainable development definition

Table 2: Literature review on definitions of sustainable development

| Definition  | TBL aspects  | Author                                    | Year |
|---|--|---|------|
| “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”  | Needs, control   | The Brundtland Commission, United Nations | 1987 |
| “Sustainable development involves devising a social and economic system, which ensures that these goals are sustained”  | Social, economic, sustained goals  | Pearce , Makandia, & Barbier              | 1989 |
| “ Sustainable development has come to mean whatever suits the advocacy of the individual concerned”   | Support  | Pearce, Makandia, & Barbier               | 1989 |
| “Sustainable development as improving the quality of human life while living within the carrying capacity of supporting ecosystems.”  | Improve quality of human life, support ecosystems.                         | IUCN , UNEP, WWF                          | 1991 |
| “Education is critical for promoting sustainable development and improving capacity of the people to address environment and development issues...environmental and ethical awareness, values and attitudes, skills and behavior consistent with sustainable development and for effective public participation in decision making” | Education, environment, ethics, values, skills, development participation. | Agenda 21, Earth Summit                   | 1992 |
| “Sustainable development of renewable natural resources implies respecting limits to the development process, even though these limits are adjustable by technology. The sustainability of technology may be judged by whether it increases production, but retains its other environmental and other limits”                       | Renewable, resources, adjustable, development production, environment.     | Holdgate                                  | 1993 |
| “Sustainable development is concerned with the development of a society where the costs of development are not transferred to future generations, or at least an attempt is made to compensate for such costs.”   | Society, development, costs  | Pearce                                    | 1993 |

|   |  |                                   |      |
|---|--|-----------------------------------|------|
| “Sustainable development involves making the present generations better off without making future generations worse off, and focusing current development in the most disadvantaged.”   | Development, future.   | Pearce (blueprint 3)              | 1993 |
| Sustainable development tries to reconcile two objectives; “1) achieve economic development to secure higher standards of living, now and for future generations and 2) protect and enhance their environment, now and for their children.”   | Economic, development, environment   | HMSO                              | 1994 |
| “to making informed, contextual and conscious decisions driven by the principles of solidarity, justice, accountability, equity and transparency for the good of present and future generations, locally and globally and to act upon those decisions for advancing social, economic and environmental wellbeing” | Decisions, present and future generations, social, economic, and environmental wellbeing | Makrakis ,                        | 2011 |
| “Sustainable development is a global response to the unprecedented challenges confronting the world community.”   | challenges   | Barry Dalal-Clayton, Barry Sadler | 2014 |
| “Sustainable development is a process of all-encompassing change.”  | change   | Barry Dalal-Clayton, Barry Sadler | 2014 |

However, the most frequent used definition of sustainable development is by The Brundtland Report “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Overall, most of the definitions used the terms such as “present and future needs”, “development”, and “environment control”.

#### 4.2 Literature review in e-learning definition

Table 3: Literature review on definitions of e-learning

| Definition   | TBL aspects | Author             | Year |
|--|-------------|--------------------|------|
| “E-learning as a wide set of applications and processes, such as Web-based learning, computer –based learning, virtual classrooms, and digital collaboration.” | People      | Kaplan - Leiserson | 2002 |
| “The use of a computer network to present or distribute some educational content”  | People      | Paulsen            | 2002 |

|  |                     |                     |      |
|--|---------------------|---------------------|------|
| “The use of new multimedia technologies and the internet to improve the quality of learning by facilitating access to resources and services as well as remote exchange and collaborations”                              | People              | Gerhard et al       | 2002 |
| “E-Learning sometimes referred to as online learning, web-based learning, distance learning and technology-based learning, among other names”  | People, Environment | Waight <i>et al</i> | 2004 |
| “E-learning as an umbrella term to represent both web-based training (conducted through computer networks) and computer-based training (which can be conducted on standalone, non-networked computers).                  | People              | Gwebu et al.        | 2007 |
| “The role and variety of interactions in learning; methods for supporting learners on-line; and the nature and sources of digital content.”  | People              | Hathaway et al      | 2007 |
| “Online learning is that transmission occurs through the internet connected computer while continuing the distance education construct where students and faculty do not need to be in the same place at the same time.” | People, Environment | Geith               | 2008 |
| “E-learning as any planned education that utilizes electronic media, which includes distance learning through the Internet.”   | People, Environment | Glancy              | 2011 |
| “E-learning is the use of information and computer technologies to create learning experiences.”   | People              | Horton              | 2012 |
| “A broad array of applications and processes that share a common feature of relying on some type of computer technology to promote learning.”  | People              | Brown , et al.      | 2012 |

Most definition by Kaplan-Leiserson (2002) was used by authors. Most definitions of e-learning contribute to meeting people needs especially in term of knowledge and skills. However, some of the definitions support the environment as e-learning offers connectivity between learners' locations. However, none of the definitions remark on benefiting the economy such as saving cost while one of the advantage of e-learning is saving cost on learning delivery (Ali 2008).

#### 4.4 Literature review in lifelong learning definition

Table 4: Literature review on definitions of lifelong learning

| Definition  | TBL aspects     | Author                                   | Year |
|---|-----------------|--|------|
| Lifelong education as involving a fundamental transformation of society, so that the whole society becomes a learning resource for each individual  | People          | Cropley                                  | 1979 |
| Four semantic interpretations of 'lifelong education';<br>'education as a preparation for the rest of a person's life'<br>'Lifelong education as education to be distributed <i>throughout</i> the whole of the lifespan'<br>'lifelong education as education <i>from</i> the whole of life's experiences'<br>'All events in which one is consciously involved throughout one's lifespan constitute education (as process) and contribute to and are part of one's education (as outcome). Education is the process and the on-going learning product of living.' | People          | Bagnall                                  | 1990 |
| 'Lifelong learning supports the decolonisation of the mind by encouraging the re-examination of relationships between scientific, often understood as 'official knowledge', and the specific diverse knowledge of local communities, cultures and contexts'   | People          | Section 6 of the <i>Mumbai Statement</i> | 1998 |
| 'Some of the principles of lifelong learning<br>. . . include the acknowledgement of the lived experience of all learners, women and men, respect for differences and diversity, flexibility of provision, recognising the complex nature of adults' lives, sensitivity to both cognitive and affective outcomes, awareness that knowledge exists in all parts of society and of all women and men'   | People          | Section 7 of the <i>Mumbai Statement</i> | 1998 |
| "Lifelong learning facilitates free mobility for European citizens and allows the achievement of the goals and aspirations of European Union. It should enable all persons to acquire the necessary knowledge to take part as   | People, Economy | Council of the European Union(CEU)       | 2002 |



active citizens in the knowledge society and the labour market.”

Above Table 4 shows that most of the definitions of lifelong learning contributes toward benefiting the people rather than the environment and economy. This means that lifelong learning should be contributing towards sustainable environment through sustainable education that contributes to environment friendly practices. Furthermore, as stated by the Council of the European Union (2002) lifelong learning should stimulates labour market by providing necessary knowledge which leads to the improvement of the economy development.

#### 4.5 Literature review in sustainable e-learning definition

Table 5: Literature review on definitions of sustainable e-learning

| Definition   | TBL aspects | Author     | Year |
|--|-------------|------------|------|
| “The adoption of technology to maintain teaching quality at reduced unit costs.”                 | Economy     | LittleJohn | 2003 |
| “Organizational factors that lead to sustained benefits of e-learning.”                          | People      | Bates      | 2005 |
| Sustainable e-learning has become normative in catering for the needs of the present and future. | People      | Robertson  | 2008 |

Table 5 above show that there is a lack of definition of sustainable e-learning. However, based on these three definitions, sustainable e-learning aims to meet present and future needs through resource management, educational realization, and development and innovation. However, none of these definitions meet all the TBL aspects.

These definitions were important to generate sample terms classification to define sustainable e-learning. The main idea is of sustainable e-learning is to portray it as a combination of sustainability and e-learning to promote lifelong learning. Based on these definitions, Figure 1 represents the key term used by Sustainable Development and e-learning definitions.

## 5. DISCUSSION

Based on the literature review on the existing definition of sustainable development, lifelong learning, e-learning, and sustainable e-learning, a few key terms were extracted (see Figure 1). These key terms were then been mapped to which context of TBL does it contributes. Moreover, these key terms were used to define sustainable e-learning that covers the all the TBL aspects. Therefore, based on these key terms a few definitions of sustainable e-learning have been developed based on each TBL aspects.

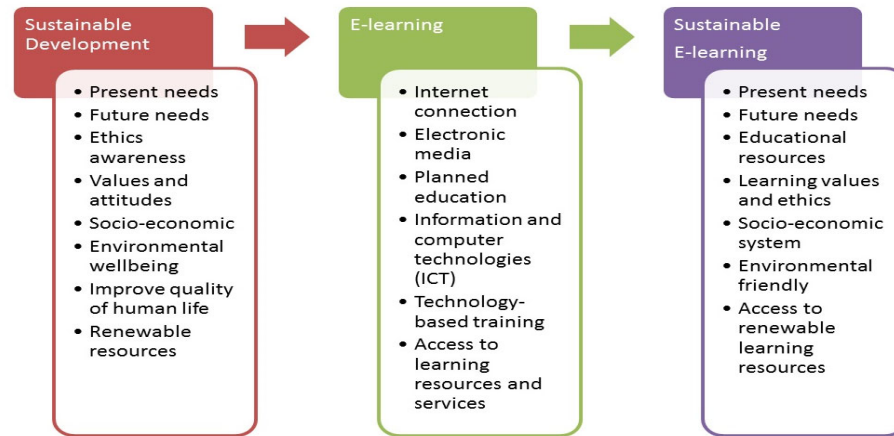


Fig.1. Key terms from the existing definition of sustainable development, lifelong learning, e-learning, and sustainable e-learning

### 5.1 Sub-theme: People

Sustainable people involve an agreement between communities and nature that meets present and future needs. This shows that the definition needs to focus the benefits for the society. In e-learning perspectives, A sustainable e-learning should meet student satisfaction (Stepanyan, Littlejohn and Margaryan 2013) and trust through quality learning. E-learning is considered sustainable if the core purposes of teaching and learning were accepted by the users (Filho 2014). Therefore, a sustainable e-learning definition was developed based on society perspective.

*“A technology-based learning that prepares the learning society for the present and future needs by providing continuous access to renewable learning resources.”*

### 5.2 Sub-theme: Environment

Sustainable environment refers to natural resources are protected and restored. Based on Kerk and Manuel (2(Kerk and Manuel 2008) sustainability preserve resources for future generations and enable present and future generations to live a healthy environment away from pollution and severe climate changes. Filho (2014) stated that the application of open source and shared services brings environmental sustainability to e-learning. The definition of sustainable e-learning was developed in respect to environment context.

*“Development towards a lifelong learning assurance through environmental technology and learning environment to meets present and future acquisition and exertion of knowledge and skills.”*

### 5.3 Sub-theme: Economy

Sustainable economy refers to practices that allow access to resources and opportunities to minimize environmental impact while save cost and improve return of investment. The aim of increasing e-learning object is to achieve technological sustainability which defined as a monetary, physical, virtual and academic resources that meets present and future demands on technological requirements(Robertson 2008). Robertson (2008) added that financial

sustainability refers to the facilities and resources availability that can be obtained through reduced costs while increasing organisational income, return on investment, and surplus. Therefore, a definition of sustainable e-learning that respects the economy perspective is as below;

“Technology-based learning system that promotes lifelong learning while achieving economic development that promotes cost savings and expands return of investment.”

Generally, a qualified “sustainable” developmental processes should satisfy the following standards (Van den Branden 2012):

- Meeting all people basic needs and desires for a better life (Sustainable society).
- Meets present needs without compromising the future generations’ ability to meet their own needs (Sustainable society).
- Does not jeopardize the natural resources and environment (Sustainable environment).

In respect to the Triple Bottom Line, sustainable development often involves changes in technological, organisational, institutional and social (Sahid, Endut and Peng 2011). Overall, based on Filho (2014) sustainability of e-learning focuses on the social (culture), ecological, and economic (politics) domains. Table 1 shows the literature review that concludes Filho (2014) on his conclusion on area of focus for e-learning sustainability.

## 6. CONCLUSION

All the above definitions were developed in respects of the TBL aspects. Therefore, a definition of sustainable e-learning that covers all the TBL aspects is:

*“The e-learning system that supports the Triple Bottom Line (TBL) which benefits the society, environment, and economy while ensuring the on-going learning goals and sustainable practice.”*

The definition suggests that a sustainable e-learning system should considered factors which are influencing the awareness and adoption of sustainable development and e-learning. This definition will be useful in assisting higher education institutions in developing an e-learning system that promotes sustainable development practices. Based on this definition, sustainable e-learning can be achieved by developing an online learning platform that benefits the society (students and academicians), environment (energy consumptions), and economy (create more job opportunities through skills development). As a result of this new definition on sustainable e-learning, a framework of a sustainable e-learning needs to be developed as a guideline for higher institutions to create a sustainable e-learning.

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