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Reliable Engineering Design vs. Economic Necessities & Safety

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This is a paper about the tradeoff between making a reliable engineering product/design, and the cost of manufacture and safety for consumers. Many different laws and court cases will be analyzed, showing different examples of when these issues arise. This is a very common issue that happens every day in the workplace.

Engineering is a much needed and scholarly occupation. As members of this line of work, engineers are anticipated to uphold the premier standards of morality and reliability. Engineering has a direct and vital impact on the quality of life for all people. Therefore, engineering services require righteousness, neutrality, justice, and impartiality, and must be devoted to the health, safety, and security of the public. Engineers must follow a standard of certified conduct that requires devotion to the uppermost values of moral conduct.

The engineer's job is to answer to the public's need by building or making something using a particular set of specifications that has a given purpose. A vital component of the projects is that it should accomplish its function without the possibility of failure. However, everything must ultimately fail, in some way, to do its set purpose at a high level. Therefore, engineers obviously have trouble designing in such a way as to completely elude failure – which could result in loss of material goods, harm to the environment, and feasibly injure or kill one or many of the public.

More often than not, an absence of proper engineering ethics knowledge is one of the main causes of an engineering disaster. An engineer has an obligation to their client, employer, and the public, to perform their jobs in reliable manner. A moral

engineer is one who eludes conflicts of interest, does not try to falsify their expertise so as to attempt jobs outside their capabilities, and acts in the best interests of the public and the environment.

In the past, an engineer could primarily concentrate on enhancing a product's design functionality. With greater safety concerns now, the engineer's job in providing design safety has significantly increased. In the past, safety features and accessories intended to protect equipment operators were considered the responsibility of the owner and user, not the engineer. But currently, more rigorous safety standards and swift technological advances means engineers can easily search out a product's potential for failure and design a way to avoid it. While these methods provide management and the customers' guarantee the products they use will benefit – not hurt them, some safety mechanisms can cause issues if not correctly used.

It is not enough to merely add a safe-stop system that shuts down the part of a machine where the problem occurs so that once it is repaired, operation can swiftly resume. That system may need a multitude of other safety features, such as self-monitoring. The effect of a protective system or safety device on other mechanisms must also be considered to avoid ancillary errors – including the risk that standard

operation be continued prematurely. Maintenance checks of the system also are critical because over time, it may stop working or become undependable without notice.

Legal action linked with engineering design has intensified immensely over the last couple decades. It has amplified the question whether social accountability or legal obligation should have priority. Where does an engineer’s responsibility end and the subcontractor's, manufacturer's, and consumer's begin? The connection between social responsibility and legal liability is convoluted by the fact that laws are typically only enacted after a catastrophe of some sort. How can an engineering company validate its actions based on existing legal designations? If a company's design has negative effects on the public, laws are sanctioned to ensure that suitable safety principles are met. Or, at the very least, legal suits are filed so the injured parties can receive compensation, and the offenders disciplined. This occurrence has become especially serious in regards to lawsuits concerning engineering design and product accountability.

Many of the challenging ethical dilemmas managers and engineers are faced with involve clashes in regards to who takes responsibility for a given action. Managers and engineers have different duties depending on their role in the company.

Therefore, the main issue at hand is role morality – which is involved with responsibilities workers have based on the role they have taken in the company. It is vital for workers within companies to take a more of a dynamic awareness in their duties as professionals, as well as to protect the safety of society. In many instances, engineers will simply have to choose their social responsibility over the law. An engineer must often place their social accountability over the objectives of their employer because sometimes the company will ignore ethical issues if it means making a profit.

Professionals need to look up from their given roles and duties to see the bigger picture of the work they perform for the benefit of society. Using the infamous Challenger tragedy for instance, while nobody technically broke the law, there was clearly misconduct on the part of the managers and engineers responsible for the failed design. For an engineer, safety is of utmost importance. The engineers should not have said the launch would be safe. It wasn't, they knew it, and should have pushed back the launch. Instead, seven people died because they did not do what they were supposed to as engineers – which is to protect the safety of the public. Engineers and their managers must always keep their commitments to the welfare of the public at the forefront of engineer design and management decisions.

Great engineering is vital to make the world a better place. Therefore, there is a tremendous need for responsible management, in both moral and innovative engineering and company practice. Engineers must hold the public safety, wellbeing, and health at the utmost importance, and use knowledge and skills for the betterment of the public. When engineers, managers, companies, and contractors take responsibility for their designs, the entire profession of engineering benefits. Ethical engineering practice absolutely affects engineering innovation, and the engineering profession benefits when ethics are followed and ingenuity is used by the engineer. When not followed, poor public affairs are a likelihood for the engineer, the company employing the engineer, and the profession overall.

Certified engineering societies have a major role in making certain that safety standards are upheld, and it is essential that professional engineers observe what their engineering society mandates. An engineer must remember the code of ethics in the practice of their profession at all times.

Engineers should not only do as their code of ethics entails, but should also encourage others in the profession to do so as well. Engineers should back their profession's code of ethics because supporting it will help protect them and the public by what other engineers design. Supporting the code of ethics will also help

guarantee each engineer a work atmosphere in which it will be easier than it would otherwise be to resist the stresses to do things that the engineer would usually not do. Engineers should support their profession's code because supporting it aids in making their occupation a practice in which they don't need to feel morally unjustified.

Despite engineers meeting their design responsibilities and following the code of ethics, failures still unfortunately happen. What is the engineer's accountability once the design is given to a contractor, subcontractor, or consumer? Is the engineer responsible for assisting others in the use of a product? What conditions can the engineer appeal? One must differentiate between morally distasteful failures to assist, and those which are merely lack of consideration. In determining whether you are obligated to do something to prevent harm to others, these two rules directly apply to engineering design: that there is adequate reason to believe that you can avoid unreasonable hazards at little cost to oneself. And that you do not have enough reason to believe another engineer can prevent harm if you do not do it yourself. This raises severe questions about what constitutes safety and the notion of irrational danger as a design consideration.

One of the issues is that engineers are usually not taught to look at designs of dangerous products abstractly. Some engineers have a tendency to disregard design considerations that cannot be easily measured for study or, at the very least, they consider them to be of less significance than others which give themselves readily to being demonstrated and examined. The true issue engineers face is that they are not suitably educated in product accountability law, so they do not fully understand when they are ethically responsible to assist others in their products.

Responsibility for a faulty product is placed into three groups: design, manufacturing, and marketing. Marketing may seem out of place, but a marketing shortcoming is tantamount with the failure of a company to give satisfactory cautions and directions for the appropriate use of the product. When observing if whether or not there was a hazard, courts test the product as to whether it was any of the following: state-of-the-art, an inevitably hazardous product, or wrongdoing by the user. Currently there is an ever-growing need to do more than simple cost-benefit analyses on products and to reexamine company marketing approaches.

Lawsuits against engineers and their companies are on the increase. Even if the engineer feels they have done everything in their power to elude unreasonable hazards in their products. Unfortunately, mishaps do occur, and engineers are held

accountable for construction and product accidents. Therefore, engineers must acquaint themselves with the proper legal documents of informed consent, third-party accountability problems, liability insurance, and legislative lobbying methods.

Engineers and their professional societies must get more involved in their code of ethics in order to prevent these issues from occurring. The way engineering works in the United States of America means that each individual state can create its own distinctive laws governing the engineering practice. This has caused an accountability predicament because nobody wants to take responsibility. While most people know engineers need to place their social obligation over problems of legal accountability. Many trivial lawsuits make being a professional a hazardous endeavor.

If engineers could simply involve themselves in the discussion over legal responsibility, conceivably they can devote more of their time supervising themselves and less time dealing with lawsuits – hence why they should be more educated in that regard. If engineers are more polished about the legal practice, maybe they can better aid the public. The court of law is mostly siding with the contractor – which implies that the public thinks that engineers should take responsibility for their designs on site. This has become more prominent, even at

the consulting firm I work at. For each big project, a few engineers are always on site with the contractor to ensure things go smoothly. The only way to confirm that their design directions are being followed is by getting themselves involved on site, and by accepting their social and legal duties.

Even though a product may have a dependable design, when the product is produced and used by the public, its dependability may be substandard. The reason for this poor dependability may be that the product was badly made. Despite the product having a trustworthy design, it is actually defective when used – which is the consequence of an inferior engineering process. There are many reasons why having a reliable product/service can benefit the engineer and the engineer's company such as:

- **Reputation** – A company's reputation correlates to the dependability of their products. The more dependable a product is, the more likely the company is to have a positive reputation.
- **Customer Satisfaction** – Even though a dependable product may not radically affect customer approval in a positive manner, a defective product will negatively affect customer satisfaction. Therefore, great dependability is a required obligation for customer satisfaction.
- **Warranty Costs** – If a product fails to perform within the warranty period, the replacement and repair costs will negatively affect revenue, as well as gain undesirable negative attention. Introducing dependability analysis is a vital step in taking corrective action, leading to a product that is more reliable.

- **Repeat Business** – A focused effort towards enhanced reliability shows current customers that a manufacturer takes pride in its product, and is committed to customer satisfaction. This type of approach has a positive impact on future business.

- **Cost Analysis** – Manufacturers may take reliability data and combine it with supplemental cost data to demonstrate the cost-effectiveness of their products. This life cycle cost breakdown can prove that although the initial cost of a product might be higher, the overall lifetime cost is lower than that of a competitor's because their product needs less repairs and maintenance.

- **Customer Requirements** – Many customers in today's market request that their suppliers have a reliability program in effect. These customers have learned the paybacks of reliability analysis from experience.

- **Competitive Advantage** – Many companies will distribute their projected reliability numbers to help gain an advantage over their competition who either do not publish their numbers or have lower numbers.

Reliability is vital in the field of engineering, whether you have your own business or are a part of one, it is important to be reliable to your customers so you can gain new customers to make more money. This is all part of following the code of ethics explained in this paper. There is much more to reliability engineering than what is shown in this paper. But this should be a good overview on the engineering code of ethics in business.

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