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Suzanna Elmassah
Zayed University

Marwa Biltagy
Cairo University

Doaa Gamal
Cairo University

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Suzanna Elmassah[1], Marwa Biltagy[2], Doaa Gamal[3]

Abstract

Purpose- Higher Education Institutions (HEIs) should play a fundamental role in achieving the international 2030 Sustainable Development (SD) agenda. Quality education is the fourth of the Sustainable Development Goals (SDGs), and one of the targets related to this is to ensure that by 2030 all learners acquire the knowledge and skills needed to promote SD. Therefore, the SDGs provide a motive for HEIs to integrate SD concepts into their day-to-day practices.

Methods- This paper presents the results of a case study analysis of the role and successful techniques of HEIs in achieving SD in three countries, Germany, Japan, and Egypt. Primary data was collected by semi-structured interviews with three Cairo University (CU) officials, while secondary data was collected by reviewing the universities' official websites, reports, publications, and related papers. This study introduces a novel framework for HEIs' SD analysis and assessment, which guides HEIs and educational leaders to support SD to fulfil their countries' commitments to achieving the SDGs. This framework is based on five categories (1) Strategic Direction & Institutional Working Practices, (2) Supporting Students, (3) Supporting University Staff Competencies, (4) Supporting Society's Stakeholders &

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[1] Associate Professor. Zayed University-College of Business. Cairo University-Faculty of Economics and Political Science. Suzanna.elmassah@zu.ac.ae
[2] Associate Professor. Cairo University-Faculty of Economics and Political Science. bilmarwa@feps.edu.eg
[3] Cairo University-Faculty of Economics and Political Science. doaagamal@live.com

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Networking, and (5) Sustainable Campus. Consideration is given to the potential role of HEIs to support SD in each of these areas.

Results- CU could learn from the novel and pioneer practices of The Leuphana University of Lüneburg (LUL) and University of Tokyo (UT) to fill in the gaps it has in different roles. Also, it can put more effort into adopting the suggested higher education programs of Egypt's Vision 2030.

Originality- The paper compares three universities, one in each of the case study countries. It draws conclusions that identify ways in which the paper's framework and findings can help to guide SD practice in HEIs internationally, especially those in the developing world.

Limitations- This research is limited to case analysis of comparing three countries, including Germany, Japan and Egypt. Secondly, this study has neglected school education, which is equally essential in the sustainable development of the country.

Implications- HEIs can also use the framework and the findings in this paper to evaluate their current roles in supporting SD, identify the gaps, and take actions accordingly to address their weaknesses.

Keywords: Sustainable Development, Higher Education, Sustainable Development Goals, HEIs, Vision 2030

JEL Codes: I23, I25, Q01

1. Introduction

The concept of sustainable development and its dimensions has not changed drastically. Since the last four decades, there have been many discussions about goals and indicators which should be used to measure progress. The discussions about indicators started in 1992 at the United Nations Conference on Environment and Development (Earth Summit) held in Rio de Janeiro, Brazil, and continue today. The first set of SD indicators was released in 1996 by the Commission on Sustainable Development. Then, every couple of years, revised versions have been published (United Nations, 2019). In June 2012, at the United Nations Conference on Sustainable Development (Rio+20), member states started their discussions about launching new goals for development after the end of the Millennium Development Goals (MDGs). As a result, the 17 Sustainable Development Goals (SDGs) were announced in 2014. The SDGs present a broad vision that encompasses both environmental sustainability and the other aspects of development required to eradicate poverty and promote peace and prosperity across the planet. One of these aspects is, of course, quality education, which is goal number 4 of the

SDGs. The targets related to this goal include both improving access to education generally and also ensuring that "all learners acquire the knowledge and skills needed to promote sustainable development." Higher education has a vital role to play in ensuring that this ambitious agenda is delivered (Azeiteiro, Bacelar-Nicolau, Caetano, and Caeiro, 2015). Improving education is of great importance to the public. Investment in education enhances the quality of life for millions of people (Elmassah, Biltagy, and Gamal, 2020). Furthermore, education has the most significant role in determining to what extent the skilled human resources may be available (Biltagy 2019b, 2019c).

HEIs as knowledge producers play a crucial role in SD. HEIs can act as a powerful means to support in building a future that is more sustainable (Blessinger, Sengupta, and Makhanya, 2018). To achieve this, sustainability education needs to be diffused throughout the entire higher education system (Hueske & Aggestam Pontoppidan, forthcoming; Velazquez et al., 2006). Therefore, in recent years, the concept of "education for sustainable development" has become one of the key educational strategies to help in the solution of many human development issues. As the world begins to become progressively interdependent and globalized, the role of higher education in sustainable development will undoubtedly take higher importance. HEIs have to play its part in SD and have a leading role (Sengupta, Blessinger, and Yamin, 2020). The core objective of HEIs cuts through all educational domains as knowledge producers. Therefore, to achieve sustainable development goals, HEIs have to play a unique role. More importantly, "Goal Four" deals explicitly with education, with the aim of "ensuring equitable and inclusive quality education and fostering opportunities for permanent education for everyone." Education becomes dominant in attaining all sustainable development goals, as through quality education and continuous learning, individuals are equipped with the necessary skills and knowledge required for a prosperous future (David and Ibrahim, 2020). HEIs have a vital role to play through their institutional policies and activities in promoting and guiding sustainable development programs (Michael et al., 2020; Blessinger, Sengupta, and Makhanya, 2018).

Institutional theory provides a useful approach in the context of HEIs and their role in implementing SD. Institutional theory literature is known as the dominant approach to understand organizations and shows how organizations and organizational domains are evolving and changing over time (Barber et al. 2014; Dacin *et al.*, 2008). The formulation of organizational activities focuses on institutional arrangements and social processes (Wooten and Hoffman, 2008). Institutional theory highlights the fact that organizations are highly dynamic, influenced strongly by their environment. The assumption that institutions require a

social mandate or authority to function, which is achieved by complying to societal expectations of various forms, is at the core of institutional theories. Organizations then respond to the "what they believe society expects of them" rather than only to technological pressures. Institutional theorists believe that the organizational environment may have a strong impact, even more strongly than market forces, on the implementation of institutional rules in an organization ((Suchman, 1995).

The current study attempts to determine the roles and practices of HEIs in terms of achieving SD. It focuses on three countries: Germany, Japan, and Egypt. To understand the role of HEIs in the National Sustainable Development Strategies (NSDSes) of the three countries, the research reviews those strategies alongside higher education ministries' official websites, other related institutions' websites, and UN national review reports. These reviews are underpinned by the understanding that countries develop effective NSDSes when they localize international SDGs to address local challenges (Elmassah & Mohieldin, 2020). The study gathers the reviewed roles to form a holistic framework that can be used to assess the contribution of HEIs to sustainable development.

Moreover, it focuses on sustainable development in the sense of environmental sustainability and the broader definition of the SDGs, with particular reference to the targets around quality education, especially 4.7, which is concerned with equipping learners with the knowledge skills needed to promote SD. Moreover, this research uses a comparative case study approach to assess the contribution of three HEIs, from the three countries, against the determined holistic framework. To achieve sustainable development, HEIs needs to work on more than one element at the same time such as: governance, education, research, outreach, campus operations (Hueske & Aggestam Pontoppidan, forthcoming; Velazquez et al., 2006). The used framework focuses on such elements and the study presents best practice case studies to follow. It also raises the challenges of a developing country's HEI (CU) and presents recommendations for development.

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2. Background and Context of Study

The three investigated HEIs are all public universities. LUL was founded in 1946 in Lower Saxony, Germany (The Leuphana University of Lüneburg, 2018a). It has 4 faculties, 3 schools (colleges, graduate schools, and continuing education schools), 8 research centers, and 1 methodology center. According to statistics from 2017, it has 9,000 students, 170 professors, 400 research assistants, and 460 administrative and technical staff (The Leuphana University

of Lüneburg, 2018b). UT, also known as U Tokyo or Todai University, was founded in 1877 in Bunkyo, Tokyo (The University of Tokyo, 2018a). It has 10 colleges, 15 graduate schools, 11 affiliated institutes, 13 university-wide centers, and 2 special institutes (The University of Tokyo, 2018b). According to the latest statistics published on the University's official website in 2018, it has 28,253 students and 10,671 academic and administrative staff (The University of Tokyo, 2018c). CU was founded in 1908 in Giza, Egypt (Cairo University, 2017a). It has 21 faculties and 6 institutes (Cairo University, 2017b). According to the statistics published on the University's official website in 2017, it has 207,853 students and 14,518 staff members (Cairo University, 2017c).

ESD aims at changing the approach of education by combining the principles, values, and successful practices of sustainable development and incorporating them into all forms of learning. Despite the importance of the topic, the empirical literature in the ESD field is limited. Less than one-third of ESD journal literature are empirical studies (Suriyankietkaew & Hallinger, 2018). ESD literature's scope varies between primary, secondary, and higher education (HE) (Kopnina, 2012). Lozano et al. (2015) made an exploratory review on the implementation of SD in HEIs by reviewing 60 articles published in 2000-2013 by different leading SD journals. Each publication was reviewed against seven elements of an HEI system proposed by Lozano, Lukman, J. Lozano, Huisingh, & Lambrechts (2013).. Some articles investigated only one factor, while others investigated more (Lozano et al., 2015). The current study uses the approach of Lozano et al. (2015) to review the empirical literature and official websites against the seven suggested elements shown in figure (1) below[4].

[Figure (1) is about here]

2. Literature Review

Since 2014, the increasing number of publications explaining the effects of Higher Educational institutions on sustainable development has gained many scholars' attention, which is the key to success for academia and the economy (Bonaccorsi et al., 2010; Wals, 2014). Similarly, the literature focusing on the impact of HEIs on Sustainable Development has generally observed the HEIs attributes and their influence on the society (Anstadt, 2009; Escobar-Tello and Bharma, 2013) and economy (Alves et al., 2015). The Research Excellence Framework (REF) of the United Kingdom has defined the impacts of research as "an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality

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[4] Elements details are presented in appendix Table (1).

of life, beyond academia" (REF, 2016, para. 1). According to Koehn and Uitto (2014, p. 624), the impact of HEIs sustainability initiatives involved the "real-world changes in ecological sustainability, policies, and people's well-being." In addition, Thomas and Ormerod (2017) distinguished the impacts of both traditional academics and non-academics on media, public policies, and civil societies. Lozano et al. (2013b) proposed that HEIs systems' critical elements have a proactive role in sustainable development. Moreover, Sustainable activities can substantially impact the social, environmental, and economic development of the country (Gupta and Singhal, 2017).

Therefore, this study has focused on universities in different countries. Other than the difference between developed and developing countries, universities' size could also influence the capability to implement best SD practices (Ferrer-Balas et al., 2008). Large-sized universities often notice that organizational complexity lessens the probability of speedy sustainability transformation. Barber et al. (2014) investigated the challenges in developing and implementing sustainable education and examined different contributing drivers behind such challenges in a detailed case study of sustainability education at the Peter T. Paul College of Business and Economics United States. Barber and colleagues' study findings established that through the curriculum, interdisciplinary cooperation, research, and society and industry involvement, sustainability could become strongly embedded in the educational institute's current value structure. Kolb, Fröhlich, and Schmidpeter (2017) investigated the relationship between education and SDGs in the context of a private business school in Germany. In the context of sustainable education, Kolb, Fröhlich, and Schmidpeter (2017) have investigated the educational activities of business school (curricula, co-curricular), and offered a conceptual framework of how educational institutes can contribute to SDGs.

Sassen and Azizi (2018), and the study of Schaffhauser-Linzatti and Ossmann (2018) investigated the topics disclosed in sustainability reports of 11 universities at Australia and Austria. A content analysis of the economic, social, and environmental dimensions in the reports was made through assessing 8 categories. Unlike the study of Sassen & Azizi (2018), this study found that most universities focused on disclosing economic information, especially accounting, with less focus on social dimension and rare focus on environmental one. They made the same policy recommendations as Sassen & Azizi (2018), at which responsible bodies should set SD reporting standards and incentives. Schaffhauser-Linzatti & Ossmann (2018) reported a limitation of their study that it only reflected the examined regions' current situation. Its scope could lead to biased results if it were generalized to other regions. They encouraged other scholars to apply similar studies internationally (Schaffhauser-Linzatti & Ossmann,

2018). Shulla et al. (2020) have comprehensively reviewed the existing literature about education for sustainable development and were empirically investigated by taking the regional center of expertise on education for sustainable development (RCEs) as a study sample. The study of Shulla et al. (2020) is focused on the approach of ESD concerning the "2030 Agenda for Sustainable Development" and significantly addressed the influences of "Target 4.7 (Education for sustainable development and global citizenship)" on the 17 SDGs.

2.1. German HEIs and Sustainable Development

Germany has been chosen as a best practice country because it has established the concept of "Gestaltungskompetenz" (shaping competency) as the central educational objective of ESD. In the context of ESD, gestaltungskompetenz is defined as a holistic concept that calls for building citizens' competencies to shape the future in a sustainable manner (Adombent & Hoffmann, 2013). According to UNESCO, the development of such citizens is one of the primary responsibilities of higher education (UNESCO, 2017). It is worth to mention that the role of HEIs to achieve SD in Germany was not only identified after the adoption of the national strategy in 2002. However, regional and national initiatives aroused before that time (Hauff & Nguyen, 2014).

In 1994, at the European Rector's Conference (CRE), the Cooperative Program in Europe for Research on Nature and Industry through Coordinated University Studies (COPERNICUS Charter) was adopted, which is an action program that identified ten principles of action for SD[5] (The Conference of European Rectors, 1994). A re-designed version of the COPERNICUS charter with a few adjustments was issued in 2011 by the European Network on Higher Education for Sustainable Development (HESD), known as the "Copernicus Alliance". As a step to achieve the NSDS and the DESD objectives, the German Rectors' Conference (HRK) and the German Commission for UNESCO published a declaration called "Universities for Sustainable Development" in 2010. The declaration identified four core areas that universities should work on to promote SD, namely research, teaching and learning, service to society, and institutional working practices.[6] In 2014, Hauff and Nguyen suggested three additional areas, models, strategy, and organizational basis (Hauff & Nguyen, 2014). They also drew upon previous regional and national initiatives to identify the role of HEIs in achieving SD in

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[5] Principles of action are described in appendix Table (2).
[6] Areas are described in appendix Table (3).

Germany (Hauff & Nguyen, 2014). LUL is a leading German HEI in terms of its sustainability practice (UNESCO, 2017).

2.2. Japanese HEIs and Sustainable Development

Japan is chosen as a best practice country because it was the country that proposed the idea of the DESD in 2002. Moreover, it considered HE as one of the three main focal areas[7] of its National DESD Implementation Plan (Nomura & Abe, 2010), which is one of the core focus areas of this study. The aims, ideas, and principles of education in Japan are outlined in the 1947 "*Fundamental Law of Education*". Higher education is considered as one of the three main focal areas of Japan's National DESD Implementation Plan, created in 2006, which has served as the country's principal policy framework on ESD (Nomura & Abe, 2010). At the same time the *"Fundamental Law of Education"* was revised so that the Ministry of Education, Culture, Sports, Science, and Technology (MEXT), which is responsible for all types of HEIs in Japan, adopted SD as a central principle (Ministry of Foreign Affairs of Japan, 2009).

In line with its policies and programs, MEXT and the Ministry of Environment (MOE) have introduced many initiatives that require HEIs to play a role in promoting SD (Nomura, and Abe, 2010; Kitamura, and Hoshii, 2010). These initiatives call for university activities at several levels, namely undergraduate education, postgraduate education and research, outreach, and support.[8] Furthermore, the MOE created in 2008 the Environmental Leadership Initiatives for Asian Sustainability (ELIAS) which defined new aims and areas of action,[9] including the development of higher education model programs, government-industry-academia partnerships, and the Asian Universities Network. Several initiatives have been taken consequently; 35 universities proposed new aligned plans in 2008, the EcoLead consortium was established in 2011, and the 'Promotion of Sustainability in Postgraduate Education and Research Network' (ProSPER.NET) was launched in 2011 by the UN University (UNU) with funding from the MOE. Among the many universities with active sustainability programs, UT remains one of the leaders.

2.3. Egyptian HEIs and Sustainable Development

Egypt published its First National Environmental Action Plan (NEAP) in 1992 with the assistance of the World Bank. In 2001, the Egyptian Environmental Affairs Agency (EEAA) launched an updated version of the NEAP (Egyptian Environmental Affairs Agency, 2001).

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[7] The other two focal areas were awareness-raising/information-sharing; and community-level practice
[8] Actions are explained in appendix Table (4).
[9] Details are presented in appendix Table (5).

The updated NEAP significantly focused on the environmental dimension without paying enough attention to other aspects of SD. This may have resulted from the misconception of considering NEAP as a substitute for an NSDS at that time (Elmassah, 2016). In the next year, the Higher Education Enhancement Project (HEEP) was launched by the Ministry of Higher Education and Scientific Research (MHESR) under the framework of the Egyptian Government's Higher Education Reform Strategy (Abdellah, and Taher, 2007). This project identified three areas of action to improve the higher education system's quality, namely legislative reform, institutional restructuring, and the establishment of independent quality assurance mechanisms and monitoring systems (World Bank, 2009). Later, in 2008, the NSDS was approved to be the new national framework to achieve SD in Egypt (Elmassah, 2016), and then in 2016 "Egypt's Vision 2030" was launched as a more unique and more comprehensive framework. It identifies three strategic objectives for higher education to support SD, improving educational system quality, providing education for all, and enhancing the educational system's competitiveness (Miyakoshi, 2016). Appendix tables (6) and (7) show the description of these objectives and their related action programs for HEIs in Egypt. CU started to take some steps with a focus on SD. In 2018, the University announced its conversion from a second-generation university to a third-generation university, which considers education and research tools to address national challenges to achieve SD (Cairo University, 2018-Arabic). The HEIs had a crucial role in achieving Egypt's strategy. Yet, before presenting its role, it is worth introducing some insights about the HEIs in Egypt. Egypt has a total of 245 HEIs divided into 24 Public Universities, 22 Private & Civil Universities, 153 Private Technical Institutes, and 46 Technological Colleges (The Ministry of Higher Education and Scientific Research, 2018).

2.4 Bodies Identifying the Roles of HEIs in SD in Germany, Japan and Egypt

The HE systems in Japan and Egypt are centralized with the relevant national ministries responsible for decision making (Nomura & Abe, 2010; European Union, 2017). In contrast to this, the HE system in Germany is decentralized, and decision making is distributed among the local states and other society members (Federal Ministry of Education and Research, 2018). Accordingly, in Japan and Egypt, the official ministries were the bodies that identified the roles of HEIs in SD, while in Germany, the roles were determined by voluntary public associations and university networks as clarified in the previous sections and summarized in Figure (2). Although each country identifies the role of HEIs in achieving SD differently, all of them agree on the same core roles with different phrasings.

[Figure (2), is about here]

3. Methodology

The design of this study is structured based on the literature review and case study analysis. This research is a case study based. The current research collects, reviews, and analyzes the various roles identified by the three countries and the other recognized roles and best practices in the literature, to come up with the ideal active role that HEIs should play to achieve SD. The study introduces a novel framework for HEIs 'SD analysis and assessment that classifies the roles according to the five categories shown in Figure (3) below.[10] Each category has a number of parameters. All roles that are related to HEIs 'commitments are classified under the first category. All roles that are related to campus development are classified under the last category. All alternative roles are classified into the remaining categories based on which target audience they develop. The second category is for the roles related to developing students. The third category is for roles associated with developing university staff. The fourth category is for roles associated with developing society's stakeholders and networking with other partners.

[Figure (3), is about here]

Although HEIs work differently to sustain development, our comparative study attempts to assess the three universities based on the parameters of the roles we have identified.

3.1. Validity and Trustworthiness

Convergent validity refers to the correlation of items or indicators of the respective construct. Each of the item must be differentiated from the other item of the same construct. Correlation among the measure of the same construct is seen through convergent validity. According to Hair, *et al.,* (2013), discriminant validity is used to identify the constructs under study that do not correlate with each other. Hair *et al.,* (2013) explained that the cross-loading process includes checking the factor loading of each item and comparing it with another factor loading of indicators of other constructs. The factor loading in the respective construct should be highest to ensure the absence of discriminant validity. The second step is to fulfill Fornell-Larcker Criterion. Tests to establish the validity and reliability of qualitative data are essential to determine the data's stability and quality. However, there is no single, coherent set of validity and reliability tests for each research phase in case study research available in the literature (Riege, 2003). Rather than proposing one generally applicable definition or operational criteria for validity, Koro-Ljungberg (2010) discussed how validity can be described during qualitative

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[10] Description of each category's roles is presented in Appendix Table (8).

research in the context of researchers' responsibility and decision-making. More precisely, when aiming for "valid" and reliable qualitative research methods, the Koro-Ljungberg (2010) follows the principle of "aporia" to address the roles of researchers in the face of unrealistic decisions. The author further discusses that qualitative researchers should reconsider the fostering of validity or validation approaches, which disable researchers' responsibility. It may also be enlightening to question how invalidity and ongoing complexities related to qualitative research quality could affect existing practice and presentation of research (Koro-Ljungber, 2010).

According to Lincoln and Guba's (1985), we tried to achieve four aspects to seek trustworthiness: credibility, transferability, dependability, and confirmability (Cho and Trent, 2006). Method triangulation and source triangulation are used in this research to ensure credibility. In the triangulation method, we used different data collection methods, and all yielded the same results. Methods included reviewing official documents, journal articles, and reports on one hand, and interviewing three officials on the other hand. In the source triangulation, we used different data sources in the same method. In the reviewing method, we reviewed official documents, websites, reports, and journal articles. In the interview method, we interviewed three interviewees, who agreed on the same results (details of data sources are presented in the next section). Moreover, we performed a member check with the three interviewees and recorded their interviews to ensure un-loss of data. Later we invited the interviewees to discuss the research results.

Our research results fulfilled the dependability when the research context is taken into consideration. Research context depends on reviewing specified data sources at a bounded time frame that ends in 2018. If the same data sources are used at any point in time, results will be the same. We extracted most of the data from the official documents/websites of countries and universities, which are not highly adjusted to change by time.

The research results can be generalized and used by Higher Education Institutions that have similar conditions to Cairo University. We used Cairo university as a model for a public HEI in a developing country. The aim was to learn from the best practices of other HEIs in developed countries to present a general model that can be followed. This ensures the transferability of the research and its application in other contexts.

Finally, our research achieved confirmability when the three authors played the devil's advocate role in a four-stage process concerning the methods and results: First, each author

read the research alone and prepared his/her comments. Then, all authors shared comments in a seminar. In the third stage, the authors updated the research as per the agreed comments. Finally, all authors reviewed the updated research.

Lincoln and Guba's (1985) notion of trustworthiness ensures the achievement of Cho and Trent, 2006 transactional validity approach. It is defined as "an interactive process between the researcher, the researched, and the collected data that aims to achieve a relatively higher level of accuracy and consensus".

However, alternative notions of validity, such as transformation validity, should be considered to achieve deeper understandings and broader qualitative research visions. Validity is defined as a progressive, emancipatory process leading toward social change that is to be achieved by the research endeavor itself. In other words, the researcher should express how he/she has progressively challenged his/ her subjectivity—and consequently transformed as he/ she collaboratively interacts with other participants. Transformation validity was achieved in this research when the authors had set assumptions at the beginning of the data collection process that Cairo University is a developing HEIs that doesn't apply any sustainable development practices. Surprisingly, some practices were being held when the case was deeply studied. Accordingly, the authors' subjectivity has been changed, which appeared in the results.

3.2. Data Sources

Data sources drawn upon for this paper include both primary and secondary sources. Secondary data sources include journal articles, published reports, and official websites of related universities, institutes/projects/initiatives. To collect further information, primary data were also collected from three Cairo University officials using semi-structured interviews. Convenience sampling is used for the selection of interviewees. Convenience sampling is the process of selecting a sample that is easily available and accessible (Saunders et al., 2012). In qualitative studies, convenience sampling is also called availability sampling, which is entirely non-random or non-probability sampling. During the data collection process under convenience sampling, the researcher collects primary data from the available sample. This sampling technique is appropriate to obtain initial information about the perception of events related to individuals' perceptions (Saunders et al., 2012). As discussed earlier, the study's main purpose is to know professional understanding regarding sustainability and how they evaluate sustainable development in HEIs. Therefore, convenience sampling was an appropriate choice for data collection. Sample interview questions include "Does the vision/mission/strategic

plan/policies of CU support SD? Is there a system of auditing and reporting that tracks the SD practices at CU?" & etc.?

3.1 Case Analysis: Strategic Direction and Institutional Working Practices

We analyze this category of roles by investigating each University's practice within the Vision/Mission, Strategic Plan, Operations, and Monitoring or Reporting System parameters.

LUL in Germany has a clear strategic direction based on SD. Its mission statement includes sustainability as one of its three core concepts. LUL believes that SD should be integrated into all its activities. The University developed a strategic plan for the period 2016–25 to achieve its mission (The Leuphana University of Lüneburg, 2018c). Earlier, in 2004, LUL launched a three-year strategic project called "The Lüneburg Sustainable University Project" (Beringer & Adoment, 2008). This aimed to integrate the idea of sustainability into all areas of the University (Adomssent, Godemann, & Gerd, 2007). The project included three dimensions, as shown in Figure (4), university organization, teaching and learning, and reflection on sustainability.

University Organization & its members	University as teaching, learning & life-world	Reflection & communication on sustainability
•Energy & resource management •Sustainability management & reporting	•University as life-world •Interdisciplinarity in teaching & learning	•Communication & knowledge transfer •Culture & sustainable development
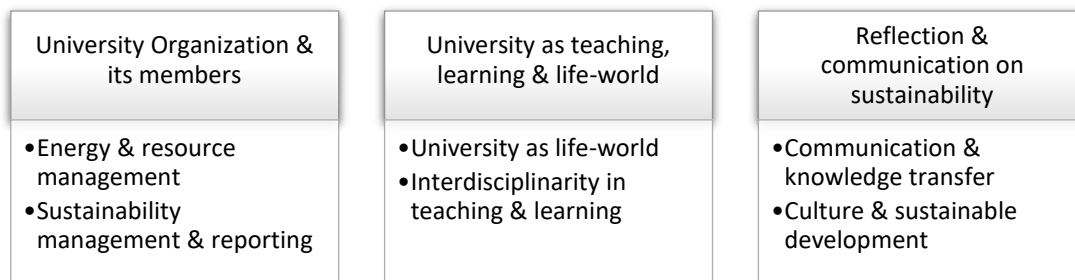
Figure (4): Lüneburg Sustainable University Project

In contrast, UT does not explicitly mention the phrase "sustainable development" in its mission statement. However, it has addressed the SD concept through its announced goals, principles, and strategic action plans. The University President, Makoto Gonokami, introduced "The University of Tokyo: Vision 2020," highlighting the University's role in building students' competencies to be the future leaders who address society's challenges (The University of Tokyo, 2018d). UT also established the strategic Utokyo Future Society Initiative (FSI) in 2017, promoting SDGs-oriented research, workshops, and lectures (The University of Tokyo, 2018e).

Cairo University, the most prominent University in Egypt, launched a new five-year strategic plan in 2015 with an updated vision, mission, policies, and strategic objectives. The vision and mission statements aimed at spreading knowledge and human capital development to achieve SD. Figure (5) presents the eight categories of strategic purposes, which serve both the vision

and mission statements. CU established an executive office responsible for implementation and a higher committee for follow-up and evaluation to guarantee the plan's successful implementation (Cairo University, 2015-Arabic). Later, in 2018, CU added a new main philosophy to its strategic plan to transform from a second to a third-generation university, which considers education and research as tools to achieve comprehensive development, to address national challenges for SD, and to develop citizens' mindsets (Cairo University, 2018-Arabic).

[Figure (5), is about here]

3.2 Supporting Students' Competencies:

We analyze this category of roles by evaluating each University's practice within the parameters of Research Centre Activities, Curriculum, Instructional Methods, and Student Activities.

LUL announced the Lüneburg Approach in 2007 within the scope of "Supporting Students' Competencies." This approach provides other universities and policymakers with a reference point for integrating sustainability into the curriculum. It is considered as a third-degree level in SD curriculum integration. [11] The approach consists of three components. First, the "Leuphana Semester," which consists of unified modules for newly enrolled students. Second, the "Complementary Studies Program," which students should join during the whole period of their bachelor's degree. This program offers interdisciplinary seminars, many of which deal with questions of SD. Finally, LUL offers Sustainable Sciences/Sustainable Development major & minor that students can choose starting from the second semester. LUL extends its SD approach by offering master's & Ph.D. programs in Sustainability Sciences, as well as an MBA in Sustainability Management (UNESCO, 2017).

UT promotes the concept of "Learning for the Future" to support students' competencies through its Centre for Research and Development of Higher Education (CRDHR). It supports the development of the curriculum and the implementation of a supportive learning environment (The University of Tokyo CRDHR, 2018). UT uses interactive instructional methods to deliver such a curriculum, such as online course platforms, interactive websites,

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[11] There are three degrees of integrating SD in the curriculum. The first is to add separate sustainability modules to existing non-sustainability modules. The second, known as "partial integration", is to integrate the content of sustainability modules with the content of already existing non-sustainability modules to form new integrated modules. The third, known as "comprehensive integration", is to consider the concept of sustainability as a core value and framework for developing the content of a whole new curriculum (UNESCO, 2017).

and hands-on activity programs (The University of Tokyo, 2018f). All of the University's "Learning for the Future" initiatives can be linked to the quality education SDG.

UT has addressed target 4.6 of the SDGs (to "ensure that all learners acquire the knowledge and skills needed to promote sustainable development") with a series of initiatives explicitly focused on sustainability, some of which predate the SDGs themselves. For example, UT, in collaboration with partners and with funding from MEXT, founded the "Integrated Research System for Sustainability Science" (IR3S) Institute in 2005. At the graduate level, UT started to offer the Graduate Program in Sustainability Science in 2007 (The University of Tokyo Integrated Research System for Sustainability Science, 2018b). The University also provides other non-formal programs such as the Utokyo Global Leadership Education Program, which was launched in 2014. This program is an innovative, trans-disciplinary 4-year undergraduate course, which is designed to equip talented students with the global competencies and skills necessary to act effectively as creative, knowledgeable, and responsible players and 'change-makers' on the global stage. The program is composed of two phases, as shown in figure (6), the phase of the designated course and the Global Education for Innovation and Leadership phase. Sustainability is addressed as the first pillar of the second phase, where students are asked to do independent research projects about sustainability-related topics (Global Leadership Program of The University of Tokyo, 2018).

[Figure (6), is about here]

In contrast to both LUL and UT, Cairo University did not set predefined standards to integrate the concepts of SD in all courses' curricula. However, its vision statement supports the Sustainable Development Competencies acquisition, which is a significant target of the SDGs education-related goals. Moreover, some university courses and programs are, by nature, associated with SDGs topics such as health economics, public policy, poverty, and inequality (Elmassah and Mohieldin, 2020). This was confirmed by the three interviewed CU officials (El Saeed, 2018; Wagdy, 2019; El Shawarby, 2018). Nevertheless, CU encourages faculty to use interactive instructional methods in teaching, which links to the overall SDG around quality education. A decree of April 2018 required all faculty members to adopt the problem-based learning approach. In the same role category, CU stimulates students' talents through different non-formal activities such as training programs, simulation models, initiatives, employment fairs, and artistic, social, and sports competitions (Cairo University, 2017d; Cairo University, 2018-Arabic). In 2018, CU launched the Future Leader Preparation Camp, which is an ideological project aimed at developing students' minds to think scientifically to establish a

new society (Cairo University, 2018a). Although the main aim of this program was not mapped with the pillars of SD, it was a good step that might serve the local SD agenda.

3.3 Supporting University Staff Related Roles

We analyze this category of roles by evaluating each University's practice within the category parameters of Training Faculty, Building Faculty Communities, Training Administrative Staff, and Research Center Activities.

LUL meets the SDG challenge to provide quality education by supporting university staff and building the teaching competencies of the faculty. The University has introduced a teaching profile, which prepares the faculty to be competent in five interactive fields, dialogue-focused teaching, digital teaching, diversity-focused teaching, experience-based teaching, and inter- and trans-disciplinary teaching. The faculty receive support from a teaching service team, in addition to a university-wide teaching development network. Both the team and the network create a community that helps faculty develop and share their challenges and experiences. LUL does build not only the faculty's competencies but also the competencies of other university staff. LUL spread SD awareness through sustainability communication and standards of excellence on and beyond the campus for all the University's stakeholders (Beringer, 2007). LUL believes that sustainability research is one of the most important fields of action to develop a sustainable civil society in the 21st century. The research activities in LUL are categorized under four inter- and cross-disciplinary research initiatives, namely education, culture, management and business activity, and sustainability. The Research Initiative on Sustainability stands under the leadership of the Faculty of Sustainability (The Leuphana University of Lüneburg, 2018d). Additionally, LUL has a joint research center with Arizona State University, named the Center for Global Sustainability and Cultural Transformation. It aims to create a new model for international academic collaboration in the 21st century (The Leuphana University of Lüneburg, 2018e).

UT offers external programs to develop staff competencies, such as visiting overseas strategic partners to attend training. Such initiatives enable the staff to understand the international environment helping them to respond to changes that happen due to globalization (Japan Society for the Promotion of Science, 2015). These programs link to the requirements of target 4.7 of the SDGs, specifically its stress on enabling "all learners [to] acquire the knowledge and skills needed to promote sustainable development … [through] global citizenship and appreciation of cultural diversity and culture's contribution to sustainable development."

CU has an affiliated training center called the Faculty and Leadership Development Centre (FLDC), which provides capacity building services & training programs for the development of both academic and administrative staff (Faculty and Leadership Development Center, 2018a). It works on building four training competencies of faculty members and leaders in the areas of teaching and education systems, scientific research, management and leadership, and group communication and interaction. Such training programs include but are not limited to, practical teaching skills, use of technology in teaching, e-learning, effective presentation skills, and many other programs that were held at the university level (Faculty and Leadership Development Center, 2018b). Adding to what the FLDC provides, there are training plans that are set at the college level to develop its administrative staff. Although these programs are not entitled to SD programs, their topics address SD-related issues. However, El Saeed added that there are research centers of excellence that make different activities related to SD, such as the Public Administration Research and Consultation Center and the Center for Economic and Financial Research & Studies in the Faculty of Economics and Political Sciences (El Saeed, 2018) and the Center for Advancement of Postgraduate Studies and Research in the Faculty of Engineering (Cairo University, 2018b). In addition to all of this, CU also develops its staff through its membership of partnerships such as the Mediterranean Network for Sustainable Development (see section 3.4 below for further details).

3.4 Supporting Society Stakeholders & Networking Related Roles

We analyze this category of roles by evaluating each University's practice within the category parameters of Service to Society, Networking, and Research Center Activities.

LUL has long been concerned with role category 4 "Supporting Society Stakeholders & Networking." In 2005, the UNESCO Chair in Higher Education for Sustainable Development was established in LUL. The Chair was an opportunity to serve society on the local, national, and international levels through contributing to research, development, teaching, exchange, and knowledge transfer of ESD.

The Chair organized four international conferences with a focus on regional interpretations of sustainability needs, and they resulted in the creation of a global network of active higher education representatives. The Chair also developed new initiatives, including the certificate program to qualify journalists in the field of SD and sustainability communication. Moreover, the Chair contributed to several working groups to promote the concept of HESD (UNESCO, 2017). LUL established the Innovation Incubator for Regional Development in cooperation with the German Federal State of Lower Saxony (2009-2015) (Audretsch, Lehmann, Meoli, &

Vismara, 2015). The incubator aimed to develop the Lüneburg district by focusing on three fields, digital media, health, and sustainable energy, to improve SMEs' innovation capacities, educational levels, employment rates, health levels, and the network and infrastructure of research institutions.

One of the University of Tokyo's Integrated Research System for Sustainability Science's (IR3S)[12] primary responsibilities is to form a meta-network with universities and research institutes inside and outside Japan (The University of Tokyo Integrated Research System for Sustainability Science, 2018c). In addition to this, UT established the Network for Education and Research on Asia (ASNET) to enable researchers to collaborate in education and research concerning Japan and the wider Asian region (Network for Education and Research on Asia, 2001). Moreover, it joined the Promotion of Sustainability in Postgraduate Education and Research Network (ProSPER.Net, 2018) and the International Association of Universities (IAU).

UT offers the Utokyo Executive Management Program as a non-degree management program for working adults (Utokyo EMP). The program aims to develop human resources so that no matter where they are in the world or what situation they face, they can lead and build specific issue resolutions based on solid knowledge and charisma (Executive Management Program of The University of Tokyo, 2011). In the same vein, UT developed a graduate program[13] for African students about sustainability challenges in Africa (The University of Tokyo Integrated Research System for Sustainability Science, 2018a). This links very well with target 4B of the SDGs, which focuses on improving access to higher education for students in developing countries, with a particular focus on Africa.

CU is involved in SD related networks and partnerships. For example, it is part of the Mediterranean Network for Sustainable Development launched in 2008. The network aims to promote HESD, share best practices, provide consultancy to different stakeholders, and synergize scattered activities for the benefit of ESD in the region (Mediterranean Information Office for Environment, Culture and Sustainable Development, 2018). Other non-SD-specific partnerships, such as that with the Qualitative Federation of the Rotary Clubs in Egypt in 2016, have indirectly supported SD and the Egypt Vision 2030. The clubs provided activities that served students, employees, and the local community, such as holding employment forums for final years students, organizing training courses for raising employees' professional efficiency,

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[12] The University of Tokyo Integrated Research System for Sustainability Science
[13] In collaboration with the United Nations University (UNU) and Arizona State University.

making educational seminars necessary for Hepatitis C infection control, and doing some medical caravans at Giza and Fayoum Governorates (Cairo University, 2016). Such activities fuel the high-quality education and serve the higher education programs of Egypt vision 2030, including the programs of "Building distinctive teaching cadres at higher education institutions and "Linking Graduates to Employment Institutions at the Local, Regional, and International Level."

3.5 Sustainable Campus Related Roles

We analyze this category of roles by evaluating each University's practice within the category parameters of Infrastructure and Green Buildings and Resources Efficiency/Recovery.

LUL has taken many steps to achieve a sustainable campus. The University's new campus building was presented at the Expo Shanghai in 2010 as one of the most energy-efficient public buildings worldwide. Most of the campus buildings are fitted with solar panels, and a photovoltaic system was installed on ten buildings. The University runs on 100% green power and is supplied with regenerative heat, the campus has an organic cafeteria, it is traffic-calmed, optimized for bicycle use, and dotted with green areas in which to relax in the breaks between seminars and lectures (The Leuphana University of Lüneburg, 2018c).

UT launched the Todai Sustainable Campus Project (TSCP)[14] in 2008 to create a low-carbon campus by reducing greenhouse gas emissions. The project was divided into two phases; the first phase, which started in 2008 and ended in 2012, aimed to reduce CO2 emissions by 15% compared to 2006 levels. The second phase, which began in 2012 and will end in 2030, aims to reduce CO2 emissions by 50% compared to 2006. In the process of achieving these aims, the University implemented power-saving measures that reduce electricity use. These measures included the renewal of large-scale heat source systems, installation of human body sensors to lighting fixtures, partial conversion to higher-efficiency fluorescent lamps, and upgrading of general refrigerators and room air conditioners (TSCP, 2018).

CU has taken some steps towards a sustainable campus. Some actions have already been applied, and others are still under discussion. Several discussions focused on the feasibility of having a recycling project at the University. The discussions concluded that there were challenges that hindered this project, the most significant of which concerned the forward linkages of the recycled waste - who would be responsible for taking it and what would happen to it next? Another discussion that addressed moving towards a sustainable campus was around

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[14] Todai Sustainable Campus Project

using solar energy to light the University's street lamps. There were technical debates about whether to initiate this project or not because of its cost; it still needs a feasibility study to make the right decision. However, some steps towards sustainability have already been successfully implemented, such as replacing paper printing with electronic copies when available, reducing energy consumption, and accommodating more green areas on campus[15].

4. **Discussion of Results**

After comprehensive case study analysis of the role and successful techniques of HEIs in achieving SD in three countries, Germany, Japan, and Egypt, and qualitative data analysis of interviews from three officials, this study introduces a novel framework to analyze and assess HEIs' commitment to addressing the SD agenda.

A group of scholars has argued that a country's higher education institutions can encounter sustainable development challenges by acquiring and imparting professional skills and knowledge (Mochizuki and Fadeeva 2010; Boström et al, 2018; Eizaguirre et al., 2019; Sibbel 2009). According to Mochizuki and Fadeeva (2010), higher education institutions can be deemed the drivers of progress to induce sustainable awareness in multiple behaviors. It has been witnessed that in a country, these institutions view as an essential means of exploring, testing, developing, and communicating the foundations of sustainable development (Salvioni et al. 2017; Disterheft et al. 2013; Leal Filho 2012). This study has critically analyzed three universities' practice using our new framework of 17 roles under five categories. We included CU in this comparison to identify its situation relative to the other two universities' best practices. Consequently, that gives an insight into the evaluation of similar HEIs. We give each University a particular rating for each identified role. The rating includes four options: Exist (E), which means that the University completely fulfills this role; Partially Exist (PE), which indicates that something similar to this role has been made or that the role was fulfilled incompletely; Doesn't Exist (DE), which means that the University did not perform this role at all; and No Available Information (NA), which means there is no information available to judge if the University fulfilled this role or not. Figure (7) presents the assessment results by comparing each University to each role.

[Figure (7), is about here]

All three of the universities have a clear strategic direction and institutional working practices that consider SD. All roles of vision and mission, strategic plan, operations, and

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[15] https://cu.edu.eg/Cairo-University-News-11939.html

monitoring/reporting system are fully realized in the three universities, except for the monitoring role at CU, which is not fully accomplished.

However, each University addresses SD differently. LUL considers SD as a holistic concept, which is to say that it sees it as both a means and an end. SD is one of three main pillars in the LUL mission statement, and it appears in the center of all of the University's day-to-day practices. This differs from UT and CU, neither of which explicitly mentions SD in their vision or mission statements. However, they both considered it a result that could be achieved through education and research.

The three universities have a different scope of their strategic plans and operation roles for SD. LUL's scope is based on the three concepts of its mission statement: humanity, sustainability, and application. UT's scope is composed of sub-visions: research, education, cooperation with society, and operations. CU's scope is based on eight areas of action,[16] which are partially similar to the UT scope.

LUL and UT have both set transparent systems for regular sustainability audits. LUL publishes a biannual report which complies with the principles of the Global Reporting Initiative (GRI). UT documents and announces any SD-related researches, symposiums, workshops, and lectures inside or outside the University through its FSI. Unlike them, CU only identifies the key performance indicators it uses to monitor its overall strategic plan, without setting any specialized system for auditing and reporting on SD practices within the University.

LUL and UT fully realize the role of the University in supporting students' competencies for SD. Since the launch of the Lüneburg Approach in 2007, it became a reference point for other universities in integrating aspects of SD into undergraduate curricula. LUL was the first European University to establish a College of Sustainability, and it offers a master's and Ph.D. programs in sustainability sciences. Likewise, UT has a postgraduate SD-related program (GPSS). There is a responsible center at UT that promotes the concept of "learning for the future" for the undergraduate curricula. Still, we did not find any clear information to confirm whether UT integrated SD concepts in undergraduate curricula or not. As for CU, we did not find any obligatory standards to incorporate sustainability ideas into curricula. Both LUL and UT uses interactive instructional methods to guarantee the successful delivery of curricula. The methods include, but are not limited to, integrating technology in teaching, using online platforms, activity-based learning, active student-centered learning, and problem-solving

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[16] Previously mentioned in Figure (5)

approaches. On the other hand, CU only uses some interactive instructional methods, with traditional teaching approaches still more common. CU has taken steps to introduce technology and problem-solving approaches to its teaching practices. However, we can consider these to be at the preliminary trial stage compared to the other two universities.

The three universities highlight the importance of student communities/activities as a non-formal way of education. They each had different student activities like simulation models, initiatives, employment fairs, competitions, international student associations, student clubs/circles, local communities, on-campus events, and non-formal training. On the one hand, LUL and UT are rated as "E" since they have specialized student activities that directly address SD, such as the Network for Environmental and Sustainability Sciences in LUL and the GLP in UT. On the other hand, CU is rated as "PE" as it has many student activities, but none of them is specialized in SD. Besides, there is no unified vision and coordination between the actions to achieve SD.

Regarding the role of research centers, the three universities include many activities that address SD-related issues and support students' competencies, such as encouraging sustainability research, conducting SD awareness and development programs, and organizing SD-related seminars and conferences. Both LUL and UT have specialized centers with the aim of addressing SD international and national agendas, such as the Center for Sustainability Management (CSM) in LUL and the IR3S institute in UT. Unlike the other two universities, CU has more than one research center that is indirectly related to SD, but it does not have a specialized center in sustainability.

The three universities showed great efforts in building their faculty competencies by providing development and training programs. However, only LUL is rated as "E," while UT and CU are rated as "PE." This is because LUL's efforts were more focused on ESD teaching practices, while UT and CU were more focused on general teaching practices regardless of their link to SD. LUL introduced a teaching profile which requires the faculty to master five interactive fields. At UT, the training programs aimed to motivate the faculty to understand the overseas environment to be able to respond to changes brought on by the effects of globalization. While at CU, the training programs provided by FLDC aimed to develop one or more of four critical competencies for the faculty.

LUL and UT created specialized ESD faculty communities, but we could not find anything similar at CU. The community at LUL has a specialized teaching service team and an ESD teaching network. At UT, the community is created through the IR3S, which provides a hub

for sustainability at the University. At CU, no one community gathers faculty to share their SD practices. SD issues are discussed only in the departments'/colleges' regular meetings.

LUL is unique in the role of administrative staff training, it conducted a number of specialized sessions focused on sustainability awareness rather than general awareness. LUL established a culture of sustainability communication on the campus so that all staff would be familiar with SD concepts. We could not find any available related information for UT. CU created some development programs for its staff to improve their skills for higher efficiency, yet again without directly addressing sustainability.

The research centers' role for staff (role 3.4) is similar to their role for students (role 2.4). Almost all the activities held by the research centers at the three universities support both students and staff. The research centers encourage and fund faculty to conduct SD-related researches and offer related seminars and conferences to students and the community. LUL and UT are rated as "E" for this role, while CU is rated as "PE" as it does not have a specialized center for sustainability.

The three universities showed great contributions in terms of spreading SD awareness and serving societal stakeholders. However, they differ in the scope of activities that they provide. Germany and Japan are developed countries, hence their scope in serving their society differs from the scope of a university in a developing country like Egypt. For instance, when LUL established its Innovation Incubator, it aimed to create a regional innovation system to develop the whole Lüneburg region for all stakeholders. However, when CU created something similar, it had a relatively narrow scope, aiming only to empower start-ups and to spread the entrepreneurial mindset among youth. The scope of activities in LUL and UT directly address sustainability, such as promoting an integrated SD system of research, conducting SD specialized training programs for different societal stakeholders, sharing SD-related information among various stakeholders, and promoting documentation in the field of SD. While CU's activities are serving society, they are only indirectly addressing sustainability and are not mapped to the SDGs. An example of this is the medical caravans that CU created and the employment fairs that the University organizes.

Both LUL and UT had leading roles in creating SD networks, and both are members in several regional and international SD-related networks. LUL was a founder member of the Copernicus Alliance, is a member of the International Sustainable Campus Network (ISCN), and leads

both the UE4SD [17] project and the SDG 4 efforts of the International Association of Universities' Higher Education and Research for Sustainable Development (HESD) Cluster[18]. Likewise, UT created the ASNET and the IR3S with other partners and is a member of the IAU and ProSPER.NET. On the other hand, CU has not made any SD-related networks and is only a member of the Mediterranean Network for SD and HESI. We can say that CU has taken some steps to join SD-related networks, but it needs to go further to be more active in this role, by creating other local or regional systems and inviting other HEIs to join them.

As previously discussed, the research centers in LUL and UT play a complete role in supporting SD through their activities, which target students and staff. The same could be said about their activities directed to society. Research centers' activities at the three universities were held to serve society. However, the activities at LUL and UT had a more focused SD vision than those of CU. CU has made great efforts to serve its society, but these efforts need to be unified under one SD-based vision.

All of the three universities have taken steps to make their campuses sustainable; however, they differ in the extent to which they have transformed. LUL and UT have gone further than CU. In role 5.1, LUL is rated as "E" as it has built one of the most energy-efficient public buildings worldwide. Similarly, UT is rated as "E" as it has made a significant investment in sustainable infrastructure through its TSCP. Such infrastructural investments have contributed to resource efficiencies at the two universities; hence, they are rated as "E" in role 5.2.

On the other hand, CU is rated as "DE" in regard to role 5.1 as it has not taken steps to create new infrastructure or systems. However, it is rated as "PE" in regard to role 5.2 since it has attempted to maximize the usage of available resources through, for example, reducing energy consumption and the usage of printed papers. Other steps are still under discussion, including a recycling project and using solar energy in lighting the University's street lamps. These steps are beneficial, yet more needs to be done.

James and Card (2012) highlighted that students of University could play an essential role in recognizing the influence of sustainable practices executed by the institutions. Moreover, determining sustainable capabilities and providing social education to people can lead countries to unlock their business and social environment (Sterling & Thomas, 2006). Primarily, it enables individuals to develop and enhance some critical behaviors, for example,

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[17] University Educators for Sustainable Development
[18] The link with information about that is here - https://www.iau-hesd.net/en/contenu/4648-iau-global-cluster-hesd.html

creativity, initiative, perseverance, teamwork, risk understanding, and a sense of responsibility. Therefore, students need to prepare themselves to encounter the sustainability challenges to pursue a successful future and to improve future business activities. Thus, to promote sustainable growth, higher education institutions must make some severe changes focused on result-oriented expertise to implement sustainable social justice and offer several opportunities to students for their social and ecological commitment (Saadatian et al., 2011). Moreover, the higher educational institute's size greatly affects sustainable development (Ramos et al., 2015). In many countries, the students have to compensate for acquiring education as it turned into a profit-making business for the investors (Bok, 2009). Thus, urgent reforms and improvements are required to improve universities' teaching and research areas for sustainable development (Brito et al. 2018). Therefore, we can say that higher education institutions can extend sustainable development by using both formal and non-formal education. The study defined formal education as curriculum learning (official education) offered by the institutions. And informal education as extra curriculum (unofficial education) events and activities (European Commission 2012).

5. Study Implications and Limitations

In terms of practical implications, this study helps the managers and direct their attention to understanding the importance of higher educational institutions and sustainable development. Academically this research will facilitate future researchers, educators, and policymakers to make the perfect policies by keeping in mind the sustainable development of HEIs. This study is a pioneer in comparing three countries, including Germany, Japan, and Egypt. Therefore, it can be a useful benchmark for researchers in emerging countries. This research extended the limited understanding of HEIs and their role in sustainable development, and therefore, contributing significantly to existing literature. The results of this study will help generate an awareness of the degree to which HEIs' curricula and their execution fulfill the sustainability-related knowledge and skills of students to be able to cope effectively with the current and potential global challenges of socio-economic and environmental sustainability. This study offers numerous implications for practitioners and society. Strong SD leads to sustainable community development (Hamstead and Quinn, 2005). This study introduces a novel framework for HEIs' SD analysis and assessment, which guides HEIs and educational leaders to support SD to fulfill their countries' commitments to achieving the SDGs. Universities' educational programs intended to develop human resources contribute a lot in the realization of a more sustainable society (Elmassah, Biltagy, and Gamal, 2020). SD is primarily about

individuals, their well-being, and equality in their relations with each other, in an environment where the imbalances between nature and society may endanger economic and societal stability. Sustainable development is a socially constructed concept that involves trade-offs between social, environmental, and economic priorities and is needed to maintain the overall system credibility (Hediger, 2000). The current study also bridges the gap between theory and practice of SD, as it gives consideration to the potential role of HEIs to support SD in the area of strategic direction and institutional working practices, supporting students, supporting university staff competencies, supporting society's stakeholders and networking, and sustainable campus.

This research has several limitations that can be addressed by futures studies. First of all, this research has highlighted higher educational institutions' role and neglected the lower level or school education. Secondly, this study has compared only three countries, including Germany, Japan, and Egypt.

6. Conclusion and Policy Recommendations

This paper contributes to the empirical literature in the field of ESD. We use a qualitative method to identify the roles HEIs should play to achieve SD by reviewing the NSDSes of Germany, Japan, and Egypt. The paper created a new framework for HEI roles for SD. The developed framework includes five categories and seventeen roles. We used our framework to evaluate the roles of three universities in supporting SD. Two of the case studies are for leading universities in the field, LUL, and UT. The third case study is for CU, which was added to the comparison to identify how it could learn from the best practices of the leading universities. In general, LUL appears to have gone a little further than UT in terms of the development of its practice related to education for SD. CU has made a good start towards fulfilling the obligations of the SDGs in terms or education for SD, but can still learn much from both LUL and UT. This paper shows that most of the identified roles were fulfilled by the two leading universities, while CU partially accomplished them. The paragraph below summarizes the findings of the paper relating to each of the identified categories for SD, highlighting the similarities and differences between the three universities.

All of the universities studied had a clear strategic direction that takes into consideration SD. However, LUL was the only one to consider SD as a holistic concept. All three universities also set strategic plans and their means of implementation to achieve SD. Yet, only LUL set a system for sustainability audits and reporting. At the undergraduate course level, LUL provides a reference point for integrating SD in the curriculum with its Lüneburg Approach. At the

postgraduate level, LUL and UT provided direct programs for SD, while CU provided programs that indirectly address SD. The three universities used interactive instructional methods to guarantee successful delivery of all curricula, regardless of whether they address SD topics or not. However, LUL added specialized staff training and communities to encourage the usage of ESD-based instructional methods. Moreover, the three universities highlighted the importance of student activities and communities in building students' characters. However, only LUL & UT had specialized student activities in SD. Both LUL and UT had SD specialized research centers and activities, while CU did not have SD specialized centers. The three universities showed great efforts in building their university staff competencies, yet LUL was more focused on SD. The three universities have also made significant contributions in spreading SD awareness and serving society. However, they differed in the scope of activities that they presented to their communities; LUL and UT had a broader and more advanced scope of activities compared to CU. Both LUL and UT have leading roles in creating ESD related networks, while CU is limited in SD networks. UT showed a model of best practice in creating IR3S, which was a research institute and a network that applied many SD related activities on the local, regional, and international levels. All three universities had taken steps to make their campuses sustainable. However, LUL and UT have taken more steps than CU and focused more on establishing the infrastructure and buildings that preserve resources. In contrast, CU's practices were limited to re-adjusting the usage of available resources.

Our discussion of results indicates that CU has put much effort into supporting SD, yet many further steps are still needed. CU could learn from the novel and pioneer practices of LUL and UT to fill in the gaps it has in different roles. Also, it can put more effort into adopting the suggested higher education programs of Egypt's Vision 2030. For example, CU could start by creating and committing to a reporting and documentation system for its existing SD practices. This would be the initial step towards gathering all its existing practices under one umbrella. Moreover, this would help to analyze the current situation in terms of the firm and weak points at the University. Then, it could directly integrate SD concepts into its formal and non-formal education programs to ensure graduating students are competent in these areas. Moreover, CU could start providing specialized ESD training and awareness sessions for its faculty and administrative staff and find new ways to spread awareness among society and different stakeholders. In addition to this, CU needs to think seriously about how to create a sustainable campus, encouraging more green campus initiatives could be a starting point. Through these measures, CU can help to achieve Egypt's 2030 Higher Education Strategic Objectives and therefore contribute to achieving SD.

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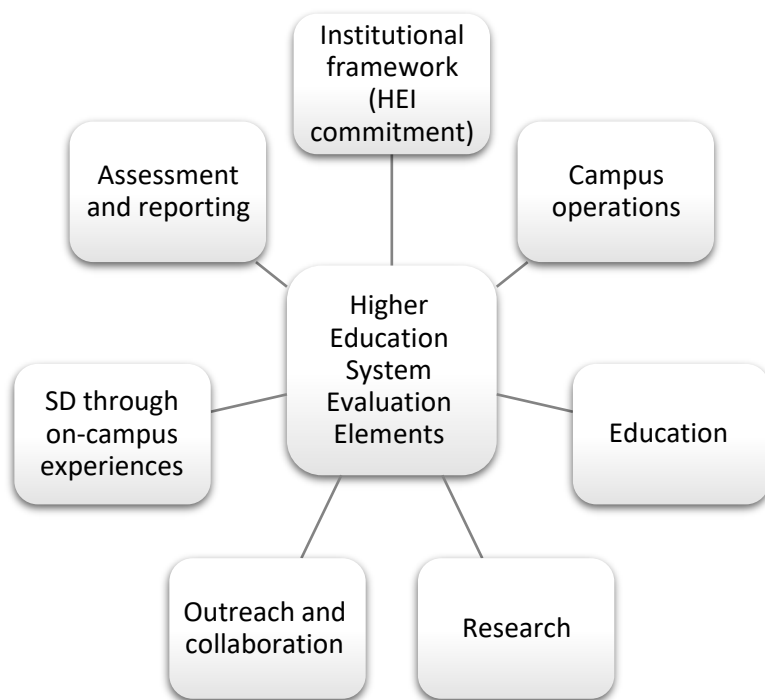
Figure (1) Proposed Evaluation Elements for Higher Education Systems

Germany			Japan			Egypt		
Initiative	**Year**	**Responsible Body**	**Initiative**	**Year**	**Responsible Body**	**Initiative**	**Year**	**Responsible Body**
Copernicus Charter	1994	CRE	Revision of Fundament-al Law of Education	2006	MEXT	HEEP	2002	MHESR
Universities for SD Declaration	2010	HRK & German Commission for UNESCO	ELIAS including ProSPER. Net	2008	MOE & UNU	Egypt's 2030 Vision for Higher Education	2015	MOP
Updated Copernicus Charter	2011	Copernicus Alliance						

Figure (2): Bodies Identifying the Role of HEIs for SD in Germany, Japan, and Egypt

1.1 Vision/Mission
1.2 Strategic Plan
1.3 Operations
1.4 Monitoring &
Reporting System

1. Strategic
Direction
and
Working
Practices

2.1 Curriculum
2.2 Instructional Methods
2.3 Student Communication
Activities
2.4 Research Centre
Activities

Target Audience

2. Supporting
Students'
Competencies

3. Supporting
University Staff
Competencies

4. Supporting
Society's Stakeholders
& Networking

4.1 Service to
Society
4.2 Networking
4.3 Research
Centre Activities

3.1 Training Faculty
3.2 Building Faculty
Communities
3.3 Training Staff
3.4 Research Centre
Activities

5. Sustainable Campus

5.1 Infrastructure & Green Buildings
5.2 Resource Efficacy & Recovery

Figure (3): The required roles by the HEIs for SD

University Organization &
its members

- Energy & resource
  management
- Sustainability
  management & reporting

University as teaching,
learning & life-world

- University as life-world
- Interdisciplinarity in
  teaching & learning

Reflection &
communication on
sustainability

- Communication &
  knowledge transfer
- Culture & sustainable
  development
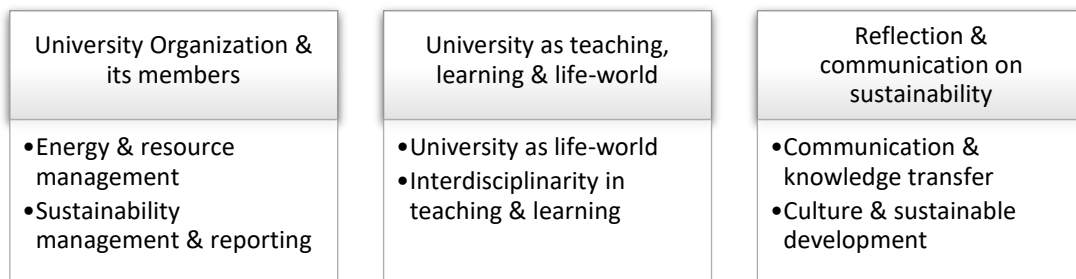
Figure (4): Lüneburg Sustainable University Project

Area	•Description
Programs & Services	Programs and services that are up to international quality standards
Institutional Performance	Excellence in institutional performance and enhancing the university's resources
Students' Competencies	Students' competencies and skills in creativity, innovation, scientific thinking, and entrepreneurship
University's Human Resources Competencies	Excellence in the university's human resources skills and competencies
Research System	Well-established system for research
Social Responsibility	Playing a special role in achieving social responsibility
Information System	Having an integrated management information system that covers all the university's activities
The University Status	Internationalization of the university

Figure (5): Areas of Strategic Objectives (Cairo University)

Source: Constructed by the authors based on information provided in (Cairo University, 2015-Arabic)

Phase 1: GLP Designated Courses
(Junior Division Year 1 & Year 2)

Global Education Subjects	Problem Solving & Practical Skills Subjects	Foreign Languages Subjects

At least 6 credits from selected subjects from at least two categories

Phase 2: GLP Global Education for Innovation and Leadership
(Senior Division Year 3 & Year 4)

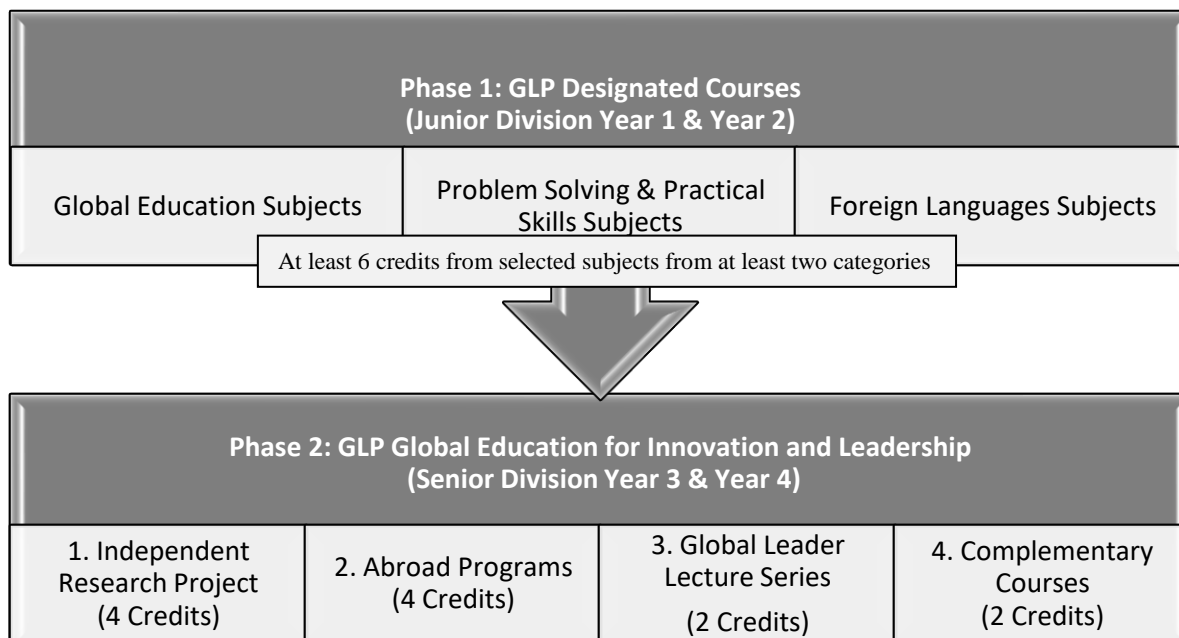| 1. Independent Research Project (4 Credits)	2. Abroad Programs (4 Credits)	3. Global Leader Lecture Series (2 Credits)	4. Complementary Courses (2 Credits)

Figure (6): The Global Leadership Program's (GLP) Structure

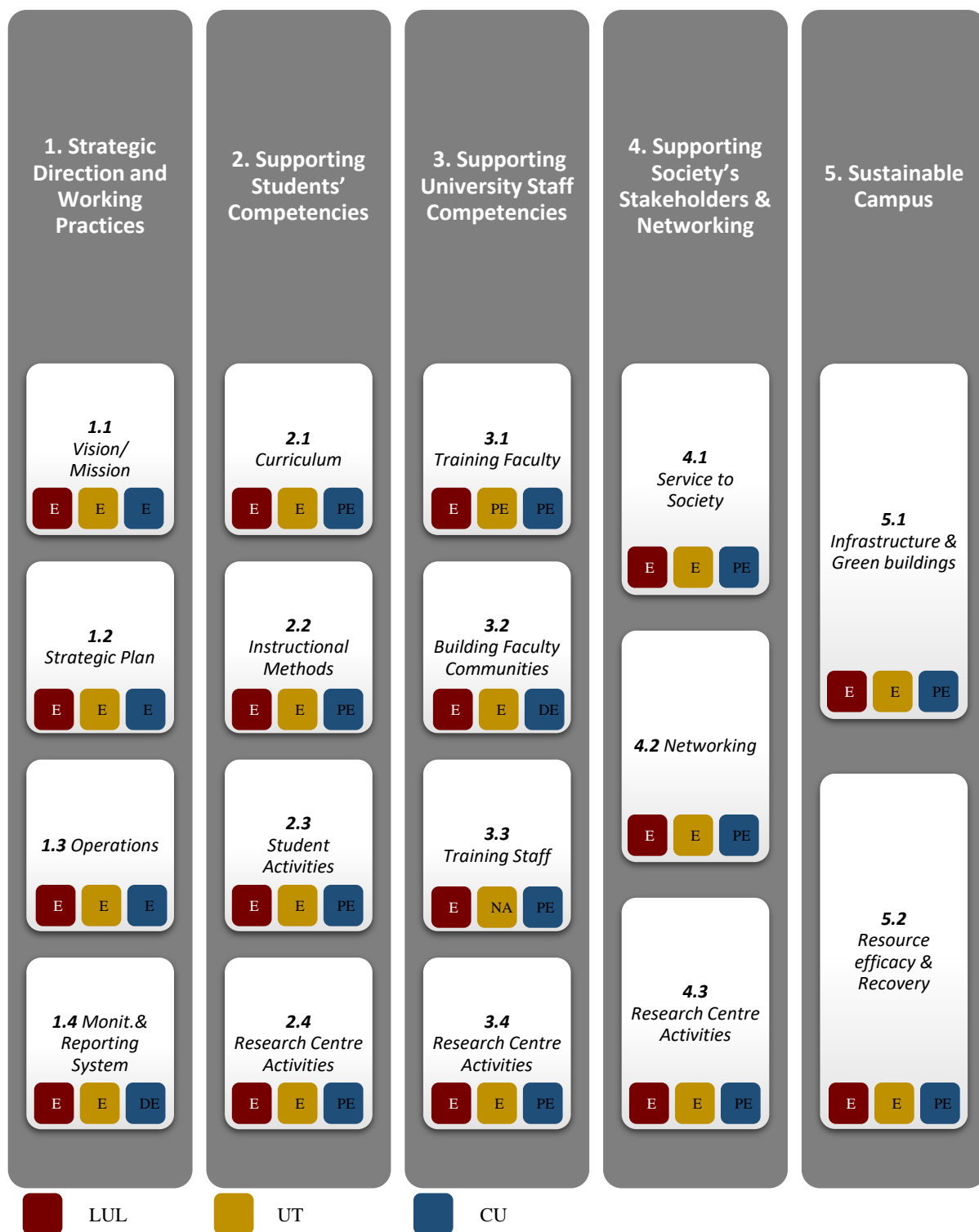Source: Global Leadership Program official website (Global Leadership Program – The University of Tokyo, 2018)

Figure (7): Proposed Assessment Framework of HEIs roles for SD

Source: Constructed by the authors

Appendices

Table A-1: Seven Elements of Higher Education System for Sustainable Development

Element	SD Practices under this Element
1. Institutional framework (HEI commitment)	Policies, vision, mission, Sustainable Development office, and signed declarations, charters, and initiatives
2. Campus Operations	Energy use and energy efficiency, greenhouse gases, waste, water and water management, food purchasing, transport, accessibility for disabled people, and equality and diversity
3. Education	Courses on SD, programmes on SD, transdisciplinary, curricular reviews, and 'Educate-the-educators' programmes
4. Research	Research centres, research funding, holistic thinking, international recognition, SD research used in teaching, publications, patents, new knowledge and technologies, collaboration, and transdisciplinary
5. Outreach and collaboration	Exchange programmes for students in the field of SD, joint degrees with other universities, joint research, SD partnerships (e.g. enterprises, non-governmental organisations, and governments), being part of a UN Regional Centre of Expertise (RCE), and SD events open to the community
6. SD through on-campus experiences	SD working group, SD policies for students and staff, sustainable practices for students, SD visibility throughout the campus, SD awareness raising in the campus, and student and staff engagement
7. Assessment and reporting	SD assessment, SD communication, environmental reports, sustainability reports, national environmental or sustainability HEIs rankings, and international environmental or sustainability HEIs rankings.

Source: Constructed by the authors.

Table A-2: Areas of Actions of Universities for Sustainable Development in Germany

Area of Action	Description
Research	Universities should encourage research in cross-disciplinary and interdisciplinary specializations rather than subject-specific specializations. This is because the global problems are not related with only one field, but a mixture of many fields such as humanities, economics, social and behavioural sciences, natural sciences, and engineering.
Teaching and learning	Universities should work on building academic as well as practical knowledge and competencies of its students to enable them to address different sustainable development issues when they join the workforce.
Service to society	Universities should engage with and serve public and private stakeholders at national and international levels.
Institutional working practices (operations)	Universities should adjust their internal practices and procedural processes to cope with the principles of sustainable development. .

Source: (German Commission for UNESCO, German Rectors' Conference, 2010)

Table A-3. COPERNICUS Charter 10 Principles of Action

Principle of Action	Description
Institutional commitment	Universities shall demonstrate real commitment to the principle and practice of environmental protection and sustainable development within the academic milieu
Environmental ethics	Universities shall promote among teaching staff, students and the public at large sustainable consumption patterns and an ecological lifestyle, while fostering programs to develop the capacities of the academic staff to teach environmental literacy
Education of university employees	Universities shall provide education, training and encouragement to their employees on environmental issues, so that they can pursue their work in an environmentally responsible manner.
Programs in Environmental Education	Universities shall incorporate an environmental perspective in all their work and set up Environmental Education programs involving both teachers and researchers as well as students – all of whom should be exposed to the global challenges of environment and development, irrespective of their field of study.
Interdisciplinarity	Universities shall encourage interdisciplinary and collaborative education and research programs related to sustainable development as part of the institution's central mission. Universities shall also seek to overcome competitive instincts between disciplines and departments.
Dissemination of knowledge	Universities shall support efforts to fill in the gaps in the present literature available for students, professionals, decision-makers and the general public by preparing informative didactic material, organizing public lectures, and establishing training programs. They should also be prepared to participate in environmental audits.

Networking	Universities shall promote interdisciplinary networks of environmental experts at the local, national, regional and international levels, with the aim of collaborating on common environmental projects in both research and education. For this, the mobility of students and scholars should be encouraged.
Partnerships	Universities shall take the initiative in forging partnerships with other concerned sectors of society, in order to design and implement coordinated approaches, strategies and action plans.
Continuing education programs	Universities shall devise Environmental Education programmes on these issues for different target groups: e.g. business, governmental agencies, non-governmental organizations, the media.
Technology transfer	Universities shall contribute to educational programs designed to transfer educationally sound and innovative technologies and advanced management methods.

Source: (The Conference of European Rectors, 1994).

Table A-4: MEXT's & MOE's Areas of Actions of Universities for SD in Japan

Area of Action	Description
Undergraduate Education	Universities shall work on undergraduate educational programs to develop human resources that can contribute to the realization of a more sustainable society in each professional field
Postgraduate education and research	Universities shall work on postgraduate educational programs or research in environmental science to foster the development of leaders in the environmental field or in sustainability science to contribute to the creation of a sustainable society
Outreach activities and networking	Universities shall work on doing activities to promote ESD at the local level, and international cooperation on ESD
School Support	Universities shall work on activities that support school education such as teacher training programs and the development of teaching materials for ESD

Source: (Kitamura & Hoshii, 2010)

Table A-5: Environmental Leadership Vision of Japan: Areas of Actions, Aims, and Initiatives

Area of Action	Aim	Initiatives
Development of Higher Education Model Programs	This area of action aims to encourage the Japanese HEIs to develop programs that train future leaders to be able to build greener socioeconomic systems in every area of the society	35 universities proposed programs in 2008, at which six of them were selected as projects for the year.
Government-Industry-Academia Partnerships	This area of action aims to establish a government-industry-academia consortium to be considered as a practical platform in which all stakeholders from government, academia, industry and civil society can participate.	"EcoLead" consortium was established in 2011.
Asian Universities Network	This area of action aims to build a network of Asian universities that work on developing its human resources in the environmental field and committed to ESD in the Asia Pacific region	"Promotion of Sustainability in Postgraduate Education and Research Network (ProSPER.NET)" was launched in 2011 by the United Nations University funded by MOE.

Source: (Ministry of Enviornment, 2011)

Table A-6: Egypt's Vision 2030 – Strategic Objectives for Higher Education

Strategic Objective	Definition
First Objective: Improving Educational System Quality to Conform with International System	- Activating quality and accreditation rules that conform to international standards - Enabling the learner to acquire skills needed for the 21st Century - Supporting and developing capabilities of faculty members and administrative staff - Developing innovative and diverse academic programs and evaluation patterns - Developing the organizational structure of the ministry and its institutions to achieve flexibility and quality of education - Reaching the effective technological and electronic forms for presenting knowledge and scientific research, so as to be considered by the students, the teachers, and the individuals of the community
Second Objective: Providing Education for All without Discrimination	- Providing educational opportunities at higher education institutions - Developing the admissions systems and policies at the educational institutions

Third Objective: Enhancing Competitiveness of the Educational Systems and its Outputs	- Improving competitiveness rank in international education reports - Activating a dynamic relationship between outputs of the education system and labor market requirements

Source: (The Ministry of Planning and Follow-up and Administrative Reform, 2016)

Table A-7: Egypt's Vision 2030 – Programs for Achieving the Higher Education's Strategic Objectives

Program	Program Description
Establishing higher education institutions in partnership with civil society and the private sector	This program aims to ease the financial burden incurred by the government due to the high cost of the expansion of higher education institutions, whether through the establishment of new institutions or the expansion of current ones. This program is included within medium-cost programs and its execution is expected to begin in 2015 and be completed by 2025
Building distinctive teaching cadres at higher education institutions	Higher education depends substantially on the teachers and professors since the work of faculty members at higher education institutions extends to include the development of curricula and specification of evaluation systems. Accordingly, the development of teaching staff becomes a key prerequisite for increasing the quality of higher education as a whole and its influence on the students. This program is included within high-cost programs and its execution is expected to begin in 2015 and be completed by 2020
Improving quality of higher education institutions	This program aims to enhance decentralization of higher education through maximizing the ability of higher education institutions to achieve efficiency and commit to quality standards. This program is included within medium-cost programs and its execution is expected to begin in 2015 and be completed by 2020
Activate the role of Research Centers at Higher Education Institutions	Scientific research indicates the student's ability to learn independently and the quality of education he has received. It also indicates the development level of faculty members. This program aims to maximize scientific research since it is seen as the path for continuous education and not limited only to educational stages. These centers form a link between theory and practice and are a channel that supports the economy due to the research it provides that contributes to the development of practical life. This program is included within high-cost programs and its execution is expected to begin in 2015 and be complete by 2020
Link Graduates to Employment Institutions at the Local, Regional, and International Level	This program aims to emphasize the dynamic relationships between the graduates of higher education and the labor market, ensuring the qualification of the graduates. This program is included within high-cost programs and its execution is expected to begin in 2015 and be complete by 2020
Adopt the Egyptian Diploma Equivalence System and Recognition of Higher Education Certificates	This program aims to internationalize Egyptian universities through the equivalence of diplomas. It is considered to be an ongoing initiative, since higher education systems are continually updated. This program is included within high cost programs and its execution is expected to begin in 2020 and be complete by 2025
Developing Curricula Based on the National Qualifications Framework	This program aims to enhance the quality of higher education through the continuous development of the curriculum based on the National Qualifications Framework to keep pace with the requirements of the labor market and international standards. This program is included within high-cost programs and its execution is expected to begin in 2020 and to be complete by 2025
Update the Admission Systems at Higher Education Institutions	This program handles the lack of efficiency of the current admission systems and its entire reliance on the students' grades regardless of their desires, which is considered one of the most significant challenges that face higher education. Accordingly, the update of the admissions systems becomes a fundamental means for acquiring successful students passionate about their fields and specializations. This program also contributes to the decentralization of higher education. This program is included within low-cost programs and its execution is expected to begin in 2020 and be complete by 2025

Source: (The Ministry of Planning and Follow-up and Administrative Reform, 2016)

Table A-8: Summary of the Roles HEIs should Play to achieve SD

Category 1. Strategic Direction & Institutional Working Practices Related Roles	
Role	**Description**
1.1 Vision/Mission	Setting a vision or mission that addresses SD
1.2 Strategic Plan	Setting a strategic plan that work on achieving the SD related vision and/or the mission
1.3 Operations	Setting & adopting policies & procedures to achieve the SD related strategic plan

1.4 Monitoring/Reporting System	Setting a system of audit and reporting to monitor the progress of implementing the SD practices & documenting them
Category 2: Supporting Students' Competencies Related Roles	
Role	**Description**
2.1 Curriculum (Formal Education)	Having pre-set standards to integrate the concepts of SD in undergraduate and/or post-graduate courses' curricula
2.2 Instructional Methods (Formal Education)	Adopting interactive instructional methods to guarantee the appropriate delivery of the SD-based curriculum
2.3 Student Communities/Activities (Non-formal Education)	Building student communities that help in building characters, preparing active citizens, and spreading awareness about SD
2.4 Research Centres/Centres of Excellences' Activities (Students-Focused) (Non-formal Education)	Having SD specialized research centres that conduct SD related awareness campaigns, seminars, workshops, research projects, or similar activities for building students' awareness and competencies.
Category 3. Supporting University Staff Competencies Related Roles	
Role	**Description**
3.1 Training Faculty	Training faculty on SD related practices & using interactive instructional methods to deliver SD-based curricula
3.2 Building Faculty Communities	Building communities that encourage sharing knowledge and best practices in ESD among faculty
3.3 Training Administrative Staff	Training administrative staff and other university employees on sustainability practices
3.4 Research Centres/Centres of Excellences' Activities (University Staff-Focused)	Having SD specialized research centres that encourage faculty to do SD related research and initiate SD related conferences, seminars, events, or similar activities specifically targeting the faculty.
Category 4. Supporting Society Stakeholders & Networking Related Roles	
Role	**Description**
4.1 Service to Society	Offering SD related services to different stakeholders of the society such as training schoolteachers on ESD practices, spreading SD awareness among civil society and doing similar activities
4.2 Networking	Sharing in established SD related networks or creating new networks to share knowledge and learn from the best practices
4.3 Research Centres/Centres of Excellences' Activities (Society-Focused)	Having SD specialized research centres that provide different activities that serve the society, such as spreading awareness about SD, or doing developmental activities.
Category 5. Sustainable Campus Related Roles	
Role	**Description**
5.1 Infrastructure and Green Buildings	Constructing green buildings or facilities that preserve the environment such as environment friendly floors and windows, rainwater collection systems, and other similar facilities.
5.2 Resources Efficiency & Recovery	Launching initiatives that calls for the efficient utilization of resources such as energy saving, preserving the environment, water saving waste management, recycling, and other similar initiatives that doesn't depend on a certain infrastructure.

Source: Constructed by the authors as a result of combining & classifying the identified roles of HEIs to achieve SD in Germany, Japan, and Egypt, in addition to the identified roles of HEIs to achieve SD mentioned in the literature.

Table A-9: The Roles of the three Higher Education Institutions in achieving Sustainable Development: A Comparison

Category 1. Strategic Direction & Institutional Working Practices Related Roles			
Role (Point of Comparison)	**LUL**	**UT**	**CU**

Role (Point of Comparison)	LUL	UT	CU
1.1 Vision/Mission	E	E	E
1.2 Strategic Plan	E	E	E
1.3 Operations	E	E	E
1.4 Monitoring/Reporting System	E	E	DE

Category 2: Supporting Students' Competencies Related Roles			
Role (Point of Comparison)	**LUL**	**UT**	**CU**
2.1 Curriculum	E	E	PE
2.2 Instructional Methods	E	E	PE
2.3 Student Communities/Activities	E	E	PE
2.4 Research Centres Activities	E	E	PE

Category 3. Supporting University Staff Competencies Related Roles			
Role (Point of Comparison)	**LUL**	**UT**	**CU**
3.1 Training Faculty	E	PE	PE
3.2 Building Faculty Communities	E	E	DE
3.3 Training Administrative Staff	E	NA	PE

3.4 Research Centres Activities	E	E	PE

Category 4. Supporting Society Stakeholders & Networking Related Roles			
Role (Point of Comparison)	**LUL**	**UT**	**CU**
4.1 Service to Society	E	E	PE
4.2 Networking	E	E	PE
4.3 Research Centres Activities	E	E	PE

Category 5. Sustainable Campus Related Roles			
Role (Point of Comparison)	**LUL**	**UT**	**CU**
5.1 Infrastructure and Green Buildings	E	E	DE
5.2 Resources Efficiency/Recovery	E	E	PE

Source: Constructed by the authors