

How to Deal with Ethical Issues in Engineering Practice

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Abstract: With the accelerated pace of engineering and technological innovation, the complexity of engineering and the expanding scope of engineering influence, engineering ethics in the future will become an important issue that must be solved by the main body of engineering practice, and for this reason, the development of engineering ethics education will become an important task for the cultivation of high-quality and excellent engineering talents in the future. The benefits of engineering to human beings are self-evident, however, there are two sides of things, on the one hand, engineering will promote the development of the country, social progress, and bring human beings a more convenient living environment; on the other hand, unreasonable engineering will also bring harm to human beings and hinder the development of society. Therefore, how to prevent engineering risks, maximize the positive benefits of engineering and reduce the negative impacts of engineering is an issue we should pay attention to. Since engineering safety accidents often contain ethical factors, there is a strong necessity and urgency to analyze and prevent them from the perspective of ethics in the study of engineering risks. This paper describes how to deal with ethical problems in engineering practice in five aspects: the importance and prevalence of ethical problems in engineering, the identification of ethical problems in engineering, the exploration of methods for solving ethical problems in engineering, the response to the challenges of ethical problems in engineering, and the education and guidance of engineering ethics.

Keywords: Engineer; Engineering Practice; Engineering Ethics.

1. The Importance and Prevalence of Engineering Ethics Issues

1.1. Importance of Ethical Issues in Engineering

Solving ethical problems in engineering practice is an important task of engineering management ethics, which runs through the whole function, whole process and whole element of engineering management activities. [1] From the perspective of safety and security, engineers have an unshirkable responsibility for the safety of society and the public. If there is a lack of sufficient ethical awareness, it is very likely to cause serious safety accidents in the future, threatening the safety of people's lives, or causing significant loss of other people's property. With an eye to financial gain, engineers can only win long-term financial gain by upholding the reputation of their field, upholding justice, and making ethical decisions. Violating ethical principles may bring short-term gains, but it will ultimately damage the image of the profession and their own development. In terms of professional responsibility, engineers are responsible for much more than delivering physical results and are committed to solving a range of real-world social problems. They need to ensure that the products and services they provide are fair, reliable, safe, and sustainable in order to fulfill the heavy responsibilities of the profession. Finally, in terms of social impact, engineers work in areas that are directly related to people's daily lives, such as transportation systems, medical technology, and environmental protection. Their every action and decision may have a profound and wide-ranging impact on society. Therefore, in their work, engineers must think carefully about every issue and fully consider its possible consequences.

The importance of the issue of engineering ethics lies in the fact that it is directly related to the safety and well-being of people. The role of engineers is to ensure that engineering

projects will achieve the desired results and will not pose any threat to human beings. If engineers have ethical problems during design, construction or operation, such as conflict of interest, unjust behavior, lack of social responsibility, etc., it may lead to engineering projects with great safety hazards or affect people's health and property.

Secondly, the importance of engineering ethics issues also lies in the fact that it can have a significant impact on corporate image and market development. In today's world, more and more people realize that ethics is one of the important factors for the success of enterprises. Some enterprises face heavy fines or penalties or even lead to bankruptcy because they violate ethical standards. On the contrary, some excellent enterprises have won public respect and trust because they have followed ethical standards.

Therefore, wrong ethical choices in engineering management can lead to engineering yawning or even going "astray", which poses a challenge to the ethical level of engineering management. This challenges the ethical level of engineering management. [2] Engineering ethics is of irreplaceable importance in protecting public interests, promoting sustainable development of the industry, and maintaining social stability and harmony.

1.2. Prevalence of Ethical Issues in Engineering

In engineering practice, both large-scale infrastructure construction projects and small-scale technological research and development work may face ethical considerations. For example, in the field of construction engineering, the choice of building materials not only involves cost and performance, but also concerns the impact on the environment as well as the health of the occupants; in real-life engineering activities, enterprises, relevant stakeholders, and even the relevant government departments, are more or less faced with the phenomenon of public morality lapses, such as illegal operations, tofu dregs projects, and performance projects;[3]

in software development, data privacy and algorithmic fairness are prevalent ethical challenges.

Similar ethical issues exist in different fields of engineering. For example, in energy engineering, the development of new energy resources needs to be weighed against damage to ecosystems and impacts on local communities; in bioengineering, the application of gene-editing techniques has sparked ethical controversies about human reproduction and the nature of life.

In addition, ethical dilemmas may arise at all stages of engineering activities. In the planning phase of a project, the equity of resource allocation and the potential impact on society need to be considered; in the design phase, the safety and sustainability of the product need to be pondered; and in the construction and operation phases, issues such as the labor conditions of workers and environmental emissions need to be looked at.

Moreover, with the rapid development of science and technology and the advancement of globalization, the scope of influence of engineering ethics issues is expanding. The application of a new technology may have a chain reaction on a global scale, such as the emerging artificial intelligence technology, whose application in the fields of health care and transportation has brought about a general reflection on the attribution of responsibility and transparency in decision-making.

In conclusion, engineering ethics issues are present throughout all types of engineering activities, across different fields and stages, and have a broad and universal presence.

The universality of engineering ethics issues involves the interests and values of society as a whole. Engineers should consider the impact of the projects they undertake on human beings, the environment, society and the public sphere as a whole, rather than focusing solely on their own personal or corporate interests. Thus, ethical issues have also become universal issues that we all need to focus on and address.

2. Identifying Engineering Ethical Issues

There are various ethical issues that may arise in engineering practice such as manipulation of data or cheating the client, thus violating the ethical requirements of the profession and compromising the quality of the project. Ignoring the public interest and safety issues and letting the organization be flooded with financial benefits, leading to undesirable consequences such as accidents or environmental pollution. Violating copyright and intellectual property laws and infringing on the creative property rights of others, thereby gaining undue benefits. Benefit exchange and benefit sharing among collaborators that exceeds reasonable boundaries, leading to losses for members within the company. Therefore, engineers need to be clear about professional ethical standards and laws and regulations, always comply with the relevant requirements, and conduct in-depth assessments of the consequences of their actions.

In real life, due to the weakness of human nature and the influence of social environment, engineering ethics often face the following problems:

2.1. Priority of Interest

In engineering ethics, the primacy of profit usually refers to the idea that when decisions are made, they should be made in a way that maximizes benefits and effectiveness. This idea

tends to be found in the business world, but can also be found in engineering practice. Profit first may lead people to ignore other important values such as social responsibility or environmental impact. Such decisions may adversely affect the business in the long run. In some cases, the pursuit of maximum profit may conflict with professional ethics. For example, when developing a new product, a company may choose to intentionally conceal defects or dangers in the product in order to maximize profits. This can threaten public safety as well as the company's reputation.

In addition, the primacy of profit can lead to an unequal distribution of gains. Employers may concentrate excess earnings in the hands of a small number of executives or shareholders, while lower-level employees take greater risks and stress in their work without sharing in the benefits. At the same time, the pursuit of maximum benefits may give rise to intense competition, causing companies to resort to unethical or illegal behavior to gain a competitive advantage. This can undermine the sustainability of the entire chain in the long run.

To summarize, some enterprises or individuals ignore public interests such as engineering safety and environmental protection in order to pursue profits, and use improper means such as deception and bribery to obtain engineering projects. In some commercialized projects and enterprises, engineers may give up the ethical principles and organize illegal acts such as transferring funds and deceiving consumers because of company interests or their own interests. The principle of profit override is something that needs to be weighed against other values in engineering ethics. Decision makers need to balance economic and social responsibilities and always think and act according to the principles of sustainable development.

2.2. Lack of Awareness of Responsibility

Some engineers do not pay enough attention to their professional ethics and social responsibilities, do not take due responsibility for the quality and safety of their work, and even fraudulently obtain construction permits. If engineers do not seriously consider the impact of their actions on the public and the environment, they may make safety mistakes or violate legal standards. Examples include ignoring the risk of earthquakes or natural disasters when designing a building or bridge, or ignoring electrical safety standards when manufacturing a product. Engineers without a sense of responsibility may be more concerned with their own interests than the rights of others, leading to unfair behavior. This may occur in hiring, promotion, contract assignments, etc., in violation of professional ethics and integrity.

And engineers who lack a sense of responsibility may not consider the environmental impact of their projects, which can lead to problems such as pollution, ecological damage and waste of resources. For example, an engineer designing a building may minimize costs and ignore energy efficiency requirements, leading to increased energy consumption and environmental pollution. At the same time, engineers who lack a sense of responsibility may violate the promises they make, making it impossible for others to trust them. For example, when contracting for a project, they may promise to complete the work on time but fail to deliver the results on time. In addition, irresponsible engineers may develop a bad reputation in the community and the industry, which may have a negative impact on their career development and landscape.

2.3. Technical Deficiencies

In engineering ethics, technological imperfections are a common and non-negligible problem that can lead to a range of serious consequences. Firstly, in terms of safety risks, imperfections in technology may bring direct threats to people's lives, property and even the environment as a whole. For example, short-circuit hazards in the electrical system can easily cause fires, resulting in huge losses; defects in product design may lead to unpredictable safety accidents, threatening the lives of users. Second is the quality problem, technical defects often make the product or service can not meet the expected performance standards, can not meet the needs of customers. This not only damages the reputation of the company, but also affects its long-term profit acquisition. Further, there is legal liability. When technical defects cause personal injury or property damage, the enterprise is bound to bear the corresponding legal liability. This may mean facing a huge amount of compensation payments, and at the same time, the image of the enterprise has a great negative impact, so that its trust in the market has dropped dramatically. Finally, there is unfair competition. Some enterprises may deliberately take advantage of technical defects to reduce costs at the expense of product quality and safety, so as to sell their products at lower prices in the market and gain an unfair competitive advantage. This not only disrupts the market order, but also jeopardizes the interests of consumers and the healthy development of the industry as a whole.

To avoid these problems, enterprises need to identify and correct technical defects, take appropriate measures to ensure the quality and safety of their products and services, and comply with relevant laws and regulations. Enterprises should establish effective quality management systems to ensure that their products and services meet customer requirements and industry standards. In addition, they should train engineers and technicians to educate them on knowledge and practical experience on how to properly identify and resolve technical defects. Without sound regulatory mechanisms and normative standards, engineers may construct defective projects that jeopardize public safety because they lack the necessary professional knowledge and skills.

2.4. Environmental Pollution

Engineering construction inevitably has an impact on the external environment. The ethics of engineering management should be particularly concerned with the negative impacts of engineering on the public and the natural environment, and the ethical issues arising therefrom. The following are some of the issues that arise in relation to the opposite of environmental pollution:

(1)irreversibility

Environmental pollution can lead to the permanent destruction of natural resources, including the extinction of many species, severe deterioration of soil quality, and long-term contamination of groundwater and surface water.

(2)Human health hazards

The harmful effects of industrially produced and manufactured chemicals on the environment arise mainly from pollutants. These chemicals can accumulate in ecosystems and enter the food chain, jeopardizing human health.

(3)energy wastage

Necessary measures to increase environmental emission limits and to carry out environmental remediation entail

energy and monetary costs, leading to wasted energy in the production process.

(4)social equity

The greatest impacts tend to be in communities with the most vulnerable environments and the least environmental protection measures. Communities or poor areas that are overly dependent on energy-intensive industries are the most vulnerable to environmental degradation and pollution because they are not in a position to protect themselves.

(5)Delayed effects of environmental issues

As industrial production continues to grow, environmental degradation is a growing problem on the planet. However, the consequences they bring sometimes only become apparent after decades. Therefore, when applying ethical responsibility to observe and solve environmental pollution problems, engineers need to take into account the fact that in the process of engineering construction, because of economic benefits and planning considerations, some projects have serious environmental pollution problems that jeopardize the quality of life and health of the surrounding residents. Therefore, it is necessary to carefully consider the possible environmental problems in all aspects of engineering design to construction, to foresee the positive and negative impacts of engineering construction on the environment, and at the same time, to seek a balance between interests and the environment, and to give up economic interests when encountering possible environmental problems. [4]

2.5. Non-compliance

Adherence to ethical engineering standards is essential in the interest of public safety and society. However, in some cases engineers may violate these norms, leading to many problems. Also, the negative impact that the violation will have on engineering ethics. If engineers do not comply with the regulations and do not consider the safety factors, they may cause serious accidents that may even lead to death and disability. In addition, if the construction is not carried out in accordance with the prescribed procedures or if unsuitable materials are used, the final result of the project is likely to fall short of the client's expectations, which not only wastes the client's resources and time, but also destroys the credibility of the engineer. Sometimes engineers violate engineering ethical standards to the detriment of others due to self-interest or other improper considerations, such as taking advantage of their position to offer and accept bribes.

In conclusion, non-compliance not only creates moral condemnation for engineers and destroys their reputation and professional trust, but also has serious consequences in society, causing great grief and property damage. Therefore, maintaining adherence to engineering ethical standards and acting with integrity are very important principles in the field of engineering.

3. Approaches to Addressing Ethical Issues in Engineering

3.1. Establishment of an Ethical Framework and Adherence to Professional Standards and Codes of Conduct

(1)Establishment of strict ethical standards and regulatory mechanisms

In the field of engineering, it is important to establish a standardized and binding code of ethics and a regulatory mechanism to ensure that engineers act in a legally compliant

manner.

(2) Establishment of a review system

Prior to the implementation of the project, it is necessary to go through a stringent vetting procedure to conduct a comprehensive assessment of the feasibility and safety of the project, and to require the contractor to provide truthful data and information, so as to prevent false publicity or misleading consumers.

(3) Strengthening awareness of social responsibility

Engineers should have a high sense of social responsibility and take into account the impact of the works on the surrounding environment and people's lives. They must strictly observe safety and health regulations and must not use low-quality and substandard materials, as well as poor processing and construction techniques.

(4) Development of professionalism

Engineers should continue to improve their professionalism through various means, such as further study of relevant knowledge and understanding of trends in national regulations and policies, as well as active participation in vocational training and practical exercises. This can achieve better results for their future work and ensure the quality and safety of the project.

(5) Supervision of legal governance

Governments at all levels and competent industry departments should take appropriate measures to urge enterprises to comply with the relevant national standards and legal requirements, so as to ensure that the project can be constructed in a safe and stable manner.

3.2. Objective Analysis, Assessment and Decision-Making

The key to objective analysis, assessment and decision-making in engineering ethics is the development of a mechanism for ethical decision-making that takes into account the following aspects:

(1) Consideration of the interests and rights of all parties concerned

In engineering ethics, any decision should take into account the interests and rights of the various stakeholders involved. These interested parties may include stakeholders, engineers, technical experts, managers, government regulators, and the public. Therefore, an objective analysis, assessment, and decision-making must take into account their opinions and recommendations.

(2) Knowledge of laws and regulations

Engineering ethics must comply with laws and regulations. When making decisions, we need to be aware of applicable laws and regulations to ensure that our decisions are legal and enforceable.

(3) Analyzing risks and impacts

Decisions on engineering projects should be based on an assessment of the ability to bear risks and impacts. Careful analysis and assessment of potential problems and uncertainties provide a good basis for future decisions.

(4) Peer review

The field of engineering places particular importance on peer review. Full discussion and evaluation of decision-making, including duties and commitments as an engineer, ethical obligations, etc., facilitates an objective evaluation and decision-making process.

(5) Transparency and accountability in reporting

Decision-making in engineering ethics should be open, transparent and accountable. All processes are documented

and reported to the relevant parties in a timely manner, and problems are corrected as they are identified. And hold people accountable based on all process records to specific things and people in charge.

3.3. Balancing the Interests of Relevant Parties

In engineering ethics, the following steps can be followed to achieve a balance between the interests of the parties involved:

(1) Identify relevant parties

Identify the people or organizations that are affected by the actions of the project. These include investors, customers, employees, local community residents, government regulators, and others.

(2) Analyzing the interests of relevant parties

Understand the interest needs and objectives of each stakeholder and analyze the interactions between them. For example, a project may have direct economic benefits for one interested party but negative impacts such as environmental pollution or traffic congestion on other interested parties.

(3) Establishment of communication channels

Establish effective communication channels with all relevant parties so that they can genuinely express their views and concerns and respond to their questions and feedback in a timely manner.

(4) Developing a balanced strategy

Based on the results of the analysis, develop balanced strategies that meet the interests of the parties involved. These strategies may include the open and transparent release of information, active listening to and respect for the views of interested parties, consultation and the development of common rules.

(5) Audit trail

With monitoring and auditing mechanisms to ensure that no interested party is unfairly affected by the implementation of the balancing strategy. If necessary, the strategy is adjusted at any time.

4. Responding to the Challenges of Engineering Ethics

Engineering ethical issues refer to various types of issues at the level of morals and values involved in the practice of engineering. Engineers play an important role in engineering activities by contributing to the design and improvement of technologies. At the same time, they are faced with conflicting interests and are caught in ethical dilemmas such as safety and sustainability or employer and public interest [5]. Successfully addressing these challenges is not an easy task, but requires a multifaceted effort and a comprehensive strategy.

First, individual engineers must strengthen their own ethical qualities. They should study and understand the principles and norms of engineering ethics thoroughly, and incorporate them into all aspects of their daily work and every decision. They should always consider it their duty to safeguard the public interest and ensure safety and reliability, and resolutely prevent any behavior that may violate the ethical code.

Secondly, the whole industry should attach great importance to ethics education and training. Through systematic learning and practical case studies, the ethical awareness and ability to cope with ethical dilemmas of engineers should be vigorously enhanced, and their keen

insight to make correct ethical judgments in complex and changing situations should be cultivated.

Thirdly, a comprehensive and in-depth ethical assessment mechanism should be actively introduced in the early stage of the project. A forward-looking and detailed analysis and accurate prediction of the possible risks and impacts will be made. In this way, adequate preparations can be made before problems emerge, and potential ethical hazards can be minimized.

Fourthly, a strict internal monitoring system should be constructed and perfected, with a clear division of responsibilities and authority, so that effective supervision and management can be carried out in all aspects of engineering practice. Once any violation of ethical norms is detected, it must be dealt with seriously, so as to play a strong warning role.

Finally, it is crucial to strengthen cooperation and communication with all stakeholders. Maintaining close communication with government departments, customers and consumers, fully knowing and understanding their needs and expectations, and discussing and appropriately resolving possible ethical dilemmas, will lead to an excellent situation of collaborative and shared governance among all parties.

Only through the above multi-dimensional and all-round unremitting efforts will we be able to better cope with the challenges posed by engineering ethics and vigorously promote the steady development of engineering practice in the right direction in line with morals and values.

5. Engineering Ethics Education and Instruction

5.1. Strengthening Education and Training in Professional Ethics and Technical Standards

It is important for companies to establish clear and detailed ethical and professional standards, and to develop education and training programs to help employees understand these standards and follow them in their work. The education and training process should emphasize the importance of professional ethics, including honesty, fairness, responsibility and respect for privacy. Employees must clearly understand that they must be committed to these ethical principles as the norm for their work.

To ensure that employees fully understand and comply with technical standards, companies should provide indispensable training and precise guidance on technical standards. Employees not only need to understand how their work fits with technical standards, they also need to learn how to recognize and solve problems related to technical standards. Implement on-site training, where employees learn how to effectively deal with real-world ethical issues. This can be done through a variety of methods, such as in-depth case studies, visual demonstrations, realistic simulations, and lively group discussions. In order to keep up with and cope with the ever-changing technological developments and industry dynamics, companies need to provide a steady stream of ongoing training opportunities. These trainings should cover the latest technical standards, cutting-edge industry news and trends to help employees keep their knowledge and skills up-to-date.

In conclusion, by building clear ethical and industry norms, strongly emphasizing the importance of professional ethics,

solidly carrying out training on technical standards, meticulously implementing on-site training, and actively providing continuous training opportunities, enterprises can strengthen the education and training of their employees in engineering ethics on all fronts. This will help employees to better understand and respond to ethical issues in engineering, and at the same time realize strict compliance with technical standards, thus laying a solid foundation for the sustainable development of the enterprise.

5.2. Provision of Support, Advisory Services and Feedback Mechanisms

In engineering ethics, the provision of ethics education, guidance and consulting services is extremely important and can be carried out in many ways. Enterprises can set up specialized support and consulting services to help employees deal with engineering ethics issues, provide them with thorough guidance and advice, and give them training in relevant knowledge. They should also provide a variety of counseling channels, such as telephone counseling, e-mail counseling, online chat, etc., so that employees can seek help anytime, anywhere, and thus more easily obtain support and guidance. At the same time, it is important to regularly collect employees' feelings and feedback, and make improvements based on their needs and opinions. The data collected can help companies better understand employee needs and provide better support and counseling services. In addition to support and consulting services, companies should also provide ethics training to help employees gain a deeper understanding of engineering ethics and conduct research on different situations. Online education and face-to-face training can be used to facilitate flexible employee participation. Moreover, specialized teams with relevant knowledge and skills should be established to provide support and consulting services, and customized solutions should be provided for different situations.

In conclusion, the construction of engineering ethics is a long-term, systematic, comprehensive and arduous strategic task, and it is a systematic project that requires the government, universities, industries and other relevant parties to make concerted efforts and promote hand in hand in a gradual and orderly manner[6]. In engineering ethics, it is of great significance to provide ethical education, guidance and counseling services. Through the establishment of support and consulting services, the provision of a variety of consulting methods, the collection of employees' feelings and feedback, the development of ethics training and the establishment of specialized teams, enterprises can do a good job of related services to help employees better deal with engineering ethics.

6. Conclusion

Engineers have to identify and respond to a number of ethical issues in their work and careers that may affect the outcome of their work and may have a negative impact on people and the environment. Need to ensure that their designs do not cause harm to users, staff or others, and to consider how to minimize potential risks. Need to be aware of their professional responsibilities, including in terms of protecting the public interest, upholding ethical standards in society, respecting privacy and non-discrimination. Should also comply with intellectual property laws, including aspects such as patents and copyright, to protect creators' ideas and

the fruits of their labor, and to encourage technological innovation.

In addition, engineers need to consider the environmental impact of their designs in terms of energy consumption, waste emissions and resource utilization. They need to strive to create sustainable solutions to support future economic and social development. There is a need to recognize that their designs and innovations may have far-reaching impacts on society and to consider how they can be more socially responsible in their designs.

In conclusion, ethical issues are essential to be recognized and addressed in the engineer's perspective. Engineers should be aware of their professional responsibilities, comply with relevant laws and industry standards, and incorporate ethical standards and social responsibility into their design and innovation processes.

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