

Engineering Ethics: Responsibility and Accountability of Engineers

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Abstract

The relationship between an individual and a community, where there is a shared duty to explain and justify actions, as well as common norms regarding what requires explanation, what constitutes a good explanation, and what the possible consequences might be, is the essence of accountability. By framing engineers' social responsibilities in terms of accountability, we can better understand the various players involved and the ways in which these responsibilities are shaped. For instance, this perspective highlights the role of engineering professional organizations, particularly when they release reports on engineering failures. It also emphasizes the critical role of whistleblowing. Instead of seeing social responsibility as something that falls solely on individual engineers, regardless of the situation, or as a detached moral issue, it's more insightful to view these responsibilities as shaped by social practices.

Keywords: Engineering Ethics, Responsibility, Accountability.

Introduction

The moral precepts that direct engineering practice are the focus of engineering ethics. This area delves deeply into the obligations engineers have to their profession, society, and their clients. It is closely related to fields such as engineering philosophy, scientific philosophy, and technology ethics. Engineers play a vital role in our society; they tackle problems and create technologies that enhance our quality of life. For those on the path to an engineering career, obtaining a license might be a necessary step down the line [Van de Poel & Verbeek, 2006]. While not every engineering discipline demands licensure to the same extent as civil and environmental engineers, there are solid reasons for chemical, ocean, nuclear, industrial, transportation, aerospace, and many other engineers to pursue licenses, especially for industrial or regulatory purposes. Engineering itself is defined as a profession that uses scientific principles to design and create things that people need. Although you could argue that ancient civilizations engineered weapons, shelters, and defenses, the true turning point for engineering on a grand scale came with agriculture. This shift fundamentally transformed human life—no longer did people have to roam as hunter-gatherers, moving from place to place as food ran out. Agriculture minimized competition with other tribes in the wild, allowed communities to settle down, and boosted fertility since food became more abundant and reliable. However, agriculture wasn't without its challenges. In many areas, rainfall wasn't steady throughout the year, leading to droughts and dry spells that could spell disaster as populations expanded. Brian Fagan highlights in his book *Elixir* that ancient civilizations rose and fell with the availability of water, making the ability to design irrigation systems a crucial profession in the ancient world. [Olanrewaju et al., 2014].



Fig. 1: Engineering Ethics

Ancient Egypt and Babylonia are prime examples of civilizations that thrived by mastering the art of engineering ditches to transport water over long distances, enabling them to cultivate crops for large populations. However, if fate took a turn and the river shifted, rendering those ditches ineffective, the community would face disarray. The individuals who designed these ditches were the pioneers of civil engineering, making it one of the oldest professions in history. Their primary challenge was to channel water for agricultural purposes, but they also had to tackle the issue of excess water, which required even more innovative engineering solutions [Mitcham & Von Schomberg, 2000].

Methodology

The ever-changing environment, along with shifts in organizational structure, has led to a new way of thinking for those working within these organizations. This evolution has particularly impacted four key concepts: authority, power, responsibility, and accountability in business management. In today's context, an organization refers to a unit that produces goods or services, consisting of workers, managers (or entrepreneurial owners), and other staff for administration. It's essential to explore the connections between the changing environment, the theories and practices of business management, and these evolving concepts, as they all come together to create a complex and integrated system. This thesis aims to delve into those relationships [Doorn & Nihlén Fahlquist, 2010].

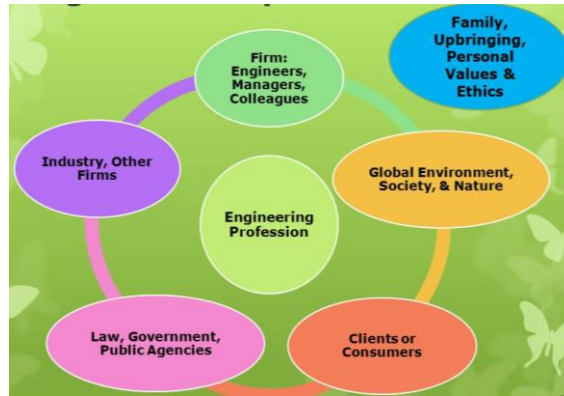


Fig. 2: Engineer Responsibilities

Results and Discussion

Ethics is a recurring topic in the engineering field, with some states even mandating periodic ethics refresher courses. The simplest definition of an ethical person is someone who adheres to a set of values [Davis, 2012]. However, this definition often falls short, as values can differ widely. For instance, someone like Robin Hood might be seen as ethical by some, while others might view serial killers as having their own twisted set of values. Clearly, a person who aligns with a shared set of values within a community is often seen as more ethical. These individuals typically share similar beliefs and follow an accepted code of conduct. Engineers, for example, belong to a group that upholds common values [Smith, 2014].

Characteristics	Extraction Sums of Squared Loadings		
	Total	Percent of Variance	Cumulative Percentage
How can engineers effectively communicate and collaborate with stakeholders to address complex ethical issues?	15.217	39.017	39.017
What are the implications of emerging technologies (e.g., AI, biotechnology) on engineers' responsibilities and accountabilities?	2.436	6.247	45.264
How do engineers' personal values and moral principles influence their professional decision-making and behavior?	2.273	5.829	51.093
What are the most effective strategies for promoting ethical awareness, responsibility, and accountability among engineers in various industries?	1.584	4.061	55.155
How can engineers balance competing interests and priorities (e.g., profit, safety, environmental concerns) in their professional practice?	1.340	3.437	58.592
What role do organizational culture and leadership play in shaping engineers' ethical behavior and accountability?	1.268	3.252	61.844
How did the engineers involved in the [specific engineering project or case study] demonstrate responsibility and accountability?	2.273	5.829	51.093

What lessons can be learned from the [specific engineering project or case study] about the importance of responsibility and accountability in engineering practice?	1.584	4.061	55.155
How do engineers in different industries (e.g. aerospace, healthcare, energy) perceive their responsibility and accountability, and what are the implications for their practice?	2.273	5.829	51.093
What are the differences and similarities between the ethical principles and standards of different engineering professions (e.g. mechanical engineering, electrical engineering, civil engineering)? How do different countries and cultures approach issues of responsibility and accountability in engineering practice?	1.268	3.252	61.844
How can engineers demonstrate accountability in their work, and what are the benefits of doing so?	1.268	3.252	61.844
What role do professional engineering organizations and licensing bodies play in ensuring accountability among engineers?	2.436	6.247	45.264
How can engineers be held accountable for their actions and decisions, particularly in cases where they have caused harm to people or the environment?	2.436	6.247	45.264

While that sounds promising, it's important to recognize that many groups, including religious cults and political parties, also claim to uphold ethical standards, which we might not agree with fundamentally [Pesch, 2015; Johnson, 2017]. Even more concerning, some groups with shared values include terrorists, fascists, racists, and neo-Nazis—groups we certainly do not support.

Conclusion

While business environments have always been in flux, the changes over the past fifty years have been remarkable, largely due to the surge of information and knowledge in business management. After World War II, there was a significant push for productivity, and education and training became top priorities. One major university in the United States experienced unexpected success with its evening program designed for adults. In 1964, the British government rolled out the Industrial Training Act, but low productivity continued to be a persistent issue, prompting an ongoing search for solutions. Many management teams began to experiment with different organizational structures to boost productivity and ensure smoother operations. Researchers took a serious look at how long it took to complete tasks in organizations with various structures. Some management teams came to realize they were grappling with bureaucratic challenges. Issues like slow decision-making and poor communication between departments were common. This realization sparked a desire for change. Consequently, a variety of organizational structures emerged, including vertical, broad, adhocracy, matrix, network, flat, and slim designs. With these new structures came a fresh approach to management. A systematic, integrated, and planned strategy was adopted to enhance the effectiveness of teams and the organization as a whole.

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