Study on Professional Engineering Organizations

PROFESSIONAL ENGINEERING ORGANIZATIONS

Professional engineering organizations are the primary channels by which engineers working in particular technical disciplines, or otherwise possessing common interests, share technical knowledge, regulate professional practice, influence public policy, and maintain the traditions and reputation of the profession. These organizations, as well as the profession of engineering itself, are of relatively recent origin, arising during the Industrial Revolution. In contrast, the primary object with which engineering is concerned—technology—is of ancient origin.

Historical Background

Throughout the history of civilization, humans have been engaged in developing and adjusting to changed circumstances for technological development. Construction, shipbuilding, irrigation, mining, metallurgy, and military fortification are prominent examples of technologies with extensive histories. Prior to the eighteenth century, the bulk of knowledge and practices in these areas was largely uncodified, slow to spread between geographic regions, and passed from one generation to another mainly through apprenticeship.

During certain periods, the artisans and tradespeople who plied these skills organized themselves for mutual benefit. In the late Roman and Byzantine periods, such organizations were called collegia, and in medieval times, guilds. Among the purposes these organizations served, were the regulation of prices, product quality, and entry into the craft. But with the coming of the Scientific and Industrial Revolutions, the status of guilds diminished as the pace of technological development accelerated and the expansion of trade routes increased the availability of imported goods.

By the late-eighteenth century, developments such as the advent of steam power, the increased complexity of military ordnance, the rise of canal building, and the genesis of mechanized production had begun to cause significant changes in society, and the need for a more formal means of acquiring and transmitting technical training began to grow. One leader in the creation of technical schools was France, first for military engineers, and then for engineers engaged in civilian projects. This model for technical education, which relied heavily upon mathematics, spread to other parts of continental Europe by the early-nineteenth century, and to England and the United States in the following decades.

Although England lagged France in developing technical schools, it was at the forefront of the Industrial Revolution by virtue of industrious, self-made engineers such as John Smeaton (1724–1792), who is widely considered to be the founder of the civil engineering profession. In 1771 he formed the Society of Civil Engineers, which was later renamed the Smeatonian Society. The meetings of this society were generally informal, and membership was not necessarily restricted to engineers; rather it also included those who had business or political interests in the engineering of public works.

In 1818 the Institution of Civil Engineers (ICE) was founded in England and is considered to be the earliest of the modern professional engineering societies. Its membership was restricted to practicing engineers and meetings were expressly for the purpose of exchanging technical information. Although the ICE grew slowly during its first couple of decades, these two characteristics formed the basic blueprint for subsequent societies, the next one of which was the Institution of Civil Engineers of Ireland formed in 1835. The Swiss Society of Engineers and Architects, followed in 1837, and then in 1847 the British Institution of Mechanical Engineers and the Royal Institution of Engineers in the Netherlands were formed. Between 1850 and 1900, no fewer than thirty additional professional engineering societies began operating in Europe, Scandinavia, North America, South America, South Africa, and Japan. Subsequently the number and types of professional engineering societies grew rapidly such that by the start of the twenty-first century hundreds of organizations existed worldwide.

Diversity of Technical Disciplines

The first main differentiation among types of professional engineering societies occurred along disciplinary lines. The original term civil engineering was meant to distinguish engineers engaged in the building of public works from military engineers. By the mid-nineteenth century, the rise of steam power, railroads, and mechanized production led to a divergence between mechanical engineering and civil engineering. By the latter part of the 1800s, societies had formed for mining engineering, electrical engineering, marine engineering, and sanitary engineering. In the United States, five organizations have become known as the founder societies. These are the American Society of Civil Engineers (ASCE, formed in 1852), the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME, formed in 1871), the American Society of Mechanical Engineers (ASME, formed in 1880), the Institute of Electrical and Electronics Engineers (IEEE, formed in 1963 from the merger of the American Institute of Electrical Engineers [AIEE, formed in 1884] with the Institute of Radio Engineers [IRE, formed in 1912]), and the American Institute of Chemical Engineers (AIChE, formed in1908). In 1904 the then existing four ancestor organizations formed a meta-organization known as the United Engineering Society (UES) in an effort to unify the engineering profession, but it failed to thrive. In 1979 the American Association of Engineering Societies (AAES) was founded with a similar goal. However the continued emergence of new and dissimilar engineering disciplines (e.g., automotive, aerospace, industrial, nuclear, computer, and biomedical), along with the increasing diversity of knowledge within each discipline, has proved to be a powerfully fragmenting force within the profession, and has generally thwarted attempts at unification. Thus the proliferation of professional engineering organizations accelerated through the twentieth century, paralleling the expanding scope of science and technology.

For this type of society, one organized around a particular technical discipline, the primary purposes are typically (a) to foster the presentation, discussion, and dissemination of the latest technical information and practices relevant to the discipline and its associated industry; (b) to provide a mechanism for overseeing the development of technical codes and standards relating to safety and uniformity in that industry; and (c) to promote the reputation and welfare of both the profession and the industry. In support of these main functions, societies frequently take on additional roles, such as supporting educational programs, lobbying political bodies, establishing professional ethics codes, documenting the history of the discipline, and offering various career development and continuing education benefits to members.

The technical engineering societies span a broad spectrum with respect to size, scope of activities, and focus of mission. Some tend to have close ties with particular industries, and engage in very practical activities that serve to promote and support those industries. Others maintain more independence, and pursue a broader agenda of technical and professional development activities. Overall these technically-oriented engineering societies, via research journals, conference proceedings, and trade magazines, are responsible for the bulk of engineering technical publication worldwide.

The technical societies are also instrumental for the development of technical codes and standards, which either serve to facilitate the compatibility of products and services across an industry, or which become incorporated in laws prescribing safe engineering practices. For example since its inception ASME has been engaged in the work of standardizing the specifications for such items as screw threads and pipe fittings, and in developing safety codes for the design of boilers and pressure vessels, explosions of which had been a serious safety hazard throughout the 1800s. The IEEE has been responsible for developing codes and standards on topics ranging from electrical insulation to digital communications protocols. What in the United States have been the purview of non-governmental organizations have in Europe, however, often been the responsibility of a government ministry.

Regulation of Professional Practice

The traditional focus of the discipline-specific engineering societies—developing a particular body of technical knowledge and overseeing its application in related industries—has proved to be a powerful organizing principle that is relatively loose and inclusive, largely transcending geographic boundaries, employment status, and political climate. In contrast there is another organizing principle that is more parochial, more exclusive, and more entwined with political and legal affairs. This organizing principle, which has given rise to a different type of professional engineering organization, is the idea that the title engineer, and the practice of engineering, ought to be controlled, either through a legislated process for licensure, or otherwise formalized procedures for registration. The organizations that have developed around this idea are the various state, provincial, and national societies and boards that oversee and promote professional licensure or registration.

In the United States the first law regarding the licensing of engineers was enacted in Wyoming in 1907 in response to disputes over property and water rights caused by incompetent surveyors. Other states also enacted engineering licensure laws following negative events, such as the St. Francis Dam collapse in California in 1928 and a school boiler explosion in Texas in 1937, both of which resulted in hundreds of lives lost. By 1950 all states had licensing laws. In 1934 the National Society of Professional Engineers (NSPE) was founded in the United States with the mission of promoting "the competent, ethical, and professional practice of engineering," mainly through the endorsement of licensure, which is a requirement for NSPE membership. In addition each state has its own NSPE affiliate organization, many of which, such as the Ohio Society for Professional Engineers (formed in 1878), pre-date the NSPE itself. Because licensing laws are enacted at the state level, these state-level organizations lobby state legislatures to maintain and improve the laws, and work with the state boards that oversee their enforcement. Licensure generally requires an education from an accredited institution, passage of qualifying examinations, and a specified number of years of probationary engineering experience.

Notwithstanding these developments, in the United States licensure has remained a difficult issue for the engineering profession. Most state licensing laws restrict the use of the Professional Engineer title and the offering of engineering services to the public. These requirements for licensure have had the biggest effects on civil engineers engaged in the design and construction of public works, and on consulting engineers. However the majority of engineers are employed by companies to do internal product design and development, product testing, technical sales, or project management. These engineers are exempt from licensure, with the result that less than 20 percent of engineers are licensed in the United States. NSPE and its state affiliates have struggled to convince more engineers of the benefits of licensure to both the individual and the profession.

While licensing laws affect only a small minority of engineers in the United States, legal constraints on engineering practice are even less strict in many other countries. In the United Kingdom, for example, neither the title of engineer nor the practice of engineering are restricted. There is, however, a voluntary engineering registration system that confers the title Chartered Engineer upon qualified applicants. This registration process is governed by the Engineering Council (UK), which is an independent, royal-chartered organization comprising most of the discipline-specific engineering societies in Great Britain as corporate members. In continental Europe, a few countries, notably Germany, Italy, Austria, and Luxembourg, place a significant degree of legal restriction on engineering practice, while in most other countries the constraints are more lax, or else nonexistent. The European Federation of National Engineering Associations (FEANI) serves to coordinate engineering registration qualifications between European nations to allow engineers the freedom to practice across international borders. FEANI confers the title EUR ING (European Engineer) to qualified applicants. In a related international effort, the Engineers Mobility Forum (EMF), together with the Engineer Coordinating Committee of the Asia-Pacific Economic Cooperation (APEC), comprising national engineering organizations from many countries in Oceania, Asia, Africa, North America, and Europe, have created the International Registry of Professional Engineers to facilitate comity in engineering qualifications between countries.

The overriding concern of these engineering professional organizations is to protect the reputation, professional status, and economic interests of the engineering profession by ensuring that engineers, regardless of technical specialty, are certified competent in their practice. In addition these organizations seek to influence political bodies to generate legislation and international agreements protective of the professional status of engineering and conducive to profitable engineering practice. One hallmark of this category of professional organization is the emphasis on the promulgation of codes of ethical conduct for engineers. Though details of the ethical codes vary from organization to organization, the codes generally emanate from a few central canons that are somewhat universal. These include holding public safety and welfare of paramount importance, performing work only in areas of competence, making public statements in an objective and truthful manner, and maintaining the interests and confidentiality of clients and employers. In areas where engineering practice is restricted by licensure laws, elements of these ethical codes are generally incorporated into the legal code. Most of the discipline-specific professional organizations have also adopted their own similar codes of ethics that members are expected to uphold.

Conclusion

The engineering profession is broad in scope, encompassing topics from nuts and bolts to satellite communications, and from deep-sea oil exploration to medical implants. It is heterogeneous in constitution, with practitioners running the gamut from independent consultants to employees of large, multinational corporations, and performing job functions from detailed component design to company CEO. Perhaps because of the diverse nature of the profession, there is a corresponding profusion in the number and types of engineering professional organizations, each seeking to meet the professional needs of some portion of the engineering community.