

Global and Local Aspects of Engineering from a Corporate Perspective

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Engineers, and the corporations in which they function, must be able to deal with the dual nature of engineering in the modern global marketplace: The global aspect of engineering involves the use of universal tools and truths, such as the scientific principals on which engineering is founded. The local aspect of engineering involves the corporate level, functioning responsively to individual customers and local culture. For the individual engineer, there are additional characteristics: The global concept embodies knowledge of the overall plans and goals of the corporations for which the engineer works, and the local concept involves the unique art by which the engineer applies scientific principles to solve problems. Success, for both the individual and the corporation, is determined by the ability to successfully integrate the global and local aspects of engineering.

INTRODUCTION

ENGINEERS and the corporations in which they function, must be able to deal with the dual nature of engineering in the modern global marketplace. The global aspect of engineering involves the use of universal tools and truths, such as the scientific principles on which engineering is founded. The local aspect of engineering involves, at the corporate level, functioning responsively to individual customers and local culture. For the individual engineer, there are additional characteristics: the global concept embodies knowledge of the overall plans and goals of the corporation for which the engineer works, and the local concept involves the unique art by which the engineer applies scientific principles to solve problems. Success, for both the individual and the corporation, is determined by the ability to successfully integrate the global and local aspects of engineering.

LOCAL ASPECTS OF ENGINEERING

For the corporation, the local nature of engineering focuses on the interface of the company with individual customers, and the environment in which they function. The environment may be a municipality, a region, or a nation. The company must be shaped by and be sensitive to the local culture, since local environments have unique problems which must be dealt with in specific ways. It is not enough, at the local level, for engineering products and services to be technically correct. While one might expect that local laws and regulations shape the product (US automobile emissions and safety regulations, for instance), there are also regulations covering the manufacturing process, business practices, and labor policies, which are

unique to the local culture. Moreover, the way in which business is conducted is very much dependent on local customs; thus a practice that constitutes good business etiquette in one country may be incorrect in another.

Since the individual engineer is a part of the company, the same local aspects of engineering that apply to the company also apply to the individual. However, there are additional aspects that apply to the individual: each engineer has individual tasks to perform within the corporation, thus these tasks characterize a part of the local aspect of the individual engineer. Another individual local aspect is the art of engineering. The word art involves the ingenuity and personality of the individual. Since engineers are influenced by their own unique experiences, and the culture(s) in which they have lived their lives, it is not surprising that engineers devise unique, individual solutions to a given problem. While the basic scientific tools they use are universal, their interpretation and use is individual.

GLOBAL ASPECTS OF ENGINEERING

The global aspects of engineering for the corporation and the individual engineer are the most easily understood, since they involve universal truths. Engineering involves the use of scientific and mathematical principles, and these are not related to national boundaries. All engineers and engineering corporations must obey the laws of thermodynamics, and any goods they produce are composed of elements found in the periodic table.

For individual engineers, global concerns also involve knowing where they fit in the corporate structure, and the overall goals of the corporation. If the corporation is truly global in nature, this can

be a difficult task, because the company has a different character in each culture where it does business. Thus, an effective engineer may have to successfully function in several different cultures in the course of a career. In other words, to be truly global, an engineer must be able to adapt successfully to a number of local cultures, which may be quite different from the engineer's native culture.

INTEGRATING GLOBAL AND LOCAL ASPECTS

Many engineering problems are global in concept but local in solution. Environmental problems are a good example: environmental characteristics are often global, but the actions that cause them, or correct them, vary according to the local culture involved. For instance, actions involving rain forests in Brazil may affect global warming. As another example, an industrialized nation may be more concerned about power plant emissions than a Third World country, even though all power plants of a given type incrementally affect the global environment in similar ways.

The concept of local actions having global effects raises the issue of ethics for both the corporation and the individual. For instance, if one develops technologies to meet stringent emissions regulations in an industrialized country, is it ethical to build a less stringently controlled plant in a Third World country, or, conversely, is it ethical to build a stringently controlled plant at a monetary cost the Third World country cannot afford? This type of dilemma illustrates the complexities that can arise due to the dual nature of modern engineering. The truly global corporation, and the engineers that work for them, must assume the responsibility to address these issues.

THE GLOBAL CORPORATION

The truly global corporation is one which functions successfully on a global and a local basis. Global corporations can be characterized according to the following criteria:

1. They must offer a global product or service.
2. They must be a global player in the field. That is, they must be one of perhaps three or four companies that meet in competition when a given product or service is required.
3. They must blend in with the local culture wherever they do business.
4. They must have global customers.

The third requirement, or the local element, is where many corporations have failed in the past. A colonial model of corporate structure includes an all-powerful central corporate headquarters which gives satellite divisions little authority or freedom to tailor themselves to the local customer and culture. In contrast, successful global corporations tend to adopt the vertical model of corporate

structure, giving the local division significant autonomy. In fact, each local division may have full global authority over a unique product or service offering. In reality, authority cannot be fully and equally distributed across the entire global network of the corporation, there must still be a central corporate unit to set overall direction, and provide a business figurehead to interface with financial institutions, investors, and other entities.

IMPLICATIONS FOR ENGINEERING EDUCATION

The local and global aspects of engineering for the individual translate loosely into the art and science of engineering. Remember that the art of engineering involves many social and cultural aspects. Successful engineers must, therefore, have an understanding of the society in which they function. In addition, since the science of engineering is not stagnant, the engineer must possess the desire and means to undertake lifelong learning. Thus, engineering education must contain a solid foundation of elements traditionally found in liberal arts curricula, such as courses dealing with the history of cultures and major civilizations. Also, there must be the traditional solid grounding in the sciences and engineering methodologies.

The liberal arts and engineering aspects should be taught in an integrated fashion, rather than being thought of as mutually exclusive. This integration should achieve the following desirable goals:

1. Engineers should be practice-oriented, and be able to continue learning on a lifelong basis.
2. They should possess a strong base for international exposure, global orientation, and global accountability.
3. They should possess a strong base for working in teams to accomplish 'simultaneous' or 'team' engineering. These teams may well be international in nature.

SUMMARY

Engineers, and the global corporations in which they work, must operate successfully at the global and local levels. While global aspects have been emphasized in the past, success in the modern global environment involves the ability to adapt to, and meet the needs of local cultures.

Because engineers must be able to function within a global corporation, they must possess the ability to adapt to a number of local cultures in the course of a career. Thus, in addition to the traditional grounding in science and mathematics, engineering education must emphasize cultural aspects and provide the means for engineers to undertake lifelong learning. There is no reason why liberal arts and technical aspects of education have to be mutually exclusive since the practice, or art, of engineering involves integrating technical concepts according to cultural needs.

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