

Science and Quality Education for Sustainability Development in Libya

Mahmoud M. Dboba^{1*}, W. Astiata¹, SP Bindra²

¹Department of Physiotherapy, Faculty of Medical Technology, University of Tripoli, Libya

²United Nations Department of Economic and Social Affairs (UNDESA) Focal Point Libya

Email: ^{1*}dbobam@gmail.com, ²w.astiata@uot.edu.ly

Abstract

The Paper is designed to present an overview on the state of art on new and emerging education and training approaches and methodologies to meet the sustainable development demands at global, regional, national, and local levels. It demonstrates that how crisis-ridden Libya is planning the vital role for effective education and training in chemical, biological, environmental science and engineering education using best practice blended learning approaches envisaged in United Nations Commission for Sustainable Development (UNCSD) Rio+20 Future We Want 2012 Report, United Nations Sustainable Development Goals (UN SDGs) 2015-30, 17 goals and 169 targets and Higher Education Sustainability Initiative (HESI) that help play in leveling the varied content knowledge, expertise and experience of professionals. It highlights a strategy and plan of action to meet the challenges of change and development in education and training required to develop the vital skills and experience of sustainable development professionals needed to perform their more sophisticated jobs with greater responsibility and accountability. Eventually, it provides a framework approach using outcomes, output, baseline, targets, performance indicators, and activities to design a wide range of formal education and training in chemical, biological, environmental protection science and engineering fields using new and emerging technologies for the enhancement of sustainable livelihood in Libya.

Keywords

New and Emerging Education and Training, Best Practice Blended Learning Approach, Crisis Ridden Libya, Sustainable Development

Introduction

Chemical, biology and environmental science and technology education & training in Libya is in the process of change for rebuilding a post-conflict country affected by the destruction of infrastructure and production facilities, disruptions to banking activity, limited access to foreign exchange, and the departure of expatriate workers. It is intended to a) address and analyze complex environmental protection problems due to insecurity, instability, and unsafe country, b) evolve substantive environmental laws

Submission: 5 February 2022; **Acceptance:** 7 May 2022



Copyright: © 2022. All the authors listed in this paper. The distribution, reproduction, and any other usage of the content of this paper is permitted, with credit given to all the author(s) and copyright owner(s) in accordance to common academic practice. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license, as stated in the website: <https://creativecommons.org/licenses/by/4.0/>

requiring specific environmental protocols of investigation, and c) raise the growing public awareness of a need for action in addressing environmental problems (Bindra et al., 2013). It is planned in line with the Rio+20 Libyan national report approved by UN General Assembly in 2012 in line with Future (2012-22) We Want (Bindra, 2012). It is designed to meet and exceed United Nations Commission for Sustainable Development (UNCSD) Future We Want guidelines issued to its Member States, United Nations Sustainable Development Goals (UN SDGs) 2015-30, 17 goals & 169 targets and Higher Education Sustainability Initiative (HESI) of United Nations Educational, Scientific and Cultural Organization (UNESCO). The idea is to commit the country to help develop solutions for the biodiversity under threat and sustainable livelihood of present and future generations using developments in chemical, biology, and environmental science & engineering in cooperation with EU neighboring countries, sister United Nations agencies, and Non-Governmental Organizations (NGOs). Bearing in mind that role of education is to serve as a catalyst for economic and social development. Therefore, the workforce needs to be equipped with tools, techniques, and technologies that focus on help reduce environmental footprint, in line with the guidance and leadership of the UN-recognized Presidential Council (PC) & the Government of National Accord (GNA) & Environmental General Authority. Its goal is to strike a balance among the three pillars of sustainability – social, economic, and environmental so that the rebuilding of infrastructure and economy grows in an environmentally sustainable manner. The Policy of Libya is to help establish democracy by access to stable, secure inclusive growth and sustainable economic development in a guaranteed manner for its future generations. Libyan national Rio+20 report has set clear objectives and provides a framework to address the new energy challenges as we transition to a low carbon economy.

Technology-enabled learning and education as envisaged by UNCSD Rio+20 Focal point in Libya for preparing manpower capable of rebuilding sustainable livelihood is a challenge. An overview based on reflection exercise on trends, role, relevance, challenges presented elsewhere by authors shows that Libyan higher education in general and chemical, biological & environmental sciences and engineering, in particular, is impacted by a growing tension between the science of learning and the art of teaching. Overview of thoughts feelings and impressions by some like British neuroscientist Baroness Susan Greenfield - argue that video games and other innovations of the information age are having a detrimental effect on our brains. There is no yet full evidence to support these outrageous claims but others feel a distinct possibility that while information is everywhere, knowledge is declining and technology is to blame.

Many consider that the current educational & learning process acquired from 42 years of the dictatorial regime is ill-equipped to enable learners to deal with the immensely complex economic, social and environmental problems. Change and development to develop expertise capable of imparting solid critical and creative thinking skills to help figure out how we can educate future generations using best practice blended learning program of UNESCO, Management of Social Transformation (MOST), Man & Biosphere (MAB), & Promoting Responsible Merit for Entrepreneurship (PRIME), United Nations Industrial Development Organization (UNIDO) as presented by one of the authors to become wise and knowledgeable to rebuild sustainable Libya (Bindra et al., 2012). It is a challenge in a world where information is cheap and easy. The ultimate aim of higher (as opposed to vocational)

education in chemical, biology, environmental science & engineering is to transform student thinking based on ways that help acquire solid critical and creative thinking skills needed to rebuild sustainable Libya. This paper-based on situation analysis is designed to show that how the chemical, biology, and environmental sciences & engineering-related education & training centers in the country are committed to meet its inclusive economy and environmental commitments through its own resources.

An Assessment of the Existing Situation

Libya accounts for approximately 6.31 million population includes 1.7 million students, over 270,000 of whom study at tertiary level, including those in the higher technical and vocational sector. Higher education in Libya is provided by universities (both general and specialized) and higher technical and vocational institutions. There are 27 public universities and 56 private universities. Technical and Vocational Education (TVE) plays a key role in employability and supplying the labor market with a skilled and qualified labor force. Libya's National Board for Technical and Vocational Education was established for the purpose of developing and enhancing the quality of education services provided through applying international standards to enable it to truly participate in the country's development. The total number of TVE's in Libya is 488. They are divided into 16 Technical Colleges, 91 Higher Technical Institutes, 381 Intermediate Vocational Institutes. In addition: there are 40 Women Training Centres. The total number of students exceeds 150000. 70442 students in Intermediate Vocational Institutes. 66457 students in Higher Technical Institutes. and 13192 students in Technical Colleges.

Global, national, regional, and local overview of different roles of chemical, biology & environmental science & engineering education show a dire need to learn and understand basic ecology. This helps to understand environmental issues, develop the value system and attitude, and be pro-actively involved in environmental problem-solving. Biology also plays a vital role in developing positive feelings toward nature. A blend of biology environment and chemical sciences knowledge helps students develop environmental skills such as the ability to identify and define, the ability to analyze, and the ability to solve environmental problems (Sharma and Sharma, 2012).

The chemical, biology, and environmental science & engineering education & training in Libya is assessed, evaluated and its findings are being implemented and monitored after a fact-finding mission. The information as gathered is to help assess and create three new concentration curriculums. One of the current curriculum objectives being developed is the specialty in infrastructure, biodiversity & environmental protection management as the first of its kind in Libya. It is based on the meetings with stakeholders from industry, academia leaders & NGOs representing a vast cross-section of the Libyan infrastructure including the aviation industry, chemistry, biodiversity & environmental protection. The overall impression is that there is a great need for curriculum, learning & teaching process in the higher education system of Libya. This paper examines the needs assessment in the Libyan educational system and also explores the content of this curriculum including the learning and teaching process.

In recent years there is an increasing interest in Environmental Microbiology that focuses on microbial properties and processes that define the structure and function of natural and man-made ecosystems. Keeping in view of the fact that since the flow of energy and matter through the environment is often governed by microbial activities, therefore, it is essential to understand, predict and leverage them, to both address and avoid environmental problems. Bearing in mind that water is a key media through which energy anthropogenic materials, waste, and elements are transported within and between ecosystems, it is being realized to focus on environmental microbiology. Because microorganisms are the primary living constituents of aquatic ecosystems and mediate globally important processes (Lu et al., 2020), therefore education and training must be grounded in microbial physiology, ecology, evolution, and environmental science and engineering.

Rationale for Change

The current state of Libyan chemical, biology, environmental science & engineering education is in turmoil. A move by the country to become a North African hub requires participation at the highest forum with regards to biodiversity, civil infrastructure including aviation & environmental protection matters. There is a need for better-trained individuals to work in this demanding and rapidly changing environment. In the Libyan UNCSD Rio+20 Future Libya Wants for the 2012-22 Strategic Plan in line with Ministry of planning 2013-30 3rd generation plan requiring, strategic mapping process. This outlines the new strategic objective to attract, develop, and retain human capital. The critical issues outlined in this process include: establishing competitive remuneration structures, favorable working environments, and commitment by management to training development, creation of a management development program, and staff Morale. It is hoped that these issues will assist in accomplishing one of its main priorities that is sustainable infrastructure, biodiversity & environmental protection, petrochemical, aviation safety, security, transformation, and growth. UN POST 2015-30 Sustainable Development Goals (SDGs) for uniform education & Higher Education Sustainable Development Initiative is supported by UN Decade of Education for Sustainable Development, led by UNESCO, the UN University system, the UN Academic Impact, the Global Compact, the UN-supported Principles for Responsible Management Education initiative and the UN Environment Programme's Environmental Education and Training, in order to exchange knowledge and experiences and to report regularly on progress and challenges.

Libya Now has introduced Higher Education Sustainability Initiative. The Higher Education Sustainability Initiative (HESI) for Rio+20 was initiated in 2012 by a group of UN partners as an unprompted initiative for Higher Education Institutions (HEIs) in the run-up to the Rio+22 (Figure 1).



Figure 1. Sign for HESI

The Sustainability Literacy Test is a tool for the various initiatives on sustainability lead by HEIs to assess and verify the sustainability literacy of their students when they graduate (Décamps et al., 2017). It assesses the minimum level knowledge in economic, social, and environmental responsibility for higher education students, applicable all over the world, in any kind of Higher Education Institution (HEI), in any country, studying any kind of tertiary-level course (Bachelors, Masters, MBAs, PhD).

Rio+20, such as the past Rio Earth Summit and Johannesburg Conferences, did provide an opportunity for the international community to assess achievements and progress since 1992 together (Bindra et al., 2012). It also gave a forum to highlight the unmet objectives and gaps that have hindered implementation of the decisions and recommendations of the two previous summits, with a view to making the improvements needed for the post-2012 global agenda. This agenda acknowledges the legitimate expectations by incorporating economic, social, and environmental concerns, in order to better respond to the necessity for growth and progress that can ensure a decent standard of living for citizens in a context of multidimensional international crisis. New Libya's input to the United Nations Conference on Sustainable Development held in Rio de Janeiro on June 20-22, 2012 is part of the national New Libya rebuilding efforts in line with the international community's global effort to promote support and enhance development that is respectful of the environment. It is the outcome of a non-exhaustive analysis of New Libya's socio-economic and environmental achievements as a result of the commitments made at the 1992 Rio Summit, Johannesburg Summit (Emelie, 2020), and numerous subsequent events & conferences. It also reflects the concerns that free Libyan society emerging out of the recent crisis and faced with the formidable task of rebuilding the nation shares with its neighbors regional and international partners in the Mediterranean & Euro-Med region, Maghreb Union, African Union, the League of Arab States and the Group of 77 and BRICS, which it shared once again in 2012.

Libya has initiated a revitalized national environment strategy (NES) and a national plan of action for the environment and sustainable development (NPAE-SD) in the context of a participatory approach involving all stakeholders as national actors. The national environmental strategy aims to achieve sustainable economic growth both

during and after rebuilding by putting in place public policies to improve health and quality of life, conserve and increase the productivity of natural resources especially its Oil and Gas reserves, reduce economic losses and increase competitiveness and, lastly, protect the environment. It is committed to putting into practice through the rebuilding of New Libya laws on sustainable development.

Trends and Research in Education and Learning

The state of the art on research in education and the learning sciences shows that the best ways of learning and teaching are based on the Massive Open Online Courses (MOOC). This helps integrate emerging technologies for either synchronous or asynchronous modes by applying the following seven principles: (1) Encourage contact between students and faculty. (2) Develop reciprocity and cooperation among students. (3) Use active learning techniques. (4) Give prompt feedback. (5) Emphasize time on task. (6) Communicate high expectations. and (7) Respect diverse talents and ways of learning (Jansen et al., 2020).

An overview of the existing situation shows that integration of emerging technologies is difficult for Libya like other countries that lack connectivity. Experience from the African unions shows that although the World Bank and other international organizations have aided virtual schools such as the African Virtual University, connectivity is still a problem for delivering Web-based courses. The African Virtual University right from its inception in 1997, has created a virtual network with 53 institutions in 27 African countries and registered more than 3,000 students (Bateman, 2008). Visionary projects such as the Southern Africa–Western Africa (SAT3/WASC) and the South Africa–Far East submarine cables, along with a recent decline in communication costs, offer hope to African distance education (Farrell, 1999). Lack of support from the government is responsible for delaying the advancement of distance education in Libya It is indeed a frustrating problem for educators who recognize the need to revise the outdated educational system and see asynchronous delivery as part of the answer. Libya's 42 years of old regime politics and culture have lingering effects on the educational system; a system that discredits degrees earned from distance education programs. Libya's potential remains untapped, despite the growing opportunities for asynchronous learning networks. In present-day Libya, it may be necessary to choose emerging technologies that extend face-to-face collaboration for those students participating in mixed-mode delivery.

Thus, online domination in respect of chemical, biology, environmental science & engineering education is leading to an apparent imminent death of the lecture. The trend is similar to the one claimed by economists and innovation gurus like Harvard's Clayton Christensen and technology advocates like Thrun. It is increasingly being felt that although a paradigm shift is occurring in education, MOOC is unable to meet the quality requirements of the learning experience in many situations. Watching videos of lectures and answering multiple-choice questions is gaining ground.

Case Study on Libyan

Like elsewhere in Libya too increasingly chemical biology & environmental professionals do need scientific, engineering, economics, law, and policy skills to translate collective resolve and resources into effective environmental actions through activities that are both experimental and analytical in nature. In Libya too most environmental professionals as part-time students at Libya Academy, full-time students at Al Jaitouna University, Al Garabouli High Institute, and Civil Aviation Technical College are being trained to focus on the critical environmental problems that transcend national and regional borders, yet also have local relevance by recognizing the interconnections between land, air, water, and biodiversity, as well as the interdependence of human and ecological health.

Libyan team has undertaken several case studies related to leaking solvent tanks of Brega Marketing company which entered the habitat soil of an endangered species of amphibian. In order to resolve or understand the extent of soil contamination and subsurface transport of solvent, a computer model is developed using knowledge of chemical & chemistry sciences to characterize the molecular bonding of the solvent to the specific soil type. Libyan biologists help in studying the impacts upon soil arthropods, plants, and ultimately pond-dwelling organisms that are the food of the endangered amphibian. Another interesting study pertains to soils erosion. Using calculations of surface runoff by soil scientists and sediment transport estimates in overland flow by Fluvial geomorphologists Physicists do contribute by assessing the changes in light transmission in the receiving waters. Libyan Biologists also help analyze subsequent impacts to aquatic flora and fauna from increases in water turbidity. This is achieved through industry academy interaction in collaboration with numerous academic industry and research departments in Science and the Schools of Engineering, Management, Public Health, Public Policy, and Law. Due to limited face-to-face interaction because of part-time faculty and part-time student the education and training are emerging as distance learning since it allows the learner and instructor to be physically apart during the learning process and maintain communication in a variety of ways. Thus, it is evolving as independent study, computer-based instruction, computer-assisted instruction, video courses, videoconferencing, web-based instruction, and online learning.

The rapid growth of online distance education like elsewhere in the world in Libya has prompted the need to revise delivery structures and re-think pedagogical practices that were once appropriate. As new technologies are emerging, thereby offerings unique opportunities to foster interaction and collaboration among learners thus create a true learning community.

Pilot experience in Libya shows that coping with part-time faculty and part-time scholars requires distance education that relies on the creation of learning communities. Through technology, interaction and collaboration are now being achieved and become attainable in either asynchronous or synchronous learning networks. The emergence of social software, software that enables a group of individuals to collaborate via the Internet, is adding a new dimension to online learning. The versatility of social software and other collaboration tools support constructivist environments that seek to motivate, cultivate, and meet the needs of both present and future learners.

Impact of Emerging Technologies

Libyan centers of learning are looking for chemical, environmental engineering jobs and internship opportunities for their members; promote interest in biological, environmental science & engineering within the community; seeks to foster interaction among Environmental Engineering undergraduates, graduate students, and faculty, and sponsors speakers. Classroom Presenter like a Tablet PC-based interaction system helps support the sharing of digital ink on slides between instructors and students. Initial deployments show that using the technology can achieve a wide range of educational goals and foster a more participatory classroom environment. However, distance education tutors and researchers are concerned with issues like how much interactivity a distance course could provide for students since the interaction is considered a necessary ingredient for a successful learning experience. Authors find that new technology tools are helping to modify how learners gather data and collaborate. Emerging technologies provide opportunities for instructor-student as well as student-student real-time and/or time-delayed collaboration. User-friendly applications are an asset to business and educational settings alike. The first-generation Web tools include email, chat rooms, and discussion boards, among others.

Second-generation Web tools to take interactivity to the next level include Blogs (Weblogs), wikis, and podcasts (also called vlogs if they use video, or audio blogs if only audio is used) can be implemented alone or in conjunction with applications such as Imeem™, Writeboard™, and InstaColl™ to create engaging learning environments (Augar, 2004).

Like elsewhere in Libya to instructors as well as students, currently use blogs to boost the learning experience; some blogs are student-controlled while others are instructor-managed. The broadcasting of audio or video files over a podcast has a news aggregator installed; the news aggregator processes the RSS feeds and accesses the broadcasts. Audio blogging, or podcasting, is getting popular with the advent of the iPod™, using MP3 audio files. Podcasts using video are easy to create with a digital video camera. It is impacting the way distance educators deliver instruction as well as the manner in which students are engaged in learning. New models of teaching are now using RSS technology to deliver up-to-the-minute expert commentaries, for example, or to have students broadcast their analysis of topics studied. Distance educators are now integrating these resources into the virtual or face-to-face classroom. Libyan using the Education Network of Australia (Beldarrain, 2016), find that it helps keeping an up-to-date listing of educational RSS feeds to help educators get connected. Some teachers do allow their students to suggest topics and then work in teams to research the topic, select information, write the script, and record their show.

The main benefit of using RSS feeds is that it allows the information to be “pushed” to the receiver, instead of the receiver having to seek the information. Pushing” information to the learner is found to be beneficial when the instructor wants to provide course updates, communicate group feedback, or introduce the discussion topic for the week. Wikis, like blogs, are either instructor-managed or student-managed. Wikis do promote collaboration among instructors, staff, and students. “Collaborative icebreaker” Deakin University’s wiki not only helps to promote student interaction but also gives a chance to socialize and get acquainted. Teaching models that integrate

technologies such as blogs or wikis do help in more learner control, and thus are more effective at delivering instructional strategies that support knowledge construction. Open-source technologies such as Imeem™, InstaColl™, and Writeboard™ do help increase real-time collaboration between learners, especially in courses that are fully asynchronous (Teixeira and Lin, 2014).

In nutshell, educators like elsewhere in Libya to are now beginning to realize the power of wikis, blogs, and podcasts, as well as emerging social software applications. It is found that it is the responsibility of instructional designers, administrators, and technology experts to investigate which tool offers the best solution for the task of providing interaction in synchronous and asynchronous online distance learning environments. Emerging technologies that have an impact on new models of teaching and new ways of learning require using flexible models that allow designers to begin at any given point in the process, anchoring the use of technology on collaborative instructional strategies that lead the student toward achieving the desired learning outcomes. Technology tools are found to have changed the roles of learners as well as instructors. It helps tap into a student's expertise and promotes collaboration through peer-to-peer mentoring, teamwork, and other strategies (Dziuban et al., 2015).

UNCSD RIO+20 Focal Point for Sustainable Development

UNCSD, Rio+20, like the past Rio Earth Summit and Johannesburg Conferences, did provide an opportunity for the international community including Libya to assess achievements and progress since 1992 together. It also gave a forum to highlight the unmet objectives and gaps that have hindered implementation of the decisions and recommendations of the two previous summits, with a view to making the improvements needed for the post-2012 global agenda in respect of Libya & its special needs for rebuilding after an 8 months conflict followed by 3 year-long turmoil. This agenda acknowledges the legitimate expectations by incorporating economic, social, and environmental concerns, in order to better respond to the necessity for growth and progress that can ensure a decent standard of living for citizens in a context of multidimensional international crisis. Libya's input to the United Nations Conference on Sustainable Development held in Rio de Janeiro on June 20-22, 2012 (Eck, 2011) is part of both national Libya rebuilding efforts in line with the international community's global effort to promote support and enhance development that is respectful of the environment. It is the outcome of a non-exhaustive analysis of New Libya's socio-economic and environmental achievements as a result of the commitments made at the 1992 Rio Summit, Johannesburg Summit, and numerous subsequent events & conferences. It also reflects the concerns that free Libyan society emerging out of the recent crisis and faced with the formidable task of rebuilding the nation shares with its neighbor regional and international partners in the Mediterranean & Euro-Med region, Megreb Union, African Union, the League of Arab States and the Group of 77 and BRICS, which it shared once again in 2012.

Libya has initiated a revitalized national environment strategy (NES) and a national plan of action for the environment and sustainable development in the context of a participatory approach involving all stakeholders as national actors. The national environmental strategy aims to achieve sustainable & inclusive economic growth both during and after rebuilding by putting in place public policies to improve health and

quality of life, conserve and increase the productivity of natural resources especially its Oil and Gas reserves, reduce economic losses and increase competitiveness and, lastly, protect the environment. It is committed to putting into practice through the rebuilding of Libya laws on sustainable development.

A number of initiatives have also been created, including the First Libyan Environmental Engineering & Sciences Center (EESC), Libyan Business Council for Sustainable Development (LBCSD), Libyan 350 org, Libyan National Platform for Risk Reduction, Care Libya Brand Foundation (CLBF), Green Sky Initiative, Desert Prosperity Initiative, Sustainable Solid Waste Management Initiative. The national, regional rebuilding schemes and initiatives provide a policy framework for a wide range of environmental protection and regional rebuilding development after the Arab Spring aimed at sustainable development.

The country is committed to implementing numerous initiatives to foster education and training on sustainable development. Authors as a focal point in Libya have set up a network of technical institutions committed to education and training on Eco-Efficiency and sustainable development in the country (Maatugh and Bindra, 2016). Technical Educational colleges are involved in this unique effort. The country is committed to launching an updated fully-fledged technical educational program, including online resources for use in colleges. Over the years, colleges are becoming capacity-building experts and the key audience is the young generation. Future Leaders Teams are being designed to train young executives on sustainability topics using innovative ways to improve the quality of the educational system. Training workshops are regularly held to educate companies on key business and sustainable development issues and understand how these could impact their competitiveness. Technical Colleges Directorate is collecting best practice examples, ranging from Eco-Efficiency to Corporate Social Responsibility (CSR) and inclusive business, illustrating how companies have drawn value from putting sustainability into practice. CSR initiative of technical colleges is running a forum to demonstrate how Libyan companies need to pursue resource efficiency initiatives. CSR is included in the curriculum of students majoring in economic development.

New Initiatives and Strategy in Libya

The numerous new initiatives by a team of leading former and serving professors, professionals, NGOs, and experts in Libya as outlined elsewhere by one of the authors are based on principles that govern both ecological systems and control and diversify economic systems. It is based on Rio +20 Future we want a framework that advocates and requires the need to use citizen power backed by intelligent management of the ecosystems and nature-based infrastructure. Libyan initiative is based on the logic that the low carbon or no carbon economy is not a burden on growth but rather a new engine for growth, employment, and the reduction of persistent frustration due to lack of stability, security, and weak governance. Through educated citizen power system using emerging technologies for better learning and teaching system as illustrated in biology, civil & environment engineering it helps provide vital links between the economy, society, and environment (Anderson, 2016). The initiative takes into account the transformation of production processes, production and consumption patterns while contributing to a reduction per unit in reduced waste, pollution, and the use of resources,

materials, and energy, waste, and pollution emission that will help revitalize and diversify economies, create decent employment opportunities, promote sustainable trade, reduce poverty, and improve equity and income distribution.

The Libyan strategy includes a project to use Proactive implementation of emerging technologies in the teaching and learning process by use of information and communications technologies to reform the science & technical education and research system, which has the potential to become a model for the proper integration of emerging technologies in education and science.

Libyan UNCSO Rio+20 Focal point as described elsewhere is leading the country in developing system-level improvement, institutional level improvement, and individual level improvement based on key principles for GEF-UNDP supported National Capacity Self-Assessment. The current initiative and strategy on enhanced use of emerging technologies in teaching and learning process by use of information and communications technologies in biology, environment, and chemistry sciences education aims at ensuring at relatively short notice, access to and progressive ownership by the Libyans, of the required technical, functional and instrumental capacities. At the international level, Libya intends to acquire assistance not only in transfer, adapt, adopt, absorb and embrace advanced technology and governance practices but also access to the most up-to-date and unbiased scientific data and information to confront challenges of the future. The objective is to help the country to play an effective and leading role in promoting international cooperation with organizations of the UN System, among others UNESCO, UNIDO, United Nations Support Mission in Libya (UNSMIL), United Nations Development (UNDP), International Civil Aviation Organization (ICAO), United Nations Environment Programme (UNEP), United Nations Educational, Food and Agriculture Organization (FAO), as well as, regional counterparts (EU Erasmus Plus, Mediterranean, Euro-Med, Megreb Union, Arab, Sahel and other African) and also other multi- and bilateral funding or assistance providing sources.

Based on the case study of Libya in Africa we find that the challenges faced by Libya in Africa present numerous opportunities, especially in the fields of chemical, biological, environmental science & engineering education research, and innovation. To take advantage of these opportunities and contribute to solving these challenges, Libya like other African countries must initiate systemic reforms to improve the quality of education at all levels and professionalize their education systems in order to educate and train youth, in particular, in the fields of science, technology, and engineering. For Libya like elsewhere in Africa to achieve the goal of economic transformation, it will therefore be imperative for countries to invest strategically in the education and training of youth. To make this happen, African synergy should be activated to promote enhanced regional integration on the one hand, and to advance science and technology in Africa on the other. To help realize its full potential, Libya like elsewhere in the Africa continent must develop partnerships, networking of researchers and students, and the establishment of collaboration with other, more established, schools on other continents, such as cooperation with the prestigious Conference des grandes écoles⁴⁴ (CGE). It also noted that while seven establishments are African only one is based in sub-Saharan Africa: The International Institute of Water and Environmental Engineering (2iE) in Ouagadougou, Burkina Faso (Mazoyer, 2021). What is required is a formula for change as shown below (Doppelt and McDonough, 2017). This requires

Libya to join #OneWorldOneAcademicLibrary Vs. #OneAfricaOneAcademicLibrary for Global Success.

Formula For Leading Change Effectively

Vision + Skills + Incentives + Resources + Action Plan = **CHANGE**
----- + Skills + Incentives + Resources + Action Plan = **CONFUSION**
Vision + ----- + Incentives + Resources + Action Plan = **ANXIETY**
Vision + Skills + ----- + Resources + Action Plan = **RESISTANCE**
Vision + Skills + Incentives + ----- + Action Plan = **FRUSTRATION**
Vision + Skills + Incentives + Resources + ----- = **CHAOS**

Libya is calling on everyone to connect, #OneAfricaOneAcademicLibrary Vs #AfricanLibrariesCongress for #OneAfricaOneEducation for the same quality learning resources access that no one is left behind.

Discussion of Stakeholders Survey Results

Based on pilot scale surveys, workshops, interviews, and meetings with stakeholders it is found that biology, environment & chemistry sciences education need not only enhance applications of emerging technologies for teaching and learning but also radical change for the new curriculum to tackle challenges of rebuilding Libya. Preliminary results on students' attitudes, interests, and liking for a biology, environment, and chemistry science subject show that it has a strong bearing on progress and learning outcomes. Libyan students are influenced and shaped by the quality and style of curriculum delivery, the choice of content, and the suitability of resources. Other important factors influencing students' achievements are the expectations and support of significant people in their lives, the opportunities and experiences they have in and out of learning institutes, and the extent to which they have feelings of personal success and capability. Younger students were generally very positive about doing science. Over 60% of students wanted to keep learning about science when they grew up, and almost a quarter thought they would make good scientists when they grew up. On the question "How good do you think you are in science?" 16% of graduate university students chose the top rating, compared with 35% of 1st-year university students.

All organizations express that they are struggling to find relevant personal with appropriate qualifications to hire for entry-level positions. Presently they are spending much time and money to introduce the basic knowledge to new hires. They all agree that there is a need for integrated technology-led biology, environment management & chemistry curriculum in higher education, and having a diploma in environmental science and engineering would help enrich the quality of future applicants.

Numerous respondents suggest that Libya needs student-student interaction as one of the three essential items needed to create effective instruction. Emerging technologies provide the flexibility of using some or all of their features to encourage active collaboration, both in real-time or on separate schedules. Emerging social software such as Imeem™ integrates not only the feature of instant messaging but other capabilities that may also promote social interaction (Veletsianos, 2010). The learner

may access the information in real-time while actively collaborating, or delayed time at the learner's convenience. Thus, social software gives the learner control over the content, without the restrictions of time and place. Most stakeholders state that new Libya needs more sophisticated IT systems. These systems are required along with skill sets needed for becoming wise and knowledgeable in a world where information is cheap and easy.

UNESCO, UNDP, UNIDO & UNEP experts all point out the need to evolve a new framework approach using outcomes, output, baseline, targets, performance indicators, and activities to design a wide range of formal training programs using education and new learning technologies for the enhancement of Quality, Health, Safety, and Environment. To achieve this a strategy and plan of action for upgrading the biology, environment, and chemistry sciences education & training is evolved. The objective is to compete, comply and connect with the Libyan market by developing the vital skills and experience of sustainable development professionals needed to perform their more sophisticated jobs with greater responsibility and accountability.

A multiple purpose method (empirical study, personal interviews, questionnaire, and case study) as presented elsewhere by authors demonstrate that out of the 92, there are 32 biologists, chemistry & environment-related health safety and environment (HSE) indicators in a modal distribution of 0-49% response and 60 HSE indicators in the modal distribution of 50-100% response. 60 HSE indicators from the modal distribution 50-100% are used for further analysis. The 60 HSE indicators selected indicate their level of importance to the HSE management performance. A response of 1 indicates critical, 2 important, and 3 minor important. The description of these respects on their relative importance is as follows: Critical: indicators perceived as critical and essential. The HSE management performance would end up in failure if these indicators do not exist in the company. Important: These indicators are considered as important but not essential for the HSE management performance in the company.

The performance process survives if these are not addressed. Minor importance: These indicators do not seriously affect the success or failure of HSE management performance. The Variation Ratio (VR) is the proportion of cases that do not fall into the modal category. It is an appropriate measure of the spread of data for the investigation. VR is calculated using the single formula: $VR = 1 - (f_{mode} / N)$, and that means $VR = 1$ frequency distribution of mode VR is computed to identify the extent of consensus on an objective basis in identifying a critical indicator, which affects the case study oil company. A value of zero means unanimity (all respondents rated a particular indicator as critical for oil companies). Values of 0.5 or less mean majority consensus while values more than 0.5 indicate no majority consensus in rating an indicator as critical. Index of Diversity is defined as a dispersion measure based on a proportion of cases in each category. In mathematical terms $Index\ of\ Diversity = 1 - \{(P_1)^2 + (P_2)^2 + \dots + (P_k)^2\} = 1 - \sum P_k^2$ and \sum stands for summation, where P_k is the proportion of cases in category k , and k is the number of categories. For example, if 84% of the respondents rated an indicator as critical, 9% rated it as important, and 7% rated the same indicator as minor important, then the Index of Diversity is measured as $Index\ of\ Diversity = 1 - [(0.84)^2 + (0.09)^2 + (0.07)^2] = 0.28$. This index shows the degree of concentration of responses in a few large categories, as squaring proportion emphasizes the large proportion much more than the small ones. Thus, the Index of Diversity can

be considered as a substitute measure of agreement among the respondents concerning the response distribution of each of the indicators. A low index value means general agreement on the importance of an aspect, while a high index value means general disagreement. This means that an index value close to zero will imply near unanimity. A value close to 0.05 is when there is an equal cluster (concentration) around two large categories. A near-uniform distribution in the three rating categories will give a maximal value close to 0.06, which will mean a high level of disagreement. In summary, these measurements of HSE protection performance management undertaken in organizations in Libya is appropriate for all or certain circumstances.

Concluding Remarks

The chemical, biology, environmental sciences & engineering education, and training for rebuilding clean and green Libya based on UNCSD Rio+20 Future We Want & UN POST 2015 SDGs framework are in a state of radical change. It requires skilled professionals to be able to advise on issues relating to rebuilding certification, regulation, security, master planning, protocol, and corporate responsibility. The appraisal of the existing situation and needs assessment surveys of rebuilding industry and government officials in Libya clearly indicate the need for improved education using new curriculum and enhanced use of emerging technologies biology, environmental sciences & green chemistry in both teaching and learning processes. The change must bring the capability to develop specialized skills using blended learning education and training in line with UNCSD Rio+20 Libya national report based on UNESCO, UNIDO & UNEP best practices for this emerging discipline. The adopted framework approach uses outcomes, output, baseline, targets, performance indicators, and activities to design a wide range of formal education & training in chemical, biological, environmental protection science & engineering fields using new & emerging technologies for the enhancement of sustainable livelihood. The objective is to develop a rebuilding Management Qualification in higher education.

Paper demonstrates that rebuilding and rehabilitation management must be treated as a process by which the manager plans, prepares, and produces a quality product, safely and efficiently. It should encompass the regulation, assessment, definition, acquisition, allocation, direction, control, and analysis of time, finances, personnel, products, services, and other resources to achieve objectives. Survey results indicate that rebuilding Libya & rehabilitation management qualification will be able to coordinate and manage the broad spectrum of chemical, biology, environmental sciences & engineering & green chemistry in rebuilding the country. It would help rebuild and rehabilitation Managers to coordinate and manage many genres through all phases, research, plan, design, and conduct and evaluate in different contexts. Of course, it requires a historical understanding of the rebuilding & rehabilitation industry, regulatory knowledge, and professional skills, allied to proven experience. Eventually, since the scale, size, and scope of change in education and training are phenomenal it is hoped that new blended learning programs would assist adequately to deal with the complexities and workforce shortages of this multi-disciplinary profession in Libya. To help realize its full potential, Libya like elsewhere in the Africa continent must develop partnerships, networking of researchers and students, and the establishment of collaboration with other, more established, schools on other continents, such as cooperation with the prestigious Conference des grandes écoles 44 (CGE).

References

- Bindra S.P. et al, Change and Development in Biological Civil & Environmental Engineering Education, Dubaie 2014.
- Bindra, S.P., 2012. Rio+ 20 Libyan National Report. UNCSO. Brazil: Rio. Retrieved June.
- Bindra, S.P., Lawafi, A., Abulifa, S. and Al Sauaiah, G.M., Change and Development in Biological Civil & Environmental Engineering Education in Libya.
- Sharma, P.D. and Sharma, P.D., 2012. Ecology and environment. Rastogi Publications.
- Lu, S., Liu, X., Liu, C., Cheng, G. and Shen, H., 2020. Influence of photoinhibition on nitrification by ammonia-oxidizing microorganisms in aquatic ecosystems. *Reviews in Environmental Science and Bio/Technology*, pp.1-12.
- Décamps, A., Barbat, G., Carteron, J.C., Hands, V. and Parkes, C., 2017. Sulitest: A collaborative initiative to support and assess sustainability literacy in higher education. *The International Journal of Management Education*, 15(2), pp.138-152.
- Bindra S.P. et al., Change & Development in Civil Aviation, Spain INTED 2012.
- Emelie, Cin. "United Nations Conference On The Environment After The Rio De Janeiro Of 1992: It's Implications For Environmental Protection." *Chukwuemeka Odumegwu Ojukwu University Journal Of Private And Public Law* 2, No. 1 (2020).
- Jansen, R.S., van Leeuwen, A., Janssen, J., Conijn, R. and Kester, L., 2020. Supporting learners' self-regulated learning in Massive Open Online Courses. *Computers & Education*, 146, p.103771.
- Bateman, P., 2008. The African virtual university. In *Handbook on information technologies for education and training* (pp. 439-461). Springer, Berlin, Heidelberg.
- Farrell, G.M., 1999. *The Development of Virtual Education: A Global Perspective. A Study of Current Trends in the Virtual Delivery of Education*. Open Learning Agency, Attn. COL Customer Service, 4355 Mathissi Place, Burnaby, British Columbia, Canada V5G 4S8; Web site: <http://www.col.org/virtualed/>.
- Augar, N., Raitman, R. and Zhou, W., 2004, January. Teaching and learning online with wikis. In *Beyond the comfort zone: proceedings of the 21st ASCILITE Conference, Perth, 5-8 December* (pp. 95-104). ASCILITE.
- Beldarrain, Y., 2006. Distance education trends: Integrating new technologies to foster student interaction and collaboration. *Distance education*, 27(2), pp.139-153.
- Teixeira, J. and Lin, T., 2014, May. Collaboration in the open-source arena: the webkit case. In *Proceedings of the 52nd ACM conference on Computers and people research* (pp. 121-129).
- Dziuban, C., Graham, C.R., Moskal, P.D., Norberg, A. and Sicilia, N., 2018. Blended learning: the new normal and emerging technologies. *International journal of educational technology in Higher education*, 15(1), pp.1-16.
- Eck, M., 2011. An opportunity not to be missed: The UN Conference on Sustainable Development (Rio+ 20), Rio de Janeiro, Brazil, 20-22 June 2012.
- Maatugh, M.M.A. and Bindra, S.P., 2016. Civil Aviation & Metrology Education & Research for Sustainable Development in Libya. *Journal of Economic Development, Management, IT, Finance & Marketing*, 8(1).
- Anderson, T., 2016. Theories for learning with emerging technologies. *Emergence and innovation in digital learning: Foundations and applications*, 1, pp.35-50.

- Mazoyer, A., 2021. This publication is available in Open Access under the Attribution-ShareAlike 3.0 IGO (CC-BY-SA 3.0 IGO) license (<http://creativecommons.org/licenses/by-sa/3.0/igo/>). By using the content of this publication, the users accept to be bound by the terms of use of the UNESCO Open Access Repository.
- Doppelt, B. and McDonough, W., 2017. Leading change toward sustainability: A change-management guide for business, government and civil society. Routledge.
- Veletsianos, G. ed., 2010. Emerging technologies in distance education. Athabasca University Press.