# Chapter No.1

**introduction**

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1. Introduction

1.1 Project Background

It is often said that design is an old activity, but a new profession. As a new profession, it is gradually occupying important position. Industrial design, which was once considered to be rather a peripheral activity, is now a strategic component of the whole marketing mix that helps companies to earn profit. Design has an immense potential to enhance Quality of product.

To achieve quality improvements in manufactured products; it requires a thorough understanding of essential aspects in the design and manufacturing process along with their interrelations. For several products, this understanding can only be gained if time-efficient, economical methods of experimenting on prototype products are available to a manufacturing industry.

Modern quality improvement methods, for example, (Taguchi, 1993), (Grove, and Davis, 1992), are used along with planned experiments to guide the designer in choosing values for the design parameters. A robust design is achieved when these values make the product performance insensitive to variability's occurring both in manufacture and in product operation. To find values of these design parameter values, experiments often need to be performed on real prototypes in which parameters relating to the design and the manufacturing process vary systematically. The aim is to determine role of design and the effect of changing the design parameters on the product performance and quality.

1.2 Role of Design:

Robust design is routinely used, in both prototypes and computer-based models, in several engineering sectors in the UK, and the USA. Multi-disciplinary groups have worked in electronics (Bates, Buck, Riccomagno, and Wynn, 1996: 77-94), food technology (Tuck, Lewis, and Cottrell, 1993: 671-676), and electrical (Su, Nelder, Wolbert, and Spence, 1996: 101-112) sectors. A much larger research effort is centered in North America; an example of current best practice for the electronic industry is presented by Aslett, Buck, Duvall, Sacks, and Welch, (1998: 31-48), and
theoretical advances in planning small experiments include Lewis, Dean, and Lin, (1995: 213-225).

Progress in some areas of mechanical product manufacturing is observed to be slower worldwide. This is, due to barriers including the lack of accurate predictive models, the expense of real prototypes. Also, the unacceptable delays in time-to-market from investigating large numbers of factors, and the lack of methods for studying non-traditional factors arising from assembly prolong the process.

Even after full exploitation of robust design procedures, performance variation can be unacceptably large in some applications, producing high rejection levels and risking loss of market share. Experimental effort must then be focused on identifying those manufacturing features that dominate performance variation. Such experiments are essential to inform decisions on where to invest resources within the manufacturing process, for example, to improve plant, operator training, and well-focused statistical process control. The pay-off from this experimentation is higher quality, cost effectiveness, etc. In the fierce global competition for more market share in manufacturing industry, the need to reduce the time-to-market for new and improved products has an ever-increasing pressure. New approaches to experimentation must be developed to meet this need and thereby maintain and extend the essential pursuit of robust design.

1.3 Need of Study

Man has been designing mechanical objects for nearly five thousand years. Beginning with the simple potters and evolving to complex consumer products and transportation system. If people have been designing for five thousand years and these are literally millions of mechanical objects that work, and work well, is there need of study design procedures? The answer, simply put, is that there is a continuous need for new, cost effective, high quality products.

Today's products are highly complex, and so it requires a team of individual from diverse fields, with expertise, to develop an idea into hardware. In addition, the global markets have fostered the need to develop new products at unprecedented rate. To compete in this market, a company must be varying efficiently in design of its products. Finally, it has been estimated that root cause of the
problems is with new products not working as they should, taking too long to bring to market, or costing too much, etc, which are the results of the poor design process.

1.4 Application of Project:

The primary purpose of this study is to have better understanding of design. This study is also intended to define the parameters of design process and to find out the vital amongst these design parameters.

Another purpose of this study is to develop conclusions from which precise hypothesis put formed. However, when hypotheses are drawn from conclusions grounded in empirical findings rather than from armchair theorizing, they have a much better chance of holding.

This project aims at providing tools to enable engineers to discover, more effectively than with conventional methods, the key features that control the variability in performance of manufactured products. Understanding of these features will enable resources to be concentrated into specific design modifications and changes in the manufacturing processes. The tools being developed enable sequences of economically efficient, planned experiments for mechanical products to be organised and analysed.

The main intellectual challenges of the work are, developing an effective strategy for planning experiments. When only a few of the components for experimentation are available at any specific time; extending the theory and method of group screening to realistic design situations; exploiting modern optimization techniques in algorithms for semi-controlled plans. A further major challenge is to convert these methods into a viable practical tool, thereby enabling transfer of the new techniques into routine product development procedure.
The methodologies developed within the research project will enable economic and time-efficient product and process improvement across a wide range of engineering products. This activity is essential for manufacturing companies to sustain and expand their market by providing quality products and reducing the time to market for new products. The generic methods will be immediately applicable to mechanical products in general. The methodology offers procedures for companies with different manufacturing philosophies and for products at varying stages of development. The work will also benefit researchers in the various theoretical subjects underpinning the ideas, for example, in engineering quality improvement and experimental design.

Any company already exploiting advantage of existing DOE (Design of Experiment) method, perceives that these methods provide a route for gaining the knowledge necessary to keep quality in the existing manufactured product, and to reduce the time to design for the newer products. A need to extend these methods into the manufacturing process has been identified which should result in improved product quality and reduced wastage.

1.5 Globalisation and the Culture of Design:

The celebrated industrial designer Buckminster Fuller (Synergy, 2002) says that, "The universe is sum-totally design integrity. It is ubiquitous; it's the essence of life." However, in this New World order, which are equally important and pervasive and they too cast their influence on design. The concept of world turning into a global village has brought a considerable paradigm shift in the design idiom. In the context of social evolution, Globalisation can also be perceived as a course of transition from the agrarian-industrial, post industrial and finally the stage of information society. Today we know what is available where, whom it belongs to and how it can be accessed.

In the Indian context, we have seen the transition from the era of protectionism that largely persisted until the 1980s to the era of Globalisation, which made its debut a decade later. From protectionism and import substitution to a free market economy, the transition had been shift and
save. Suddenly there is surge in the market. Products and services are influencing our lifestyle, pattern of consumption, cultural values and ideologies. Life style is simply not concerned with our way of living, its statement of relative affluence and material status, which may, or may not indicate the social status.

Never in the entire history of our civilization did we have so much to choose from the plethora of products. In fact, it’s complicated production consumption web masquerading as life style. Dreams are being sold and marketed aggressively. World is being market place and has broadened the scope for design as well. But is design all about marketing?

What it’s promoting may be formed as ‘cross border consumerism’ unleashed by the multinational giants. Their financial clouts help them buy any intellectual property and patent it to further their business interest. They form cartel take over smallest ventures to finish competition and then dump the market with products often without caring for their cultural relevance and impacts on different societies. In the realm of design, the fist of indigenous verses imported will intensify in the days to come. Socio-cultural studies have revealed that the conversion of local markets into Globalised market has led to the transformation of traditional products, generally used by local communities, into marketable commodities. This might create a situation in which a well-established social order will be replaced by chaos will it commensurate with spirit of design?

Paranoia is no solution to meet any challenge. For its strong economic reasons, Globalisation is here to stay at least until its own contradiction sign it off. The way people were responding to its clarion calls shows it has some kind of a mass appeal. It has opened up new doors of opportunities for certain and made the confluence of cultural possible. This is destroying cultural diversity of world and paring way for a monolithic culture. As design is problem solving device and such, it can’t afford to add to the problems either through products or communication of values that follows. Secondly because design is also very much a part of own social and material environment and response to its needs. Therefore, it could remain obvious of its Socio-cultural and its requirements.
It is also need to look beyond design and marketing relationship, which often reduces its status to mere log in the giant wheel of business. Design must be able to work in tandem with technology, aesthetics, marketing etc; at the same time it should be able to maintain the sovereignty of its own domain. Communication as an important activity of design can help different virtual and real communities re-invent, re-invigorate and finally re-interpret their social norms and cultural identities in terms of global ideas. And this will be a rewarding and fulfilling task for design in the era of Globalisation.

Last year’s Nobel Prize in Economics went to the well-known Economist Mr. George Akerlof, Mr. Michel Spence, and Mr. Joseph Stiglitz for their work on, “Market with Asymmetric Information.” This is based on price-based quality of product in Asian countries. What quality affords customer and what is his buying capacity? Lot of companies is giving commodities at lower price of poor qualities. People are buying these products due to low cost. Until customer getting complaints started, this company vanishes from market. Nevertheless, this is for not all products. Our study reveals that cost is not dominating factor in consumer market. What are his expectation and how to incorporate these expectations inherently in product? This study is a kind of finding solution to it on the way suggested by Mahatma Gandhi. It is recommended to consider end user’s expectation while designing any product. Routine market research method are becoming outdated in today’s competitive environment. So there is a need of the paradigm shift.

Even in Asia, if we consider the example of China, Taiwan, Korea, Malaysia, etc. they are well ahead of India. Concentration on design is one of the reasons behind it. (Outcome of Techno-Design Fusion Workshop, NID, Ahmedabad, 2002). China has more than 100 Design Schools, while India has just about 4-5 Design Schools. We are in need of more design schools, or design parks in
India. DST is concentrating on this issue. They are planning to start more design parks all over
INDIA. The author along with his guide attended Technology-Design Fusion Workshop at NID, Ahmedabad, during 24-25, Jan 2002. In this workshop, it is observed that present research is among the very few researchers working in this area.

1.6 Beyond Market Research, User Participation in Design

Participatory Design approach drawn upon the power of the ordinary people and gives them in turn the means to visualize and express their vision of desired experience vis a vis the products they use. Mahatma Gandhi’s idea of customer has greater relevance for customer-oriented product. He says: “A customer is the most important visitor on our premises. He is not dependent on us. We are dependent on him. He is not an interruption of our work. He is the purpose of it. He is not an outsider to our business. He is part of it. We are not doing any kind of favour by serving him. He is doing us a favour by giving us the opportunity to do so.” Nowadays industry is facing competition from local competitors as well as from MNC also. Therefore, consumer centric product design and development becomes an imperative.

The approach involves use of innovative research tools. This gives an idea about people’s perception of new products, brands and retail environment. The participatory design is essentially an investment into ideas that have their genesis in the customers who are the end users.

User needs and aspiration, aesthetics of form verses aesthetics of experience, role of users in conceptualizing new products, bonds and retail environment etc. are major issues that are taken as area of research work.
1.7 Design for Consumer Products

All the international brand leaders in consumer goods sector, such as Sony, IBM, Bosch, Toyota, Hewlett Packard etc have effectively integrated design into their product development process. Of late, many Indian industries have also developed global competence with the help of design. Telco, Titan, VIP, Symphony, Bajaj and TVS are to name a few. They have well established in house design studios, which has ushered in a new design culture in the country. However design in India still has a long way to go. It has been realized that design is a strategic tool for maximizing profitability. Industrial design has the potential to translate innovative ideas into design, which eventually helps earn profit. Issues like product analysis, product ergonomics, product aesthetics, product graphics, emerging trends in the market, design management and intellectual property rights are having more emphasis nowadays.

But, small-scale industries cannot afford these costly tools for their work. What is the status of design in SSI, ancillary and how to improve it is still a challenge to researchers?

1.8 Application to Small Scale Industries (SSI)

Since Independence, India has been facing major problems such as, (a) Unemployment, (b) Non-efficient Utilization of Resources, etc. As the employment potential is the highest for SSI sector and investment required per person is about 9.7 times less than that of LSI sector. (Kallurkar, 1993:16) SSI is a promising tool for solving above problems. However, the literature study reveals that SSI sector is facing problems for several years. Their product lack in markets and these problems leads to sickness of unit. The no of sick units has been an ever-growing phenomenon.
Clearly, the industrial sickness is an area in the consideration of which the Government must give the priority. Thus, the market performance of SSI sector is a problem of national importance. Considering the national importance of the problem, the SSI sector is undertaken for a research study.

Clear understanding of customer requirements, its use while designing a product reduces substantial time and cost of SSI. This will help them to satisfy customer and enhance market share. A theory is suggested for considering the design parameters of all stakeholders’ preferences. This will minimizes gap and help them to produce sound designed products. Sound designed products minimizes complaints of end user and adds more in qualities to face challenges from others. This model will help them in problem formulation and product design and development. Decisions taken in early stages, have high impact on strategic decisions and saves much time and money of SSI entrepreneur.

This ultimately leads to success of small-scale industry.

1.9 Broad Objective of the Project

The broad objective of this research is to suggest the, “Use of optimized vital design parameter for market success of small scale industries”, and with this broad objective, the work is carried out and reported in the thesis. This project is important to designers, research workers in this field, the research scholars, new/existing entrepreneurs in small-scale industries and the parent institute of the research scholar.

The specific Objectivcs of this study arc as mentioned below.

1.10 The Specific Objectives of the Project

- Provide engineers with economical methods to identify design parameters and these aspects of manufacturing process which achieve improvements in an optimal and cost effective manner
- The demonstration and validation of the new methodologies within manufacturing environments, where the dependency of the product's performance on the design and manufacturing parameters is largely unknown, and where the resources required for conventional methods is prohibitive.
• The incorporation of state-of-the-art optimization techniques into the algorithm to enable rapid on-line generation of product.

• The advancement of the theory, practice and evaluation of screening strategies to reduce the anticipated experimental resource required.

The development of methods of efficient experimentation requires a multi-disciplinary approach involving research and design engineers, with a physical understanding of the engineering processes, applied mathematics with modeling experience of such products, and statisticians with an understanding of the methodology of the design and analysis of experiments.

The importance of the project to the student/the research scholar and the present institute are presented below.

1.11 Usefulness/Importance of the Project to the Research Scholar

It is thought that the project is important to the Scholar due to following aspects.

1. To improve the level of thinking and knowledge about the various aspects of the selected project.

2. To improve the qualification and achieve academic excellence.

3. The satisfaction for contributing a solution to the problem of national importance.

4. To use the knowledge gained by the study, to guide the potential and the existing entrepreneur, and the designer.

5. To convert the present honorary consultancy service to the entrepreneurs of SSI units into a professional consultancy.

6. To provide consultancy in the form of guidance and help to the existing designers and entrepreneurs for improving market share of their product and more customer satisfaction.
1.12 Usefulness / Importance of the Project to the Parent Institute of the Research Scholar

The project is also important to the parent institute in the following areas.

i) It will be useful for establishing and developing ‘Design Park’ in the institute with the main objective:
   a) To produce sound designed product.
   b) To minimize product lead-time by optimizing cost.
   c) To help new entrepreneurs to take strategic planning decisions.
   d) To develop the effective Industry-Institute-Interaction.

ii) The project will be useful to start a Design School at parent institute.

iii) This will also help for Institute’s participation in the DST plans, and Government’s programs related to it.

iv) To introduce M-Des. Program in Engineering Institute, which will have more emphasis on Design, Design Theory and Design Parameters relation with market, success of industries etc. to undertake the research projects in the areas of Design Theory, Problem formulation and Product Design Selection, Consumer Satisfaction, Performance Improvement etc.

   DST has already started to give emphasis on this issue. They are planning to establish more and more Design Schools in India. DST had arranged one workshop at National Institute of Design, Paladi, Ahmedabad, during 24-25 Jan. 2002, named ‘Technology Design Fusion Initiative workshop.’ This workshop recommended emphasizing to Design, establishment of Design Parks, and establishing more Design Schools at Various Engineering Institutes for facing competition from MNC in the era of liberalization, privatization and Globalisation. The workshop pointed that it is the need of hour to put more effort in design research. Hence, it is needless to emphasize the need and importance of research in this area. Observations from the study lead to conclude that this century will be dominated by technology. Hence to tune with the market, to face competition from Global companies, to fight against dumping strategies like China and others consumer centric design is more important tool. Development of such tool is the aim of this research.