Chapter 3

Engineering Professionalism and Professional Organizations

Chapter Objectives

Having read this chapter, completed the included exercises, and answered the associated questions, readers should be able to

- describe the ways "profession" has been defined, the relationship of professions to society and individual professionals, and the "contract-model" account of professions;
- give reasons engineering should and should not be considered a profession, in relation to the history of engineering and current state of its professional organizations;
- explain the nature of and reasons for codes of ethics for engineers, with reference to both the history of codes of ethics and the American Society for Mechanical Engineering (ASME) code of ethics as a sample.

CASE STUDY ONE—MCDONNELL AND MILLER, AND THE ASME: PROFESSIONALISM IN QUESTION?

On May 17, 1982, the Supreme Court, in a 6–3 ruling, found the American Society for Mechanical Engineering (ASME) guilty of having violated the Sherman Antitrust Act, which aims at preventing unfair and collusionary business practices. The ASME was eventually ordered to pay the Hydrolevel Corporation (henceforth Hydrolevel) $4,750,000. This ruling was a result of actions taken by members of the ASME that unfairly disadvantaged Hydrolevel, which produced boiler cutoff valves.

This incident called into question the integrity of the ASME and its professional members specifically and calls into question the potential integrity of professional organizations and their group members in general: it illustrates conflicts of interests that can arise between corporations and professional organizations, between the role responsibilities engineers have in their business and professional lives. This case can serve as a starting point to examine the nature and roles of professionals and professional organizations within society in general and engineering specifically.

In 1971, Hydrolevel received a large order for boiler cutoff valves from the Brooklyn Gas Company. At the time, Hydrolevel was a relatively small

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company with a minor share of the boiler cutoff valve market. Until then, the Brooklyn Gas Company had been a major client of the much larger McDonnell and Miller Incorporated (hereafter MM). Disturbed by this situation, Eugene Mitchell, MM's vice president for sales, approached John James, MM's vice president for research, regarding a course of action. At the time, James was not only the vice president for research at MM but also a member of the ASME's heating boiler subcommittee (henceforth the ASME's HBS). In hopes of defaming Hydrolevel and gaining back market shares for MM, James and Mitchell approached T. R. Hardin, the chairman of the ASME's HBS. The three men met over dinner and discussed an interpretation of the ASME's Boiler and Pressure Vessel Code (henceforth the B-PV).

The B-PV dictates the safe design and operations of boiler valves. As boilers can explode if water levels become too low, the B-PV stated that each "automatically fired steam or vapor system boiler shall have an automatic low-water fuel cutoff, so located as to automatically cut off the fuel supply when the surface of the water falls to the lowest visible part of the water gauge glass" (Harris, Pritchard, & Rabins, 2009). Whereas the boiler cutoff valves manufactured by MM would shut off a boiler immediately if water levels became too low, those produced by Hydrolevel were time delayed.

James and Mitchell brought this code and these facts to Hardin's attention in the hopes that—as the chair of the ASME's HBS—Hardin would deem the cutoff valves produced by Hydrolevel unsafe. This would result, in turn, in MM gaining back market shares from Hydrolevel. Hardin agreed to James and Mitchell's interpretation of the code. In addition to acting as the chair of the ASME's HBS, Hardin was the vice president of the Hartford Steam Boiler Inspection and Insurance Company (hereafter HSBIIC). Both James and Hardin thus held multiple roles—ones in companies that operate for the sake of profits and ones in the ASME that operates for the sake of engineering professionalism. In this situation, their responsibilities came into conflict: they abused their positions in the ASME for the sake of profit.

With this agreement in place, James sent a letter to the ASME's HBS, including Hardin's opinion. When Bradford Hoyt, the secretary of the Boiler and Pressure Vessel Committee, received James' letter, he forwarded it to the appropriate subcommittee chair, Hardin. Hardin then responded in agreement with James' letter, without either consulting or obtaining the approval of the other subcommittee members. As a result of these actions, Hydrolevel suffered financial losses: the company eventually went bankrupt.

Salespersons at MM used James' letter and Hardin's response as a basis for claiming Hydrolevel's valves were unsafe and should not be purchased, which Hydrolevel learned of from a customer in early 1972. In Mar. of that year, Hydrolevel requested that the ASME review and correct its assessment of their valves. The ASME's HBS met in Jun. and upheld part of Hardin's original interpretation of the B-PV. In Aug. of 1975, Hydrolevel sued the ASME, HSBIIC, and MM. The HSBIIC and MM both agreed to out-of-court settlements with

Hydrolevel, although the ASME did not. The ASME argued that it was not liable as an organization, since the actions that harmed Hydrolevel were those of individual members of the ASME rather than the ASME itself.

The case went to court, and in Feb. of 1979, the ASME was ordered to pay Hydrolevel $7,500,000, although this amount was subsequently reduced. The decisions of the courts were based on the tremendous power of the ASME as a professional organization: the ASME has the ability to issue decisions on design, operation, guidelines, and procedures that affect the lives and businesses of millions of people. As a result of this case, the ASME changed a number of operating and review procedures to protect against perceived, potential, and actual conflicts of interest.[33]

Although this case is generally analyzed in the context of perceived, potential, and actual conflicts of interests—to which this text returns in Chapter 9—it can also serve as a starting point to examine the nature of professionalism, both individually and organizationally. Although most would agree that James and Hardin abused their positions in the ASME, the responsibilities that should have followed from their roles as professionals within a professional organization (the ASME) might not be clear.

What does professionalism mean? What kinds of relations exist between professions and society? Which criteria should be used to determine what counts as a profession? Why should society care about professions and—just as importantly—why should professions care about society? Most importantly, what is the relation between professionalism and ethics? As answers to these questions are not simple and—in many cases—widespread misconceptions exist regarding the nature of professionalism, professionals, professional organizations, and their relations to society, those are some of the questions this chapter addresses.

EXERCISE—MCDONNELL AND MILLER, AND THE ASME

Before moving on to the topic of professionalism, complete the case-study procedure with regard to the case of McDonnell and Miller, and the ASME. To refresh your memory, these steps are as follows:

1. Identify ethical issues—list five ethical issues.
2. Narrow your focus—narrow your focus to one ethical issue.
3. Determine relevant facts—list facts that would be relevant to resolving this ethical issue and any missing information.
4. Make reasonable assumptions—make reasonable assumptions regarding missing facts.
5. Undertake definitional clarification—clarify any terms/ideas that might be unclear, in relation to both issues and facts, paying special attention to those that have "value connotations."

33. This account is additionally based on Davis, Jones, and Wells (1986), Harris et al. (2009), and Department of Philosophy and Department of Mechanical Engineering (n.d.).

6. Conduct ethical analysis—list any ethical principles that would be relevant to resolving the ethical issue you identified, noting and prioritizing possibly conflicting principles.
7. Review the process—go back through the previous steps again, checking your work.
8. Resolve the issue—answer the question you posed before, giving a brief justification for your answer.
9. Identify practical constraints—do practical constraints exist that could excuse either individuals or organizations from the answer given? If so, then list these conditions.
10. Avoid ethical problems—how might the ethical problems you listed have been avoided in the first place?

3.1 "PROFESSION": MORE THAN YOU MIGHT THINK

This chapter explores the notion of "profession" and related concepts of "professional" and "professionalism." This represents a traditionally US manner of conceiving ethics within the field of engineering. Although this approach has developed in the United States, as engineering becomes an increasingly global occupational discipline, it will standardize along professional lines, developing in terms of the professional model.[34]

An often initially given—but ultimately incorrect—definition of a "professional" is someone who is paid to do something, such as a "professional" baseball player. This definition is incorrect, since persons in nonprofessional occupations are paid as well. Someone engaged in selling admission tickets at a ballpark, for example, would not be considered a professional. In fact, one of the characteristics of most professions is that its members are expected to do some type of *pro bono* work, work for free, for the benefit of either the professional community or the community as a whole. The idea of a profession will, therefore, be more complicated than initial, common conceptions might indicate.

3.2 THREE WAYS OF DEFINING "PROFESSION"

Several proposals have been made to define "profession." Definition by:

1. Paradigm or ideal type—This method focuses on identifying a group widely recognized as a profession, using the characteristics of this group to evaluate others, thus creating a hierarchy of professions and semiprofessions, based on how closely they resemble the paradigm. Medicine is the most commonly

34. The nature and development of professionalism and professional organizations in China and India are addressed at the end of this chapter.

used, and its characteristics consist in a theoretical knowledge base, long period of training, specialized skill set, set of licensing requirements, rights to and expectations of autonomous action, codes of ethics, and professional associations.

2. Central characteristic—This method attempts to arrive at the essence of what it means to be a profession, most commonly located in the "service ideal." This refers to the establishment of a profession when the public recognizes that a specialized, highly skilled, and necessary activity can be performed best if a small group is delegated responsibility as the sole provider of that service. This perspective thus focuses on conditions such as the exclusive right to perform a particular service, autonomous judgment of the quality of the professional activity, and control of entrance requirements to the profession. For instance, a task assigned to medicine is control over medical services, to law that over legal services, and so on. Individuals who are not members of these professions are not allowed to provide these services.
3. Definition by prestige—This method begins with the actual circumstances of occupational groups, rather than ideals or essences. It assumes that occupational groups want the prestige and power associated with being a profession, and that, based on self-interests, they will take the steps necessary to achieve that title: occupational groups will attempt to acquire whichever characteristics society demands from the group it refers to as a "profession," for example, the formation of professional associations and the development of codes of behaviors. Groups identified as professions are, therefore, simply those that are called "professions" by society. Based on this definition, any occupational group could be a profession.[35]

Readers should note that all three of these approaches emphasize the idea of professional ethics: the first because, going back to the Hippocratic oath, medicine has stressed ethics; the second because it can demonstrate to society that a profession is fulfilling its end of a social contract; and the third because it can serve as a way to create a favorable public impression.

All three of the above definitions have elements of truth: first, groups are modeled on ideal professions. Historically, there have been three of these: medicine, law, and the clergy, which traditionally served a teaching function. Second, society perceives professional groups as performing particular, necessary services, and society rewards professional groups accordingly. Third, groups do seek out the prestige of "profession" status in ever-increasing numbers. In thus analyzing the idea of "profession," it is valuable to keep all three perspectives in mind. All three views can be synthesized in what could be called the "contract model."

35. For more on the natures and developments of professions and professional organizations, see, for example, Bucher and Stelling (1969), Bucher and Strauss (1961), and Larson and Larson (1979).

3.3 THE RELATIONSHIP OF PROFESSIONS TO SOCIETY: THE CONTRACT MODEL

In theory, professions need not exist: society chooses groups to perform particularly valuable services. Medicine, for example, has long been recognized as such a service. A relationship of exchange is thus established between society and a particular professional group; a trade is made. The professional group performs a service for society in an exemplary fashion and, in exchange, society gives the professional group a monopoly on the service, prestige, and (generally) good pay. Both society and professions have generally perceived this arrangement as a fair trade. At times, however, such a relationship can be seen breaking down.

Either society no longer needs the services performed by the professional group, or the professional group no longer fulfills its part of the social contract—in other words, carrying out the service ideal—instead appearing to be primarily self-interested. This can even occur with the core professions, as is reflected in the sinking reputation of lawyers in the United States.[36] A lessening of prestige would thus occur, and society could potentially withdraw the privilege of an occupational groups' status as a profession. In the meantime, other groups strive to obtain professional status, resulting in a hierarchy of professions that changes over time, based on the prestige accorded to occupational groups by society. As society places less trust in lawyers, for example, "mediators" have striven to provide some of the services traditionally associated with the legal profession at a higher quality and lower costs.[37]

3.4 CHARACTERISTICS OF A PROFESSION

Based on the above description, certain attributes can be used to characterize a profession, not all of which need be met, but that establish a hierarchy among professions:

1. The development of a specialized body of knowledge, based on a theoretical framework.
2. Learning a set of skills that puts this knowledge into action—in other words, professionals ultimately deal with applied knowledge.
3. A long period of formal education necessary to acquire the above described knowledge and skills and to socialize prospective members into the profession.
4. The profession controls educational and extraeducational requirements for admission into the profession. This often takes the form of accrediting educational programs and licensing individual professionals.

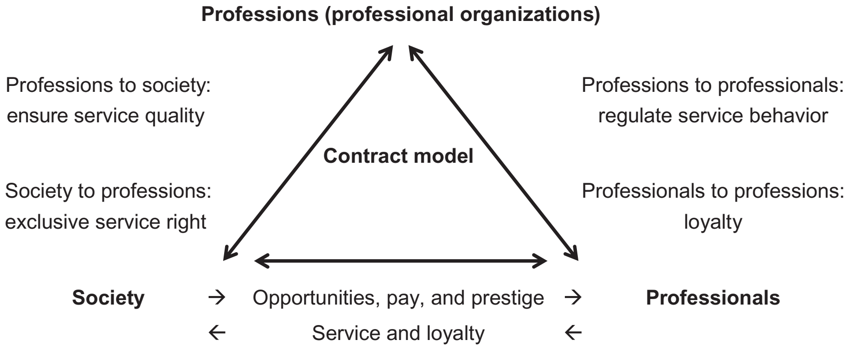
36. Concerning the sinking reputation of the legal industry, see, for example, Re (1994), Galanter (1993), and Galanter (1997).
37. For more on this, see Hensler (2003).

5. The profession controls the actions of individual professionals—in other words, a way of punishing the actions of individuals who fail to adhere to professional norms.
6. Lifelong membership in the profession: once someone becomes a member of the profession, unless that person is formally evicted, he or she remains a member of the profession for life, even if and while undertaking different activities. This attribute characterizes "professional identification."
7. The existence of a professional culture that establishes the norms and behavioral patterns appropriate for members of the profession.
8. The profession fosters individual autonomy and authority. The professional is an independent practitioner who serves clients rather than an employee who has a boss. Based on the knowledge and skills of a professional, the professional has authority over the client, even though the client pays.[38]
9. A way of demonstrating to society that the service ideal is met: this is generally achieved through principles established in codes of ethics, to which we return below.
10. The establishment of professional organizations, to disseminate technical knowledge and enhance the professional culture.
11. Society accords prestige and good pay to the members of the profession.

3.5 THE RELATIONSHIP OF A PROFESSION TO THE INDIVIDUAL PROFESSIONAL

In general, the profession serves as an intermediary between society and individual professionals. Society grants the profession an exclusive right to provide a service—a monopoly—as no other group is in a better position to determine whether the service provided is being performed adequately. This implies that the profession should establish control over the actions of its members. As mentioned above, professions do so by establishing criteria for education and membership and by punishing the wrongdoings of members. These conditions are often given legal status in the United States. Additionally, however, professions also attempt to foster a sense of individual responsibility in their members, through the development of professional autonomy, and a sense of duty to the professional community and society as a whole.

38. This relation would generally be characterized as one of "paternalism." This word is based on the Latin root *pater*, which means "father." Hence, a professional would relate to a client as a father does to a child, knowing more and making decisions for a child, although ultimately holding the child's best interests as a top priority. Potential problems exist with this relation, topics related to which are covered in more detail in Chapter 8 on the notion of (professional) autonomy.



At times, professions in the United States have emphasized one or more of these characteristics too much: they have been accused of restricting membership for the economic gain of present members. They have been accused of punishing those who speak out against misdeeds in the profession. They have been accused of failing to punish the misdeeds of members. They have been accused of fostering an atmosphere where upholding the good of the profession becomes more important than the good of society. While there are instances of all of these, it is also important to remember that society continues to accord a great deal of respect to professions and the work of professionals[39]:

- In the case of McDonnell and Miller, and the ASME, list and explain some of the responsibilities the ASME failed to fulfill as a professional organization.
- Do you think professional organizations should be held accountable for the actions of their members? Why or why not?

3.5.1 Engineering as a Profession

Each profession benefits society in terms of its particular mission. The major mission of engineering consists in designing and being responsible for the production of technological devices. In contemporary society, this is an incredibly important and specialized function. However, in the United States at least, the professionalization of engineering has been a relatively recent phenomenon.

In terms of its historical tradition, engineering was primarily craft-based, emphasizing the "apprenticeship" rather than professional model. Schools of engineering did not develop until the mid-19th century, and even then these were organized on a shop floor model. In other words, their main emphasis was on *doing* engineering rather than *theoretical* knowledge. Thus, both educationally and occupationally, the professional model developed

39. Again, with regard to the natures and developments of professions and professional organizations, see Bucher and Strauss (1961) and Bucher and Stelling (1969).

quite slowly. Not until the last part of the 19th century were national professional organizations for engineers founded, and not until the early part of the 20th century were codes of ethics developed. Since that time, there has been intense activity to achieve and maintain the professional status of engineering.[40]

The present state of affairs is somewhat mixed: engineers are generally recognized by society as professionals, but their prestige is not as great as that of traditional professionals, such as doctors. Engineering has been termed "the invisible profession," since its members have generally not had the authority and autonomy associated with other professions.[41] Engineering has had difficulties establishing universal licensing requirements and controls over admission to the profession. Corporations can still hire students without engineering degrees as "engineers," and engineering has been unsuccessful in establishing more than a 4-year degree as the minimum requirement for admission to the profession.[42] However, at least with regard to public perception of engineering, as noted previously, the profession has been quite successful.

3.6 PROFESSIONAL ORGANIZATIONS

The profession plays an important role in the lives of individual engineers. It mainly does so through a variety of professional organizations. The following section considers the role of these organizations in more detail, by examining how engineering organizations have influenced the development of a moral basis for engineering through the establishment of codes of ethics.

3.6.1 Professional Organizations and Codes of Ethics: Some Examples

Based on the contractual model of professions discussed above, one of the most important functions professions exercise is control over their members: the profession guarantees to society the adequacy of work performed by the profession, and it must have the means to ensure this guarantee is met. Professional associations are generally responsible for exercising these controls over their members. As was shown in the case at the beginning of this chapter, professional associations, such as the ASME, are responsible for the development of technical standards, setting up of behavioral norms, and, additionally, the establishment of licensing and educational requirements.

Some professions have one central organization that exercises all of these functions, for example, the American Medical Association, and various specialty organizations devoted to subdisciplines, for example, the American

40. For more on the nature and development of engineering as a profession, see Layton (1986).
41. Regarding engineering as "the invisible profession," see Fitzgerald (2005).
42. For more on licensing requirements of professional engineers in the United States, see the NSPE's (National Society of Professional Engineers) website: http://www.nspe.org.

Psychiatric Association.[43] In the United States, engineering has no such central organization, probably in large part because engineering lacks universal licensing requirements. Instead, different organizations administer the various functions of the profession:

1. *National Society of Professional Engineers* (NSPE)—responsible for the development of licensing procedures. However, in the United States, licenses themselves are granted by individual states through the administration of individual state professional engineering organizations. In the United States, less than 20% of practicing engineers are licensed, due to an "industrial exemption." This refers to the fact that, in companies, licensed engineers can certify (approve) the work of other, nonlicensed engineers. As a group, civil engineers are the most heavily registered (licensed).[44]
2. Technical organizations—each major branch of engineering has its own organization responsible for the transmission of new knowledge and fraternal bonding. Many smaller, subspecialty organizations also exist. The major technical organizations include the *American Society of Mechanical Engineers* (ASME), *American Society of Civil Engineers* (ASCE), *American Institute of Chemical Engineers* (AIChE), and *Institute of Electrical and Electronics Engineers* (IEEE). These organizations are responsible for the development of technical standards within engineering. The *American Association of Engineering Societies* (AAES) was formed to bring together the various professional organizations in a common forum, but its effectiveness has been somewhat limited.
3. *Accreditation Board for Engineering and Technology* (ABET)—responsible for accrediting engineering and technology education programs at colleges and universities. ABET periodically reviews the contents of programs in accredited departments. Even if programs are not accredited, however, colleges and universities can still offer engineering programs and grant degrees.
4. *American Society for Engineering Education* (ASEE)—responsible for assisting in the exchange of the latest educational information and developing ties between universities and industry.

Again, due to the wide variety of organizations to which engineers belong, the enforcement powers of engineering as a profession have been somewhat limited.

3.6.2 A Short History of Codes of Ethics

Along with informal social sanctions, codes of ethics are the primary means through which professions control the actions of their members. In some

43. For more on the nature and development of the medical profession in the United States, see Ham and Alberti (2002).
44. Again, for more on the NSPE, readers are referred to its website at http://www.nspe.org.

professions, these codes have the force of law, since the state has designated them as such. Nurses in the United States, for example, can be prosecuted and punished for violating their professional codes of ethics, no longer able to practice nursing. Due to the fragmented nature of the profession, however, this is not the case in engineering. Nevertheless, engineering codes of ethics are visible symbols of the profession's commitment to the public good. To better understand the ideals underlying engineering codes of ethics, it is necessary to turn to ancient times.

In ancient Greece, Hippocrates developed one of the most famous codes for medicine. Its well-known introduction begins, "first, do no harm." Even before that, however, a code existed with implications for engineers: in 1758 BC, the Babylonian king established laws for civil engineers in the Code of Hammurabi, based on an "eye-for-an-eye" philosophy: "if a builder has built a house for a man and has not made his work sound and the house which he has built has fallen down and so caused the death of the householder, that builder shall be put to death."

In more recent times, 1847, the American Medical Association institutionalized a code of ethics, to which to the development of engineering codes can be traced back. In the early 20th century, the first US engineering codes of ethics were based on the medical code. The development of these codes was a rather obvious attempt to share in the prestige associated with the medical profession and, for this reason, they reflected the perspective of the medical code almost in full. The greatest consequence of this perspective is that engineers were conceived as independent practitioners in serving clients, rather than as employees working in companies. Additionally, these codes stressed the importance of fraternal relations between engineers. It was almost half a century before the ideal of public service came to prominence in engineering codes of ethics.[45]

A variety of engineering codes now exist, although most are similar to the ASME code of ethics (ASME, 2012a). For this reason, the rest of the discussion here focuses on the ASME code of ethics as an example. In examining this code, its historical nature should be kept in mind; it results from a variety of compromises. Additionally, as with other engineering codes of ethics, the ASME code contains propositions that potentially conflict with each other:

- Identify an occupation other than engineering that might be considered a profession but is currently not. Explain why and how it could be regarded as a profession.
- Do you think one professional organization responsible for overseeing the whole of engineering—like the American Medical Association for medicine—is feasible? Why or why not?

45. For more on the nature and history of codes of engineering ethics, see Luegenbiehl (1983) and Davis (2001).

3.6.3 The Contents of Codes of Ethics: ASME as an Example

The ASME Code of Ethics is comprised by ideals, principles, rules, guidelines, and rights. It has been used in a variety of ways: for the sake of professionalization, protection of group interests, teaching etiquette, inspiration and education, enforcement, and public relations. The focus here will be on the ethical content of the ASME code. The code consists of three main parts: (1) the Fundamental Principles, (2) the Fundamental Canons, and the (3) Criteria for Interpretation of the Canons (ASME, 2012b).

The Fundamental Principles section describes ideals toward which engineers should aspire. These principles are broad in scope and represent to the public the engineering profession. The following is the Fundamental Principles section of the ASME code in full:

"Engineers uphold and advance the integrity, honor, and dignity of the engineering profession by

- **I.** using their knowledge and skill for the enhancement of human welfare;
- **II.** being honest and impartial, and serving with fidelity their clients (including their employers) and the public; and
- **III.** striving to increase the competence and prestige of the engineering profession."[46]

Compared with the Fundamental Principles, the Fundamental Canons are more rule-like in their assertions. There are 10 canons in total, and they address the following: the fundamental responsibility of engineers to maintain public safety, the environment, requirements of competence, honesty, loyalty, and fairness, as well as duty to support the profession and professionalism. The following is the Fundamental Canons section of the ASME code in full:

1. "Engineers shall hold paramount the safety, health, and welfare of the public in the performance of their professional duties.
2. Engineers shall perform services only in the areas of their competence; they shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
3. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional and ethical development of those engineers under their supervision.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees and shall avoid conflicts of interest or the appearance of conflicts of interest.
5. Engineers shall respect the proprietary information and intellectual property rights of others, including charitable organizations and professional societies in the engineering field.

46. The ASME Code of Ethics can be found in its entirety at the ASME's website: https://www.asme.org/getmedia/9EB36017-FA98-477E-8A73-77B04B36D410/P157_Ethics.aspx.

6. Engineers shall associate only with reputable persons or organizations.
7. Engineers shall issue public statements only in an objective and truthful manner and shall avoid any conduct that brings discredit upon the profession.
8. Engineers shall consider environmental impact and sustainable development in the performance of their professional duties.
9. Engineers shall not seek ethical sanction against another engineer unless there is good reason to do so under the relevant codes, policies, and procedures governing that engineer's ethical conduct.
10. Engineers who are members of the society shall endeavor to abide by the constitution, bylaws, and policies of the society, and they shall disclose knowledge of any matter involving another member's alleged violation of this code of ethics or the society's conflicts of interest policy in a prompt, complete, and truthful manner to the chair of the ethics committee."[47]

Related to the ASME's Code of Ethics is its criteria for interpretation of the Canons. These give more detailed interpretations of the canons, to provide engineers with guidance in how to interpret the canons and to provide the profession with specific, enforceable entries. Unlike either the principles or the canons, the guidelines are rather long and go on for a number of pages. Thus, the following is merely a sample from the ASME's criteria for interpretation of the Canons, included to give readers a sense of their specificity:

> "1.c.(2)Engineers shall conduct reviews of the safety and reliability of the designs, products, or systems for which they are responsible before indicating preliminary acceptance and before giving their approval to the plans for the design…
>
> 1.d.If engineers have knowledge of or reason to believe that another person or firm may be in violation of any of the provisions of these Canons, they shall present such information to the proper authority in writing and shall cooperate with the proper authority in furnishing such further information or assistance as may be required…
>
> 2.a.Engineers shall undertake responsible charge of engineering assignments only when qualified by education and/or experience in the specific technical field of engineering involved…
>
> 4.e.Engineers shall neither solicit nor accept gratuities, directly or indirectly, from contractors, their agents, or other parties dealing with their clients or employers in connection with work for which they are responsible. Where official public policy or employers' policies tolerate acceptance of modest gratuities or gifts, engineers shall avoid a conflict of interest by complying with appropriate policies and shall avoid the appearance of a conflict of interest…

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47. Again, the ASME Code of Ethics can be found in its entirety at the ASME's website: https://www.asme.org/getmedia/9EB36017-FA98-477E-8A73-77B04B36D410/P157_Ethics.aspx.

4.j.Engineers shall treat information coming to them in the course of their assignments as confidential and shall not use such information as a means of making personal profit if such action is adverse to the interests of their clients, their employers, or the public…

4.m.Engineers shall admit their own errors when proven wrong and refrain from distorting or altering the facts to justify their mistakes or decisions…

7.d.Engineers shall issue no statements, criticisms, or arguments on engineering matters that are inspired or paid for by any interested party, unless they preface their comments by identifying themselves, by disclosing the identities of the party or parties on whose behalf they are speaking, and by revealing the existence of any financial interest they may have in matters under discussion.

7.e.Engineers shall be truthful in explaining their work and merit and shall avoid any act tending to promote their own interest at the expense of the integrity and honor of the profession or another individual…

8.a.Engineers shall concern themselves with the impact of their plans and designs on the environment. When the impact is a clear threat to health or safety of the public, then the guidelines for this Canon revert to those of Canon 1…"[48]

- What do you think legitimizes codes of ethics, causing members of professions to adhere to them?
- List and explain both advantages and disadvantages engineers active in professional organizations might face versus engineers not active in such organizations? Explain your answers.

CASE STUDY TWO—GLOBAL PROFESSIONALISM? CHINA AND INDIA

In this chapter, establishing the relationship between professionalism and ethics, discussions have mainly focused on the nature and examples of professionalism in the United States. However, some have argued that grounding ethics in professionalism is inappropriate, since the notion and nature of professionalism is a largely US phenomenon and, therefore, inappropriate as a basis for applied ethics in cross-cultural and international contexts (Luegenbiehl & Fudano, 2005; Didier, 2010).

Although engineers should be sensitive to the environments in which they find themselves, professionalism should not be construed as a uniquely US phenomenon. In fact, the ambiguous nature of engineering as a profession and the consequences that follow from this ambiguity are a relatively universal phenomenon. To support this claim, the following considers the state and nature of professionalism in two of the world's most populous and quickly developing countries, China and India. China and India now graduate and employ more

48. The complete criteria for interpretation of the Canons can be found at the ASME's website: https://www.asme.org/getmedia/6e30b7a8-1be2-452a-83ec-9330d06175c8/Criteria_Fundamental_Canons.aspx.

engineers than any other countries. Better understanding the natures, while examining examples, of engineering professionalism in these countries helps to support the centrality of professionalism to a global account of engineering ethics.

Engineering Professionalism in China[49]

As in the United States, in China the terms "engineer" (工程师) and "engineering" (工科/理工) are somewhat ambiguous: no clear definitions or definite criteria exist regarding what it would mean to be an engineer or count as engineering, although the terms are tied to "science and technology" (科技). In China, the term "engineer" denotes a job title more than a profession. For example, like the computer industry in general and the field of software development specifically, one who holds a degree in computer science might be referred to as a "software engineer," although this would be used as a job title rather than a professional moniker. Hence, as in the United States, in China, the professional nature of engineering is fragmentary, originating from and evident in university education to professional organizations and government-industry initiatives.

Considerable variation exists in the organization of Chinese universities, affecting the institutional standing of engineering. In Peking University, for instance, departments fall under broader categories, such as science, engineering and technology, and art and humanity. In Tsinghua University, by contrast, departments fall under specific subjects, such as math, physics, chemistry, and mechanics. Hence, although engineering is related to science and technology, clear boundaries between them do not exist. The ambiguous status of engineering as a profession within China is also evident in the nature of its professional organizations.

Founded in 1994 and under the direct administration of the State Council, the Chinese Academy of Engineering (henceforth the CAE) is the highest academic institution in the field of science and technology. However, the CAE does not directly oversee either research institutes or state labs and, thus, does not carry out research, unlike, for example, the Chinese Academy of Science. Rather, the main role of its members is to provide expertise guidance regarding potential engineering programs carried out by the State Council. For this reason, membership in the CAE is highly selective and honorary in nature. Traditionally, CAE members have been based in research universities and institutes although, as of late, the ratio of members from the private sector and business has increased. Membership is based on approval by the whole of the CAE, and the nomination of new members is proposed by current members of the CAE or China Association for Science and Technology (hereafter the CAST).[50]

49. This refers to the People's Republic of China (mainland China) rather than the Republic of China (Taiwan).

50. Information regarding the CAE can be found at its website, including a list of members and their educational background and work experience: http://www.cae.cn.

Unlike the CAE, which is an elite advisory organization consisting in honorary membership, the CAST is primarily a social organization with millions of members—although most individuals holding executive positions have government backgrounds. The CAST was established in 1958, resulting from the combination of two previous organizations focused on exchanging knowledge between scholars and distributing knowledge to the public, respectively. Based on its origins, today the CAST is responsible for providing educational assistance programs, transmitting knowledge to the public, and facilitating the exchange of knowledge within industries. For example, in collaboration with the Ministry of Education, the CAST organizes educational programs and competitions for students—such as an award program for future scientists—activities for the exchange of academic information for scientists and engineers, and science events for the general public. These programs and competitions aim at integrating academic education and research with industry. Hence, similar to technical engineering organizations in the United States, the CAST has a variety of suborganizations associated with different specialties, such as the Chinese Mechanical Engineering Society (CMES) and Chemical Industry and Engineering Society of China (CIESC). Unlike technical engineering organizations in the United States, however, the CMES, CIES, and other suborganizations within the CAST are not responsible for developing technical standards for industry.[51] Rather, these are the responsibilities of the Ministry of Industry and Information Technology (henceforth the MIIT).

The MIIT is responsible for developing industrial production standards: it sets all official industrial and technical standards in China. Having been founded in 2008—as a result of departmentalization reforms in the State Council—the MIIT is a relatively new institution (Xu, 2008). Since the Chinese government takes an active role in markets, the MIIT is also responsible for determining the technical directions toward which industries should move. Information technology is particularly important, such that the MIIT controls communication networks, tasked with safeguarding information. Hence, within the field of information technologies, the MIIT is also responsible for foreign cooperation and exchange. In 2016, for example, it organized a group to attend and present at the Consumer Electronics Show in Las Vegas, the United States, both to present Chinese research and learn about that of other countries[52]:

- What advantages and disadvantages might result from fluid definitions and understandings of engineering?
- What advantages and disadvantages might result from the MIIT—rather than organizations associated with engineering specialties—determining industrial standards?

51. Information about the CAST, including organized events, can be found at its website: http://www.cast.org.cn.

52. Information concerning the MIIT, including that regarding its foundation, functions, and members can be found online: http://www.miit.gov.cn. For more on the nature of engineering practice and ethics in China, see Zhu (2010).

Engineering Professionalism in India

Given its colonial past under British rule—and the subsequent development of institutions based on this past—the organization of engineering in India is closer to its North American and European counterparts than that of China. Examining this development sheds light on the nature of engineering in India today.

Professionally, the Institution of Engineers India (henceforth the IEI) is the oldest engineering organization in India, established in Calcutta (present-day Kolkata) on Sep. 13, 1920. It gained prominence when granted a royal charter by King George V in 1935. Educationally, the first Indian Institute of Technology (IITs) was founded in Kharagpur (West Bengal) by parliament in 1956, although engineering did not become popular as a field of education and occupation until the 1990s (Karnik, 2015).

To a large extent, this increase in popularity can be explained with reference to changes in India's economy: the expansion of foreign trade in the private sector, resulting in greater national importance attached to software services, technology outsourcing, building construction, etc. This emphasis has resulted, in turn, in greater demand for specialists and experts in the field of engineering (Karnik, 2015). Meeting this demand has helped to create a better, more fluid Indian economy, but has also required greater oversight to ensure the quality of engineering education and engineering as a profession.

Within education at the IITs, the IEI has recognized programs in agricultural, electrical, mechanical, and metallurgical engineering, as well as naval architecture and marine engineering ("Historical Events"), and the National Institute of Technology (NITs) was founded to administer regional colleges by the Indian government in 2002. In Aug. 2014, the Indian Ministry of Human Resources and Development (MHRD) brought together directors of IITs and NITs, establishing a committee to set up a national ranking framework for engineering and business institutions.[53] In terms of professionalism, the IEI is a signatory of the International Professional Engineers Agreement (IPEA), with bilateral agreements between a variety of national and international engineering institutions.

To become a professional engineer (PE) or an international professional engineer (IntPE) in India, an applicant must hold a Bachelor of Engineering (BE), Bachelor of Technology (BTech), or an equivalent degree—for example, a Bachelor of Science (BSc)—from an institution recognized by the Indian government or a statutory authority. Additionally, an individual should have at least 7 years experience in his or her field, of which two should be in positions of responsibility devoted to significant engineering activity ("Professional Engineers"). The Board for Certification, composed of representatives from national professional institutions, reviews and decides on applications.[54]

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53. For more information, see https://www.nirfindia.org/Home.

54. This process is similar in nature to that of becoming a PE in the United States, as established by the NSPE, where, in general, an applicant should (1) hold an engineering degree from an ABET accredited program, (2) pass the Fundamentals of Engineering exam, (3) acquire 4 years professional experience, and (4) pass the Principles and Practice of Engineering exam in the licensing state ("How to Get Licensed").

Although the profession of engineering in India is similar to that in many Western countries, as a profession, engineering exists in India among other features of social organization, one of which is the caste system.

With premodern roots, the Indian caste system is a form of institutionalized social stratification based on birth, where those occupying higher castes have traditionally had greater opportunities—in terms of work, marriage, etc.—than those occupying lower castes. The Congress party, formed approximately 200 years ago, has run on ideals of equality and progress, coming to power and forming coalition governments by promising greater opportunities to those marginalized within Indian society. This has lead to the creation of quotas for Scheduled Castes (SC) and Scheduled Tribes (ST) for spots in institutions of national education and jobs in government, influencing the profession of engineering throughout the country. As with programs of affirmative action in the United States, many in India worry that this quota system results in less-qualified candidates receiving positions based on their castes.[55] Additionally, many multinational corporations have set up programs to address inequalities associated with the caste system in India. The software giant Infosys, for instance, has set up programs to train individuals from lower castes, and the company often hires candidates from these programs.

3.7 SUMMARY

As the case at the beginning of this chapter demonstrates, versus mere occupations and occupational workers, society has higher expectations of professions, professionals, and professional organizations, holding them to higher standards. In part, this results from the fact that society provides professionals with relatively high prestige, pay, authority, and autonomy. This would be part of a contract-model understanding of professions, where society gives these to professionals in exchange for professionals providing society with indispensable services and insuring the quality of these services. Professions ensure this quality through the control of its members, in the form of the licensing, accreditation, and codes of ethics. Although engineering has gone a long way in establishing itself as a profession, its status is still ambiguous: neither has engineering a monopoly on the service of engineering nor does it solely determine who can or cannot be considered an engineer. This organization of engineering as a profession is not limited to the United States. Engineering exists in the form of a profession—with complex relations between individual engineers, engineering organizations, and society—in two of the world's most populous, quickly developing countries, China and India.

55. For more on India's caste system, see Business and Caste in India: With Reservations (2007).

REVIEW QUESTIONS

1. List and explain the characteristics of Hydrolevel's boiler cutoff valves that allegedly made them unsafe.
2. In which companies did Hardin hold positions and how did he take advantage of holding these positions simultaneously?
3. Explain how the Hippocratic Oath and Code of Hammurabi have shaped modern-day understandings of ethics for engineers.
4. List the parties involved in the contract model of professionalism and explain the relations between these parties.
5. What roles do codes of ethics play in the relationship between individual professionals, professional groups, and society?
6. Describe how engineering has developed as a profession since the mid-19th century.
7. Name the three main components of the ASME Code of Ethics, explaining how they function.
8. Explain similarities and differences between the development of engineering as a profession in China and India and potential reasons for these differences.

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