

Exploring Environmental Ethics Challenges and Responses for Engineers

Xinyu Yang^a, Yumei Zhuo^b

Southwest Petroleum University, Chengdu 610000, China

^a1769893083@qq.com, ^b1504344478@qq.com

Abstract

The rapid development of high technology in modern social production and the expansion of engineering activities have gradually raised the issue of engineering ethics, especially the environmental ethical challenges faced by engineers and how to cultivate their sense of environmental ethical responsibility are the key links to achieve sustainable human development. Therefore, based on the introduction of related concepts about engineering ethics, engineers and environmental ethics, this paper explores the challenges faced by engineers in environmental ethics from four aspects, and proposes that the above challenges can be met by enhancing the awareness of environmental ethics, improving the norms of engineering activities about environmental ethical, and establishing the environmental ethical dimension of engineering evaluation.

Keywords

Engineer; Environmental Ethics; Sustainable Development.

1. Introduction

With the development of modern society and the continuous progress of science and technology, the living environment of human beings has also undergone great changes, and engineering activities, as an important part of the development process, have a crucial impact on the environment. At present, the issue of environmental ethics of engineers has been incorporated into an important category of philosophical research, especially it will become an important content and subject studied by engineering ethics in the future. "The future direction of research in engineering ethics will revolve around all the issues facing technological development in the era of global economization, with environmental issues at the top of the list of these issues [1]."

As key figures in engineering activities, engineers' sense of environmental ethical responsibility becomes extremely important, and they must take the main object of consideration in natural environment engineering activities and take real ethical responsibility. And how to deal with and solve the environmental ethical challenges encountered in engineering activities is a problem that engineers must face. Therefore, it is necessary to study the environmental ethical challenges faced by engineers in engineering activities and their countermeasures. Thus, based on the study of existing literature on environmental ethics of engineers, this paper points out the environmental ethical challenges faced by engineers and proposes corresponding responses and countermeasures.

2. Literature Review

In foreign researches, a separate study on environmental ethics of engineering was first conducted around 1950s, and although it was not studied as a special research field, it was

mentioned in many scholars' works. The relevant research ideas proposed by Martin Mike W. (2002) [2,3] are very classical. Based on the examples of existing environmental ethics issues, he argues from the professional ethics of engineers, and proposes "integrating environmental ethics into engineering".

Wujack J (1995) [4] and David G. Wareham, Panagiotis Elefsiniotis (1996) [5] pointed out that we need to maintain the existing ecological balance in order to survive. And the activities of engineers must also have an ethic that applies to them. Also, engineers have a responsibility to improve the environment.

In domestic studies, the research on engineering ethics began in 1980s, and most of the studies on environmental ethics were conducted from the environmental ethical responsibility of engineers, for example, W.Q.Chen (2006) [6] pointed out that the environmental ethical responsibility of engineers mainly includes environmental legal responsibility and environmental ethical responsibility. Q.Q.Wang (2009) [7], on the other hand, points out that engineers need to take responsibility not only for the present generation, but also for the future generation, and also take environmental responsibility for the whole ecological environment. L.F.Li (2022) [8] studied how engineers can seek a balance between engineering activities and ecological environment and assume environmental ethical responsibility from the current situation, value implication and realization way of environmental ethical responsibility assumed by engineers. F.R.Xi and H.Li (2013) [9] investigated the environmental ethical responsibilities of engineers and the factors that constrain engineers to assume environmental ethical responsibilities, such as interests, fear, ignorance, personal factors and so on, which based on the exploration of the ethical responsibilities in engineering activities. In addition, many other scholars have proposed corresponding countermeasures based on exploring the existing engineering environmental ethics problems, such as T.J.Liu (2014) [10], after exploring the social formation of engineering ethics, analyzed the engineering environmental ethics from time dimension and space dimension in terms of process and realm, and finally proposed the path of building engineers' environmental ethics. G.J.Zhou (2008) [11] and Y.Xu (2013) [12], on the other hand, proposed that the environmental ethics responsibility of engineers could be improved by offering courses related to environmental ethics, establishing environmental ethics education and self-discipline mechanisms, improving ethical norms of engineering activities, and strengthening regulatory mechanisms.

3. Definition of Related Concepts

3.1. Engineering Ethics

Engineering ethics belongs to the field of applied ethics, which mainly refers to the research related to the code of conduct and moral principles involved in engineering activities of technicians in engineering, including engineers, assistant engineers, senior engineers, technicians, etc.

3.2. Engineer

An engineer is a person with a professional degree or experience in engineering, such as in a technical or production department, or in a design or research department, who is involved in the design, implementation, management and supervision of engineering activities. They are mainly involved in the application and modification of materials and energy in the natural environment.

3.3. Environmental Ethics

Environmental ethics mainly refers to the ethical behavior and moral relationship between human beings and the natural ecological environment and the social environment, and is committed to the harmonious coexistence between human beings and human beings and

between human beings and nature, and to green, scientific and sustainable development. The essence is mainly to the value of post-modern civilization, that is, when the environment, after satisfying the survival needs of human beings, promotes the sustainable development of the environment, while satisfying the higher level of human civilization needs. It mainly involves the following principles.

3.3.1. Environmental Justice Principles

Environmental justice refers to the justice that is manifested in environmental-related matters. Generally speaking, it can be divided into two main forms: distributive and participatory environmental justice. The former refers to the reasonable distribution of environmental benefits and costs, which requires not only the fair distribution of the good benefits brought by the environment, but also the shared responsibility for the environmental risks associated with economic development; the latter refers to the right of everyone to participate directly or indirectly in the formulation of environment-related policies and laws, which ensures that all parties have equal opportunities and rights to express their views on environment-related issues, so that their demands are taken care of accordingly and distributive justice is ensured.

3.3.2. The Principle of Intergenerational Equality

The principle of intergenerational equality means that while the present generation pursues and realizes basic rights such as freedom and equality and a happy life, it should take into account that future generations should also enjoy these rights. Therefore, while modifying the environment, the present generation should not reduce or impair the rights and opportunities of future generations to pursue a happy life, and should follow the laws of nature, maintain ecological balance, achieve sustainable development, and leave a sustainable natural ecological environment for future generations.

3.3.3. Respect for the Principles of Nature

In the natural ecosystem, human beings are also an important part of it, and all the components of the system are interdependent and inter-reliant, and the fate of human beings and other creatures are closely related and intertwined. Man's disrespect for nature is also a disrespect for man himself.

4. Analysis of the Existing Challenges of Environmental Ethics for Engineers

Engineering itself involves many complex activities, including the design of engineering projects, decision-making and implementation of engineering activities, etc. In these processes, environmental issues are inevitably involved, and even many engineering activities have a greater impact on the environment, such as generating exhaust gas and noise, causing soil erosion, climate abnormalities, environmental pollution, ecological imbalance and destruction, etc. Engineer as the subject of engineering activities, they should not only pay attention to the project they are responsible for, but also pay attention to whether it has an impact on the environment, and place environmental ethics in the important position of engineering activities. Therefore, environmental ethics poses many challenges to engineers, which are analyzed in this paper from the following four aspects.

4.1. Harmonizing the Transformation of Nature with Ecological Laws

Whether it is road construction, infrastructure construction or construction of water conservancy, hydropower and electric power facilities, all of them are activities to transform nature, which will cause different degrees of damage to the ecosystem. Since engineering projects involve a wide range and a long time, if they are built according to the natural form, it will not only waste a lot of time, but also cause a lot of waste of material, human and financial

resources, so when engineering projects are designed, little or no consideration or protection is given to the ecosystem in all aspects, so that the survival of plants and the living environment of animals are affected, which changes the law of interdependence and mutual. This changes the law of interdependence and interconstraint between organisms, reduces the transformation and regeneration capacity of the material cycle, and destroys the dynamic balance of material input and output.

Human transformation of nature is not a predatory exploitation and control of nature, but an understanding, improvement and adjustment control, that is, a rationalized control of their own behavior. Therefore, while transforming nature, human beings need to conform to the laws of nature and keep their behavior within the scope of ecological laws. Especially in the arid desert and plateau areas, the ecology is very fragile, and a slight transformation will cause irreversible damage to the ecology, and even produce a "chain effect" of environmental damage to the surrounding areas, such as the destruction of the ancient Babylonian civilization, the frequent occurrence of dust storms in the north of China in recent years, and the serious environmental pollution in industrial cities, which are the direct consequences of ecological damage. Harmonization of nature and ecological laws is a challenge that engineers face in the design and implementation of engineering projects, and it is also a problem that must be taken into account.

4.2. Harmonization of Resource Development and Utilization with Natural Reproductive Capacity

The natural resources in any ecosystem on which human beings and living things depend, such as energy resources, mineral resources, biological resources and water resources, have certain limits in terms of quantity distribution and spatial distribution, and cannot be supplied and exploited without limit or restraint, because their natural reproduction capacity has an upper limit. For example, the intensity of grazing should not exceed the supply capacity of pasture, and salvage fishing should not exceed the reproduction capacity of marine resources.

For engineering activities, when extracting natural resources for product manufacturing or transforming them into human-useable resources, the regeneration capacity of the resources should also be considered, adhering to the principle of equal emphasis on development and protection, so as to promote the enhancement of natural reproduction capacity, avoiding that in the long term the rate of species evolution is slower than the rate of species extinction, the rate of soil formation is slower than the rate of soil erosion, the rate of forest regeneration is slower than the rate of forest destruction, etc. The capacity of fishery regeneration is smaller than the size of fishing, etc. Therefore, when engineers are involved in engineering activities, they should first understand that natural resources are not inexhaustible and inexhaustible, and that they should not demand too much from nature for the sake of maximizing economic benefits, and blindly exploit it to cause resource shortage, species extinction and environmental damage. Instead, we should think about how to leave sufficient space for the sustainable development of human beings and the earth's organisms, so that the natural reproductive capacity can be coordinated with the exploitation of resources.

4.3. Harmonization of Pollutant Emissions with the Self-purifying Capacity of Natural Ecosystems

On the one hand, the large amount of exhaust gas or harmful gas emissions will cause urban air pollution, such as the destruction of the ozone layer, the formation of acid rain, etc. Often breathing muddy or toxic air mixed with various impurities will cause an increase in the incidence of many diseases, especially respiratory diseases. On the other hand, the discharge of untreated wastewater or waste materials will deteriorate the quality of the water environment, and the pollution of water, which is the source of life, will not only put human health at risk, but also affect the normal intellectual development of children, and even endanger the survival of

plants and other animals. There are countless examples of serious consequences caused by the indiscriminate discharge of pollutants, such as the earliest recorded "Smog in the Maas Valley" in Belgium in 1930, which caused the death of more than 60 people and a large number of creatures; the "Chernobyl nuclear leak" in Ukraine in 1986, which caused the death of 31 people, 237 people suffered from radioactive damage, all the surrounding trees died, and the ecology was completely destroyed, even the impact on the health of the locals would last at least 20 years and the biological damage would last at least half a century.

As we can see above, if the discharge exceeds the self-cleaning capacity of the natural ecosystem, the pollutants will accumulate in the water environment, air and organisms, causing continuous harm to the natural environment, organisms and human health. Therefore, when carrying out engineering activities, the challenge for engineers is to strictly control the amount of discharge within the limits of nature's self-cleaning capacity.

4.4. Reconciling the Interests of the Present with the Interests of the Future

In ancient human society, the productivity level was limited, the exploitation of nature were limited, and the pollution of the environment was not outstanding, but with the continuous development of society and the progress of science and technology, the ability of human beings to transform nature has increased significantly, and they even want to conquer and overcome nature. Therefore, in modern society, many human activities are not in accordance with the laws of nature, and the impact of engineering activities on the environment, while bringing benefits to contemporary people, can also bring harm to health and life, and even affect the living environment of future people. Renk, a famous German ethicist, has proposed: "We not only have a positive responsibility to leave a good and healthy living environment to future generations, but also have a more positive responsibility and obligation to avoid fatal damage, depletion and poisoning of the environment, so we should create a valuable human living environment for the future survival of human beings. Therefore, it is a great challenge for engineers to deal with the relationship between the interests of the present generation and the future ones in today's gradually deteriorating ecological environment.

5. Suggested Responses to Environmental Ethics for Engineers

How to make engineers fulfill their due obligations and assume their due sense of environmental ethical responsibility is the key link to achieve ecological balance and sustainable human development. As the American scholar Veselin once pointed out, "The biggest difference between engineers and other professions is that they are directly involved in the issue of environmental protection, and no matter what kind of engineering, engineers have a special responsibility for the environment [13]." Therefore, engineers need to seek a balance and optimal solution between engineering activities and the natural environment, human existence and the natural environment as much as possible. How engineers should respond to the challenges posed by environmental ethics, this paper proposes corresponding responses and countermeasures from the following aspects.

5.1. Enhancement of Environmental Ethics Awareness

In engineering activities, engineers not only need to master a wealth of professional knowledge, but also should consciously establish a sense of environmental ethics, have a sense of responsibility for environmental ethics, consider the relationship between engineering activities and the natural environment from the perspective of environment and morality, and dedicate their wisdom and strength to achieve the harmonious development of both.

On the one hand, engineers need to change the traditional concept and advocate green engineering. In the past, many engineering activities of human beings have developed economy at the cost of destroying natural environment, without the awareness of environmental

protection. But in fact, many projects can be carried out on the basis of considering environmental protection, and many new engineering activities can not only create environment-friendly products, but also promote economic and social development, which requires engineers to change their ideology and pursue sustainable development to achieve the dual purpose of environmental improvement and economic development.

On the other hand, engineers can be educated on environmental ethics through courses related to environmental ethics in order to make them consciously aware of environmental ethics. While the inducement of profit may cause engineers to abandon their sense of environmental ethics in the process of project implementation, education can achieve the result of "internalization in mind and externalization in action", and improve their level of environmental awareness and environmental ethics attitude, so that their behavior will develop in the positive direction of environmental protection.

5.2. Improving the Environmental Ethics Code of Engineering Activities

Engineering code of ethics is a generally accepted and observed moral code of conduct based on fair play, respect for human life and welfare, etc. The influence of engineering activities on human and natural creatures is becoming more and more profound. It is not enough just to cultivate and enhance engineers' sense of ethical responsibility, but also need corresponding industry norms and laws and regulations for restraint. In recent years, with the gradual development and improvement of engineering project processes, engineers have formed certain codes of conduct in engineering activities, which also include environmental ethics codes and related regulations, prompting engineers to make reasonable use of relevant technologies to avoid irreversible harm to the environment when conducting engineering activities.

First of all, the sense of responsibility of environmental ethics can be cultivated by establishing the self-regulatory mechanism of environmental ethics for engineers. Environmental ethics mainly reflects the relationship between human and nature, and the harmony of its relationship mainly depends on whether individuals can form a solid moral quality and self-control ability through correct moral cognition. On the one hand, engineers need to improve their own environmental moral cultivation. The methods are mainly: i. Strengthen learning, improve environmental awareness and adapt to the requirements of the times; ii. Conduct self-reflection, self-criticism and self-improvement of their words and actions in the engineering activities they are involved in, so as to avoid making the same mistakes next time; iii. Learn to be discreet, and consciously comply with the requirements of environmental ethics and moral codes even if there is no supervision. On the other hand, engineers also need to improve their own ecological design ability. i. They should combine various factors such as natural, economic and social factors to design the plan and choose the plan that takes up the least resources and has the least environmental impact; ii. They should take appropriate environmental protection measures when the project is carried out; iii. They should design the compensation to minimize the possible impact on the environment at the later stage after the engineering activities are finished. Although ethical codes are not as mandatory as laws, they allow engineers to control their own behavior from within and exercise self-restraint.

Second, strengthen the regulatory mechanism. One of them is to improve the legal system related to the protection of the environment. In modern society, we cannot rely on moral norms alone to restrict the behavior of engineers, but should also combine environment-related laws and regulations with moral norms, create an atmosphere of environmental rule of law by formulating a set of reasonable, scientific and perfect environmental laws and regulations, improve the legal effect, and further clarify engineers' sense of environmental responsibility. Second, improve the supervision mechanism. There should be someone responsible and followable in the whole engineering project, and a perfect supervision mechanism and system

for the whole process to ensure environmental protection and quality requirements of the project.

Finally, strengthen social supervision. Firstly, we should improve the public system of environmental information, so that the public can participate in the supervision of engineering activities; secondly, we should strengthen the public's awareness of participation. Strengthen the publicity and education of relevant environmental knowledge as well as environmental laws and regulations to cultivate the public's environmental awareness, thus enhancing the intensity of social supervision.

5.3. Establishing the Environmental Ethical Dimension of Engineering Evaluation

Effective and timely environmental impact evaluation of engineering activities is very necessary. In the evaluation, the relevant national policies and laws and regulations on protecting the environment should be fully observed and implemented, and the natural resources should be used scientifically and reasonably to optimize the natural environment.

To establish the environmental ethical evaluation dimension of engineering, firstly, the various responsibilities of engineers should be clarified from the national level and the corresponding scope of responsibilities should be delineated; secondly, from the social level, environmental protection departments at all levels should emphasize the importance of environmental protection, and strengthen the corresponding supervision and regulation, and open up the channels of supervision, such as using the network, media and other channels to guide the public groups to actively participate in the process, so as to comprehensively improve the engineering environmental. Finally, from the individual level, especially for engineers, everyone should establish the concept of environmental protection, abide by environmental ethics, and cultivate a sense of responsibility for environmental ethics from practical actions.

6. Conclusion

Nature is the foundation of human survival and life. Only by protecting nature and obeying the laws of nature can human beings achieve sustainable development. Engineers should continuously enhance their awareness of environmental ethics responsibilities in engineering activities, consciously comply with environmental protection regulations and environmental ethics norms, so as to harmonize the transformation of nature with the ecological laws, the exploitation of resources with the natural reproduction capacity, the discharge of pollutants with the self-purification capacity of the natural ecosystem, and the interests of the present generation with the interests of the future generation.

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