

## CHAPTER 1 INTRODUCTION

The design of a product is a critical step in the development of a new product. It is the design that determines the product's performance, reliability, and cost. In a global market, the design must be able to meet the needs of a wide range of customers and to be manufactured in a cost-effective and reliable manner. This will provide the leading edge in any manufacturing environment.

There is a global need to encourage designers to explore the opportunities which design may be able to enhance a product's performance, assembly and reduce costs. A key requirement will be for designers see the common link between design and manufacturability and to consider their requirements for new concepts and methods in an integrated manner.

Schweninger [10] believes that all design engineers must interact with the customers and factory. He attempts to make product development engineering and process engineering add together into one hard to distinguish function called "simultaneous engineering". This concept is being practiced in some big multinationals like General Motors of America.

Another important aspect of a good product design is customer involvement. A magazine survey carried out in the United States found that its readers who rated their top twenty suppliers of the year have one thing in common - all practice PFM (Design For Manufacturability) [8]. Among the

related companies are AMI, Inoki Int., General Electric, IBM and Honeywell. They are all concerned with cost reduction in their designs. Industrial Engineering Corp., one of the related companies, will analyze their customer's products and analyze each customer's applications. They then provide their customers with a detailed analysis and make proposals for reduced part count and manufacturing costs.

Robotics and automated assembly has found its niche in today's manufacturing environment. Japan leads the rest of the world in this field. Robotics increases productivity, enhances product quality and also lower product costs. It also provides greater manufacturing flexibility and frees workers from hazardous, strenuous and monotonous jobs. Most companies today are looking towards "ghost factories" type of automation. Future product design will incorporate features for both manual and automated assembly. Such flexibility will allow for future conversions from manual to automated assembly to be made with relatively less cost in redesign.

The reported annual productivity increases of the major industrialised nations between 1976 to 1979 were [5]:

Japan	7.2 %
Italy	5.3 %
Germany	5.0 %
United States	2.3 %

The big disparity between the United States and Japan

... of the utilization of high technology in the US, but the greater acceptance and implementation of new technology by the Japanese. At the Toyota plant it works, for example, each Japanese machine assembler can assemble nine engines per day compared to only two per day by his American counterpart. The difference is brought about partly by the Japanese working culture and largely by the Japanese approach in product design. A good product design is one that will give a more manufacturable product, better quality and reliability with the least cost. All these means that the product should be more easily assembled or manufactured with the minimum amount of rejects. This does not necessarily mean using high technology but rather good product design. Japanese designers design their products with these factors in mind.

Product designs typically account for only 5% of product costs whereas the design itself can directly affect up to 95% of the product's manufacturing processes [7]. Hamiller Engineering Co. of Elgin, Illinois, USA which manufactures aerosol valve assemblies used to have six operators (two per shift) to produce 60 parts per minute (ppm). By switching to automation, it manages to produce 100 ppm with less operators [6]. It modified its vibratory bowl feeders for more efficient and faster feeding. Its piece parts were redesigned using customer feedback and design costs drop from 36% to 25% of total machine costs. All these were achieved with close consultations with customers with no sacrifice to quality.