

Interests and Responsibilities: Multiple Subjects and Their Normative Settings in Engineering Ethics

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Abstract: The complexity of modern engineering makes engineering increasingly become a collective activity, and the multiple subjects involved are constantly being highlighted. When engineering risks occur, it is often impossible to attribute all the responsibilities to a specific person, especially when researching to maximize profits. Engineering activities face more significant risks and challenges. Engineering ethics research addresses the ethical challenges and dilemmas engineers encounter in their professional practice. However, existing research methods and models may not adequately capture the diversity and interdependence of the actors and factors involved in engineering projects. For this reason, it is urgent for engineering ethics research to build a research and decision-making model that can integrate multiple subjects and multiple disciplines to solve ethical problems in specific engineering practices. By doing so, this paper hopes to promote ethical awareness and responsibility among engineers and other stakeholders and to ensure that engineering activities can genuinely serve the common good of humanity.

Keywords: engineering ethics, multiple subjects, interest, responsibility

1. Introduction

In recent years, accidents such as “fatal bridges,” “honeycomb roads,” and “unfinished buildings” have occurred across the country. More and more people have begun to care about engineering risks and safety issues and think about engineering ethics principles in engineering activities [1]. To discuss engineering ethics issues, this research must first clarify the concept of “engineering.” The idea of engineering was originally mainly used to refer to military-related design and construction activities, such as the design and construction of artillery, ladders, and other war tools [2]. After modern times, the meaning of engineering has gradually become broader. People often refer to the behavior of human beings to purposefully transform nature and build artificial objects to meet human needs as engineering, such as building water conservancy and bridges. With the advancement of industrialization, human transformation of nature is increasingly linked to science and technology. Therefore, engineering is based on technology, and technology selection and application will directly or indirectly affect the progress and development direction. Chinese scholar Professor Li Bocong pointed out that engineering activities are a material construction social activity, including technology, economy, knowledge, ethics, management, and other factors. The ethical issues and dilemmas formed by the entanglement of these elements are the academic premise and practical basis of engineering ethics research [3].

The study of engineering ethics must involve the engineering subject. The ancient engineering subject was relatively single, the “craftsman,” while the modern engineering subject combines scholars and craftsmen, the “engineer.” Engineering evolves from simple to complex as productivity increases, from low-level to high-level. The scale of modern engineering is getting larger and larger, various technologies are becoming more and more comprehensive, and their impact on human society and nature is becoming more and more profound. This requires engineering professionals to not only master solid theoretical techniques but also have professional ethics and Engineering ethics literacy. The complexity of modern engineering makes engineering increasingly become a collective activity, and the diversity of its subjects is constantly highlighted. Engineering activities include engineers and builders, investors, decision-makers, managers, workers, governments, the public, and other stakeholders. Therefore, when engineering risks occur, all responsibility cannot often be attributed to one person, but multiple subjects are involved. For example, when a driverless car causes a car accident, which party should bear the responsibility? software engineer? Chipmaker? Car company? Or the vehicle driver? In today’s society, as engineering becomes increasingly complex, engineering ethics research urgently needs to construct a research and decision-making model that can comprehensively integrate multiple subjects and disciplines to solve ethical issues in specific engineering practices.

2. Ethical Responsibility of Multiple Subjects in Engineering Activities

In today’s era, engineering accidents are gradually increasing due to the complexity faced by the project itself. This reminds us that this research must standardize and embed engineering ethical principles into engineering practice activities. The essence of engineering ethics is to play a preventive role, using norms, guidelines, clauses, etc., to prevent accidents in engineering activities [4].

The diversity of subjects in the process of engineering activities has its benefits. For example, the decision-making of a particular project is a collective decision of multiple issues rather than an individual decision. This is conducive to scientific decision-making to a certain extent but also makes the project subjects at different stages. The other responsibilities are intertwined, and the duties are therefore more complex, which can easily lead to the generalization and ambiguity of tasks. The pursuit of duties can be in trouble, forming a de facto “collective irresponsibility,” which leads to the difficulty of investigating the responsibility for engineering accidents. It is a difficult situation that even an individual can bear. Therefore, this research must clarify the ethical responsibilities of each project subject.

2.1. Engineers’ Ethical Responsibilities

Engineers are the most critical subjects of engineering responsibility ethics. They play an active role in economic, political, cultural, and other fields through engineering construction. They have universal responsibilities for the entire society. Human welfare has become the focus of engineers’ ethical obligations.

Engineering activities have unique knowledge requirements. Engineers, as professionals, must have specialized engineering knowledge. They should have a more comprehensive and profound understanding of the benefits that a particular engineering result may bring to humanity and the potential risks. Therefore, engineers have an unshakable ethical responsibility to prevent engineering risks. That is, engineers should consciously think, predict, and evaluate the possible adverse consequences of the engineering activities they are engaged in and proactively grasp the research direction; when circumstances permit, engineers should take the initiative to Stop hazardous work. In addition to fulfilling ethical responsibilities within the scope of their duties,

engineers must also use appropriate channels and methods to stop actual activities that violate ethical decision-making and proactively reduce engineering risks [5].

Individual engineers have limited decision-making power in the process of engineering activities. At this time, engineers should fulfill their ethical responsibilities of notification and suggestions, that is, notify relevant decision-making departments of their foreseen results, actively participate in the decision-making process of decision-makers, put forward their pertinent advice, and positively influence decision-maker behavior. The ethical responsibilities of notices and recommendations also include that engineers should effectively disseminate relevant engineering theories to the public through various means and channels to promote the public's correct understanding of engineering activities.

2.2. The Ethical Responsibilities of Governments or Other Decision-Makers

In engineering activities, the government or other decision-makers, such as enterprises, have considerable or even decisive influence on engineering activities due to their absolute superiority in funds, resources, and power. Therefore, governments or other decision-makers must also assume relevant engineering ethics responsibilities [6].

The government and other decision-makers should give priority to protecting the interests of the public as the highest principle, fully consider not only ensuring social development but also being fully prepared for possible risks in project approval and project funding, and clarify which engineering activities should go first, which engineering activities should make concessions, or the scope and extent of application of a specific engineering project, when formulating relevant laws and regulations, comprehensively consider the interests of the country and society, and try to avoid benefiting some people at the expense of others. Engineering activities that cause burden or damage and unify humanity's actual and long-term interests [7]. The government and other decision-makers should improve specific ethical and legal norms for engineering activities, build a sound ethics review and supervision agency, conduct ethical investigations on controversial projects, listen extensively to the opinions of professionals and the public, and conduct ethical investigations based on ethical and moral principles. And legal requirements to make decisions to minimize the negative impact of engineering activities.

2.3. The Ethical Responsibilities of the Public

The public has to bear engineering ethical responsibilities mainly because their value preferences and tendencies considerably influence engineering activities. The public's recognition of a particular project affects the attitude of the government and other decision-makers to a significant extent.

The public's engineering ethics mainly focuses on paying attention to and understanding the development of science and technology and engineering, having a basic understanding of science and technology and engineering, and establishing correct views on concepts and consciousness so that they can better participate in the decision-making discussions of the government and other decision-makers. Provide your opinions, support proper engineering practices through actions, and refuse to use engineering activities that pollute the environment or damage human society in pursuit of short-term interests.

In short, with the rapid development of society today, the era of the traditional sole subject of engineering ethical responsibilities has ended. Engineers, governments, other decision-makers, and the public must bear corresponding ethical responsibilities because they all have influence and benefits in engineering activities. Engineering activities can benefit humanity only when the diverse subjects of engineering ethics each assume their moral obligations.

3. Ethical Risks of Engineering Activities Based on Maximizing Interest

Engineering is a technical and economic activity, and “profit first” is its criterion. “Interests” include economic, cultural, environmental, etc. Although the implementation of projects must fully consider social, ecological, and other factors, economic interests are undoubtedly the most important motivation for people to carry out engineering activities. Many projects can be approved and implemented mainly because they bring significant economic benefits. In an era of diversified project entities, the interest groups involved in the project are more complex, such as project investors and owners, organizers of project implementation, designers of project plans, project builders, project users, and those affected by the project. Other groups affected by the project. They coordinate the relevant demands of different interest groups as much as possible while striving to maximize benefits, an essential issue in engineering ethics and a fundamental problem to be solved in engineering activities.

To maximize economic benefits, reducing costs has become an essential way for engineering projects to improve economic benefits when other factors remain unchanged. Generally speaking, there are two main ways to reduce costs: to improve engineering efficiency and reduce costs through technological progress; the other is to reduce engineering investment by reducing engineering and production costs. The former is a way to reduce expenses pursued by all engineering activities; the latter is an issue that must be focused on in engineering ethics: a critical root cause of many major engineering quality problems at home and abroad is artificially reducing necessary investments without hesitation. Inferior materials and poor technology even cut corners to reduce costs. For example 1971, Ford considered adding an \$11 component to each vehicle. This component could protect the vulnerable fuel tank from exploding in the event of a rear-end collision, thus significantly reducing the casualties of car users. But by adding this \$11, the cost will rise, and the approximate increase will be \$137 million. On the contrary, paying for casualties without installing this component will cost nearly \$50 million annually. Under the principle of “profit first,” the company will not add this component. Investors gain economic benefits but leave the risks to users and society [8].

Under the “interests first” principle, relevant interests often dominate project subjects. For a project to achieve its expected goals, it must require the project subject to maintain a high moral quality and ethical awareness in the face of interests or economics. However, many engineering subjects have low moral quality and lack ethical understanding, making engineering activities fall into ethical anomie. For example, a designer in the project body cannot resist material temptations and is driven by economic interests. He adopts means of lowering standards, distorts relevant principles, ignores project quality indicators, and ultimately destroys the environment in exchange for economic interests.

4. How to Identify and Standardize Engineering Ethics

A large part of these ethical anomie problems among engineering entities in engineering activities is the need for engineering ethics education. As Zhang pointed out, this lack may even bring the risk of good people doing bad things: “Most engineers are social elites. It’s not that they don’t understand ethical and moral choices. It’s just that under certain circumstances, they don’t realize that their choices are contrary to ethics and morals, which ultimately tarnishes their reputation.” [9] When making decisions, many project decision-makers hope that the project can benefit humanity through their choices. However, because they did not realize the inherent ethical demands of the project and the relationship between project decision-making and ethics, they originally wanted to benefit humanity. Human beings, but they didn’t expect that it would endanger one party. Therefore, engineering ethics education is critical today with the rapid development of engineering. The United

States is the first country to develop engineering ethics education and requires that all engineering education programs must include ethics education content. As China moves towards becoming an “engineering power,” engineering ethics education has not received due attention, and technical education in engineering majors is more critical than ethical education. To change this situation, the national government should fundamentally solve the practical problems of engineering education, give more institutional care to engineering ethics education, and provide policy guarantees for the lifelong implementation of ethics education for engineering subjects.

Judging from a large number of engineering misconducts and engineering anomalies, in reality, quite a few engineering entities have not actively and effectively assumed their social and ethical responsibilities. To improve this situation, it is necessary to strengthen engineering ethics education for engineering subjects, promote communication and dialogue between engineering subjects and ethicists, and cultivate and enhance the “self-discipline” of engineering subjects, that is, the internal supervision and evaluation system of engineering subjects. , which requires engineering subjects to internalize engineering ethics principles, consciously understand and recognize engineering ethics awareness and sense of responsibility, and thereby constrain their own behavioral norms and value choices in engineering activities. In addition, engineering ethics education must also vigorously advocate engineering ethics ideas in the whole society, form a social atmosphere and pressure of public opinion, and form a “heteronomy” for engineering subjects, that is, an external supervision and evaluation system for engineering subjects [10]. External supervision and evaluation models such as supervision agencies and evaluation systems impose constraints and controls on project subjects, thereby promoting project subjects to carry out engineering activities by ethical standards and fulfill decision-making responsibilities. Only under the joint action of “self-discipline” can engineering activities be genuinely and effectively promoted to serve the development of society and humanity.

5. Conclusion

Engineering activities not only create human material civilization but also profoundly affect the appearance of nature and change the human spiritual world and lifestyle. Today’s China is at the climax of industrialization. Engineering practice plays an increasingly important role in social development. Engineering activities have an increasingly extensive impact on people’s lives. The types of engineering activities are rich. The scale is grand, and the story The unique methods are among the best in the world and have achieved remarkable results. At the same time, the challenges faced by Chinese engineering are unprecedentedly complex. In the atmosphere of industrialization, informatization, urbanization, marketization, and globalization, how to deal with engineering activities in the face of climate change, resource shortages, environmental pressures, and other problems and ethical issues such as ecological protection, social development, and human welfare. These ethical issues involve thinking and value judgments on the legitimacy of engineering actions, which often require making correct value choices in value conflicts. Therefore, the importance of contemporary engineering ethics education has become increasingly prominent. A core issue that engineering ethics education focuses on is how to standardize the professional ethics of engineering subjects. This standard is conducive to enhancing the awareness of the ethical responsibilities of engineering subjects, constraining engineering subjects to engage in engineering practice activities under the principles of engineering ethics, and based on moral principles, the diversity of engineering, the issue carries out persuasive specifications and strives to achieve the dual achievement of engineering practice and ethics.

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