MANUFACTURING FOR QUALITY: IMPLICATIONS FOR INDUSTRIAL TECHNOLOGISTS

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INTRODUCTION

Manufacturing a product traditionally begins with a product designer or a product engineer who draws an idea into a master drawing generally known as the blueprint. In the process of generating this drawing, the designer usually notes necessary specifications that the manufacturer should incorporate into that product during its production. From this point the manufacturing personnel undertake the task of producing a finished product.

In the process of manufacturing that product, many individuals play different roles along the line. Niebel (1988) noted that "here is where they use initiative and ingenuity to develop efficient tooling, worker and machine relationships, and workstations on new jobs in advance of production, thus assuring that the product will stand the test of stiff competition" (p. 3). Eventually, the materials leave the plant in the form of a finished product, which is then shipped to a customer who needs the manufactured item.

The personnel and tasks involved in the above example are inextricably tied to Industrial Technology programs in two aspects:

1. The personnel of the imaginary manufacturing company could be Industrial Technology graduates, and

2. The materials, processes, and machines are part of what Industrial Technology students learn.

These two factors are not only important aspects of Industrial Technology programs but also are some of the most important elements of this dynamically changing society.

Current Trends in Manufacturing Industry

Current trends have shown that as a society becomes technically mediated, it not only enters into the world market but also, inevitably, struggles to survive the powerful forces of domestic and global competition. Usually, consumers want quality products. Manufacturers, therefore, strive to provide quality products for their customers. This struggle results in a survival-of-the-fittest environment, a major reason why many companies go out of business today. On an international level, it explains the current massive financial investments in research and development by many industrialized nations. For example, the United Nations Industrial Development Organization (cited in Niebel, 1988) reported that while the 10 nations with the highest R&D expenditures per workers are the United States, Japan, France, Switzerland, Sweden, West Germany, Norway, Israel, Belgium and Netherlands, "These countries are among the leaders in productivity" (Niebel, 1988, p. 5).

Many of the thousands of the men and women employed by industrial organizations are graduates of Industrial Technology programs. It then becomes logical to assert that while the responsibility of industrial technology educators rests heavily on educating informed individuals, there is always the need to produce individuals who can work for industrial organizations which are operating in a competitive world.

Many observers share the notion that quality improvement should be the theme in American classrooms if the nation is to regain its competitiveness. Moir (1988), for example, noted that even though quality improvement, as an instrument of corporate policy, is relatively new to students of business and management, it is very important today in the country in order "to ensure survival" (p. 11).

Hayes (1985) observed that productivity improvement (increasing the rate of output per unit dollar) used to be more important to American industrial scene. But, beginning in the early 1970s,

> there was growing concern that consumers did not receive the level of quality they believed they purchased. In an era in which sales are increasingly made on the basis of competitive quality, advertising 'quality' on the basis of warranties and guarantees has lost some of its sales appeal. Consumers would rather receive quality the first time without having to resort to the secondary inconveniences of delay and having to 'negotiate' reimbursements or replacements (p. 7).

Agreeably, producing quality products appears to be the best way to satisfy customers and, at the same time, save the organization. This is particularly true of today's economy.

Implications for Industrial Technologists

The previous discourse relates to the basic functions of a typical manufacturing organization relative to quality. While these activities are true of many industries, it is vitally important to recognize that they are some of the content matters that Industrial Technology students learn at school. It is in the light of this relation that this article is written.

The term 'quality' is difficult to define due to the fact that different users of a product have different standards for the same product. Some users may like the color of a product best, while others may prefer the shape. Still, some may prefer one that is durable, while others may want a product that has some other 'extra features'.

Lumsdaine (1989) stated that "Quality is innate excellence". Some of the characteristics he listed were "performance..., extra features..., conformance..., reliability..., durability..., availability..., aesthetics.., and reputation" (p. 6). Apparently, these descriptive terms join forces in meeting customers' satisfaction. Quality should focus at meeting the needs of customers. Moreover, whatever determines the quality of the product should be designed into its blueprint in the initial stages of the product's development (Wright, 1987). Lumsdaine went further and stated that "...quality is designed into both the product and the manufacturing processes" (p. 7).

According to Wright (1987), three major elements should be considered during the design of any product. First, the designer must design something that must sell, or it will result in a loss for the organization. Clearly, customers (or consumers) make this important decision since they alone know what they want. Designers must be able to verify and retrieve that knowledge from consumers. Determining what consumers want is usually achieved through a potential market study for the product in question.

Secondly, the designer should design for function. Designing for function and selling go hand in hand except that consumers not only want something that functions but also one that has other elements of quality incorporated into it. Hayes (1985) found that "More than a third of the American public thought that U.S. automobiles were poorly made" (p. 8). The functionality of a product also relates to its durability both in the field and over time. Japanese automobiles, for instance, are currently noted for their long life and relatively low maintenance cost.

The third element that the designer must consider is the question of manufacturability. The issue in this regard is that designers should design products with consideration for the resources available to the manufacturer who will eventually make that product.

Leading authorities on quality improvement recognize the importance of education in the struggle to be on the competitive edge. In industry, for example, many employee training programs have been implemented to keep employees up to date with current trends. Although the average Japanese worker spends more days per year on training relative to his or her vocation than the average Western worker, current trends indicate an increase in the worker training programs in general (Moir, 1988). This means that U.S. industries are currently recognizing and implementing employee educational improvement programs.

However, industrial organizations employ thousands of graduates of Industrial Technology programs every year. These employees start with whatever has been taught them throughout their postsecondary education. The impacts they make depend on what they learned at school as students of Industrial Technology. With regard to this, several facts are brought to mind relative to training Industrial Technology students. Heuer (1990) summarized them in the following questions: "What do employers want? What do students need? What should educators teach?" (p. 17) These questions have direct and indirect relations to the following factors:

(1) the prevailing trends in industry versus the curricular offerings of Industrial Technology programs, and

(2) the medium of instruction (instructors and facilities) with which students are taught.

A brief look at these factors will help to understand them better.

Prevailing Trends in Industry Versus Curricular Offerings

Industrial employers endeavor to employ graduates who can identify with their (employers') industrial processes. As a result, they employ individuals with the kinds of competencies which will be beneficial to the employers' organizations.

As has already been indicated, current trends in industry emphasize quality, accompanied by its mother: computer integrated manufacturing (CIM), both of which are now under the shadows of computer integrated business (CIB) (Browne, Harhen, & Shivnan, 1988). Moreover, "The U.S. automakers have been introducing new technologies into their plants. At a cost of more than $80 billion, they are undertaking one of the most massive conversions of plant facilities in industrial history" (Lumsdaine, 1989, p. 7). Weiner (1989) also reported that:

> From tennis shoes to jet airlines, there are few industries in the United States not affected by the cost savings, design efficiency and increased productivity generated by CAD/CAM technology. Each year new vistas are opened as CAD/CAM penetrates further into every corner of American Industry (p. 16).

One common implication from the accounts of these observers is that whatever is out there in the business world determines what students should know which, in itself, has a direct bearing to the curriculum. The curricular offerings are very much associated with the trends in industry. So much has been written on this topic relative to curriculum development (Mager & Beach, 1967; Freitag, 1989). In most cases, the occupational analyses of prevailing industrial jobs are incorporated into the curriculum to ensure that the goal of education is fulfilled relative to the industry in question. Lumsdaine (1989), for example, recommended that the use of computers should be integrated into the entire curriculum in order to keep up with current industrial practices.

In addition to employing current occupational analyses in developing current curricula, there is a growing emphasis on stressing creativity in the classroom. Lumsdaine (1989) recommended that faculties should spend more time teaching problem-solving skills and higher-level thinking. Heuer (1990) noted that:

> In the past, a worker would present a problem to a supervisor, get a solution from that person, and proceed with the work. Present and future workers must not simply recognize the problem, they must also define the problem and propose solutions. In addition, workers must implement the solutions and evaluate the results.(p. 17)

Heuer (1990) also threw a challenge to Industrial Technology educators. He stated that in teaching students creative thinking, "most of all, educators should offer opportunities for failure without reprisal, focusing on the goal rather than the path to the goal" (pp. 18-19). This can only be achieved by giving to the students very challenging assignments/projects, all of which are what industrial enterprises encounter on a daily basis.

The Medium of Instruction with which Students are Taught

The university's core objective has always been the dissemination of knowledge. Because of this, it has been recognized as an expert and granted an autonomy in disseminating that knowledge through its faculties (Corson, 1975).

To maintain that autonomy demands constant personal and professional development of the faculties particularly in the areas of new technologies. Much of this can be accomplished through industrial internships, workshops, reading current technical articles, research/publication, visiting industrial exhibitions, consulting, implementing strong advisory committees with industrial representatives, and such likes. By participating in such professional activities, faculties in turn relate the new knowledge they gained to their students, and at the same time update obsolete facilities with modern ones.

The buildings and equipment that are used for all Industrial Technology programs need constant upgrading to reflect prevailing industrial trends. Many times this involves much capital expenditure in procurement of machines and constructing modern buildings.

However, this is not always the case. Stauffer (1990) suggested that some older pieces of equipment could be retrofitted to bear the features of many state-of-the-art equipment. This has been successfully demonstrated in some universities (Holmes, 1990).

Similarly, buildings and classrooms can be redesigned to suit the particular emphasis. Modern technology demands that appropriate buildings be constructed to match with instructions. Writing to technology educators, Kuskie (1989) stated that "A good technology education facility needs the following areas: research, seminar, storage, production, service and computer.... The curriculum model selected should determine how the areas are arranged" (p. 13). The result of any efforts made in this direction is that students will get an education reflecting any prevailing industrial trend. Such a result is well worth the investment.

CONCLUSION

Society, which Industrial Technologists serve, is experiencing a dynamic technological change as it struggles to compete in the domestic and world market. With consumers demanding quality products, industrial organizations are forced to delve into the inevitable war of internal and global competition. In such an environment, quality means survival to every industrial organization: hence, the need for competent employees who are knowledgeable about quality.

Students of Industrial Technology need to be in tune with current trends in industry. To accomplish this demands that current curricula reflect prevailing trends in industry. Instructors should be familiar with current industrial practices so as to relate those experiences to their students. The facilities with which Industrial Technology programs are taught should also reflect those in the modern workplace, a process that can be facilitated by keeping current with societal change. This is a professional obligation.

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