

Marketing Based Decision Making Process in Engineering Design

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Abstract

Marketing based decision making process in engineering design is an important study required for industries. How to take efficient decision in design that influence marketing? Most of the engineering design decisions are based on consumer behaviour. Decision making in risk and uncertainty in engineering design is an important phenomenon. Cost and time are the two important factors that results loss because of inefficient decision and it affects marketing. Problems involved in marketing based engineering design and decision making process in solving problems is elaborately studied in this journal. How to choose a design in various alternatives, design process, manufacturing feasibility, material and methodology are the important factors that influences decision making in engineering design for marketing. Different types of theories in decision making process that helps in taking proper decision were studied in this journal. This study is based on data taken from various Research & Development centre in Industries.

Key words: Decision Making, Marketing, engineering design

1. Introduction

Marketing based decision making process is an important phenomenon in engineering industries. Decision making process in engineering design depends on consumer behaviour. In all department decision making process is playing a role. Here in this study, marketing based decision making process in Engineering design is studied. Data collected from various R&D centers that involves in engineering design is used for preparing this journal. Industries that manufacture automotive parts, heavy machinery, heavy vehicles and passenger vehicles are included in this study.

Decision making in engineering design involves a huge investment and it requires a wide range of expertise in design. Cost effective solutions to avoid failures, reducing the number of variants in design process and avoiding failure in final stage of design process making a big impact in design that caused due to inefficient design, and it influences marketing.

How to choose a proper decision in engineering design for marketing, what are all the factors to be studied in making decision, how to resolve a failure in design, and how to rectify the failure in design are ensured by proper decision making process.

2. Objective of this study

Decision making process in engineering design based on marketing is an important phenomenon in management. This study is to understand the marketing dependency for decision making process in engineering design. Decision making process in Engineering plays an important role in output for a manufacturer. Improper decision and delay in making decision makes a huge loss.

The primary objective of this paper is to study the decision making process in engineering design that depends on marketing and secondary objectives are,

1. Decision making process in preparing a design for market requirement
2. Impact of decision making on cost and time for marketing.

3. Literature review

Marketing based decision making process in engineering design is an important factor that defines the efficiency of a product. There are various studies for marketing decision making process in engineering design.

Design process is usually started with a rough data available either theoretical data or practical data or past history of design data for the market requirement. Different kind of design possibilities should be studied to achieve a design approach, and then proper design should be finalized and tested. Design process requires several stages in design and it involves number of iteration in design process and it should be based on the customer requirement.

Marketing based decision making process in engineering design involves study of different types of design process for marketing requirements. Traditional design process consumes lot of effort. Instead of using traditional decision making process, systematic thinking in design methodology make cost effective and efficient design (PTC).

Managerial decision making process in engineering design reduces the failure possibilities in design (Ari Riabacke, 2006). There are so many failure possibilities in design. It is not possible to make a perfect design at the first step itself; it requires several iterations for developing a design. While implementing a design, design failure should be rectified at the initial stage itself to avoid the waste of cost and time involved in design process. There are various failure prediction methods in failure. A proper failure prediction method should be implemented for rectifying the failure at the initial stage itself for an efficient design process.

There are various methods in predicting failure and rectifying failure. What kind of failure prediction method is suitable for that product and should be implemented. That methodology should be cost effective. To manage is to forecast and plan, to organize, to command, to co-ordinate, and to control (Henri Fayol, 1949).

A major concern in management is to understand and improve decision making. Various approaches have been proposed by psychologists, most based on a “divide and conquer” strategy. This strategy also labeled “problem decomposition” involves breaking a large decision problem into similar parts. The idea is not new. In a “Letter to Joseph Priestly,” Benjamin Franklin was one among the first to describe a decomposition strategy. Normative and descriptive analysis in managerial decision making process explains the different types of theories in decision making process (Shanteau, J, 2001).

Number of variants made while freezing a design process involves huge cost and time. Proper decision making process in engineering design reduces the number of variants. Reduces the marketing time. Different types of alternatives should be studied at the initial stage of the design process and then number of variants should be tried for testing. So that number of variants can be reduced. It increases the overall cost involved in engineering design. (Basi, 1998) gives insight to the types of decision making skills required individuals require at various levels in an organization.

Most of the design involves risk and uncertainty because it requires lot of failure prediction techniques to withstand the failures at different circumstances for marketing. Failure in design causes bad name for the product with the customers. Life cycle evaluation of the product based on several failure possibilities avoids this risk and uncertainty in design. Probability study is conducted for the number of occurrences for the failures and reason, because some kind of failure may be specific and it is not same for all kind of applications. So specific kind of approach can be used to study the requirement and a product should be designed based on the market requirement.

4. Marketing based decision making process in engineering design

Decision making process is very important in engineering design. What are all the factors to be considered in making decision in engineering design for marketing? Is an important question that usually arises in making a new design.

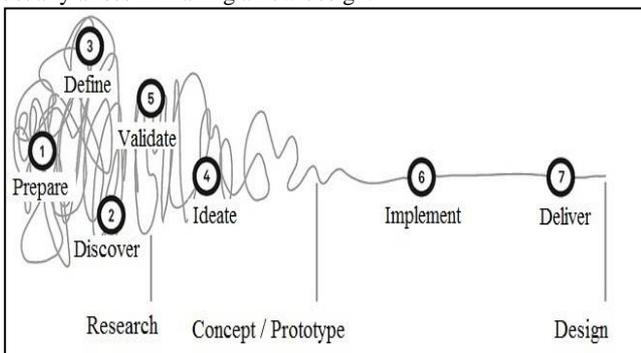


Figure 1: Design process

While starting a design, there will be a rough data and after that it will get standardized based on various factors and market requirements, decision taken at different levels in design process streamlines the design (Figure 1).

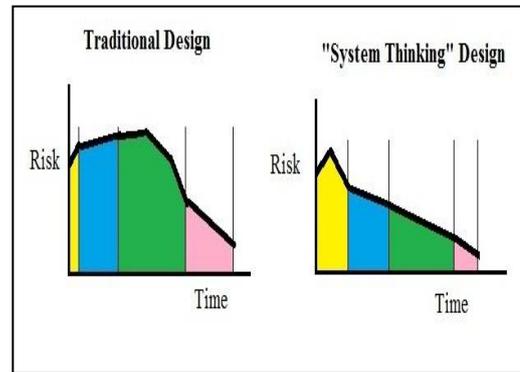


Figure 2: Traditional design Vs System thinking design

Traditional methods available in design consumes huge time and cost. It can be avoided by systematic design with testing. It requires lot of expertise and creative thinking for making a decision in evolving a new design. Market plays a role in that and it requires new designs with competitive price.

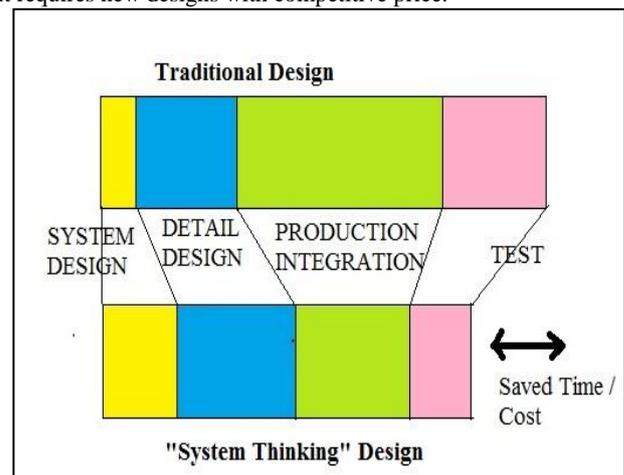


Figure 3: Cost /Time involved in traditional and systematic design

Decision making process starts with market requirement from a customer in marketing for making a new product to launch in market. After studying the requirement, concept should be evolved first.

Then 3D model or drawings should be prepared. While making the drawings, manufacturing methodology should be decided, because tolerances and other details like welding should be decided for making the drawings. Theoretical calculation and computer aided validation using Finite Element Analysis or Computational Fluid Dynamics or Kinematics tools should be performed for checking and rectifying the failures. Once design is approved it should be given for making prototype, prototype can be made with wax or same material in reduced size.

Testing has to be performed for the prototype and if there is any defects, design process should be repeated till getting a proper design to withstand the requirement. After confirming the prototype, sample product should be manufactured in certain numbers using sampling method, testing should be conducted to validate the product. After confirming the reliability of the product and passing the quality issues, it should be given for mass production.

If there is any failure, then product should be redesigned and the whole design process should be repeated. Decision making plays a vital role in design process.

How to avoid failure in design, choosing an option for manufacturing in a set of alternatives, choosing a testing process and approach for validation, are some among them. Decision making process makes a huge impact on time and cost.

Those are major factors in marketing. Making changes in design in starting level change from making changes in design at the stage of production.

Cost involved is high, decision making process reduces that cost factor. Number of variants in design while designing the product also influences the cost and time.

5. Design process flow chart

Design process in engineering design starts with a market requirement. Decision making process in engineering design involves series of steps. Different steps involved in design is given in Figure 4.

Design process can be mainly divided in to Concept stage, prototype stage, manufacturing and mass production. Approval is required at these stages for proceeding next stage. Proper decision making at appropriate stages reduce cost and time.

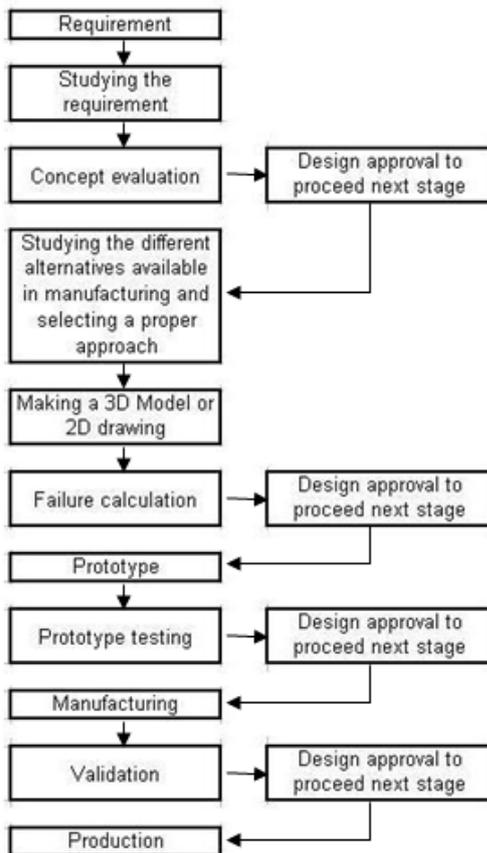


Figure 4: Design process flow chart

6. Important factors to be checked

6.1. Design methodology

Methodology of design has to be chosen while starting a design process. Three types of design are available Different type can be used based on the requirement in market.

1. New design: Starting a new design process with concept evaluation.
2. Development of existing design: Developing a design from a existing design.
3. Modified design: Modifying a design from available design.

6.2. Availability of raw materials

Customer provided raw material requirement need to be maintained in manufacturing. Different materials are available for manufacturing, material has to be chosen based on the requirement considering cost factor.

6.3. Manufacturing feasibility

After making a design, manufacturing feasibility should be checked, whether that design can be manufactured, kind of manufacturing process to be implemented in manufacturing, market budget for the product is an important factor.

6.4. Testing

Product should be tested for failures and should be redesigned for withstanding the market requirement. Customer specifications for the requirement and testing procedures need to be satisfied to meet the market needs.

6.5. Reliability

Reliability of a product is important for retaining existing customers and for new customers. Life cycle of the product should be checked and required measures should be taken to maintain reliability. Warranty of a product is important to maintain the long term relationship with the customer.

6.6. Quality

Quality of the design has to be checked using different parameters and how it influences the overall quality of the product has to be studied properly in design process. It helps in marketing to improve the sales.

7. Manufacturing methodology

There are different types of manufacturing methods. How to choose a methodology in manufacturing depends on requirement from the customer. Say for example, same product can be machined or forged for same dimensions. Choosing a manufacturing method depends on requirement and various factors like strength, cost, time, life cycle, etc.,

Here in Figure 5, comparison of forged and machined part is shown. Grain structure of the forged part varies from the grain structure of the machined part. Different types of manufacturing methods makes changes in grain structure.

Cast Iron has more compressive strength when compared to mild steel. For kind of applications like valves, it requires more compressive strength, so casting can be preferred instead of machining process.

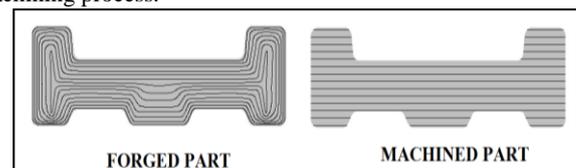


Figure 5: Comparison of forged and machined part

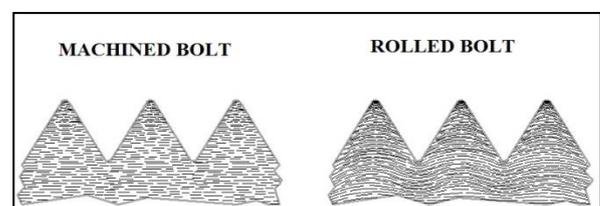


Figure 6: Comparison of forged and machined bolt

Figure 6 explains the favorable grain orientation of the cold rolled bolt will give it directional strength beneficial to its application. Proper decision has to be taken in design process and drawings should be prepared based on the manufacturing method. It is mainly based on the requirement from marketing what kind of strength it should possess and where the component is used. Different type of markets requires different type of methodologies. After finding a proper methodology, different failures should be studied and proper manufacturing method should be implemented for the market requirement.

8. How to resolve a failure in design?

There is a failure in Design. How to resolve that failure? Usually there will be warranty for a product, and failure can make some problem for good name in market and requires replacement of a product or rectification of failure, and that need to be Reason for failure should be studied based on different testing methods, and failure should be rectified using different testing methods. There are different methods available for testing. Some kind of failure proof design is required by the customers that need to be implemented with marketing for a failure proof design.

8.1. Theoretical calculation

Theoretical calculation involves checking a design failure using theoretical formulas.

8.2. Practical validation

Practical validation involves validating a product using practical testing approach. There are so many proven methodologies for testing and most of the industries have such testing lab for validation.

8.3. Past history of failure

Testing data available in past history and that data can be used for predicting and rectifying a failure.

8.4. Computer aided applications

Computer Aided Applications like Finite Element Analysis, Computational Fluid Dynamics, Kinematics, are some of the methods used for testing a product to identify a failure. Such kind of failure predictions for engineering design now becomes mandatory in industries.

Failures in design can be rectified by properly implementing a design technique to avoid failure and to rectify a failure. That can help to retain a good name in market.

9. Risk and uncertainty

Risk is essentially the level of possibility that an action or activity will lead to a loss or to an undesired outcome. The risk may even pay off and not lead to a loss, it may lead to a gain. Uncertainty, on the other hand, is unpredictable. It has too many unknown variables which do not even allow one to estimate as to what is going to happen.

In most of the design process outcome is unknown. Risk and uncertainty is high in decision making process in engineering design. Design failure to satisfy the customer requirement can cause a huge loss in marketing. Design process without failure evaluation technique leads to risk and uncertainty, proper failure evaluation techniques should be implemented to reduce the failure possibilities to retain good name in market. Uncertainty is high in engineering design and it causes huge loss because of making so many decisions in design process for design changes compared to

the cost of the product. Properly implementing a failure evaluation technique may completely eliminate risk and uncertainty in design process and helps to ease the marketing management.

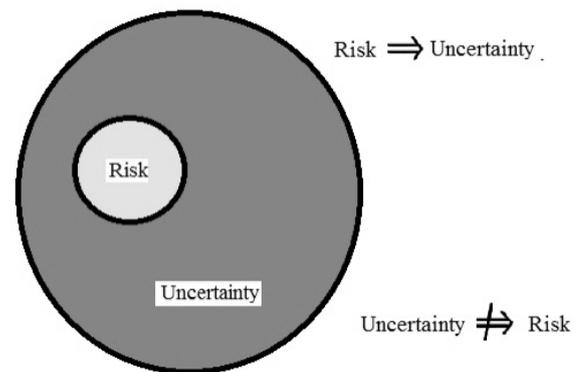


Figure 7: Risk and uncertainty

Design based on previous experience, past history of testing data are some options to reduce the loss due to risk and uncertainty. Risk and uncertainty in a product design cannot be eliminated in first sample itself, it requires lot of testing iterations to reduce the risk and uncertainty. This factor of loss should be reduced step by step. It takes several iterations to improve the design. It requires a proper planning for reducing risk and uncertainty. Quality in design should be improved with various failure techniques to avoid this risk and uncertainty.

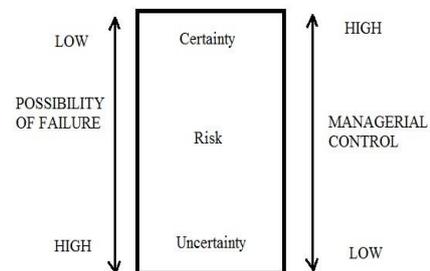


Figure 8: Managerial control for design failure

Figure 8 shows the risk and uncertainty varies because of managerial control in checking a design in design process.

10. Cost and time

Two important marketing factors that are influenced because of decision making are cost and time. There are important factors that decision making process in engineering design depends on marketing. Proper decision reduces cost and saves time. It increases productivity. Certain kinds of products are required only in certain season. How to make a proper decision, what kind of factors to be considered in making decision for a marketing requirement

How simple is the design and that much cost is saved and it reduces the time of design process. Figure 9 explains this clearly, what is the effect of cost and effort when ease of making design is the factor considered with respect to time.

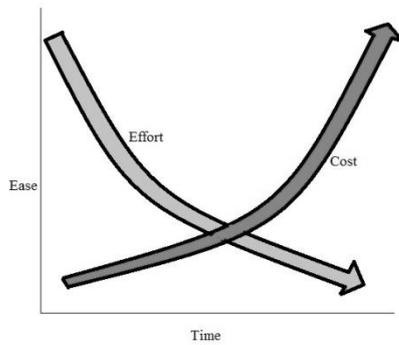


Figure 9: Ease of design Vs time considering effort and cost

Figure 10 explains the cost involved in making number of variants in achieving a proper design. Number of variants depends on taking proper decision and using an expertise with past history of data and other analytical methods to reduce the number of variants. It involves huge cost and time in finalizing a design, proper decision making reduces the variants by selecting an alternative.

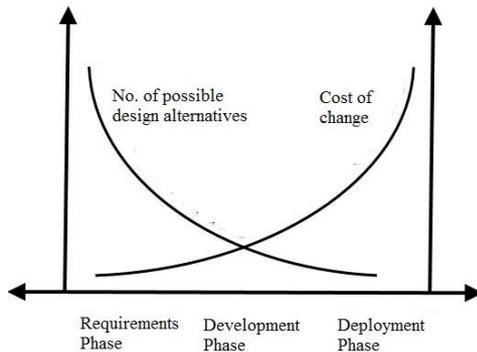


Figure 10: Number of variants and its effect on cost

Rectifying a defect at the initial stage of design and fixing defect at the final stage of design are differing with a huge cost. Fig. explains the cost involved in rectifying a defect at various stages. Failure at the final stage cause time lagging in manufacturing and it may make loss to the company by even losing an order. It involves a lot of effort if the design change has to be implemented at the final stage of design process. Properly studying different alternatives, studying the failure possibilities using theoretical calculations and computer aided design software may avoid that failures and reduce the cost involved in design process.

11. Conclusion

Marketing based decision making process in engineering design is studied elaborately in this paper. Different measures to be taken at various stages of design to make an efficient design for the market requirement is studied. Consumer behaviour is important for most of the engineering design decisions. Most of the decision making process involves risk and uncertainty, failure evaluation techniques reduces the risk and uncertainty in design process for stable market. Cost and time can be saved by making a proper decision and systematic approach in design. Number of variants in concluding a design should be reduced for improving the influence of cost and time in design process, that are important factors for marketing. Rectifying the failure at the final stage makes a huge impact in cost when compared to rectifying the failure at the initial stage. So, a proper failure analysis technique should be implemented at the initial stage of design itself and that cause delay in manufacturing and ultimately leads to customer dissatisfaction. Implementing quality in design process with different measures improves the design process and improves stability of a product in market.

12. Future research scope

Marketing based decision making process in engineering design is studied elaborately in this paper. Most of the engineering design involves risk and uncertainty that are marketing factors. This risk and uncertainty can be resolved using a proper design technique. Different types of failure prediction methods can be studied to find a suitable failure technique to reduce the risk and uncertainty in design for market requirement. What are all the different methodologies available in decision making process for reducing the number of variants in design process for an efficient marketing? are some of the research studies that can be carried out in future.

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