

Environmental Ethics Challenges for Engineers and How to Address Them

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Abstract: Engineers are the core of modern engineering activities, the designers, managers, implementers and supervisors of engineering activities. The special social role of engineers determines that they must take more moral responsibility, not only to the public and others, but also to the environment and the future of mankind. Nowadays, environmental and resource problems have become a major issue that restricts economic development and affects people's life and health. Engineers are facing more challenges from environmental ethics. For example, how to harmonize the relationship between economic and ecological interests, and between the interests of the present generation and those of the future generations, and the weak awareness of environmental ethical responsibility and insufficient ability to protect the environment among some engineers. To cope with these challenges, it is necessary for engineers to make efforts on their own and for society as a whole to work together to form internal and external safeguard mechanisms for engineers to fulfill their environmental ethical responsibilities.

Keywords: Environmental ethics, Engineers, Challenges, Responses.

1. Introduction

Nowadays, the issue of environmental ethics is increasingly becoming a focus of global concern. With the acceleration of globalization and the continuous advancement of industrialization, engineers, as the promoters of technological innovation and social progress, are faced with unprecedented ethical challenges. The development of the engineering field not only brings unprecedented convenience and well-being to human beings, but also has a non-negligible impact on the natural environment, which involves a variety of aspects such as resource consumption, energy utilization, and ecological damage. This paper aims to provide guidance for engineers and decision makers at both the theoretical and practical levels in order to promote the harmonious development of engineering practice and environmental protection.

First, this paper will introduce the basic concepts of environmental ethics, the environmental ethical view of sustainable development, and the environmental ethical responsibilities of engineers, and analyze their importance and current status of application in the engineering field. Secondly, it will explore the challenges that engineers may encounter when facing the challenges of environmental ethics. Finally, some corresponding improvement strategies will be proposed. Through the research in this paper, it is hoped that a wider discussion and concern can be triggered to promote the benign interaction between engineering practice and environmental protection, and to contribute wisdom and programs for the future development of the engineering field and the sustainability of the global environment.

2. Environmental Ethics for Engineers

2.1. The Meaning of Environmental Ethics

Environmental ethics studies the moral relationship between human beings and the natural environment. It focuses on the interdependent relationship between human beings and the natural environment, explores how human

beings should treat the natural environment, and emphasizes that human beings should respect nature and protect the environment in order to achieve harmonious coexistence between human beings and nature. Under the threshold of environmental ethics, the ideal state of high-quality development should be: when human beings get along with nature, they can satisfy their reasonable needs without neglecting the rights and interests of others; when pursuing individual happiness, they can neither sacrifice the interests of the whole nor jeopardize the development of the future; when enjoying the fruits of modern civilization, they can neither destroy the ecological balance nor aggravate the social injustice; when achieving the goal of sustainable development, it is necessary to plan scientifically and reasonably, and distribute them fairly and reasonably.

2.2. Environmental Ethics for Sustainable Development

The environmental ethics of sustainable development is a rational choice of human development goals and modes, with the following main elements: moderate development, focus on intra- and intergenerational equity, public participation, environmental protection and coordinated development. Among them, moderate development refers to the planned and limited development and utilization of natural resources according to the needs of engineering and construction, without wasting resources and improving the efficiency of resource use. Focusing on intra-generational and inter-generational equity indicates that engineers should not only deal with the distribution of interests among the relevant subjects at present, but also coordinate the distribution of interests between us and future generations, so as to realize the fair and sustainable distribution of natural resources. Public participation requires every citizen to assume responsibility for environmental ethics and to work together to maintain a sound and sustainable ecological environment. Environmental protection requires us to give full consideration to ecological and environmental benefits when we carry out our production and living activities. Coordinated

development refers to the integrated planning and coordination of the three aspects of production and construction, social development and environmental protection, so as to realize the common development of the three.

The creation and application of an environmental ethic of sustainable development is of far-reaching significance. The environmental ethic of sustainable development, which has a bearing on the survival and development of all mankind, is widely recognized and supported by the international community and is of global significance. At the same time, the environmental ethics of sustainable development provides rational norms for the correct handling of the relationship between human beings and nature, and advocates the responsibility of human beings for the protection of nature, so that human beings need to give full play to their subjective initiative and take practical action to protect the natural environment.

2.3. Environmental Ethical Responsibility of Engineers

The environmental ethical responsibility of engineers refers to the need for engineers to make full use of their professional knowledge and low-carbon and energy-saving technologies to utilize and transform nature under the premise of consciously complying with the laws and regulations, industry standards and practices related to environmental protection in engineering activities and respecting people's health, safety and interests. At the same time engineers need to take responsibility for other creatures in nature and protect them from harm. The traditional engineer ethics emphasizes loyalty to the employer and doing a good job, and its focus on the evaluation mechanism of internal affairs in the field of engineering, but neglects the relationship between engineers and the public, engineering and the environment. In contrast, the environmental ethical responsibility of engineers focuses on human health and the long-term sustainable development of natural ecosystems. The norms related to the environmental ethical responsibility of engineers provide the right idea to help resolve the conflict of interest between engineering and the environment, and engineers can take the initiative to show the risks when facing potential risks and unclear environmental risks in the case of technical compliance. As the core of engineering activities, engineers play a key role and bear important responsibilities in the innovation and application of new technologies. In complex engineering situations, when engineers are faced with moral conflicts, conflicts of interest, and ethical contradictions, they should know how to be responsible for people's safety, health, and welfare, how to effectively regulate conflicts of interest in the engineering community, and how to resolve conflicts between engineering practice and environmental protection.

3. Environmental Ethics Challenges for Engineers

3.1. Harmonizing Economic and Ecological Interests

As the contradiction between the rapid development of industrialization and the carrying capacity of the ecological environment intensifies, coordinating and balancing the relationship between economic and ecological benefits has become one of the important challenges facing modern engineers. In the past industrial development, people usually

took the efficiency and effectiveness of unidirectional development mode as the most concerned goal, and excessively pursued economic benefits, which resulted in a series of global ecological crises and environmental degradation. These serious consequences have prompted people to continuously improve their ecological awareness and realize that only by following the cyclic law of the ecosystem can we realize the harmonious coexistence of industrial development and the natural environment. The task before us now in practice is how to verify the feasibility of circular economy and eco-industry from the scientific, technological and managerial levels when applying them to engineering and economy, how to save resources and improve production efficiency by adopting new high-tech achievements in various projects and processes, as well as how to penetrate the concept of environmental protection into the whole life cycle of the products to minimize pollution and energy consumption to the environment and minimize environmental damage to the environment as much as possible. pollution and energy consumption as much as possible, improve the efficiency of resource use as much as possible, and ultimately build a circular economy development model to realize the ecological development of industry. Under the background of creating green ecological life and the global call for low carbon economy and low carbon construction, engineers must participate in engineering design and construction with low carbon thinking.

3.2. Harmonization of the Interests of Present and Future Generations

Today, when the ecological crisis is becoming more and more serious, how to deal with the relationship between the interests of the present generation and the interests of future generations is also a great challenge for engineers. The environmental ethics of sustainable development requires that engineering and construction activities not only need to satisfy the needs of the present generation, but also must not jeopardize the ability of future generations to satisfy their needs, and that they must not only achieve the goal of economic development, but also protect all kinds of natural resources and ecological environments on which human beings depend for their survival, so as to provide a certain degree of protection for the perpetual development of future generations and for them to live in peace and contentment. From a historical and long-term perspective, in order to achieve intergenerational ecological equity as far as possible, engineers must correctly address the relationship between the needs and interests of present and future generations, balance the relationship between the present and the long term, effectively implement intergenerational storage of environmental resources, and maintain ecological sustainability.

3.3. Weak Awareness of Environmental Ethics Among Some Engineers

Some engineers in China have a poor awareness of engineering environmental protection and fail to realize the environmental ethical responsibility they should assume. In recent years, the environmental pollution caused by engineering in China has become more and more serious, in order to prevent the ecology from being destroyed, engineers as one of the engineering communities have the responsibility to use their professional technology to reduce the pollution of engineering and maintain the sustainable development of

human beings. However, some engineers in our country did not focus on the natural environment into the consideration system when guiding engineering activities, excessive pursuit of social benefits and ignored the harm caused by engineering activities to the environment. Some engineers do not establish the concept of environmental protection in engineering, there are problems of excessive development and waste of natural resources, in the implementation of the project did not include environmental protection into the scope of the investigation, did not systematically check the environmental safety index of engineering products in the final stage of the project, ignoring the importance of the ecological ethics of engineering construction.

3.4. Inadequate Capacity of Some Engineers to Protect the Environment

The environmental ethics of engineering practice requires engineers to have not only the awareness of environmental protection but also the ability to protect the environment. However, many engineers in China do not yet have the ability and technology to create ecological, environmental, green and low-carbon engineering. At present, the low carbon level in China is still relatively low. As the concept of low-carbon construction is not popular in practical application, and the level of low-carbon technology is in its infancy, large-scale engineering construction lacks advanced and effective emission reduction technology and low-carbon technology to reduce greenhouse gas emissions, and many enterprises are still on the road of high energy consumption and high emissions. On the one hand, compared with developed countries, there is a large gap between China's low-carbon engineering program design, research, development and use of low-carbon materials and equipment. On the other hand, most enterprises do not know much about the research and development of low-carbon processes. Due to the lack of international exchanges and cooperation, enterprises generally use traditional processes to create low-carbon projects through simple improvements, which will not be able to achieve the expected results. There are many reasons that hinder the application and promotion of low carbon technologies in China, such as insufficient technology level and technology research and development capability, shortage of professionals, significant increase in technology transfer fees, and imperfections in laws and policies related to technology transfer. Research and innovation of low-carbon technologies cost a lot of money. At the same time, the use of new low-carbon materials, the utilization of new low-carbon technologies, and the adoption of environmental protection and energy-saving measures will also lead to an increase in construction costs. Engineers must have strong financing ability and professional and technical support in order to seize the project from the source and enhance the market competitiveness of the project, while realizing ecologically sustainable development.

4. How to Address These Challenges

4.1. Engineers' Own Efforts

In order to cope with the challenges posed by environmental ethics, engineers must first start from themselves, give full play to the subjective initiative of engineers to actively seek countermeasures, improve the ability to deal with ecological and environmental problems in engineering construction, and balance the relationship

between economic and ecological interests as well as the relationship between the interests of the present generation and the interests of future generations.

First, enhance the awareness of environmental ethics. Engineers must have a full sense of responsibility for environmental ethics and fully understand their ecological and environmental responsibilities and the obligations they need to fulfill as core personnel in engineering design and construction. Engineers should consciously take the initiative to accept the environmental ethics education, consciously cultivate the environmental ethics attitude, and improve the ability and level of environmental awareness. At the same time, engineers should consciously resist the temptation of interests and firmly maintain the ecological environment in engineering decision-making. The requirements of sustainable development determine that engineers must develop a new set of values and attitudes. The concept of sustainable development requires engineers to pay attention to the environment while emphasizing economic development; to pay attention to the present generation and also to the future generation; to pay attention to material growth and also to social equity; to pay attention to the rich and also to the poor. Engineers must strictly follow the laws of ecological movement and development in the process of utilizing and transforming nature, strictly controlling the pollution emission within the self-purifying capacity of nature, controlling the exploitation of natural resources within the natural reproduction capacity, and leaving sufficient space for people's sustainable development. Engineers should truly integrate the principles of sustainable development into their designs and attitudes, and effectively fulfill their environmental ethical responsibilities.

Secondly, improve the ability of environmental protection. As one of the important subjects of engineering activities, engineers play an extremely crucial role in ecological environmental protection. Engineers are the main force in developing and transforming nature, and they convert natural resources into material wealth through certain engineering technologies, and utilize the substances and energy in nature to design and manufacture engineering products. It can be seen that this process requires appropriate engineering technology to maintain, and the environmental protection ability of engineers relies on certain clean and low-carbon technologies. Engineers should be proactive in learning everything they can about how to design, develop and deploy clean, low-carbon technologies. Whether it's designing for more efficient energy through ecological conservation measures and shifting to renewable sources, reducing waste pollution and increasing green production through materials recycling and reuse, including full product life cycle analysis, or more comprehensive technology assessments and better risk management and resources, engineers should take a leadership role. By integrating sustainable engineering techniques such as full life cycle production, pollution reduction, and energy efficient manufacturing, engineers can help their corporate clients better grow and become more competitive in the marketplace.

Third, practicing the basic principles of environmental ethics. The basic principles of environmental ethics include the principle of equality and mutual love, the principle of ecological safety, the principle of fairness and justice, and the principle of concern for the future. Engineers should practise the basic principles of environmental ethics and follow them in their engineering design and construction activities. The

principle of equality and mutual love refers to the fact that human beings and nature together constitute an ecosystem, and that human beings and the natural environment are both interdependent and interact with each other. In order to maintain the integrity and stability of the biological system in which we live together, engineers must practice the principle of equality and mutual love in environmental ethics. The principle of ecological safety requires that ecological safety be placed at the forefront of all social and economic decisions, and that the various risks brought about by the uncertainty of ecological safety be fully considered. The principle of fairness and justice means that the rights, responsibilities and obligations of engineers in society are unified, and embodied in environmental ethics, the principle of fairness and justice requires that engineers, as the rights holders, should also assume their responsibilities and obligations to society and the natural world. The principle of concern for the future means that engineers need to take a long-term and developmental view of engineering and construction, give full consideration to the survival and development of future generations, and should economize, act prudently and shoulder the responsibilities of the present generation.

4.2. Joint Efforts of the Whole Society

Engineering is a joint work of stakeholders, formed together by their collective decisions, and these stakeholders include government departments, experts, businesses and the public concerned. The work of engineers cannot be separated from the constraints of others, politics, economics and other conditions. Therefore, responding to the challenges of environmental ethics for engineers requires the joint efforts of many parties to establish and improve the external guarantee system for engineers to fulfill their duties in environmental ethics.

Firstly, give full play to the leading role of the government. First of all, the government should introduce and improve the legal norms and supporting policies related to environmental protection of engineering activities, and supplement them with some administrative supervision means, in order to guide engineers more clearly and forcefully to give full consideration to the ecological and environmental benefits in engineering construction activities, and to limit their behaviors of arbitrarily destroying the natural ecological environment and excessively wasting natural resources used in engineering construction. Secondly, the government needs to play a leading role in strengthening the construction of environmental ethics, change the ideology of single-mindedly pursuing economic growth, emphasize the quality of development, and insist that engineering construction and environmental protection go hand in hand. Further, the government should restrict and prohibit engineers from using high energy-consuming backward technologies in engineering construction, encourage them to apply energy-saving and low-carbon technologies, and provide engineers with financial and technical learning support as much as possible. Finally, the government must strengthen the environmental assessment of engineering projects, fulfill its supervisory duties during the whole process of engineering construction, and do a good job of monitoring the data related to pollution emissions and resource usage.

Secondly, enhancing education in engineering environmental ethics. The importance of engineers in today's society is obvious, and the decisions they make often have a critical impact on the environment and society. Therefore, the

relevant subjects must strengthen the environmental ethics education for engineers and engineering-related students to improve their ecological literacy and sense of responsibility for environmental ethics. Higher education institutions should optimize the setting of environmental ethics-related courses and training programs for engineering students, and guide engineering-related students to learn systematically about sustainability and energy-saving and low-carbon technology knowledge, so as to lay a good professional and technical foundation for their future design and construction of engineering activities. Environmental ethics education is a process of developing students' awareness, abilities, attitudes, and values that will enable them to participate effectively in building sustainable development at the local, national, and international levels. Educating students in environmental ethics improves their ability to address environmental issues that arise in engineering and construction. Environmental ethics education should be closely linked to the reality of today's society and the actual engineering problems that arise, and it should be a practical guide for the students' behavior in their future engineering activities and be well applied, so as to produce engineers with environmental ethics values, thinking and action.

Thirdly, coordinate the support of engineering leaders, experts, and others in the engineering community. The collective decision-making mechanism composed of officials, experts, and business owners can have a significant impact on engineers' engineering construction decisions, and some engineers use this as an excuse to shirk their responsibilities for the ecological environment and natural resources. Most engineers work in enterprises as employees, and the main body of major engineering decisions are often officials and entrepreneurs rather than engineers. For business leaders, they need to be aware of the dual attributes of the enterprise, i.e., the enterprise is both an economic organization and a social organization, and in addition to economic responsibility, it also has to assume certain social responsibility as well as environmental responsibility. Businesses should aim to maintain the ecological balance as far as possible, treat natural resources fairly and equitably, and they will be supported by the public in the process of taking good environmental responsibility. Some politicians and entrepreneurs have little knowledge of specific technologies and the actual situation of engineering construction, and these organizations or individuals do not have the ability to make specific decisions on engineering activities, but should put forward feasible suggestions and goals, provide a good platform for engineers to express their views and give full play to their skills and abilities, and give full play to the dynamic and decisive role of engineers in engineering activities.

Last but not least, improvement of citizens' engineering literacy and the role of public supervision. The democratization of engineering decision-making depends on the improvement of the engineering quality of social citizens and the effective participation of the public in engineering decision-making. Only when citizens of the whole society realize that the engineering sector has a direct and vital responsibility for the sustainable development of human society, so that the environmental ethics in engineering construction can be understood and paid attention to, can the participation and monitoring role of every citizen be brought into full play to cope with a series of challenges brought about by the environmental ethics of engineering. Therefore, it is important for engineers to better communicate and interact

with the public, to understand the public's views on the construction of engineering activities, and to listen to useful suggestions for engineering construction. Engineers should create platforms for mutual communication with the public and introduce and elaborate their projects to the public, informing the public about the impacts of their projects on natural resources and the ecological environment. At the same time, every member of the public should actively learn to understand the general knowledge of engineering activities and their impact on the environment, actively participate in the decision-making process of engineering activities in China, supervise the whole process of design, implementation and operation of engineering activities, and fulfill their supervisory responsibilities and obligations, so as to make the construction of engineering activities in China consistent with the fundamental interests of the general public.

5. Conclusion

Several conclusions can be drawn from an in-depth discussion of the challenges of environmental ethics for engineers and their coping strategies:

First, environmental ethical issues are becoming increasingly prominent in engineering practice, requiring engineers to give full consideration to ecological sustainability in technological innovation and project implementation. Engineers need to focus on the protection of ecosystems and the rational utilization of resources while pursuing economic benefits.

Secondly, engineers often face moral conflicts and interest trade-offs when facing environmental ethical challenges. In such cases, they should follow the principles of human-centeredness and environmental prioritization, and guide engineering practices toward sustainable development by conducting comprehensive social impact assessments and risk analyses, as well as formulating strict ethical guidelines and policies.

Thirdly, engineers themselves need to enhance their awareness of environmental ethics, develop ethical decision-making ability and a sense of social responsibility, and improve their environmental protection ability through the use of clean and low-carbon engineering technologies, as well as practicing the basic principles of environmental ethics.

Finally, the government and enterprises should strengthen supervision and compliance, and establish a sound system of environmental protection systems and laws and regulations to ensure that engineering practices follow ethical norms while realizing a win-win situation in terms of economic and social benefits.

To summarize, in the face of the challenges of environmental ethics, engineers need to respond through a comprehensive approach and global thinking in order to promote engineering practices towards a more sustainable

and socially responsible direction. Only in this way can we ensure that future generations will continue to enjoy a clean and healthy ecological environment.

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