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An Analysis on The Promotion of Engineers' Professional Spirit from The Perspective of Engineering Ethics

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Abstract: In modern society, as the leader of new productive forces and the founder of emerging industries, engineer's engineering practice has a profound impact on human survival and development. However, since modern times, the improper implementation of some engineering activities has led to significant ecological imbalance and social risks, and seriously threatened the life safety of the public. As a result, the engineering profession has gradually become the focus of social and public attention, and its professional responsibilities have been widely scrutinized. In view of China's status as a major engineering country, the popularization and research of engineering ethics and professional spirit are particularly important. An in-depth analysis of the root causes of the lack of professional spirit of contemporary engineers will not only help us understand the nature of this phenomenon, but also provide strong support for the strategies and suggestions of cultivating and improving the professional spirit of engineers from the aspects of society, government, universities and other aspects.

Keywords: Engineer; Engineering ethics; Professional spirit.

1. Introduction

Engineering ethics focuses on the codes of ethics and conduct that engineers should follow in their career paths. Engineers, as an important force to promote social progress, the embodiment of their professional spirit not only reflects the personal moral quality, but also directly relates to the safety of engineering projects, the credibility of enterprises and the overall well-being of society. In recent years, a series of major engineering accidents have made the public and academia begin to reflect deeply. In the popular view, the reason why engineers face these challenges often stems from their inadequate education in engineering ethics and neglect of professional ethics and social responsibility. Therefore, it is particularly important to popularize and deeply study engineering ethics and professionalism. At present, although the research of professional ethics and spirit has been relatively mature in the fields of medicine, education and law, the research in this field is still weak in the engineering field. Although the research of engineering ethics in China started a little late, it has made remarkable progress, especially in the field of education. However, many related issues need to be further explored. As engineering practice plays an increasingly critical role in the fields of national development, social progress and natural environmental protection, especially under the promotion of national strategies such as the "Belt and Road Initiative" and "Made in China 2025", the ethical issues in engineering practice and the professional ethics of engineers have increasingly become the focus that cannot be ignored. Therefore, based on the background of current engineering practice, this paper takes the engineer's professional spirit as the research center, deeply analyzes the micro-engineering ethical factors that affect the engineer's professional spirit, and strives to put forward a series of operable solutions, in order to provide valuable references for the research and practice of engineering ethics.

2. Engineering Ethics and Professional Spirit of Engineers

2.1. Engineering Ethics

Engineering ethics, also known as engineering ethics or ethical engineering, is a field of study that combines philosophy, ethics, organizational management, and sociology. It mainly focuses on ethical and value issues in engineering practice, ensuring that engineering activities meet the requirements of social public interest, respect for human dignity and rights, and maintain environmental health. From the perspective of engineering, engineering ethics analyzes and solves the ethical norms or moral basis of technical, social, economic, environmental and other issues behind engineering. "Ethics" is the cornerstone of human social interaction, which defines the norms of behavior that people should abide by. Engineering ethics, in particular, refers to the moral code that engineering subjects should follow in engineering practice, which guides the harmonious coexistence between engineering and technology, engineering and society. In engineering, these ethics are indispensable. In a nutshell, the subject of engineering ethics is diverse and multi-level engineering participants, who are concerned not only with the relationship between individuals, but also with the harmonious symbiosis between individuals and collectives, collectives and societies, as well as between human beings and the environment. Therefore, compared with traditional ethics, the complexity and depth of engineering ethics research are more significant.

2.2. Professional Spirit of Engineers

The professional spirit of engineers is the professional attitude, moral concept and code of conduct embodied by engineers when they engage in engineering practice. It covers many aspects of an engineer's career and is a concentrated embodiment of his professional quality and moral character.

In recent years, with the frequent occurrence of a series of major engineering accidents, the public's attention to engineers' professional ethics has increased significantly. However, we must make a clear distinction between the concepts of work ethic and professionalism. Professional ethics is usually in the form of clear provisions, such as employee codes, to guide and regulate the behavior of engineers in engineering practice, it is the basic moral requirements for engineering and technical personnel engaged in engineering design, construction and management work, and is more manifested as an external constraint and institutional restriction. The professional spirit is more profound, it represents the values that the engineer profession adheres to, and it is the conscious belief and unremitting pursuit of the profession deep in the heart of the engineer. Obviously, the professional spirit in the level beyond the code of professional ethics, it more reflects the internal quality and spirit of the engineer profession.

For the professional group of engineers, the connotation of their professional spirit is far-reaching and extensive. Among the many core elements, we particularly emphasize its "people-oriented sense of responsibility." Although in their daily work, engineers mainly face managers and employers, and rarely face the general public directly, so it seems that they have no direct interest with the public. However, it cannot be ignored that engineers design and build engineering projects and products with the ultimate goal of serving human society and benefiting the general public. The direct users and ultimate beneficiaries of these projects are the general public. Therefore, a truly professional engineer must always put the safety, health and well-being of the public at the heart of his work as the highest criterion.

According to relevant statistics, in the decade from 1999 to 2011, China experienced more than 30 significant bridge collapse accidents, and the life span of these Bridges did not reach the 20-year standard. Digging into the causes of these accidents, we found that unreasonable design and construction is one of the key incentives. These so-called "inferior projects" not only bring significant economic losses and environmental pollution, but also frequently cause safety accidents, which has become a pain point that is difficult to ignore in the field of engineering construction in China. In any industry, practitioners should adhere to their unique professional spirit, for this group of engineers, this requirement is more urgent and realistic significance. However, the current situation is that the professional ethics of domestic engineers have not been fully upgraded to the height of professional spirit. Especially with the rapid development of science and technology in the new century, the advancement of economic globalization in the all-media era and the impact of information fragmentation, the whole society presents an open, diverse and complex context. In this context, engineers are easily affected by "materialization" and "alienation", which leads to the dilution of professional emotions and even the crisis of professional cognition and professional identity.

3. Factors Affecting the Professional Spirit of Contemporary Engineers

3.1. Social Factors

The first is the change of social values. With the progress of society and the rapid development of science and technology, people's values are constantly changing. In the pursuit of economic benefits and material comforts, some people begin to neglect professional ethics and social responsibility. This change of values has a negative impact on the professional spirit of engineers, making some engineers may choose to act against professional ethics when faced with the temptation of interests.

Second, laws and regulations are not perfect. Although China has established a relatively perfect system of laws and regulations, there are still legal gaps and inadequate supervision in some areas. This makes some engineers lack clear legal guidance and constraints in their professional activities, and are prone to violations of laws and regulations. At the same time, the imperfection of laws and regulations also increases the risks and uncertainties faced by engineers in their professional activities, affecting their professional spirit.

3.2. Economic Factors

The first is the temptation of economic interests. Under the condition of market economy, economic benefit is one of the important factors driving people's behavior. For their part, engineers may face the temptation of financial benefits from companies, customers or suppliers. In the pursuit of financial gain, some engineers may choose to act unethically, such as cutting corners and using substandard materials. This not only compromises the quality and safety of engineering projects, but also affects the professional reputation and image of engineers.

Second, the pressure of market competition. With the intensification of market competition, enterprises often put forward higher requirements and expectations for engineers in order to gain a foothold in the market and gain advantages. This makes engineers face greater pressure and challenges in their professional activities. Under pressure, some engineers may choose to pursue speed and quantity while neglecting quality and safety, thus affecting their professionalism.

3.3. Enterprise Level

In modern society, enterprises play the core role of production and management, its fundamental purpose is to respond to social needs, and on this basis to obtain economic benefits. This purpose not only highlights the company's sense of social mission, but also reveals its nature as an independent entity. However, in some situations, in the process of pursuing profits, enterprises may ignore their responsibilities in the engineering field, resulting in deviations in the operation process, thus triggering problems in the ethical practice of engineering construction enterprises.

As members of an enterprise, engineers' actions are often influenced by the values of the enterprise. If the enterprise lacks the correct value orientation, it will not only reduce the efficiency of engineering project management, but also lead to the distortion of the enterprise code of conduct, which will have a negative impact on the individual behavior of engineers.

According to the current organizational structure of the enterprise, the manager is usually responsible for issuing instructions, while the engineer mainly assumes the role of execution. As payers, companies also expect engineers to adhere to a "loyalty" work ethic. However, in some cases, managers may neglect the safety, health and welfare of the public in pursuit of maximizing economic gain. In this regard, engineers, as a profession with special duty to inform and prevent, should put the public interest first, which is not only

their professional responsibility, but also the core of their professional conscience and professional spirit. When managers ask engineers to violate this ethos, engineers are left with an ethical dilemma: how to balance loyalty to the company with professionalism? On the one hand, loyalty to the company is the embodiment of professional spirit, on the other hand, the engineer's duty is to safeguard the public interest. If the employer's instructions are followed, it may be contrary to professionalism; If you refuse to implement it, you may violate the principle of "loyalty" and even face the risk of dismissal and exclusion from the industry. In this context, it is often difficult for engineers to form an independent work ethic and truly fulfill their social responsibilities.

Taking a design industry as an example, the top manager of the enterprise once proposed the concept of "creating value for every penny of the owner". On the face of it, there is nothing wrong with the idea. However, under the one-sided interpretation of some middle managers, the concept was distorted into "saving every penny of cost for Party A". In the design industry, Party A is usually a real estate development company, so the concept is misunderstood as sacrificing the quality and cost of the project to reduce the developer's expenses. However, these cost savings are ultimately translated into profits for developers, rather than actually being returned to home buyers. This misunderstanding leads to cutting corners in the actual construction of the project, the quality of the project fails to meet the expected standards, and the public is unaware of it, and its interests are damaged.

3.4. The University Level

Universities are the cradle of training "future engineers", but compared with the developed countries, China's engineering ethics education started relatively late. At present, many universities with science and engineering backgrounds still pay insufficient attention to engineering ethics in curriculum setting, and "the cultivation standards of students' ethical literacy in higher education policies are not clear". In recent years, although the national level has increasingly attached importance to ecological environmental protection and social sustainable development, engineering ethics education has gradually attracted attention in colleges and universities, but its educational ideology and implementation have not been deeply integrated into engineering education and professional quality cultivation of students. As a result, most students of science and engineering majors have limited knowledge of engineering ethics, lack corresponding ethical awareness, and fail to deeply understand the importance and urgency of engineering ethics from the perspective of personal development. At the same time, science and engineering teachers in colleges and universities generally have a weak knowledge reserve in ethics, and they pay more attention to the transmission of engineering professional knowledge in the teaching process. Some teachers even lack ethical awareness themselves, and it is difficult to show the professional spirit of teachers, and the understanding of engineers' professional spirit is even superficial. Therefore, when these engineering students, including undergraduates, master's students and doctoral students, who lack the awareness of engineering ethics and do not have a deep understanding of the professional spirit of engineers, enter their careers and become professional engineers in the future, their choices and decisions in the face of ethical issues in engineering practice will be worthy of our deep consideration and attention.

The deficiency of practice teaching link. Practical teaching is an important part of engineering education, and it is of great significance to train the professional spirit of engineers. However, in the current engineering education, there are often deficiencies in practical teaching. Some schools lack sufficient practical teaching resources and conditions, resulting in students unable to truly experience and understand the importance of engineering ethics and professionalism in practice.

4. The Countermeasures and Suggestions of Training and Promoting the Professional Spirit of Engineers

4.1. Strengthen Ethical Practices and Create a Positive Atmosphere

Develop a detailed code of ethical practice. Clarify the ethical principles and codes of conduct that engineers should follow in practice and provide them with clear guidance. Strengthen the supervision and management of engineers' ethical practices, ensure that they comply with norms, and create a positive ethical culture atmosphere. We will strengthen industry self-discipline and supervision. Establish industry self-regulatory organizations, formulate industry standards and norms, and strengthen the supervision and management of engineers' professional behavior. Conduct serious handling of ethical violations to safeguard the fairness and credibility of the industry.

4.2. Fostering an Open Mind and Fostering Innovation

We will encourage cross-disciplinary exchanges and cooperation. Engineers are encouraged to jump out of their professional fields and communicate and cooperate with counterparts in other fields to broaden their horizons and ideas. Promote integration and innovation between different fields by organizing interdisciplinary seminars and collaborative projects. Strengthen the cultivation of practice and innovation ability. Encourage engineers to participate in innovative projects and practical activities to improve their innovation awareness and practical ability. Provide the necessary resources and support to ensure the innovative activities of engineers.

4.3. The Social Level: Strengthen The Guidance of The Atmosphere and Guide the Social Evaluation

The shaping and cultivation of the professional spirit of engineers is closely related to the whole social environment. Relevant government departments should strengthen the rectification and guidance of social atmosphere, give play to its core role in moral construction, strengthen social integrity and moral foundation, so as to provide a healthy social soil for the cultivation of engineers' professional spirit. In addition, the whole society should make greater efforts to cultivate and practice socialist core values, actively establish and promote the model of engineer professionalism, and spread the positive energy of engineer professionalism through the leading role of example, and establish the correct career orientation for engineers.

4.4. The Level of Government Agencies: Establish and Improve Relevant Laws and Institutional Norms

Compared with developed countries such as Europe and the United States, there are significant lags and deficiencies in engineering ethics in China, which not only restricts the progress of Chinese engineers, but also inhibits the stimulation of engineers' professional consciousness and spirit. In response to this problem, the government and relevant departments should actively organize seminars on engineering ethics, and establish engineering ethics research centers with universities, combining with national conditions, formulate and promote engineering ethics standards that meet the actual situation of our country, and take practical measures to ensure that engineers comply with them. How should engineers act as insiders when managers or decision makers harm the public interest for personal gain, such as insisting on unsafe design, jerry-cutting construction, irresponsible acceptance, etc.? The codes of ethics of many engineering societies have made it clear that when safety and public interest are involved, engineers have a duty to report problems to the relevant authorities if their employer ignores their professional advice. However, in practice, even when engineers do report, the relevant departments often do not take it seriously enough, leading to the risk of dismissal and even rejection by the industry.

Therefore, in order to ensure that engineers can act in the public interest without fear, we need to clarify the powers and responsibilities at the legislative level, and stipulate the legal responsibility of the relevant personnel in the case of violations. At the same time, we also need to legally protect those engineers who dare to reveal the truth, establish whistleblowing incentives, so that their justice can be guaranteed, and bravely stand at the forefront of public health, safety and happiness.

4.5. University Level: Vigorously Strengthen Engineering Ethics Education for Science and Engineering Students

(1) Strengthen engineering ethics education. Establish a perfect engineering ethics education system, make clear the status and role of engineering ethics education in engineering education, and bring it into the whole process of engineering education. Formulate engineering ethics education syllabus and textbooks to ensure the systematic and complete content of education. In view of the importance of engineering ethics in engineering education, it is necessary to set it up as a professional course. Since 2016, the Education Steering Committee has been promoting the construction of an engineering ethics curriculum. By 2018, the Position Office of The State Council officially issued the Notice on Forwarding the Guiding Opinions on Formulating the Training Program for Engineering Master's Professional Degree Graduates and Explanations, which clearly listed engineering ethics as a required public course for engineering master's professional degrees, marking a solid step forward in engineering ethics education in China. However, this is just the beginning. In order to cultivate students' engineering ethics in a more comprehensive way, it is suggested that the engineering ethics course should be included in the compulsory professional course system from the undergraduate stage. Relevant departments should carefully plan to ensure that engineering ethics education at undergraduate, master and doctoral levels can form a coherent and well-defined system, and specify the specific training objectives at each stage, so as to promote the comprehensive improvement of students' engineering ethics.

(2) Change the teaching method, innovate the teaching mode and optimize the teaching content. To improve the teachers of engineering ethics education, strengthen the training of engineering ethics education teachers, improve the quality of engineering ethics and teaching ability of teachers. Industry experts and scholars are invited to participate in the teaching of engineering ethics to provide students with more abundant learning resources and perspectives. In order to deepen the teaching of engineering ethics, we should abandon the single teaching method and shift to more diversified teaching methods, such as case analysis, discussion learning, debate training and task-oriented teaching. In the course of teaching, closely combined with current events, simulate various practical situations, stimulate students' enthusiasm for participation, and guide them to carry out in-depth discussions and debates around engineering ethics. Encourage collaborative discussions among students to enhance their voice in the classroom and enable them to participate more actively in the learning process.

In addition, we should break with the traditional model of one teacher in charge of one course, and invite experts from different disciplinary backgrounds and engineering fields to form interdisciplinary teaching teams to teach together. Such a team can provide students with a richer and more diversified professional and ethical knowledge, helping them to understand more comprehensively the hot issues and cutting-edge developments in the field. In this way, we can create a broader and deeper learning platform for students and promote their all-round development in the field of engineering ethics.

(3) Strengthen engineering ethics education in practice, school-enterprise cooperation, and industry-university-research combination education. Students are encouraged to participate in engineering ethics research projects to improve their awareness and practical ability of engineering ethics. Colleges and universities can actively seek in-depth cooperation with enterprises, regularly invite enterprise engineers to hold knowledge lectures, academic exchanges and other activities, and share with students the engineering ethics cases they encounter in practical work. This mode of cooperation is not limited to lectures, but also enables students to experience and perceive real engineering ethical problems through social practice, engineering research and graduation practice, and discuss solutions with engineers. In addition, in order to evaluate students' engineering ethics more comprehensively and flexibly, we should build a long-term evaluation system. In addition to the traditional classroom and final grades, we encourage students to conduct in-depth research and write research reports on the engineering ethics problems encountered in the internship stage. This part of the results will be used as part of the course grades to stimulate students' initiative and creativity.

5. Summary

With the transformation of China from a big engineering country to a strong engineering country, the importance of engineering ethics has become more and more prominent. In order to ensure the quality and efficiency of engineering construction, we urgently need to strengthen the theoretical and practical research of engineering ethics. This paper

discusses the multiple factors that affect the professional spirit of engineers from a micro point of view, and emphasizes that it needs the joint efforts of all sectors of society, including society, government, universities, enterprises and individuals.

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