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CONCEPTS OF ENVIRONMENTAL (BIO)ENGINEERING IN ENVIRONMENTAL HEALTH

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Abstract: Most of the people in the world today have an immediate and intuitive sense of the urgent need to build a sustainable future. Environmental engineering is the branch of (bio) engineering that is concerned with protecting people from the effects of adverse environmental effects, such as pollution, and improving environmental quality. Environmental (bio) engineers work to improve recycling, waste disposal, public health, and water and air pollution control. Environmental health (bio) engineering can be considered as sanitary (bio) engineering brought to meet the needs of the future of the World. Sanitary (bio) engineering is essentially disease-oriented: it may be defined as the use of (bio) engineering principles and (bio) engineering devices for public health purposes. Environmental health (bio) engineering, is the application of (bio) engineering fundaments to the control, modification or adaptation of the physical, chemical or biological characteristics of the environment in the interest of the health, comfort and social activities of people. It requires the control (quantity and quality) of the basic necessities and waste by-products, whether solid, liquid or gaseous. These by-products, if uncontrolled and allowed to accumulate, lead to widespread disease and physical damage, and could literally make human existence impossible. The fundamental concept of sustainable development is depending on the social, the economic and the environmental dimensions. For development to be sustainable, all the 3 dimensions need to be addressed in a balanced and integrated way, to reach present and future needs. Many health problems will continue to be exacerbated by pollution, noise, crowding, inadequate water and sanitation, improper waste disposal, chemical contamination, poisonings and physical hazards associated with the growth of densely populated cities. Education for sustainable development is an emerging but dynamic concepts that encompass a new vision of education that seeks to empower people of all ages to assume responsibility for creating a sustainable future. Today, the prospects for future health depend to an increasing extent on the processes of globalisation and on the emergence of global environmental changes occurring in response to the great weight of humankind's economic activity. The globalization of trade, travel and culture is likely to have both positive and negative impacts on health. Increased trade in services and products harmful to health and the environment, travel and mass migration of people constitute additional global threats to health. A healthy population is essential for economic development. The modern engineering education should be reformed to include the spheres of economy, science and education. Finally, we have to accelerate progress towards universal health coverage and the sustainable development goals by ensuring equitable access to a skilled and motivated health worker within a performing health system.
Keywords: (bio) engineering, education, environment, health, sustainable development

1. INTRODUCTION

There is increasing evidence that the integrity of the environment is under substantial pressure. The science of Environmental Health has always been concerned with the study of the human - environment interface, and now even more than ever, practitioners are needed who understand this link and the strategies available to control and minimize the risks associated with environmental health hazards. The practice of environmental (bio) engineering dates back to the dawn of civilization. Ever since groups of people began living in semi-permanent settlements, they have had to deal with the challenges of providing clean water and disposing of solid waste and sewage. With the growth of cities and the advent of large-scale farming and manufacturing, people have also had to worry about air quality and soil contamination. So, the topics covered include: an introduction to environmental health, ecosystems and sustainability; environmental health issues (e.g. air pollution, water and sanitation, waste and contaminated land, communicable diseases and food safety, physical agents, disaster management); and environmental health settings including the built environment.

Makienko and Panamaryova [1] mentioned that about 40% of the students used the term "innovative technology" in their responses, but could not explain the meaning of innovative technology, innovative organization and the innovative university. Perhaps the reason for this is that the term is widely used today as a slogan in the various spheres of the whole World reality: mass media, speeches of politicians, economists and analysts in the field of education, and etc., but the desire to give a rigorous definition of the term "innovation" is present only in the academic community.

2. SCOPE OF ENVIRONMENTAL HEALTH

The term environmental health covers at least: water supply engineering, sewage treatment, solid waste disposal, the control of disease vectors, air pollution control, water pollution control, radiation protection, environmental biology, industrial hygiene, industrial toxicology, urban noise control, the prevention of road accidents, town planning, architecture, the peaceful uses of outer space, and preventive, occupational, aerospace medicine, etc. Most of these subjects are concerned with physical, chemical, or biological environmental agents and not the social environment as exemplified by culture and by social, economic, political and administrative institutions.

— **Environmental health monitoring and surveillance**

Environmental health monitoring and surveillance include two classes of activity, each applied to two different types of phenomenon. Systematic collection of data by standardized procedures can be carried out either for examination at convenient times or under convenient circumstances or as a basis for action; these two activities, conveniently distinguished as monitoring and surveillance, are often confused with each other and opportunities for the use of the same techniques to solve different environmental health problems are overlooked.

Surveillance and monitoring is one fundamental class of activities, often having elements common to many programmes. Environmental management is an activity which the health authorities share with many other governmental agencies. Either the environmental agents affecting human health, such as heat, viruses, polluted water, insanitary food, or photochemically polluted air, or the indices of their effects on human health, such as mortality, morbidity, chronic illness, accelerated aging, the impairment of function, sensory irritation, or other damage to health, can be monitored or kept under surveillance. Environmental epidemiology is the systematic study of the health effects of defined environmental factors on defined populations-makes exacting demands on monitoring and surveillance systems, but the results obtained are of great importance in environmental health evaluation.

— **Environmental hazards and quality evaluation**

The qualitative and quantitative study of the effects of various environmental factors on human health on the biosphere involves environmental physiology, laboratory and clinical toxicology, and environmental epidemiology. The impacts are less likely to appear as rates for disease entities, but rather as measurable deviations from health and biotas, such as accidental injuries, skin irritation or inflammation, cough or headache, altered immunity or respiratory or neurological function, community or job dissatisfaction, changed blood constituents, or abnormal substances in the blood or urine. A systematic study of environmental hazards must therefore develop measurable criteria of health.

Environmental health (bio) engineering can be considered as sanitary (bio) engineering brought to meet the needs of the future of the World. Sanitary (bio) engineering is essentially disease-oriented: it may be defined as the use of (bio) engineering principles and (bio) engineering devices for public health purposes. Environmental health (bio) engineering, is the application of (bio) engineering fundaments to the control, modification or adaptation of the physical, chemical or biological characteristics of the environment in the interest of the health, comfort and social activities of people. It requires the control (quantity and quality) of the basic necessities and waste by-products, whether solid, liquid or gaseous. These by-products, if uncontrolled and allowed to accumulate, lead to widespread disease and physical damage, and could literally make human existence impossible.

The practice of environmental health, (bio)engineering is based on the systems and/or resources approach which realized that in dealing with the environment humans are dealing essentially with water, air and soil systems, and that these represent resources which must be conserved and used in the best interests of humans. This means that the (bio) engineers can no longer be concerned solely with public water supply, waste water disposal, air pollution or solid wastes, etc. In dealing with water they must recognize that it is not used solely for public water supply purposes; its uses in agriculture, medicine and industry, for recreational and transportation purposes, and for power generation are important, and aesthetic aspects cannot be neglected. Thus public water supply must be developed as a logical part of a broad water resources plan and the engineer involved must be responsible for ensuring that such a plan is developed.

Air resources are not unlimited and must be used rationally. Air pollution over worldwide areas is a matter of direct interest not only to those concerned with aesthetics and morbidity, but to the (bio) engineer, who must be responsible for the beneficial use and conservation of global air resources. In dealing with solid waste disposal, (bio) engineers are directly involved in questions of land use and indirectly in those of air and water pollution. Housing is another major problem; although somewhat neglected, its importance is being increasingly recognized as people throughout the world rebel against the unsatisfactory conditions existing in most urban areas.

3. DIFFERENCE BETWEEN ENVIRONMENTAL (BIO) ENGINEERING AND ENVIRONMENTAL MANAGEMENT?

- ENVIRONMENTAL (BIO)ENGINEERING is a branch of engineering and it deals with biology, botany, chemistry, climatology, ecology, ecological fisheries, environmental law, forest sciences, geo-sciences, soil science, information science, public affairs, public health, toxicology, zoology and etc. to develop the solution to the environmental problems such as public health, waste disposal, water/air pollution control, and recycling waste at local and global level to improve overall quality of environment. In addition, the environmental (bio) engineering contributes towards preventive measures to sustain the environment. They help government or team manager to improve the policies or resolve the issues by providing the valuable technical inputs.
- ENVIRONMENTAL MANAGEMENT is a broader term that adds economic and finances to understand the viability and profitability of the project before proposing the same to the senior management. Apart from that include environmental (bio) engineering and management to improve existing policies or create new policies and implement them. The environmental management is managing the environmental related project and guide the

engineering team to implement it. At global level they help creating awareness, policies, and process related to global warming, water/air pollution, waste management.

— Manager is to manage the team as team-lead with help of technological/technical strategy, business strategy, and organizational strategy to guide and with help of man-management to monitor the team, the progress and quality of the work to ensure high quality delivery on time. It deals with technology, people and resources needed for implementing the entire project.
— ENVIRONMENTAL MANAGEMENT offers research and opinions on use and conservation of natural resources, protection of habitats and control of hazards, spanning the field of Environmental Management Services without regard to traditional disciplinary boundaries.

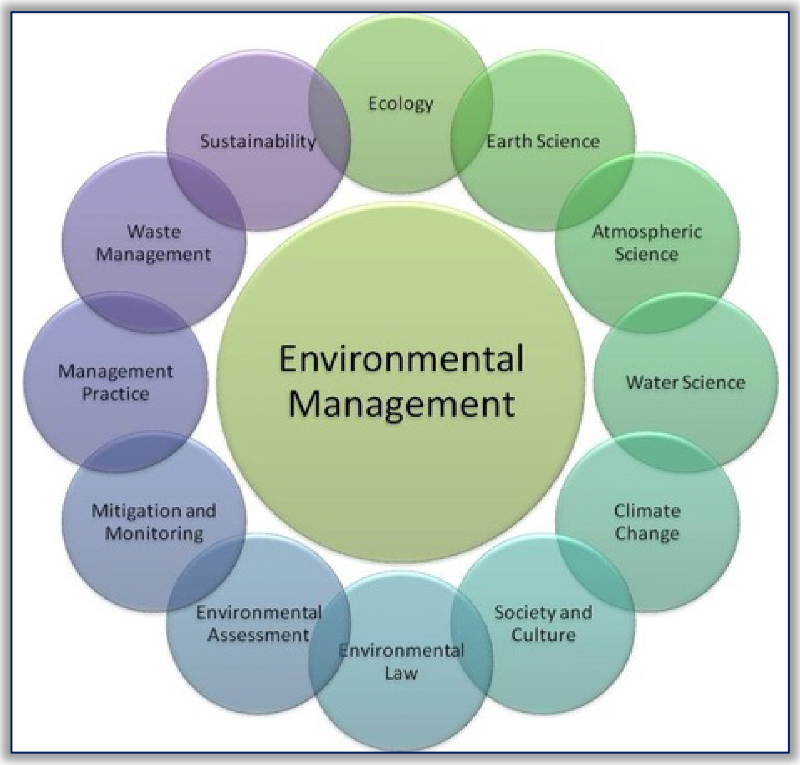

Figure 1. Environmental Management

Environmental Management presents the work of academic researchers and professionals outside universities, including those in business, government, research establishments, and public interest groups, presenting a wide spectrum of viewpoints and approaches.

4. CONCEPTS OF ENVIRONMENTAL HEALTH

— **What are environmental (bio) engineers responsibilities?**

Environmental (bio) engineers typically are the project designers leading to environmental protection, such as water reclamation facilities, air pollution control systems, and operations that convert waste to energy, soil protection, etc. Obtain, update, and maintain plans, permits, and standard operating procedures.

— **What is environmental (bio) engineering management?**

Environmental (bio) engineers devise solutions for waste water management, water and air pollution control, recycling, waste disposal, and public health. They evaluate hazardous-waste management systems to evaluate the severity of such hazards, advice on treatment and containment, and develop regulations to prevent mishaps.

— **What is the importance of environmental (bio) engineering?**

One of the most important responsibilities of environmental (bio) engineering is to prevent the release of harmful chemical and biological contaminants into the air, water and soil.

— **What are the branches of environmental (bio) engineering?**

The main areas of environmental (bio) engineering include air pollution control, industrial hygiene, radiation protection, hazardous waste management, toxic materials control, recycling, water supply, wastewater management, storm water management, solid waste disposal, and public health and land management.

— **What are the 4 types of environmental hazards?**

Four categories: physical, chemical, biological, and cultural.

≡ Physical hazards are physical processes that occur naturally in the environment.
≡ Chemical hazards can be both natural and human-made chemicals in the environment.

— **What are the five components of environmental science?**

These five components are: atmospheric sciences, environmental chemistry, forestry and agricultural science, geosciences, and oceanography and marine sciences.

— **What are examples of environmental problems?**

The environmental problems like global warming, acid rain, air pollution, urban sprawl, waste disposal, ozone layer depletion, water pollution, climate change and many more affect every human, animal and nation on this planet.

— **What are the environmental factors that affect health?**
- Exposure to hazardous substances in the air, water, soil, and food.
- Natural and technological disasters.
- Climate change.
- Occupational hazards.
- The built environment.

5. CHANGING CONCEPTS OF ENVIRONMENTAL HEALTH

The most important principle of modern environmental health is that no advance in technology is without its risk of environmental degradation or hazard.

— **Modern environmental health problems**

The modern experts in environmental health must be capable of working on problems of air, water, soil, housing, or work place, etc., and of improving the situation in one place without making it worse elsewhere. He must see the environment as a whole, not as a series of disconnected parts. They must be appreciate and understand not only human disease but human health too. Environmental health calls for both the abatement of nuisances and their prevention. Nevertheless, it is practically certain that those trained in environmental health (bio) engineering in the next ten years will spend much of their professional lives in the field of environmental health planning, concerned with the prevention of environmental hazards and of environmental degradation.

The experts in environmental health must be able to say with authority and on a reasonable basis where power plants or cities should or should not be located; how much of a fertile basin can be used for commercial and residential purposes; what type of waste disposal facilities a new industry, factory or crop will require; what type of engine can be used as the prime mover in a transportation system; which domestic materials are suitable for a house and which must be imported. In less developed areas, the environmental health experts must understand the sequence of development in the provision of water supplies, the disposal of liquid and solid wastes, the provision of wholesome food and adequate food storage facilities, the prevention of occupational diseases and industrial injuries, the abatement of air and water pollution, the prevention of soil pollution etc.

The evaluation of environmental health hazards and their abatement, or the prevention of hazards and of environmental degradation, is the two basic activities in environmental health.

6. PROBLEM-SOLVING AND (BIO) ENGINEERING DESIGN

— **Problems of systems**

Engineering and bioengineering have always involved problems of systems and of components; what have changed dramatically is the scale of the systems (e.g., in air traffic control, urban sewage and waste disposal, electric power systems, information storage, retrieval, etc.).

The systems approaches to problems have had a marked effect on the way problems are tackled. For example, unusual groupings of humans are proving essential in tackling problems effectively in bioengineering and environmental engineering. There is no standard academic curriculum that will not guarantee insight into any given problem, nor is an unusual background necessarily a bar to the possession of insight. In engineering today, rigid professional classification is unacceptable if it impedes a free attack on problem-solving.

Problem-solving in engineering and bioengineering involves the selection of materials, the synthesis of components and the structuring of systems in such a manner as to yield an effective result in terms of some combination of technological, economic, political, social, and aesthetic criteria. The selection of one among a set of possible solutions has always been a fundamental task of the engineering profession.

7. THE USE OF SYSTEMS ANALYSIS IN ENVIRONMENTAL (BIO) ENGINEERING

Four necessary steps for decision-making:

1. Construct a model that satisfies the conditions of the available mathematical and computational techniques, and that at the same time adequately represents the important features of system performance. This step involves one of the traditional goals of the natural sciences: **description**.
2. Define a criterion function, or "measure of merit", that enables all of the possible designs or plans to be arranged in order of preference. This must be expressed formally and quantitatively as a function of the system variables and parameters. The principal purpose of this **objective** function is to reduce the indeterminacy of the model. Stated differently, the objective function is used to eliminate all the less desirable, but technically possible, systems designs. As opposed to the descriptive role of traditional natural sciences, this step lends emphasis to the prescriptive role of modern systems analysis.
3. Obtain empirical estimates of the parameters of the model for the given situation. Almost inevitably this will involve the use of conventional or advanced statistical techniques.

4. Solve the model, using mathematical and computational techniques to select values of decision or design variables that maximize-or, more generally, optimize-the objective function. In this process modern computing facilities are increasingly necessary

Optimization of an objective function for purposes of selecting best designs or making best decisions is a relatively new concept, but invoking of optimality principles for purposes of prediction bas long been of theoretical importance, particularly in the physical sciences.

Besides the objective function, there are usually a number of technical and other requirements. These may be either constraints or objectives, as defined below:

1. Constraint: A requirement is a constraint if:
   - » it is never to be violated at any cost, however high; or
   - » there is no gain or advantage in over fulfilling it.
2. Objective: A requirement is an objective if it can be violated, though at sorne cost or penalty, or if there is an advantage in over fulfilling it.

8. TRENDS IN ENVIRONMENTAL HEALTH (BIO) ENGINEERING EDUCATION

A new kind of (bio) engineer is needed to meet the complex environmental problems of the future. The civil and sanitary (bio)engineers who pioneered such innovations as water-borne sewerage, municipal water treatment and distribution, sewage treatment, vector control, and air pollution abatement, must gradually give way to the environmental health engineer, prepared to treat these problems in a new and different context.

The environmental health (bio) engineer, must deal with the environment as a system, controlling, modifying, or adapting it in the interest of the well-being of mankind.

New concept, environmental design, is developing, which recognizes the interrelationships between the work of (bio) engineers, architects, landscape architects, and planners who have the ultimate responsibility for the form, shape, and character of our urban environment. In considering environmental health (bio) engineering from the resources point of view, increasing use must be made of systems analysis. This involves new methods of assessing, controlling and designing systems.

In planning educational programmes to produce the new environmental health (bio) engineer, capable of understanding and dealing with the complexities of environmental control, there must be adequate recognition of recent trends in education. Accordingly, a part of any educational process should be to develop the ability to:

(1) perceive problems and solve them;
(2) understand people, to communicate with them, and to deal with them as individuals and in groups;
(3) organize;
(4) concentrate; and
(5) memorize.

In addition to education in the humanities and social sciences, all engineers should have a fundamental background in mathematics, including statistics and computer technology; physics, including modern physics; chemistry; the engineering sciences, which include fluid mechanics; solid mechanics; materials; thermodynamics; and electrical science. All environmental health (bio) engineers should study systems analysis; epidemiology; biology, including physiology; biochemistry; and management, including policy, law, administration, and finance. Not all educational institutions will be in a position to prepare (bio) engineering specialists in all fields of environmental health.

Contribution of education to sustainable development over the past decade, since the UNs Conference on Environment and Development held in Rio de Janeiro in 1992. The task of Conference was based on the International Work Programme on Education, Public Awareness and Sustainability of the Commission on Sustainable Development. It was mentioned that reorienting education towards sustainable development requires a new vision for education. Education, including formal education, public awareness and training should be recognized as a process by which human beings and societies can reach their fullest potential.

So, education is critical to social and economic development and has a profound impact on population health. Principle I of the Rio Declaration on Environment and Development states that "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature" and to achieve this vision, we have to follow:

- ≡ Ensure that basic education and functional literacy for all is achieved,
- ≡ Make environmental and development education available to people of all ages,
- ≡ Integrate environmental and development concepts, including those of population, into all educational programmes, with analyses of the causes of the major problems, and
- ≡ Involve schoolchildren in local and regional studies on environmental health, including safe drinking water, sanitation, food and the environmental and economic impacts of resource use.

It is important to consider the impact of health on education and the conditions that occur throughout the life course that can impact both health and education. The health benefits of education accrue at the level of individual; the community and the larger social or cultural context.

Good-quality basic education for all is an agreed strategy and an essential prerequisite for further skills development. Moreover, a wide distribution of education across society is a better indicator of future economic growth than a high average level. However, education has been identified as an important determinant of economic growth. Higher levels of educational attainment lead to a more skilled and productive workforce, producing more efficiently a higher standard of goods and services, which in turn forms the basis for faster economic growth and rising living standards.

Innovation and technological change are powerful drivers of economic growth. Innovation and technology translate into investment in fixed capital and in workforce and entrepreneurial skills which in turn lead to higher productivity.

The goal is to form the educational method which will allow students to get a BSc degree in technologies to understand that the engineer influences the world by manufactured products. As a result of applying the project educational method in the philosophy course, students have received necessary social cultural skills: realizing the anthropocentricity of the engineering profession and engineer's responsibility towards society, understanding basic tendencies of social development and forming the strategic view on reality.

Education is a strategic resource for building resilient and sustainable societies [2], because it plays a central role in changing the lifestyle and minds of people in relation to specific themes. It may lead to the right type of actions, attitudes and behaviour, creating conditions for active and aware citizenship that will lead to sustainable and inclusive growth [3].

Sustainability requires methodological innovations. Universities should develop curricular and extracurricular activities, teaching and research as well as environment-friendly educational structures [4].

The strategy of providing the future environmental engineers that must realise the dependence of professional activity on calls of the times, the state policy, human needs and at the same time understand that technologies change different life aspects both of the human and all biosphere.

Priorities here include the increasing access to: education and training; improving the quality of apprenticeships; making training in public institutions more relevant to workplace needs by strengthening coordination and partnerships with the private sector; and combining institution-based education and training with enterprise-based learning.

The highly concentrated topics are: development, energy, planning and design, engineering and technology, climate change. The most frequent topics are: sustainable development, sustainable energy, sustainable management development planning, sustainable design, international development, chemical engineering.

Education can accelerate progress towards the achievement of each of the proposed sustainable development goals for 2030 and beyond in a multiplicity of ways. Education opens up new work opportunities and sources of social mobility. The effects of education are significant across many development sectors. Education deserves to be a prominent cornerstone in the post-2017 development framework. The political and financial commitments to education by countries and donors need to be secured and renewed. There is a pressing need for closer collaboration across sectors to enable these synergies to take shape and take root.

The hypothesis of the changing in the modern environmental engineering education is competence which a graduate with a BSc or MSc degree in environmental technology must possess.

The professional competence for this modern education includes both specific knowledge and skills determined by professional activity. It indicates a need for a system of advanced training of specialists paying attention to the professional qualifications and to accept new technologies and draws attention to the new methodology of engineering activities: creative thinking and finding new ways to solve problems. So, the main new aim of the modern engineering profession requires above all creative activity aimed at solving the problems of society. For this, the new method of comparative analysis from the theoretical and experimental investigations is needed in this area.

9. THE FURTHER DEVELOPMENT OF THE TECHNOLOGY NEAR FUTURE

It was necessary to specify the social functions of the engineer. This issue was focused on finding out whether the students perceived the impact of engineering activity results for the development of various sectors of the economy, changes in the structure of society, the transformation of the spiritual and physiological components of the human being.

Nowadays higher modern engineering education should focus on the Professional Education. Students were offered the following issues: mechanisms of technology influence on the environment; the technology effects on the human or society; factors that affect the development of technology (economic, political, geopolitical, etc.).

Formation of this principle requires the students to understand technology at the professional level and on the other hand, probable and known effects of the use of technology. The students have showed positive dynamics in realizing the anthropocentricity of engineering profession and engineering responsibility to society. But in most cases the responsibility is recognized in the traditional sense: product quality and impacts on the ecosystem. It is necessary to continue the study of topics related to the personal responsibility of the engineer to the team and understanding of the concept of sustainable

development. There is a positive tendency in the formation of deliberate vision of the future students. But we should also note a serious contradiction – realizing the impact on the surrounding world and understanding of the future.
Following Commission on Sustainable Development appointed UNESCO [2] as a task management, there seven objectives of the Work Programme were to:

- clarify and communicate the concept and key messages of education for sustainable development
- review national education policies and reorient formal educational systems
- incorporate education into national strategic and action plans for sustainable development
- educate to promote sustainable consumption and production patterns in all countries
- promote investments in education
- identify and share innovative practices
- raise public awareness.

Some key points about education for sustainable development for future are illustrated here:

- Education for sustainable development is an emerging but dynamic concept that encompasses a new vision of education that seeks to empower people of all ages to assume responsibility for creating a sustainable future
- Basic education provides the foundation for all future education and is a contribution to sustainable development in its own right.
- There is a need to refocus many existing education policies, programmes and practices so that they build the concepts, skills, motivation and commitment needed for sustainable development.
- Education is the key to rural transformation and is essential to ensuring the economic, cultural and ecological vitality of rural areas and communities.
- Lifelong learning, including adult and community education, appropriate technical and vocational education, higher education and teacher education are all vital ingredients of capacity building for a sustainable future.

Education not only provides scientific and technical skills, it provides the motivation, justification, and social support for pursuing and applying them. For this reason, society must be deeply concerned that much of current education falls far short of what is required. Improving the quality and coverage of education and reorienting its goals to recognize the importance of sustainable development must be among society's highest priorities.
Declaration on Science agreed by nearly 2000 scientists at the World Conference on Science (In June 1999, the first global conference on science and society in Budapest, Hungary), organized by UNESCO and the International Council for Science: ICSU) focuses on 'Science and Technology should be resolutely directed towards prospects for better employment, improving competitiveness and social justice. Convened by UNESCO and the ICSU, the conference called for sustainability to be both the goal of scientific endeavour and a guide to processes for new approaches to scientific research.

10. ENVIRONMENTAL SUSTAINABILITY

Environment includes the physical, biological, social, and cultural factors that can influence health, either directly or through their impact on essential life-supporting ecosystems. The environment and these life-supporting ecosystems are affected by many natural forces, but mostly they are influenced by human activities. Environmental sustainability depends on such elements, as biotic and abiotic factors with natural and anthropogenic origin [5].
Global environmental threats to health include climate change, depletion of the ozone layer, reduction of biodiversity, degradation of ecosystems and the spread of persistent organic pollutants. The 3 main determinants of human disruption of the environment are population size, the level of material wealth and consumption, and the types of technology. Therefore, and for this reason the environmental engineering education and environmental engineers are needed to recognize the direct or indirect influences and activities of human in the air, water and soil environments.
Climate change is a major driver of technological change and innovation in the search for measures and policies to mitigate or help adjust to its effects. Sustainable development and the integration of environmental protection into economic and social development objectives are among the most challenging issues on the national and international policy agenda. The goal of cutting carbon emissions poses significant challenges to the world of work.
Green jobs have a high projected level of growth between now and 2024, especially in lower income countries. This is determined by two processes: the development of the green industry and of the green economy sector and the demand for new "green skills" in traditional sectors.
The notion of "green jobs" has become an emblem of a more sustainable economy and society. Jobs in all economic sectors are subject to "greening", but six sectors have particular salience in this respect: energy supply, especially of renewable energy; construction; transportation; basic industry; agriculture; and forestry.
Since the industrial revolution, urbanisation and industrialisation, together with economic development, have led to increases in energy consumption and waste production. Exposure to environmental pollution remains a major source of hazard not only for our health but also for our planet. In 2012, WHO estimated that exposures to polluted soil, water, and air contributed to an estimated 8·9 million deaths worldwide. Of these deaths, 94% (8·4 million) were in low-and-middle-

income countries. Different pollutants are linked in children to non-communicable diseases (such as asthma), cognitive disorders, and perinatal defects, and, among adults, to heart disease, stroke, and cancer. However, although environmental pollution is reaching disturbing proportions worldwide, it remains a neglected problem in national policies and on international development agendas.

11. EDUCATION OF (BIO) ENGINEERS IN EPIDEMIOLOGY AND PUBLIC HEALTH

The role of environmental health (bio) engineering is particularly important in the control of water-, food- and arthropod-borne infections, zoonoses, and worm infestations. The preventive measures used by modern medicine in the control of these infections embrace all the fields of environmental health (bio) engineering. Water- and food-borne enteric infections caused by the members of the *Salmonella* family, cholera, diseases caused by enteroviruses, malaria, schistosomiasis, and plague are examples of infections in which the control of the vector and animal reservoirs is largely in hands of the environmental health (bio) engineer. The control of such diseases calls for close collaboration between the physician, the epidemiologist, the environmental health bioengineer, and their assistants. Successful collaboration depends on a variety of factors; the physician need not know much about bioengineering or control measures, but must understand them. The environmental health (bio) engineer, must be able to understand and communicate with the various medical and paramedical specialists (epidemiologists, microbiologists, entomologists, etc.).

12. HEALTH AND SUSTAINABLE DEVELOPMENT

Usually, good health facilitates development, and the development promotes improved health. However, improved health may be a prerequisite for development, some behavioural determinants of health. Equally, development which is economically desirable e.g. in agriculture and industry, may have harmful consequences for health and the environment. 'Health' and 'sustainable development' are complex entities. "Making Health Central to Sustainable Development that planning the Health Agenda for the World Summit on Sustainable Development" held in Oslo, Norway, from 29 November to 1 December 2001. It represents a point of departure, rather than a definitive account of all issues relevant to health and sustainable development. The main concept of sustainable development is an elusive one, and its relationship with health highly complex, variable and subject to a large number of interacting factors which influence the relationship (Figure 2).

The fundamental to the concept of sustainable development is depending on three pillars: the social dimension, the economic dimension and the environmental dimension. For development to be sustainable, all 3 dimensions need to be addressed in a balanced and integrated way, to reach present as well as future needs. These 3 dimensions should be seen as mutually enforcing, interdependent entities of sustainability.

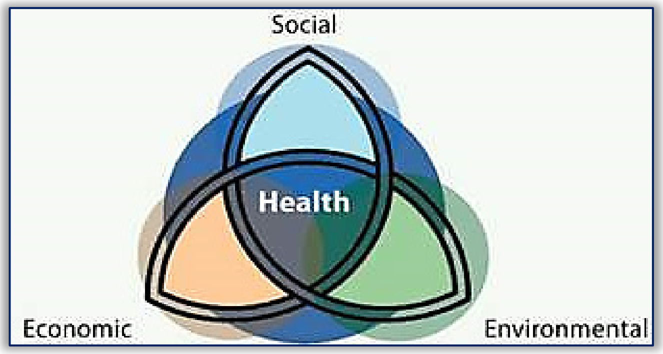

Figure 2. The relation between the health and socio-environmental issues

Health and sustainable development policies and programmes depend on convenient access to information about a large variety of hazards, ranging from biological hazards in food and water, to chemical hazards such as pesticides, to the different physical and social factors. This is necessary so that health authorities can effectively discharge their responsibility to protect public health. But it also serves to clarify the extent to which health hazards are attributable to environmental and social conditions and/or to the activities and policies of sectors other than health.

Good health facilitates development, and development often promotes improved health. Improved health may be a prerequisite for development, some health behavioural determinants such as attitudes towards the environment, and lifestyles of people and consumption patterns, can impede the sustainability development process in the longer-term. Equally, development which is economically desirable e.g. in agriculture and industry, may have harmful consequences for health and the environment. Under different possible future scenarios, in order to manage health workforce labour markets and devise effective and efficient policies that respond to today's needs while anticipating tomorrow's expectations (Figure 3).

Genetical factors are more relevant at individual and family level than at the population level, but gene-environment interactions are responsible for much human diversity. Environmental determinants of health are too numerous and complex, nevertheless the wide range of possible exposures to pathogens and environmental pollutants, and the individual and population-level responses to these exposures, are well known. Yet pollution is preventable. But when compared with the attention given, for example, to AIDS, malaria, and tuberculosis, environmental pollution receives far less attention at the national and international levels, making it hard to put policy interventions and prevention strategies into practice.

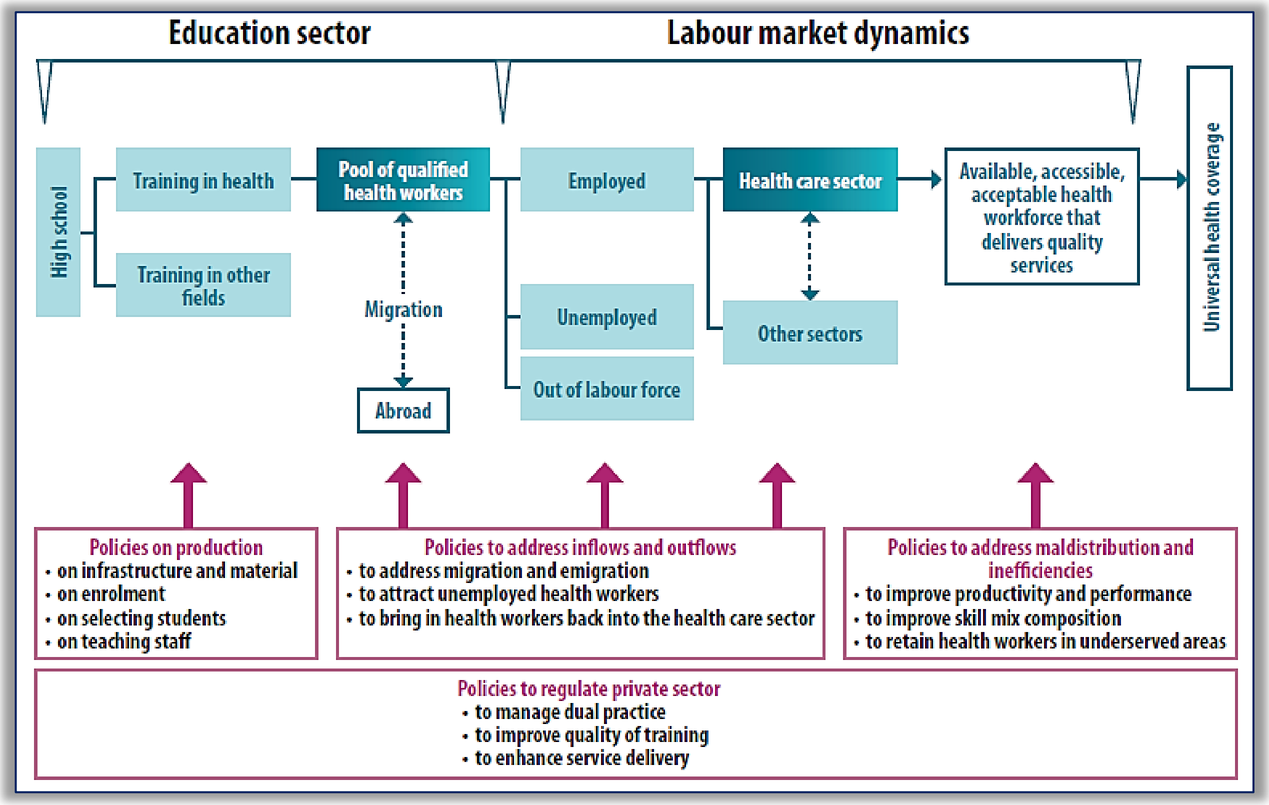

Figure 3. Policy levers to shape health labour markets (Source:[6]).

In October, 2017, The Lancet, together with the Global Alliance on Health and Pollution and the Icahn School of Medicine at Mount Sinai in New York, will publish a Commission on Pollution, Health, and Development. The Commission will aim to catalyse attention to this escalating planetary danger, increase resources allocated for it, and initiate coordination of policy action at the global level. Environmental pollution should be tackled from multiple perspectives, including social, economic, legislative, and environmental approaches. It is time to take action to control the endemic pollution of our world.

13. COOPERATION PROGRAMMES

There is a wide scope to build on current development cooperation programmes for skills development. Fruitful avenues could include engaging national institutions in:

≡ Further exchange of experience, promotion of the training strategy for strong, sustainable and balanced growth;
≡ Integrating skills into national and sectoral development strategies through the UN Common Development Framework system;
≡ Providing capacity-building and financial help to expand the coverage and the quality of education and training available to disadvantaged groups;
≡ Upgrading the informal apprenticeship systems which are the only means of acquiring skills available to most young people;
≡ Building skills into current "aid for trade" initiatives.
≡ This in turn requires good-quality education in childhood;
≡ Good information on changes in demand for skills;
≡ Education and training systems that are responsive to structural changes in economy and society; and
≡ Recognition of skills and competencies, and their greater utilization in the workplace.

14. SUSTAINABLE DEVELOPMENT

Principle I of the Rio Declaration on Environment and Development states that "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature".

Sustainable development is frequently defined as development that meets the needs of present generations without compromising the ability of future generations to meet their own needs.

As evidence of the harm to health and well-being from widespread environmental degradation and global climate change grows, communities and governments are placing greater emphasis on assuring that economic development is achieved in a sustainable way.

In September 2015, during the UNs General Assembly, a new global development agenda was adopted by all the member states in order to define development priorities up to 2030 in line with the Millennium Development Goals and Education for All, which expired in 2015. The 2030 Agenda for Sustainable Development includes a set of 17 Sustainable Development Goals, which are reference objectives for post-2015 international development. Within this new international framework, education was identified as a standalone goal since it has a pivotal role as a key enabler of sustainable development. For these reasons, it is necessary to analyse in detail what kind of education we need to ensure its impact is positive: i.e., the best practices, tools and solutions that are able to foster sustainable development at a global level.

So, the action of Global Programme on Education for Sustainable Development is to mobilise the community of stakeholders in Education for Sustainable Development towards urgent action to further strengthen it and scale it up.

Technological innovations, environmental policies, the consequences of climate change and new habits of consumption are all factors that determine this new demand.

The growing number of people employed within the environmental economy since 2000 is mainly due to growth in the management of energy resources, especially those concerning the production of energy from renewable sources and the production of equipment and installations for heat and energy saving.

Within this complex framework of different actors, universities play a central role in education for sustainable development, as well as in networking, and often play a leading role in relation to local populations [7].

There are 3 main strategies currently in use for achieving these goals and integrating sustainability concerns into university activities:

- ≡ Classes in Sustainability
- ≡ Research on Sustainability, and
- ≡ Green campus.

Education for Sustainable Development is an "umbrella concept" that covers a broad range of topics and aspects to cope with the complexities posed by socio-environmental issues. Such complexities are often grouped into the well-known 3 dimensions: economic, social, and environmental Sustainability (Figure 4).

Figure 4. Matrix of Sustainability: economic, social, and environmental dimensions. [8]

From such processes of social study, it can be realised that sustainable development is a catalytic vision rather than a neatly defined, technical concept. Indeed, we have learnt that:

- ≡ Sustainable development is more a moral precept than a scientific concept, linked as much with notions of peace, human rights and fairness as with theories of ecology or global warning.
- ≡ Sustainable development involves the natural sciences, policy and economics; it is primarily a matter of culture.
- ≡ Sustainable development requires us to acknowledge the interdependent relationship between people and the natural environment. This interdependence means that no single social, economic, political or environmental objective be pursued to the detriment of others.

Rapid worldwide urbanization is at once the main cause and, potentially, the main solution to global sustainable development challenges [9]. The growth of cities is typically associated with increases in socioeconomic productivity, but it also creates strong inequalities. Rapid urbanization is creating the conditions for widespread economic growth and human development, but its consequences are very uneven.

Most nations worldwide have recently committed to solving their most severe challenges of sustainability by 2030, including eradicating extreme poverty and providing universal access to basic services. A new systematic understanding of these processes is critical for devising policies that produce faster and more equitable universal sustainable development.

15. CONCLUSION

Thus, underlying the concept of sustainable development is the increasing recognition that the goals of sustainable development cannot be achieved when there is a high prevalence of debilitating illnesses, and the health of the population cannot be maintained without ecologically sustainable development. In this respect "ecological" has both social and physical dimensions.

Note:

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