



## ORIGINAL ARTICLE

**The Role of Environmental Engineering in Sustainable Economic Development****Pedram Saremi**

Department of Civil Engineering, Sapienza University of Rome, Rome, Italy

Email: [pedram\\_saremi@yahoo.com](mailto:pedram_saremi@yahoo.com)Received: 25<sup>th</sup> Aug. 2019, Revised: 10<sup>th</sup> Sept. 2019, Accepted: 14<sup>th</sup> Sept. 2019**ABSTRACT**

*This paper first examines the history of environmental economics and then the importance of using economic tools to protect the environment has been considered. This analysis and comparison shows the economic tools of environmental protection that are used in environmental policy making have a crucial and important role to play in the sustainable use of environmental resources and provide mechanisms for integrating environmental considerations into macroeconomic policies. For this reason, they have rapidly emerged as economically viable tools worldwide; in this article have also highlighted the important and basic role of environmental engineering in applying a collection of engineering sciences and techniques regarding to study, evaluate conditions, improve and betterment of the environment. Considering the importance of environmental engineering is used in executive and construction affairs in infrastructural construction, Urban, Industrial and Residential projects and its Impacts on Economic Development of the Country. The destruction of natural environments and the increase in the percentage of different pollutants resulting from the implementation of infrastructure and industrial projects, especially in urban and rural areas, and the endangering of natural and human resources are issues that are of concern in the application of environmental engineering in any development project. The most important task of experts in this field is to oversee the implementation of environmental projects. These include the recognition and control of water, soil and air pollution, the design of municipal and rural water and wastewater installation and facilities, the control of environmental pollution that will affect the economy and the wealth of the nations. The main purpose of institutionalizing these tools in development programs is to raise the awareness of economic decision-makers at national level so that they can integrate environmental considerations into macro and international planning using appropriate economic markets. Studies have shown that, until recently, the focus of environmental protection orientations and policies was more on legal and deterrent policies and make less benefit on the economic approaches that expressed in form of economic instruments. While the use of economic instruments in addition to law and regulations can play an essential and decisive role in protecting the environment. And this is the most important conclusion that can be drawn in this article.*

**Key words:** Environmental Economics, Economic Tools, Environmental Protection, Environmental Standards, Environmental Engineering

**INTRODUCTION**

The environment is a distinct branch of economics science that considers the values of both economics and the environment issues together and proposes new alternatives based on these values. Its main purpose is to balance economic activities and their environmental impacts by considering all the cost-benefit related to them. Environmental Economics is designed to calculate the costs of pollution and degradation of environmental resources (Amit Bijon Dutta and Ipshita Sengupta, 2014).

In resource management and development economics has emphasized on the necessity of calculating environmental values and costs and consider these values and costs in the feasibility study process of developmental or environmental economics is. Environmental economics theorists define the environment economic as effect of economic activity on the environment and the impact of environment on the economic activity and Human welfare. An environmental economics system that also considers the flow of energy and materials is described as a true representation of the interactions between the economy and the environment. Environmental economics is not as old as in many developing countries.

In spite of the passage of time since its emergence in form of independent branch of economics science and a split from resource economics, its place in the analysis of environmental issues and problems It has received considerable growth and popularity.

Since facing with some of the economic and social problems associated with the destruction of environmental resources, and especially where they deal with the illegal harvesting of resources or the release and entry of pollutants into the natural arena, they have involved huge costs and seems inevitable to have necessary knowledge and technical information about the true costs of pollution control and return to pre-destruction status, paying attention to the key dimensions and issues relevant to the country's economic environment is of paramount importance.

Economic approaches and tools are appropriate mechanisms for the optimal use of natural and environmental resources and play a critical role in achieving sustainable development goals. But not having a tool that is the best. The use of each depends on the economic, social, political and environmental conditions of the countries. Using a set of these tools is the best option. Where resource use policies and their effects on the environment are associated with uncertainty, command-control approaches are superior to other market-based approaches.

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#### **THE CONCEPT OF DEVELOPMENT**

By definition, development refers to all human activities and works that it performs to improve its life in the environment (Niloofer Morad Hasel and Amir Hossein Mazini 2010). However, if this development is to be sustainable in the long run, it should take into account the bottlenecks that environmental and Natural resources have created.

Typically, development can be considered in various dimensions. Political development, cultural development social development, economic development. When speaking about development in a society in absolute terms, it really means development in a variety of dimensions. Undoubtedly, a developed society is a society in which development has taken place in various dimensions. Development is a general phenomenon that does not include only the economic dimension. Although contributing to growth and helping to The driving forces of development but from now on, other aspects of development including environment, social justice, democracy and peace must also be taken into account.

#### **SUSTAINABLE DEVELOPMENT DEFINITION**

Sustainable development, as defined by the World Commission on Environment and Development, called the Brand Land Commission, and the 1987 report of the United Nations Commission on Environment and Development, means development that addresses and provide the present needs without compromising the ability of future generations to meet their needs. In other words, sustainable development is a holistic approach that promotes development in ways that do not harm the environment or waste natural resources, so that they are available in the future.

The report adds that the aforesaid conditions not only applicable to environmental policies but also to economic and social policies. The most complete definition of sustainable development consists of two key concepts: First, the concept of need, especially the basic needs of the world's poor people, which must be prioritized. Second, the idea of the imposed constraints by technology situation and social organization on the ability of the ecosystem to meet present and future needs. Whereas meeting the needs of the today's poor people is not necessarily compatible with the needs of future generations, it is obvious that the countries of the world do not have the same level regarding providing energy, clean water, clean air, political freedom and protecting their communities from crime and war. Correspondingly, the sustainable development of the Three realms of the environment, including water and waste, employment community, human rights,

gender equality, peace and human security, and poverty alleviation economy, links corporate responsibility and accountability.

#### **ENVIRONMENT CONSERVATION DEFINITION**

Environmental Conservation refers to any action taken to protect or prevent the destruction of the environment. Environmental Conservation is an effort in order to protect Environmental health and human health both at the personal, organizational or governmental levels, for the protection of natural environment. Due to population growth and technology, the biophysical environment sometimes it is ignored. This issue must be recognized and governments must impose restrictions on environmental destruction activities. Since the 1960, environmental activist movements have been created that are aware of various issues in this area. There is no consensus on the of impact extent of human activities on the environment, and conservation measures are sometimes criticized. Environmental Conservation needs attention a variety of human activities. Waste generation, air pollution and biodiversity loss (caused by the introduction of invasive species and endangered species) are some of the issues related to environmental protection.

Scientific institutions are now offering courses, such as environmental studies, environmental management and environmental engineering, that teach the history and methods of environmental Conservation.

Environmental Conservation is influenced by three factors: environmental law, ethics, training & education. Each of these three factors impact on environment at internationally decisions as well as personal and behavioral values level. In order for environmental protection to become a reality, it is important for communities to move forward in these areas and make environmental decisions.

#### **ENVIRONMENTAL ENGINEERING DEFINITION**

The environment industry is one of the fastest growing industries today, population growth, urbanization development, economic and industrial development, and increased resource consumption in recent decades causing numerous environmental problems worldwide.

Biodiversity Reduction, deforestation and vegetation, soil erosion, water, soil and air pollution, greenhouse gas and emissions increase and climate change are the most important environmental challenges in the country.

Therefore, the strategy of environmental Conservation and sustainable development is a fundamental goal of improving and maintaining human living standards. The use of different sciences and technologies in the field of sustainable assessment and management of renewable and non-renewable resources can help reduce or solve environmental problems.

Protecting the environment and achieving sustainable development at the local, regional and global levels is an essential goal of improving human living conditions. To achieve this goal, it is necessary to increase environmental science and knowledge by developing comprehensive and effective training courses. In this regard, environmental science and engineering, with an interdisciplinary approach, tries to understand the environmental issues and to plan and implement necessary measures for their solution.

Environmental engineering is a multidisciplinary field that requires the combination of physical, chemical, and biological principles with engineering analysis to protect and restore the environment.

Environmental Engineering combines lessons from different departments to create a program that has a strong foundation in science and engineering. Interdisciplinary disciplines are bridges between two or more courses, one of the goals of these courses is to make science more applicable. Environmental engineering, meanwhile, is a multidisciplinary field that requires the combination of physical, chemical, and biological principles with engineering analysis to protect and restore the environment.

Environmental engineering is a branch of the environment that uses scientific and engineering principles to protect the environment (both domestic and global) against the adverse effects of natural factors and the potentially harmful effects of natural and human activities and strive to improve environmental quality of environment.

There is an environmental engineering field in civil engineering as well, but the environmental engineering program provides a broader foundation than what there is in civil engineering.

Environmental Engineering Solves Environmental Problems (Water, Soil and Air) with Principles of Engineering, Soil Science, Biology and Chemistry.

Wastewater management, air pollution control, radiation protection, industrial and public health, and environmental cost reduction are issues that studying by environmental engineering. Environmental science is actually a combination of biological, geological, physical, chemical, social and cultural sciences that effective in interact with the life of the individual or society. Environmental problems can be attributed to various factors including overpopulation, climate change, and habitat fragmentation. Many of these problems are caused by human activity and, of course, they endanger human health (Ferzan Pour-Asghar Sangachin, 2010).

The problems facing the environment today are not only solvable by science and knowledge, but by an equal discovery and knowledge of culture, sociology, economics, politics and ethics that can be addressed in this regard Environmental engineering is very effective.

#### **HISTORY OF ENVIRONMENTAL ECONOMICS IN THE WORLD:**

The origins of the environmental economy began in 1960, coinciding with the first green movements and political conceptions in the developed world known as environmentalism (Farzam Pour-Asghar Sangachin and Alireza Saleh, 2005). Of course there have been discussions of environmental economics in the past, for example, Marshall was the first person who proposed a method for environmental degradation economically analyzing by introducing a concept called lateral economics in 1890. Although Marshall considered only the benefits of industrial development, the main key to analyzing environmental issues lies in this concept. Pigard later in 1920 likened the concept of side effects to a double-edged sword, which included not only benefits but also costs.

Pegu, for example, mentions forest lands destroyed by rail. He says it's clear that it's not just the producing's status of those who are out of the market (actually a third party) also be affected, but also the welfare of private individuals (or key parties who are first and second parties) affects through cost and benefits changes.

One of the major issues raised in environmental economics is the discussion of is lateral, or external effects. The first serious debate about the side effects was raised by Kop in 1950 that predicted the reverse effect of economic growth on the environment. In his analysis emphasize on social costs. Social cost is an explainer of direct and indirect burden imposed on people by economic activities. He clearly defines all costs is generated out of the Production process and transmitted to others by polluting the climate. Side effects are also mentioned under other names such as external or outside effects, release effects, side effects and outside advantages and disadvantages and costs focused to others also raised.

These effects arise when the activities of economic entities (firms and consumers) affect the production and consumption of other entities, and these costs and benefits imposed on others are not formally included in profit and loss calculations. In other words, although these effects are seen in practice, they are not priced and officially no compensation is provided for them. If we can price these side effects and compensate for the damage, then we say we have internalized the external or side effects.

In environmental economics, this assumption accepted that there is a close relationship between the economic system and the environment. Because if the three main functions of the raw material supplier (renewable and non-renewable resources), be considered for the production of products, the absorption of many wastes resulted of manufacturing processes, and for the Spiritual satisfaction of individuals with regard to the possibility of aesthetic exploitation. Each of these functions is considered to be economical function and if they are exchanged in a store they will have good prices. Unfortunately, many of these functions have not been priced. This has caused people to behave inappropriately with the environment and in various ways cause its pollution and destruction. Therefore, pricing environmental functions is an important step to modify economic decisions and to take environmental considerations into macroeconomic policies. As mentioned,

there is a market for the exchange of private goods and services. There is also relatively clear information on their specifications and prices.

But this is not the case for environmental goods classified as public goods because there is a disconnect between the use of environmental resources because there is a disconnect in the use of environmental resources, not just between the benefits and the costs of using them, but also there is not relatively accurate information on their prices. The same issue will be a prelude to market failure and consequently negative externalities (external costs).

This phenomenon causes consumers to use environmental resources more intensively and to degrade their quality and quantity. Ultimately, as a viable option (Not necessarily the best option) will be Justifiable for integrating environmental resources and economic development goals.

Since environmental resources are scarce and, on the other hand, by expanding production activities, quality is defined and appropriate economic tools are used accordingly.

One of the most important applications of biological service evaluation is to incorporate changes in ecosystem service value into cost and benefit analysis and consequently in the decision-making process.

The main objective of environmental economic valuation is to enable comparability between Socio-economic development and environmental protection to achieve optimal use of scarce resources in developed countries, the most importantly issue is the environmental debate, which unfortunately is not really taken care of in Third World countries.

In this regard, we can point out the very important role of environmental engineering, which is the application of a set of engineering and sciences techniques in relation to the study and evaluation of environmental improvement and betterment conditions. These sciences and techniques are applied in executive and construction affairs in infrastructure, urban, industrial and residential development plans.

The destruction of natural environments and the increase in the percentage of different pollutants caused by the implementation of infrastructure and industrial projects, especially in urban and rural areas, and the endangering of natural and human resources are issues that are of concern in the application of environmental engineering in any construction project.

The most important task of experts in this field is to monitor the implementation of environmental projects. Out of these projects may indicate to the recognition and control of water, soil and air pollution, the design of municipal and rural water and wastewater installations, Controlling Solid Waste Pollutions and Planning and Managing Environmental Plans. Today, with the increasing expansion of cities and the rapid development of industry, the amount of air pollutants and greenhouse gas emissions, including carbon dioxide shows an increasing trend.

The world produces 1.6 billion tons of cement annually and for each tone of Portland cement production, it requires 1.4 GJ of energy. Therefore, for every ton of cement produced, approximately one tone of CO<sub>2</sub> gas is released into the atmosphere, which can be said to be seven percent of the carbon dioxide in the atmosphere due to cement production.

For this reason, carbon dioxide, as one of the harmful pollutants, plays an important role in the destruction of reinforced concrete structures. The degradation of the concrete by carbon dioxide occurs through a slow process called carbonation in the concrete which corrodes the concrete bars and reduces its alkalinity. Many factors such as carbon dioxide concentration, temperature, humidity, structure and components of cement and type of cement affect the carbonation process. At the beginning of the 21st century, the situation in the world reached an unstable development; its characteristics include population growth and consumption increase and unequal distribution of resources.

Sustainable development can be described as environmental, economic, social development, and environmental sustainable development is one of the tasks of architects and civil engineers, including the optimal use of energy, the use of renewable materials, the conservation and supply of energy, and its complete recycling without pollution, Researchers and engineers must design and construct buildings that is free of materials without pollutant in environmental sustainability and compatible to environment, with the aim of comforting human and nature. It is an undeniable fact that in the growth and development of society, civilization, architecture and the environment have played a significant role.

According to civil science, the city can be defined as a set of different civil structures: "A modern city with a population of about 1 million people enter the atmosphere, at least 500,000 tons of sewage and wastewater, 2000,000 tons of home waste, 950,000 tons' various kind of gas and fine particles.

One of the major challenges in the environmental issue can be described the greenhouse effects, and these are the effects of CO<sub>2</sub> produced in these homes that can have very adverse effects on insects and are a major cause of CO<sub>2</sub> infectious and parasitic diseases. Environmental economics generally involves the following steps: Assessing the economic importance of environmental degradation and finding the economic causes of this degradation and providing the economic incentives needed to slow, halt, and reverse the process of this degradation.

### **HUMAN IMPACT ON THE ENVIRONMENT**

Although humans make up only a very small percentage of the Earth's biomass (weight or volume of living creatures), but they are the dominant species. At the beginning of the Pleistocene period, human also, like other creatures, were fully affected by environmental factors (Sadeghi, Hussein and Rahman Happiness, 2006).

Since then, human have progressed and been able to drastically change the physical environment around himself gradually. In fact, the relationship between human and the environment has been changed with the evolutionary process of human and the technologies used completely have changed, while human especially early humans influenced by the environment around himself in the past, and, today this is man who has influenced the environment through his behaviors and actions. The mutual and grown relationship existence, between nature and organized society, and equipped with the technical means is an undeniable fact that uninterruptedly achieve and consume the necessary and required resources from nature, and to return the waste resulting from vital and productive activities to it.

The Study of "human-community-environment" system is very important i.e. because of constant and intense ever-increasing exchanges of materials and energy between the factors of the system, that are obtained from ever-increasing social production, ever more complex structure, and the use of raw materials from lands which are in form of undergoing continual change, but the impact that human has on the environment is due to the way he behaves and acts in its environment. Actions, such as natural resources utilization, cutting down trees, Homebuilding, factories construction and more in natural environments causes change the face of the environment if this process continues It can be irreversibly damaging to the environment.

The fact is that humans have been able to increase their interference and impact on the environment with the development of science and technology, day by day to further restrict for greater material gain and welfare. Although emerging technology has delayed the population crisis, it has ultimately increased human impact on the environment. Technology has not only increased the use of resources but also made modern humans affect the environment by new ways in compare to the hunter-gatherer and food collector who used simple stone and wood tools.

### **ORIGIN OF ENVIRONMENTAL ECONOMICS**

In fact, the origin of environmental economics is 1960, i.e. at the beginning of the first modern wave of "green" thinking and political perception in advanced countries, which known as environmentalism). The foundation of the environmental economy was undoubtedly established during the 1990s. Environmental economics is a branch of economics and has a common history with its main field. Some of the fundamental ideas that have built the framework of environmental economics are rooted in the nineteenth century (Sadat Hashemi Mohadeseh, *et al.*, 2006).

Environmental pollution as an external cost Since the economy is an open system, the three main processes (extraction, processing or production and consumption) all involve the generation of waste that is ultimately returned to the environment (air, water or land). Excessive waste existence in inappropriate locations and time will cause occurrence of biological changes in the environment, if damages animals, plants and ecosystems. If Environmental damage to human health and hygiene or somehow negative affect on human welfare, economists believes that economic pollution has occurred (Jahangir Esfandiar, 2018).

### **UTILIZATION OF NON-RENEWABLE AND RENEWABLE RESOURCES**

Based on the material equilibrium model at the intersection point of economics and the environment, extraction (and harvesting) operations are the sources of the beginning of the economic activity process. The resources can easily be classified into two groups of perishable (or non-renewable) and renewable resources. The first one its value is constant and its use over a specified period of time means less access to it at other times. The basis of the economics of non-renewable resources was formulated and formulated by Gary (1914) and Hotelling (1913). Their analysis was based on the idea that the world's resources could be extracted quickly and wasted lowly.

### **ECONOMIC GROWTH, POPULATION GROWTH AND ENVIRONMENT**

Economic activity can be conceived as a process of material and energy transformation. Since materials and energy cannot be eliminated in its absolute sense (the first law of thermodynamics), they therefore return to the environment in the form of emerging wastes. Thus, the greater the economic gains, the greater the waste produced. If we consider environments that have to accept waste such as rivers, landfills, seas, and the atmosphere have limited capacity to absorb them, then the potential for economic development is clear. Economic development is estimated in terms of the rate of increase in national income, or GNP. An increase in GDP is commonly referred to as economic growth. Therefore, there is likely to be scope for economic growth. As growth increases, the amount of waste increases relative to the limited capacity of the natural environment to absorb them. As the amount of waste exceeds the absorptive capacity, severe environmental damage may occur and higher levels of well-being may practically decline. We call this restriction against growth the "waste acceptance limit" (Niloofer Morad Hasel and Amir Hossein Mazini, 2010).

### **ENVIRONMENTAL COST-BENEFIT ASSESSMENT METHODS**

Economic evaluation means that we express environmental impacts in monetary terms. Cost-Benefit Analysis is the oldest method of economic evaluation in which the costs and benefits of a project are examined to determine its usefulness. Cost-benefit theory does not impose any restrictions on the nature of costs and benefits of the project i.e., all the costs and benefits to the environment will also be part of the cost benefit study (Nasrallah, Zahra and Mariah Ghaghara Golak, 2009).

### **THE ROLE OF ENVIRONMENTAL ENGINEERING IN SUSTAINABLE ECONOMIC**

Development Sustainable development is one of the challenging concept in present era. Ecological, social and economic change is one of the major contributor for sustainable development of present civilization. Though technical advancement is there but ethical, legal and political aspect has come to a downward trend. Agricultural, scientific and industrial revolution of the past has a significant contributor towards sustainable development. in this context we not only required the requisite knowledge but also at the same time required technical as well as environmental possibility. The sustainability of environmental engineering is a major innovation in the field of science and technology. Environmental sustainability largely depends on green revolution and ecological balance. Failure in this front leads to environmental pollution and hazards. Environment plays a major role in economic development in a nation. Intensive Growth in economy is a specific issue which largely or mostly depend on science, culture, language as well as society as a whole (James R. Mihelcic, *et. al.*, 2016).

Sustainability growth can be expressed in terms of a given system which is a balance between components like 'to have' 'to be' and 'to have and to be'. For this, time is a major factor in terms of devastation caused by human being towards environment. Sometimes the environmental devastation can be observed and sometimes it can be felt. This is due to the fact that now environment is not independent from human action, human need and human ambition. On the whole environmental sustainability is a global phenomenon and its crises cannot be resolved without a positive and constructive environmental engineering system. It is the opinion of large sections of scientists that sustainability of environment is the necessity for the present generation without compromising the ability of the future generation. In order to meet their demands, the

formulation of present development strategy largely depends on principles of sustainable development which is directly or indirectly related to environmental engineering.

So far as contribution of environmental engineering for protection of the environment is concerned it can be said that role of environmental engineering is commendable. Some of the contributions of environmental engineering are as follows-

1. To protect soil erosion for safeguard of forest.
2. Using environmental engineering technology degradation of bio social system can be prevented.
3. Air pollution can be minimized up to a maximum extent by utilizing environmental engineering.
4. Development of agriculture is necessary and the requirement can be fulfilled through environmental engineering.
5. Environmental engineering is utilized for preservation of social energy.
6. Global crises on environment can be minimized by utilizing environmental engineering technology.
7. Facilitate for sustainable development of the society.
8. It helps for social and economic development

Remedial Majors for Sustainable Development with The Help of Environmental Engineering  
Environmental engineering can be used for sustainable development. Some of the remedial majors through environmental engineering are mentioned below-

1. Environmental engineering can successfully have utilized for protection of external natural environment. Water resources, waste management, air protection, soil erosion are some of the natural environment which can be protected with the help of environmental engineering.
2. Internal environment like construction devices and installation devices for shaping of rooms can be facilitated with the help of environmental engineering.
3. Industrial ecology which is designed to adopt raw material and update technology in the field of industry for industrial development. This can be possible with the help of environmental engineering.
4. Green chemistry which is popularly known as green engineering. This can be processed by reducing hazards implications of chemical products. Environmental engineering can be successfully utilized for protection of green engineering.
5. Energy supply, preservation of energy, usage of energy and carrier of energy are some of the burning problems can be solved through the help of environmental engineering. By analyzing the above remedial majors, it can be concluded that environmental engineering can be utilized in various pro ecological activity which leads to sustainable development.

In the era of globalization global socio economic system can be associated with sustainable development. In this context the role of environmental engineering is noteworthy for progress of 21st century. Urban ecology problem is a concern for sustainable development in these context challenges of environmental engineering is considered to have paradox value. Implementation of sustainable development though suffers due to some problems like social, economic, ethical, technical, ecological, legal and political but in the long run application of environmental engineering will be a major source for eradications of those problems. It is assumed that we are in a road to sustainable development. In this road the role of environmental engineers is crucial. They should utilize the technical method and tools so that we can rationally preserve the environment which is a challenging task for our future generation. A systematic approach by utilizing technical method in environmental engineering is a source of aspiration for sustainable development. Hence it can be concluded that environmental engineering and its application can lead to sustainable development

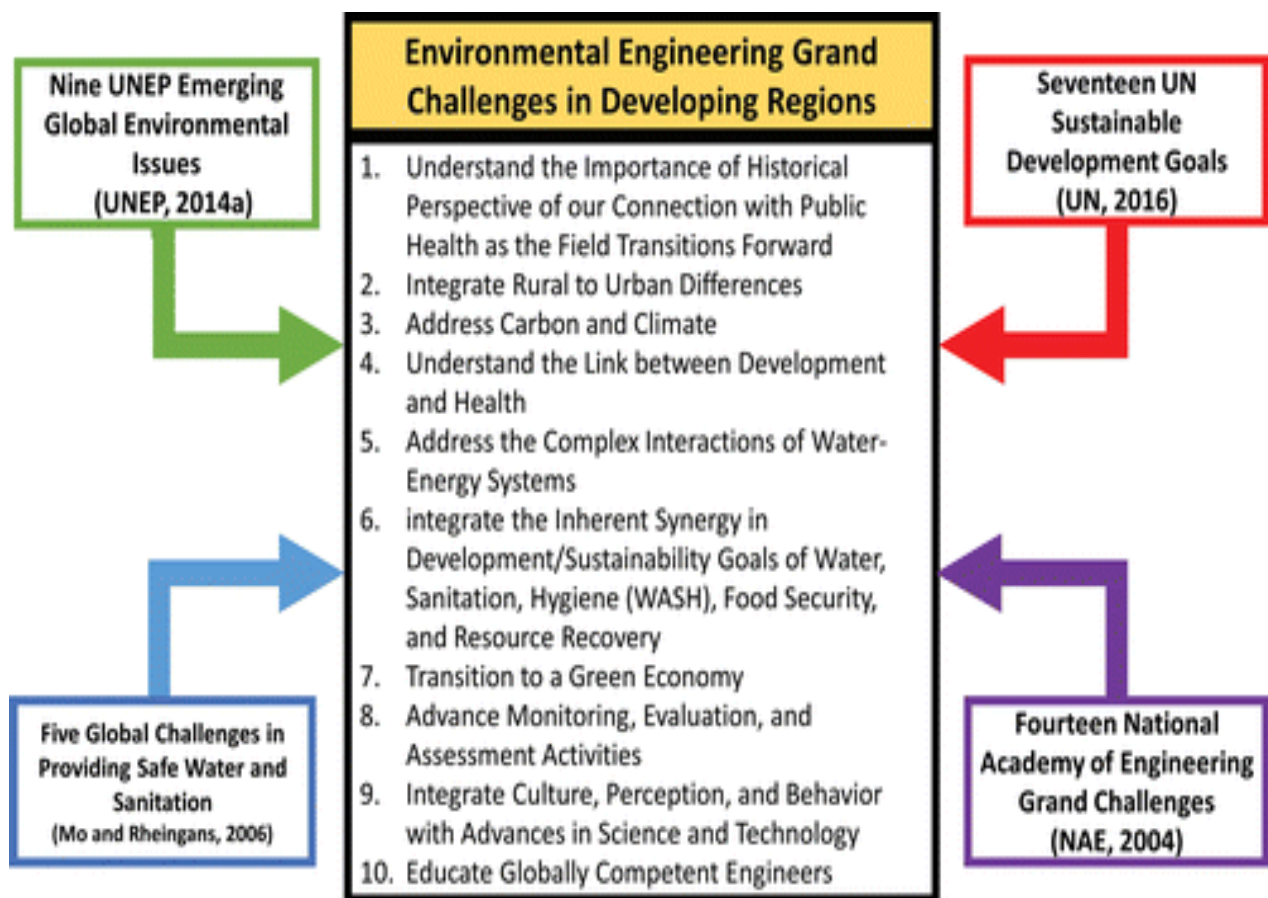
Environmental engineering has always played a critical role to assure environmental sustainability. However, today's environmental challenges are increasingly subtle and complex and solutions must now consider global change. Environmental engineering must continue to adapt to current and future grand challenges and work with existing and new partner disciplines. Staying connected to the historical origins of environmental engineering can help provide perspective through this transition. Accordingly, the goal of this review is to critically examine the many roles that the environmental engineering discipline can and should be playing as we seek to achieve



sustainability in developing regions of the world. Our hope is that this discussion will drive new innovations and opportunities in research, education, practice, and service that support the emerging post-2015 development agenda (including the SDGs) and lead to a better world through monumental improvements in the environment and human well-being.

The 10 environmental engineering Grand Challenges to achieve sustainability in the world's developing regions are shown in Fig. 1. They can be briefly summarized as follows-

1. understand the historical perspective of the discipline's connection with public health as the field transitions forward
2. integrate the differences encountered when operating over rural to urban locations;
3. address emissions of greenhouse gases (GHGs) and other important carbon-containing pollutants;
4. understand the link between development and health to better connect health outcomes and reduction in risk with ecosystem management and other development interventions;
5. address the complex interactions of water–energy systems;
6. integrate the synergy inherent in development/sustainability goals of WASH, food security, and resource recovery;
7. transition to a green economy;
8. advance monitoring, evaluation, and assessment activities that include life cycle assessment (LCA),
9. integrate culture, perception, and behavior with advances in science and technology,
10. develop the global competency of early career engineers. Supplementary Table S1 breaks these 10 Grand Challenges into individual objectives discussed in more detail in this article.



**Fig. 1:** The 10 environmental engineering Grand Challenges to achieve sustainability in the world's developing regions that integrate the United Nations Sustainable Development Goals (UN, 2016) and other environmental issues and challenges (NAE, 2004; Mo and Rheingans, 2006; UNEP, 2014a).

## **A NEW VISION FOR ENVIRONMENTAL ENGINEERING**

Environmental engineers were instrumental in pulling the United States and other countries out of the depths of environmental crises such as Love Canal and urban smog. Rivers in Ohio no longer catch fire. Cholera and other once-prevalent waterborne diseases are now so rare in the United States that lightning strikes pose a greater threat. These successes, worthy of celebration, reflect the value of the field's approach to creating systems and solutions that are grounded in sound scientific, ecological, and engineering principles while being cost-effective, feasible, and acceptable for the many stakeholders that environmental engineers serve.

But these battles are not over. Pollution and waterborne diseases persist around the globe. Rivers are still catching fire. Billions of people suffer from inadequate access to clean water, food, sanitation, and energy. As the human population continues to grow, demands intensify and humanity's mark on the planet deepens. In short, the challenges ahead are of a different nature and a larger scale than those faced in the past (Samira Vahidian and Seyyed Mehdi Heshmat vaazian, 2012).

Today's environmental engineers also operate in a different policy context than the one that fueled past achievements. The types of sweeping laws that directed public attention and funding toward large-scale infrastructure expansion, basic research and technology development for environmental remediation in the 1970s-1990s have not emerged to address today's national and global challenges. Legislation may not be the primary drivers of future innovation.

As we face this period of dramatic growth and change, it is time to step back and consider new roles that environmental engineers might play in meeting human and environmental needs. Although efforts to characterize, manage, and remediate existing environmental problems are still essential, environmental engineers must also turn their skills and knowledge toward the design, development, and communication of innovative solutions that avoid or reduce environmental problems. The core competencies of environmental engineering, which emphasize not only specific goals related to human needs and the condition of the environment but holistic consideration of the consequences of our actions, are uniquely valuable in developing the solutions that will be needed in the coming decades.

## **CONCLUSION**

Today, the issue of sustainable and comprehensive development is in the interest of both the developed world and the developing world. Development in the true sense of the word, with the semantic burden of progress or transcendence, must be comprehensive, inclusive, and sustained in order to mobilize the homogenous and interconnected forces within society. When it comes to the versatility of development, society is considered to be a system that its components all require change in order to increase quantitatively and qualitatively.

Development should not come at a cost at the cost of eliminating the facilities of future generations. The whole community's facilities should be preserved as a set of comprehensive and sustainable development for future generations available to everyone. Resources and facilities should not be declining and decreasing, but renewable and increasing. It must be remembered that sustainable development without the environment and its protection is neither meaningful nor possible. Sustainable development requires a sustainable environment. On the other hand, the proper environment is the bedrock of peace and security. Even if there is no peace and security, the environment will be in danger seriously. One of the most devastating effects of war has always been environmental damage. Therefore, one of the most important aspects of security in the world is the security of the environment and the resources and systems of earth's life protection that the longevity and prosperity of all humanity depend on them. Economic approaches and tools are appropriate mechanisms for the optimal use of natural and environmental resources and play a decisive role in achieving sustainable development goals. But for a tool to be the best this is not the case. The use of each depends on the economic, social, political and environmental conditions of the countries. Using a set of these tools is the best option. In the conditions that resource utilization policies and their effects on the environment are associated with uncertainty, command control approaches (such as standards) are superior to other market-based approaches.

This article, in addition to familiarizing environmental issues enthusiasts with new ways of estimating the monetary and economic value of the environment, reminds that in the current conditions, the environment can no longer be considered a Free and priceless product, but rather a program. Rather, planners and environmental engineers should pay special attention to this issue that Environmental has value and economic cost, with a latent appearance that It is very impressive today. In this regard, environmental engineering can be very useful given its skill, ability in environmental impact assessment projects, environmental pollution, environmental health and safety.

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