

# Chemical biological environmental science & agriculture technologies in education for sustainable development of Libya

## Abstract

Paper is designed to present an overview on the state of art on new & emerging education & 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 & agriculture technologies in 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 UNSDGs 2015-30 17 goals & 169 targets & 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 & 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. Finally it provides a framework approach using outcomes, output, base line, targets, performance indicators and activities to design a wide range of formal education & training in chemical, biological, environmental protection science & agriculture engineering fields using new & emerging technologies like geographic information systems (GIS), global positioning systems (GPS) and remote sensing (RS), that farmers can use to refine nutrient recommendation and water management models to the site-specific conditions of each field for the enhancement of sustainable livelihood in Libya.

**Keywords:** emerging technologies in agriculture, education and training, crisis ridden Libya & sustainable development

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## Introduction

Chemical, biology and environmental science & agriculture engineering technology education & training in Libya is in the process of change for rebuilding 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

- Address and analyze complex environmental protection problems due to insecurity, instability & unsafe country,
- Evolve substantive environmental laws requiring specific environmental protocols of investigation and
- Raise the growing public awareness of a need for action in addressing environmental problems.

It is planned in line with Rio+20 Libyan national report approved by UN General Assembly in 2012 in line with Future (2012-22) We Want . It is designed to meet and exceed UNCSD Future We Want guidelines issued to its Member States, United Nations Sustainable Development Goals (UN SDGs) 2015-30, 17 goals & 169 targets & Higher Education Sustainability Initiative (HESI) of UNESCO. The idea is to commit the country to help develop solutions for the biodiversity under threat and sustainable livelihood of present and future generation using developments in chemical, biology and environmental science & agriculture 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, work force needs to be equipped with tools, techniques and technologies that focus on help reduce environmental footprint, in line with the guidance and leadership of UN recognized Presidential Council (PC) & 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 rebuilding of infrastructure & economy grows in an environmentally sustainable manner. 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 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 show that Libyan higher education in general and chemical, biological & environmental sciences & 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.<sup>1</sup> 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 dictatorial regime is ill-equipped to enable learners 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 & Bio Sphere (MAB), & Promoting Responsible Merit for Entrepreneurship (PRIME, (GRIP) of UNIDO as presented elsewhere [2] by one of the author to become wise and knowledgeable to rebuild sustainable Libya. Precision agriculture involves the integration of the new technologies (including GIS, GPS and RS) to allow farm producers to manage within field variability to maximize the benefit-cost ratio. 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 & agricultural engineering related education & training centers in the country are committed to meet its inclusive economy & environmental commitments through its own resources.

### **An assessment of existing situation**

Libya accounts for approximately 6.31 million populations 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 & Vocational Education (TVE) plays a key role in employability and supplying the labour market with skilled and qualified labour force. Libya's National Board for Technical & Vocational Education (NBTVE) was established by Prime ministerial Decree no 519 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. 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. Total number of students exceeds 150000. 70442 students in Intermediate Vocational Institutes. 66457 students in Higher Technical Institutes & 13192 students in Technical Colleges. Global, regional, national and local overview of different roles of chemical, biology & environmental science & agricultural engineering education shows 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 & chemical sciences knowledge helps students develop environmental skills such as the ability to identify and define, ability to analyze, and the ability to solve environmental problems.

The chemical, biology and environmental science & engineering education & training in Libya is assessed, evaluated & its findings are being implemented & 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 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 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, therefore education and training must be grounded in microbial physiology, ecology, evolution and environmental science and agricultural engineering.

### **Rationale for change**

The current state of the 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 2013-303<sup>rd</sup> 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, petro chemical, aviation safety, security, transformation and growth. UN POST 2015-30 Sustainable Development Goals (SDGs) for uniform education & Higher Education Sustainable Development Initiative (HESI) 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 (HEI) in the run-up to the Rio+22. See Figure Below.



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. 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, like the past Rio Earth Summit & Johannesburg Conferences, did provide an opportunity for the international community to assess achievements and progress since 1992 together.<sup>2</sup> 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 in June 20-22, 2012 is part of the both national New Libya rebuilding efforts in line with 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 formidable task of rebuilding the nation shares with its neighbour 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 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 & Gas reserves, reduce economic losses and increase competitiveness and, lastly, protect the environment. It is committed to put into practice through the rebuilding New Libya laws on sustainable development. A number of initiatives,<sup>3</sup> 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.<sup>3</sup> 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 implement many initiatives to foster education and training on sustainable development. Authors as 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.<sup>4</sup> Technical Educational colleges are involved in this unique effort. Country is committed to launch an updated fully-fledged technical educational program, including online resources for use in colleges. Over the years, colleges are becoming capacity-building experts and 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 in practice. CSR initiative of technical colleges is running a forum to demonstrate how Libyan companies need to pursue resource efficiency initiatives. CSR is included into the curriculum of students majoring in economic development.

### Trends & research in education & 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 or 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
- 7) Respect diverse talents and ways of learning
- 8) Overview of the existing situation shows that integration of emerging technologies is difficult for Libya like other countries that lack the connectivity.

Experience from African union 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.<sup>5</sup> Visionary projects such as the Southern Africa–Western Africa (SAT3/WASC) and the South Africa–Far East (SAFE) submarine cables, along with a recent decline in communication costs, offer hope to African distance education (Naidoo & Schutte, 1999). Lack of support from 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 asynchro-nous delivery as part of the answer. The Libya's 42 years of old regime politics and culture have lingering effects in 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 the 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 on line 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 grounds.

### Libyan case study

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 of environmental professionals as part time students at Libya Academy, full time students at Al Jaitouna University, Al Garabouli High Institute & 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 is 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 too 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 & 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 the both present and future learner.

### Impact of emerging technologies

Libyan centers of learning are looking for chemical, environmental engineering jobs and internship opportunities for its 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 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 audioblogs 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. Like elsewhere in Libya too 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 have 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 (EdNA Online, 2006), 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 for 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. In nutshell, educators like elsewhere in Libya too 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 requires 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 promote collaboration through peer-to-peer mentoring, teamwork, and other strategies.

### **UNCSD RIO+20 focal point for sustainable development**

United Nation Commission for Sustainable Development UNCSD, Rio+20, like the past Rio Earth Summit & 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 a 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 in June 20-22, 2012 is part of the both national Libya rebuilding efforts in line with 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 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 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 & 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 & Gas reserves, reduce economic losses and increase competitiveness and,

lastly, protect the environment. It is committed to put into practice through the rebuilding 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 implement many initiatives to foster education and training on sustainable development. Author as 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. 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. UNCSD Focal point 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 in practice.

### **New initiatives & 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 author is based on principles that govern both ecological systems and control & diversify of economic systems. It is based on Rio +20 Future we want 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 economy, society, and environment. 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.

### **New Libyan strategy**

The Libyan strategy includes a project to use Proactive implementation of emerging technologies in teaching and learning process by use of information and communications technologies to reform the science & technical education and research system,<sup>6-11</sup> which has the potential to become a model for the proper integration of emerging technologies in education and science. Libyan UNCSD 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 (NCSA). 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 in not only in transfer, adapt, adopt, absorb and embrace advanced technology and governance practices but also access to most up to date and unbiased scientific data and information to confront challenges of future. The objective is to help country to play an effective and leading role in promoting international cooperation with organizations of the UN System, among others UNISMIL, UNDP, UNIDO, ICAO, UNEP, UNESCO, 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.

### Discussion of stakeholders survey results

Based on pilot scale surveys, workshops, interviews and meetings with stakeholders it is found that biology, environment, agriculture emerging technologies & chemistry sciences education need not only enhance applications of emerging technologies for teaching & learning but also radical change for new curriculum to tackle challenges of rebuilding Libya. Preliminary results on students' attitudes, interests and liking for a biology, environment, agriculture 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% 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 percent of graduate university students chose the top rating, compared with 35 percent 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 environment science and engineering would help enrich the quality of future applicants. Many 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. 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 say that new Libya needs more of 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 need to evolve a new framework approach using outcomes, output, base line, targets, performance indicators and activities to design a wide range of formal training programs using education and new learning technologies for the enhancement of QHSE. 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 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 biology, chemistry & environment related health safety and environment (HSE)<sup>7</sup> indicators in a modal distribution of 0-49% response and 60 HSE indicators in 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 indicates their level of importance to the HSE management performance. A response of 1 indicates critical<sup>4</sup>, 2 important<sup>4</sup>, and 3 minor important. The description of these respects on their relative importance is as follows o 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. o 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 important: 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 spread of data for the investigation. Variation Ratio (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

$$Diversity = 1 - \left\{ (P_1)^2 + (P_2)^2 + \dots + (P_k)^2 \right\} = 1 - \sum P_k^2 \text{ and } \Sigma \text{ stands for summation}$$

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:

$$Index \ of \ Diversity = 1 - \left[ (0.84)^2 + (0.09)^2 + (0.07)^2 \right] = 0.28.$$

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 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 high level of disagreement. In summary, these measurements of HSE protection performance management undertaken in organizations in Libya are appropriate for all or certain circumstances.

## Concluding remarks

The chemical, biology, environmental sciences & agriculture 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 state of radical change. It requires skilled professionals to be able to advice on issues relating to rebuilding certification, regulation, security, master planning, protocol, and corporate responsibility. The appraisal of 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, agricultural engineering & green chemistry in both teaching and learning processes. The change must bring 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 these emerging discipline. The adopted framework approach uses outcomes, output, base line, targets, performance indicators and activities to design a wide range of formal education & training in chemical, biological, environmental protection science & agricultural 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 how precision agriculture involving the integration of the new technologies (including GIS, GPS and RS) are allowing farm producers to manage within field variability to maximize the benefit-cost ratio. It also helps in rebuilding & rehabilitation Managers to coordinate and manage many genres through all phases, research, plan, design, and conduct and evaluate in different contexts. Rebuilding and rehabilitation management treats it as a process by which the manager plans, prepares and produces a quality product, safely and efficiently. It should encompasses 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, agricultural engineering & green chemistry in the rebuilding

the country. Precision farming technologies in agriculture have now being used to spatially vary nutrients and water prescriptions within a field based on various information sources (soil properties maps, terrain attributes, remote sensing, yield maps, etc.). It would help rebuilding & 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. Finally, 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.

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## Conflicts of interest

The authors declared there is no conflict of interest.

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