Chapter 13
Ethical Principles for Engineers in a Global Environment

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Abstract Engineering ethics has undergone an evolutionary process from a national perspective to a recognition that global concerns matter in engineering. However, this has been an additive process which is still generally based on an American model of ethical theory as a foundation, with professional ethics as the outcome. Neither of these elements can be expected to be understood or accepted on a worldwide basis. This chapter therefore argues that a new foundation for a global engineering ethics must be established, one which derives ethical principles from the nature of engineering and the universal use among engineers of the faculty of reason. Arguments are presented why this is the appropriate approach given the contemporary work environment of engineers. A number of fundamental engineering ethics principles are derived.

13.1 Introduction

Traditional engineering practice has been relatively localized in specific cultural contexts. Ethics education for engineers, in the instances where it actually occurred, could therefore legitimately be based on the background conditions existing in a particular society and assume a general familiarity with the value structure of that society among learners. Starting in the latter part of the twentieth century, this was no longer the case. The previously existing conditions of engineering practice underwent significant changes, these including the coming to dominance of multinational corporations, the location of plants by national corporations in other countries, the increasing international mobility of engineers, and the establishment of international supplier and customer systems. While some texts on engineering ethics ignored these developments, others responded by adding one or more chapters regarding issues sometimes encountered by engineers dealing with foreign entities, such as the

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question of grease payments (Martin and Schinzinger 1983, 2005). Such responses, while a legitimate first attempt at dealing with the new international environment of engineering, did not however address the need for a fundamental evaluation of how ethics should be conceptualized if it was no longer sufficient to look at international issues from within the framework of a national perspective.

Necessary is instead a rethinking of engineering ethics at a more fundamental level, one where the global environment of engineering is the starting point for discussion, rather than a mere addition. This, in turn, requires setting aside particularized national assumptions about the practice of engineering, as well as avoiding the theoretical foundations of practical ethics which arise out of specific cultural traditions, since these will likely either be unfamiliar or unacceptable to engineers from other cultures. Only those claims which can be justified on the basis of the nature of engineering itself, or are relatively universal human characteristics, are legitimate starting points for a global discussion about the nature of engineering ethics.

The work in this chapter forms part of a larger project of the author's, one focused on integrating business ethics, engineering ethics, and cross-cultural concerns into an ethical foundation for engineers working in the contemporary environment of technology. Within that project, the current discussion focuses on the recognition that contemporary engineering operates in an international context requiring a globally acceptable foundation for an engineering ethics. I will argue that this foundation cannot be provided by either an approach of ethical theory or one of casuistry. Instead, a set of engineering ethics principles will be proposed based on the nature of engineering activity and the universal use of reason in engineering.

13.2 A Global Approach to Engineering Ethics

Given the role of engineers and engineering in the contemporary world, it is my intention to take a global approach to engineering ethics. While this may make immediate sense to younger engineers, it is in fact a departure from the tradition. Engineering ethics is a relatively new area of study which originated in the United States and has only begun becoming significant in other parts of the world, largely due to the establishment of engineering program accreditation standards in other parts of the world. Because the American model of engineering ethics was first, it has become somewhat of a global standard. The problem is that the American model carries within it some uniquely American or Western features, such as an emphasis on ethical theory and on the ideal of professions (Luegenbiehl 2004). Some of these features are not readily, or not appropriately, adaptable to other parts of the world. It is thus necessary to begin anew in the development of an appropriate engineering ethics. One could, of course, begin with a cultural perspective other than the American one, but that would raise the same issues of being too focused on one cultural perspective at the expense of others. My approach is instead to begin the development of an engineering ethics without any cultural presuppositions, but to raise questions of culture at a later stage of analysis.

In thinking about engineering ethics independently of a particular cultural background, it is instead helpful to consider engineers to be a community with a shared set of values. A bond is created among engineers based on these values, whatever their nationality or cultural background, just as there typically exists a set of common core values in other types of societies. These values provide for an element of trust among the group's members, and a legitimate defense against forces that would undermine the appropriate application of technology. In dealing with engineering ethics in a global context it will thus ultimately be necessary to describe this actually existing value structure, although that is beyond the scope of the current discussion. For now I take it as an indication that a global approach will emphasize the interplay between the descriptive and normative dimensions of ethics. That is, unlike some philosophical approaches to ethics, it holds that real-world conditions must be accounted for by developers of a global engineering ethics.

13.3 Foundations for Analysis of Ethical Issues

13.3.1 Problems of Ethical Theory

Many of the texts on engineering ethics currently available begin with a discussion of philosophical ethical theories (Martin and Schinzinger 2005; Baura 2006). Such theories have been developed over several centuries to serve as foundational principles for ethical analysis. Dealing with specific ethical issues that arise in the world has consequently become known as applied ethics, indicating that procedurally it is the ethical principles which form the basis for discussion. Recently there has begun a trend away from this form of applied ethics because of the difficulty students find in applying these general principles and because there continues to be serious disagreement among philosophers as to which principle or set of principles should be used.

When ethics is viewed on a global basis, these problems become magnified, because foundational ethical principles as the major source for ethical decision-making are a specific product of the Western philosophical tradition. Consequently, many students not familiar with that tradition have a difficult time understanding that approach in the first instance, before it even becomes a question of whether or not they agree with a particular instantiation of the approach. Courses in applied ethics in such cultures thus face the danger of becoming an introduction to Western philosophical thought at the expense of actually considering specific applied issues. Fundamental disagreements about the appropriateness of utilizing ethical theory, perhaps based on the claim that ethical theory seeks to operationalize a uniquely Western perspective and impose it on the rest of the world, also stand in the way of reaching agreement on how specific ethical issues should be resolved. This discussion, in addressing a global perspective, will therefore avoid reference to specific ethical theories or to the identification of duties based on particular religious/philosophical traditions.

13.3.2 Problems of Casuistry in a Global Context

In recent texts on applied ethics casuistry, or the building up of theoretical framework through the study of specific cases, has become an increasingly common approach (Harris et al. 2005). As a foundation for the study of ethics by those with a common cultural background this is a useful tool because it can be assumed that to a large extent learners share a common approach and a common moral outlook. However, when engineers with diverse cultural backgrounds are put together, this shared bedrock for analysis will be missing and lead to divergent interpretations and decisions. It will also be difficult to separate general social values or matters of custom from more fundamental ethical concerns. Further, fundamental problems of differing interpretations of the same vocabulary will also exist. Rather than aiding communication, the case study approach in a global environment will actually hinder the development of an ethical framework. This can be seen in the difficulty foreign engineering graduate students in America often have in adapting to local normative standards regarding such issues as plagiarism. In some cultures, for example, the process of copying another work is seen as honoring the original author rather than a form of theft. In others, it is viewed a form of teamwork with the original author which is encouraged in other engineering contexts. For practicing engineers the time and effort necessary to develop a global standard based on the method of casuistry thus is not a workable solution.

Eliminating casuistry as a basis for establishing a global framework for engineering ethics is not to suggest that cases should not be utilized in the study of the subject. Consideration of cases is important. For example, working with cases emphasizes the process of active learning and furthers engineers' ability to analyze a series of events. These are not activities which are common in all societal educational systems and thus also broader educational value beyond the study of ethics.

13.3.3 The Important Role of Reason

In a general sense, the ability to reason is a feature common to all adult human beings. It is the ability to logically think through problems. Often pointed to as features of reason are the ideas of consistency, reversibility, deliberation, disinterestedness, and universality. The ability to reason is claimed to be so central to human existence that some have identified it is the core of human identity, that which separates humans from other creatures. Whether this is true may be subject to debate and it is certainly the case that the use of reason is stressed more in some societies than in others. In some societies is may even be given a clearly secondary role in practice. Independent of a specific societal approach to reason, however, what is indisputable is that without the ability to reason, engineering, at least in its modern manifestation, could not exist. All engineers must therefore accept the premise that the use of reason is a valid decision-making instrument, independently of what thought processes they may use in other parts of their lives. While other elements of humanness are also significant, such as an emphasis on emotions for example, it is only reason which we expect to manifest itself among engineers in a uniform fashion across cultures.

It is important to notice that in advocating the universality of reason among engineers, I am not proposing a subtle reintroduction a Kantian framework into engineering ethics. Immanuel Kant is concerned with the primacy of basic principles of reason, such as the principle of non-contradiction, while I am advocating reason in its broader, more colloquial sense, of using logic and evidence in support of a conclusion, that is, that decisions should be "reasonable." Given this interpretation, it is then justified to expect that reason as a tool for establishing a cross-cultural and global foundation for the development of ethical principles should be understandable and acceptable to engineers from all cultural backgrounds.

13.3.4 Role Responsibilities and Engineers

A further foundation for establishing a global engineering ethics is the idea of "role responsibilities." Role responsibilities, as the name indicates, are duties associated with a particular position that we hold in life. All of us have many roles, and different duties may be associated with each of these, arising out of the nature of the role itself rather than out of a more general principle. For instance, parents have a special responsibility to nourish and support their children, much beyond the responsibility that strangers or the state might have. Teachers have special responsibility to ensure students learn. Physicians have a special responsibility for the physical health of their patients.

In making a list of one's own roles, it will quickly be discovered that these will be numerous. An engineer might also be a parent, a golfer, a sibling, a student, a lunch room customer, a driver, and on and on. Once we identify our own roles, two things need to occur. We need to decide what special duties are associated with our roles, or at least to be informed by others what these should be, and we need to prioritize the relationships among our many roles. It is part of the aim this chapter to identify the responsibilities associated with being an engineer, based on the nature of engineering itself. As for the process of prioritizing among different roles, that is a vital task, but one beyond the scope of this chapter. It should at least be noted, however, that the role of individuals as engineers will in practice not automatically supersede all other roles of the individual, as is assumed by most current engineering codes of ethics.

A second reason why we need to specifically consider the idea of role responsibilities is that engineers are in fact different from the general public. They have specialized knowledge and skills which are only acquirable through long periods of intensive study. Their knowledge is the equivalent of a black box to the public. What goes on inside that box is a mystery. The public thus exists in a relationship of dependency to engineers. It must trust the work that engineers do on its behalf. Through an establishment of ethical constraints in their activities, engineers can help assure the public that they are worthy of this trust.

13.4 Foundation for Principles of Engineering Ethics

Traditional moral theory seeks to develop one or a very few moral principles on which to base all ethical judgments. My approach differs from this in that I begin at the more concrete level of engineering itself. Based on a specific conception of engineering as a universally possible activity, I will then derive a set of obligations and rights which specifically apply to engineers. These guiding principles will need to be somewhat fluid in application, because none of them can be considered absolute or completely determined, needing instead to be thought through in the process of application to specific instances. They will, however, provide a general framework on which to base ethical engineering judgments. What I am proposing here is similar to the development of a code of ethics for engineers like those which have been promulgated by a number of engineering societies throughout the world, with the difference being that codes come to us as finished products with no justification for the individual entries being attached to them. They thus appear as instruments of external authority, in a similar fashion to laws. They share the further characteristic with law that they are ultimately political instruments based on compromise. My process is instead intended to have engineers see the why behind the adoption of specific principles and to therefore have a rational basis for following them. It is worth mentioning that this has become a more common approach in the more mature field of bioethics, where use of lower level principles is often advocated, rather than an emphasis on theory as such (Beauchamp et al. 2008).

13.4.1 The Nature of Ethics

To begin the process of determining a set of appropriate ethical principles for engineering, we must first define the term "ethics." For the purposes of this discussion, I am defining "ethics" as being about *actions which have the potential to have a serious impact on the lives of other people.* A number of aspects of this definition are subject to debate in the contemporary literature, such as its limitation to people and not including conduct of a self in isolation. As well, the meaning of the word "serious" is quite vague. This limited conception of the domain of ethics does not mean, of course, that animals or the environment should not be covered in ethical discourse, since our actions toward other beings and things often have consequences for the lives of people. For example, global warming as such is not of ethical interest, but when we consider that what we do to the environment can seriously harm people it becomes a matter of ethical concern.

In the context of a global ethics, especially, it must also be noted that the definition of "ethics" is framed in terms of actions. The question of the inner being of individuals, or their character, is thus left unresolved. There exist a number of moral traditions which stress the idea of character development or the spiritual state of the person. My neglect of this issue in establishing an ethics for engineers is not to indicate that this is not an important dimension, but rather that it is often not suitable for assessment by an outsider. For example, private thoughts which some individual has, as repulsive as those might be to others if they knew about them, if they do not have effects on others do not fall under the proposed definition, which must be one that is useful and acceptable in a cross-cultural context.

13.4.2 The Nature of Engineering

A number of alternative definitions for "engineering" have been proposed historically, with none having achieved universal assent. Perhaps the biggest contrast among the definitions is that some emphasize the requirement of engineering activity to benefit humanity, while others choose a value neutral approach. Here I choose the latter course, as it avoids having to deal initially with the questions of culturally based ideas of benefit and harm. It also seems to me that not all engineering activity needs to have a socially constructive purpose. However, some value element is unavoidable, in that I assume that engineering activity should leave the world no less well off and that disbenefits created by engineering not be catastrophic in nature. Whether these assumptions are justified requires extensive separate discussion.

Another concern relevant to defining "engineering" is the common public conception that engineering is solely concerned with the making of things, with the creation of artifacts. This understanding of engineering is likely linked to the craft tradition of engineering and is less typically relevant to more modern occupational activities of engineers, which include dealing with processes rather than simply with products.

A final issue is that some would argue that engineering is centrally, and perhaps exclusively, about the activity of designing. While this is certainly a core activity for engineers, it does not capture the wide variety of activities trained engineers engage in. Yet there are numerous attempts to segregate engineers into different hierarchies and to separate "true" engineers from others. The question of who does engineering is thus integrally connected to what engineering is, and the answer varies across different countries. My definition in a global context will thus have to be somewhat stipulative and subject to possible criticism.

Based on the above discussion, I then propose the following definition of "engineering:" Engineering is the transformation of the natural world, using scientific principles and mathematics, in order to achieve some desired practical end.

This is a relatively broad definition which attempts to capture the great variety of activities possible for engineers. The definition also attempts to be value neutral as far as possible. It clearly, however, reflects the modern scientific foundation of engineering, rather than the craft tradition, and this in itself involves a value judgment.

13.4.3 Deriving the Principles

Once the above definitions have been established, we can ask what ethical principles follow from them, using the tool of reason. The basic question is: Using the ability to reason, what makes certain types of actions appropriate or inappropriate, given our definition of engineering? Key elements to remember are that the world should not be left less well off as a result of the transformation, and that costs incurred in the process should not be catastrophic. In addition, when speaking of costs or benefits, the final concern is the potential impact on the lives of human beings, as was stipulated in relation to our definition of "ethics." In other words, ethical discussion in relation to transforming the natural world will determine the appropriate application of engineers' abilities.

The principles established will be somewhat general in their enunciation and subject to interpretation. That is the nature of general principles, but is also what makes them at times less useful in the sphere of application than might be expected. This is one reason why engineers need some practice of dealing with example instances where they use the principles to analyze specific situations, thereby helping to clarify the nature of the principles for themselves.

13.5 Foundational Principles of Engineering Ethics

13.5.1 The Principle of Public Safety

Modern technology has vast power to impact the lives of people. What might at the time seem like minor design decisions may harm or benefit millions or even billions. The power of even contemporary dictators is puny compared to the power of engineers. This power carries with it a great deal of responsibility, yet it is often unrecognized by the holders of the power themselves. A quote from the American Accreditation Board for Engineering and Technology *Code of Ethics* is an apt reminder: "Engineers shall recognize that the lives, safety, health and welfare of the general public are dependent upon engineering judgments, decisions and practices incorporated into structures, machines, products, processes and devices" (ABET 1997). While the power of engineers can greatly benefit the public, it also has the potential to do great harm. Neglecting appropriate safety considerations in the design of a nuclear reactor, for example, may result in destroying many lives and making great swatches of land uninhabitable for decades. The emphasis on safety shows us that ethics is central to engineering, for it means that the engineer is responsible not only for the technical adequacy of products, but also for the consequences which result from their intended and unintended (but foreseeable) uses, insofar as these products have the potential to harm the public.

There is a strong association of safety with not being subjected to harm, but harm can take many forms. It can be physical, psychological, emotional, monetary, and so on. Clearly, it would unjustified to hold engineers accountable for all of these possible consequential harms resulting from the introduction of technology, although they might have contributory responsibility. However, due to their expertise, they do have a central connection to the potential for resulting physical harm.

For the individuals affected by technology, the greatest possible cost to bear is loss of life or bodily integrity, that is, significant injury. Some have even argued that life is of infinite value and that therefore any societal benefits derived from actions cannot be measured against the potential for loss of life. In practice, however, we do assign value to human life, albeit to different degrees in various cultures. Yet the import of the more radical claims is clear: human life is of very high value. Actions which risk life have significant primacy in countering potential benefits from the introduction of technology and must be of special concern to engineers. If engineers are aiming to not leave the world less well off as a result of their transformations of the world, they must give great consideration to the possible endangerment of human beings. This is not to claim that no introduction of technology which can potentially harm the physical integrity of human beings can be justified, because that would imply that no degree of risk could ever be justified, which in turn would eliminate the possible introduction of technology, but only that engineers must give great weight to such risks. This conception of the priority to be given to safety is in accord with statements found in many codes of engineering ethics, as in, for example, the ethics code of the American National Society for Professional Engineers: "Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties"(NSPE 2007). Given that engineers have knowledge and expertise regarding technology which is not available to the general public, it is part of their role responsibility to protect more ignorant individuals from potential danger. It is reasonable to assert that knowledge generates responsibility. As an example from ordinary life, if we gain knowledge that an individual is about to murder someone, a duty is generated to warn that person or to take other appropriate action, a duty which we would clearly not have if we were ignorant about the potential murder. The first principle based on the nature of engineering can then be stated as follows:

> *The Principle of Public Safety:* Engineers should endeavor, based on their expertise, to keep members of the public safe from serious negative physical consequences resulting from their development and implementation of technology.

13.5.2 The Principle of Human Rights

Once the safety principle is established, a number of others follow, which I will here discuss only briefly. Although the assertion of rights has perhaps gone too far in some Western societies, the idea of respect for human rights has by now been firmly established on the world scene, for example in the UN convention on human rights. Most fundamentally, the rights that are asserted to be human rights are the protection of human life and the right to conditions being met which are required for the continued existence of that life in a condition fit for human beings. Most basic to support life might then be the right to food and shelter, the right to education, and the right to just treatment. For engineers, a duty derived from keeping people safe, or protecting them from physical harm, is then the demand that they do not undercut the conditions which are necessary for life to be maintained in a viable state. It would, of course, be asking too much of engineers to be responsible for all positive promotion of human rights. If that is a duty, it is a duty for governments and/or the general public. Engineers' duty in relation to rights is thus a limited one, namely that they should not cause the violation of human rights through their actions. This would amount to a requirement for engineers to exercise the duty of respecting fundamental human rights in carrying out their role and the ability to refuse to participate in activities which threaten those rights. The second principle then reads:

> *The Principle of Human Rights:* Engineers should endeavor to ensure that fundamental rights of human beings will not be negatively impacted as a result of their work with technology.

13.5.3 The Principle of Environmental and Animal Preservation

Emphasis on the preservation of the natural environment is a relatively recent phenomenon on the world scene. However, engineers clearly have a major role to play in contributing to a sustainable global environment or to its destruction, a role which has perhaps been insufficiently recognized. If the global environment is not adequately sustained, human life will be endangered. A similar claim can be made for destruction of diversity in the animal kingdom. Thus the relevant engineering duty follows from the safety responsibility of engineers for human life, but again as a limited duty.

> *Environmental and Animal Preservation:* Engineers should endeavor to avoid damage to the animal kingdom and the natural environment which would result in serious negative consequences, including long-term ones, to human life.

13.5.4 The Principle of Engineering Competence

If engineering work is carried out in an incompetent fashion, it takes no great stretch of the imagination to envision that it might turn out badly and endanger the lives of human beings. Although it is often not recognized to be such, technical competence is at its core an ethical requirement. The next principle then follows directly:

> *Engineering Competence:* Engineers should endeavor to engage only in engineering activities which they are competent to carry out.

13.5.5 The Principle of Scientifically Founded Judgment

An important component of my definition of engineering is that engineering is based on the use of scientific principles and mathematics. Using these tools in one sense is then simply acting as a competent engineer in the global context where the criteria for good engineering must be expanded beyond local craft traditions. But, in another sense, it has wider implications, namely that using other types of principles or other decision-making procedures is inappropriate and not in line with appropriate engineering work. This proposition is clearly somewhat controversial, since it would hold that engineers are engaged in an illegitimate conflict-of-interest when they let non-engineering considerations influence their judgments. If we view the issue from the perspective of engineering seen in isolation, however, non-engineering considerations are not relevant. Thus for example, cost considerations are clearly part of the ultimate decision-making process regarding the products of engineering. These, however, become relevant only when a wider context for engineering is established (as it will be elsewhere). Further, it must be kept in mind that the ideal of scientifically founded judgment is not an absolute one, but must rather be seen in conjunction with the other principles established in this chapter. In that context, the following principle then applies:

> *Scientifically Founded Judgment:* Engineers should endeavor to base their engineering decisions on scientific principles and mathematical analysis, and seek to avoid influence of extraneous factors.

13.5.6 The Principle of Openness and Honesty

The final engineering principle concerns the direct relationship of engineers to the public. I have shown that engineering is an esoteric activity, in the sense that much of what engineers do is opaque to the public. However, explanation of the above principles has shown that engineers cannot take sole responsibility for everything which is a potential effect of their actions. Although they must be worthy of trust, their direct responsibility relates only to engineering aspects. To begin to fit this responsibility into a larger context, communication with other constituencies is necessary. This communication must of such a nature that competent decisions can be made by others. Our principle then follows:

> *Openness and Honesty:* Engineers should endeavor to keep the public informed of their decisions which have the potential to seriously affect the public, and to be truthful and complete in their disclosures.

13.6 Limitations of the Discussion

There is no claim implied in the previous discussion that the proposed principles are radically innovative, although some do project a relatively new emphasis. They should in fact have an intuitive appeal to engineers, since otherwise the implication would be that the current practice of engineering fails to meet ethical standards, a claim I am not prepared to make. The important point is that they are derived from a foundation which should be able to gain acceptance in the global engineering community, whereas emphasis on instruments which have an apparently Western bias will not.

For evaluation of the appropriateness of the above discussion it needs to be kept in mind that the principles derived are solely from the perspective of engineering as an isolated activity, independent of particular cultural, societal, or business contexts. The principles considered thus do not include, for example, as do most current engineering ethics codes, the important issue of the duty of loyalty to employers or clients and its potential for conflicting with the principle of public safety (NSPE 2007). That duty does not follow from the activity of engineering itself. It is instead established as a result of the fact that most engineers function in the employ of someone else (be they considered employers or clients) and requires analysis in a broader contextual framework. It must thus first of all be recognized that the engineering principles are not to be taken as necessarily supervenient, either individually or as a set. A fundamental assumption of the current discussion is that while engineering ethics can be derived from the activity of engineering, in practice it is a contextual activity in the course of which engineers function in multiple roles. For example, engineers may also be managerial employees and thus have to be concerned with their duties in those capacities. Those duties may well conflict with duties assigned to engineers. With W.D. Ross' distinction between *prima facie* and actual duties in mind, it should not be assumed that engineering duties should always become the actual duty (Ross 1930).

More significantly even, engineers themselves have responsibilities to others which are not solely based on engineering. As I have pointed out, each human being plays many roles. For engineers, often two additional major roles are that of being a member of a family and an employee of a corporation. These other primary roles can create conflicting interests. Traditional professional engineering ethics holds that engineering duties, especially the duty to the safety of the public, should always take priority. However, this seems an unreasonable expectation in light of the implications of failure to fulfill one's duties in the other areas. Ethical theory typically holds that one life is the equal of another, so that if two were to die as a result of failure to do one's engineering duty while only one of the engineer's children should die, then ethical theory would demand that the engineering duty be performed. From the perspective of role responsibilities, on the other hand, the situation is less clear, because the duty of the parent is first and foremost the welfare of the parent's own children. If there were only one child, the role of being a parent would, in fact, be completely destroyed with the death of the child.

For most parents the choice in this type of situation would be obvious. Would we be willing to condemn them for acting unethically? If not, then we have to recognize that we cannot look at engineering duties in isolation and simply condemn any action contrary to them as unethical.

Finally, I want to remind readers that the above discussion is intended to be part of a larger project. A fuller discussion of ethical principles for engineers in a global environment will need to stress two important elements: the connection of engineering to the business environment and the need to understand that a variety of cultural value systems exist in the world which must be recognized and taken into account. It will also require that the ethical discussion of engineering be seen in a real-world framework, rather than looking at it as an ideal phenomenon which can be analyzed independently of external considerations. Further principles thus need to be developed regarding duties of engineers as employees, requirements for potential involvement by engineers in public affairs, rights of engineers as employees and as engineers, and intercultural requirements for engineers. However, those are subjects for other venues.

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