

REALIZING CONCURRENT ENGINEERING IN PRODUCT DEVELOPMENT: A SURVEY ON TWO WHEELER AUTO INDUSTRY

Dr. V.Venkata Ramana¹, H.M. Anil Kumar², B.Nagaraj³

*¹Professor, ^{2,3}Asst. Professor, Department of Mechanical Engineering,
Ballari Institute of Technology and Management, Bellary, 583 103, Karnataka, (India)*

ABSTRACT

Introducing a new product with high level expectation of customer satisfaction is an intricate and immense challenge to the companies in present day aggressive business environment. Concurrent Engineering (CE) has a great deal of importance in design and development of new products in automobile industry and is posing an intense challenge to manufacturing firms in the wake of globalization. Success of concurrent engineering demands that key areas of product design and development of an organization are kept in spotlight concomitantly. The aim of the paper is to present survey results of major factors influencing the new product design and development in selected two wheeler auto industries. The survey presents its evaluation based on the data analysis using statistical tool with the help of primary data collected through a pre-tested questionnaire. The findings reveal that the application of concurrent engineering techniques, involvement of outsiders (customers, suppliers), and coordination of internal groups (design, manufacturing) etc., are prioritized by awarding first, second and third ranks further two wheeler manufacturing companies are realizing maximum benefits with the implementation of the concurrent engineering in new product design and development. The research also recommends that companies must focus on fragile areas of design and development, identify the appropriate revolutionary technologies for proto-typing and thus increase cost savings and reduce time to market, enhance the productivity ultimately satisfying the customer needs.

Keywords: *Concurrent Engineering, New Product Development, Productivity, Technologies*

I INTRODUCTION

The study of concurrent engineering (CE) and its implementation has been the greatest themes in the engineering sciences. Many disciplines have developed theoretical literature and empirical findings about the origin, expansion, transformation, decay, and refuse of the system. Concurrent engineering is indisputably the wave of the future for new product development for all companies regardless of their size, sophistication, or product portfolio. In order to be competitive, firms must alter their product and process development cycle to be able to complete diverse tasks concurrently. This new process will benefit the company, although it will require a large amount of refinement in its implementation. This is because concurrent engineering is a process that must be

reviewed and regulated for continuous improvements of engineering and business operations. In today's global business world, the firms must be able to act and react quickly and responsively to the changing market needs. Moreover, they must be able to significantly reduce their time to market and adapt to the shifting business environments, because of product's shorter life period. Therefore, concurrent engineering has emerged as way of bringing swift solutions to product design and development process.

II DEFINITION

According to Nielsen (2003) [1], concurrent engineering is the simultaneous consideration of more than one aspect of a system during its design phase. Concurrent engineering is a system of practices that provides the environment for design engineering and production departments work together, which enhances productivity and leads to high-class designs. Concurrent engineering is defined as “a business strategy which replaces the traditional product development process with one in which tasks is done in parallel and there is an early consideration for every aspect of a product's development process”. This strategy focuses on the optimization and distribution of a firm's resources in the design and development process to ensure effective and efficient product development process.

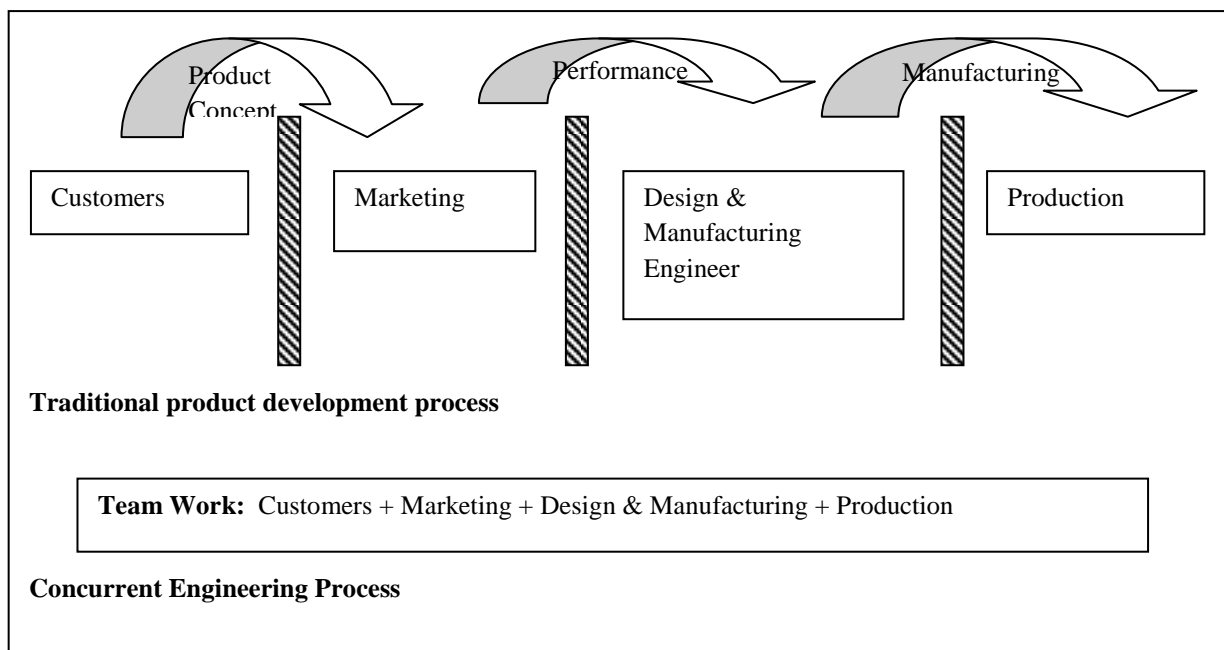


Figure 1: Traditional Product Development Process Vs Concurrent Engineering Process

III LITERATURE SURVEY

Scott E. Dahne of Westinghouse Electric Corporation (1992) [2] in his paper “A Concurrent Engineering Model of the Design and Manufacturing Process for Electronic Assemblies” writes that the global marketplace for manufacturing of electronics has become increasingly competitive and promises to become even more so in the next decade. In order to remain competitive, manufacturers must utilize the abundant resources of the information age along with the philosophy embodied by concurrent engineering to reduce costs and improve efficiency in all aspects of their enterprise.

Harvey Maylor in his paper “Concurrent New Product Development: An Empirical Assessment” (1997) [3] has discussed operationalization of concurrent new product development in U.K. firms. He concludes that use of new tools like concurrent engineering helps the firms to achieve effective satisfaction of customer needs and less time to penetrate the market. But the limitations of the use of these techniques needs changes in organizational set up, creates adverse effects.

Ray Gosling in his study “The Reality of Concurrent New Product Development” (1998) [4] have concluded that many companies are going for concurrent design and redesign of new products by using the new techniques which have worked best in industries. The success of many industries lies in using certain technologies which are in the domain of product development manager. They have also shown that these technologies are better than the high levels of usage of technology. Finally conclude that this type of using workable technologies to develop product has significant effect on firm’s investment policy. The limitations are the firm has to train the management in project management and training.

J.A. Harding, A.R. Omar, K. Popplewell in their paper “Applications of QFD within a concurrent engineering environment” (1999) [5] writes that the companies which are willing to bring their products quickly to market, concurrent engineering techniques will help them. The companies must maintain quality standards desired by the consumer, but consumer is not available to him during design stage hence the design should concentrate to satisfy functional aspects than trying to satisfy individual customers. They have discussed the method of getting concurrent engineering environment and quality function deployment techniques to provide an extended design team with valuable, shared information throughout the design process.

Hojjat Adeli, in his paper “Competitive edge and environmentally- conscious design through concurrent engineering” (1999) [6] has advocated that Concurrent engineering or simultaneous engineering helps to companies can manufacture and market the product in shortest possible time and with minimum cost. He also concludes that the technological advances will help to expedite the process. Martin Jarvis in his paper “Concurrent engineering” (1999) [7] has discussed how the concept of concurrent engineering shortens the life cycle time of product development and design stage and getting it to the market and also highlighted factors influencing successful approach of concurrent engineering.

In the literature survey, Scott .E.Dahne, Harvey Maylor, Ray Gosling, J.A. Harding, Hojjat Adeli, Martin Jarvis have clearly discussed in their articles that the main way to success in achieving shortest time in product development and design time is *the adoption of Concurrent Engineering Techniques*. In their attempt, to meet the competition in the market, when they introduce the new / improved product many companies have realized that concurrent engineering technique is the best way to reach the market early and to capture the market.

IV THE SCENARIO

The managers of automobile sector are of the opinion that the complexity of the product and the economy of the country, the legal barriers, and road conditions are some of the reasons for drop in product introduction time. In addition of the above factors, the technology level and the work force co-operation also act as barriers. In spite

of all the above barriers the industry is trying to develop the product and introduce in the market at the earliest possible.

V PURPOSE OF THE STUDY

The objective of the research study is to identify and establish the impact of different parameters that are influencing the product design and development in two wheeler automobile industries.

VI METHODOLOGY

The evaluation of the study is based on data analysis (primary data) collected using statistical analysis technique. The primary data was collected through a well-structure questionnaire from the respondents of design, production and marketing groups of two wheeler manufacturing companies. The questionnaire was sent to the respondents of 3 automobile companies and the usable response rate was 53% (see the Table 1).

Table 1: Response Rating of the Survey

	Number of Organizations		Response Ratio (in percentage)
	Questionnaire Sent to	Response Received	
Two Wheeler Industry Automobile manufacturers	03	03	100%
No. of Respondents	243	129	53%

Source: Information given by respective Industries departments.

A request is made to the managers of the companies who have responded for the questionnaire to rank the selected parameters and the weighted scores were calculated accordingly by allocating four points to the first rank, three, two, one to the second, third and fourth respectively. The points each parameter received are totalled to obtain the weighted score for that parameter. The weighted scores received by each of them and their ranking are shown in the table2.

Table 2: Weighted Scores and Ranking of Parameters Having Influence on Product Development and Design

S. No.	Parameters	Ranking				Weighted Scores	Ranks
		R ₄	R ₃	R ₂	R ₁		
		I (4)	II (3)	III (2)	IV (1)		
1	Application of concurrent engineering techniques.	10	01	01	-	45	1
2	Involvement of outsiders – customers, suppliers etc.,	08	02	02	-	42	2
3	Coordination of internal groups – design, Manufacturing etc.	07	03	02	-	41	3

4	Smoothing of organizational barriers.	07	03	01	01	40	4
5	To entertain external agencies like research organizations.	05	05	01	01	38	5
6	Implementation of collaboration /partnership of managements	05	04	02	01	37	6
Total						243	

Source: Field Survey.

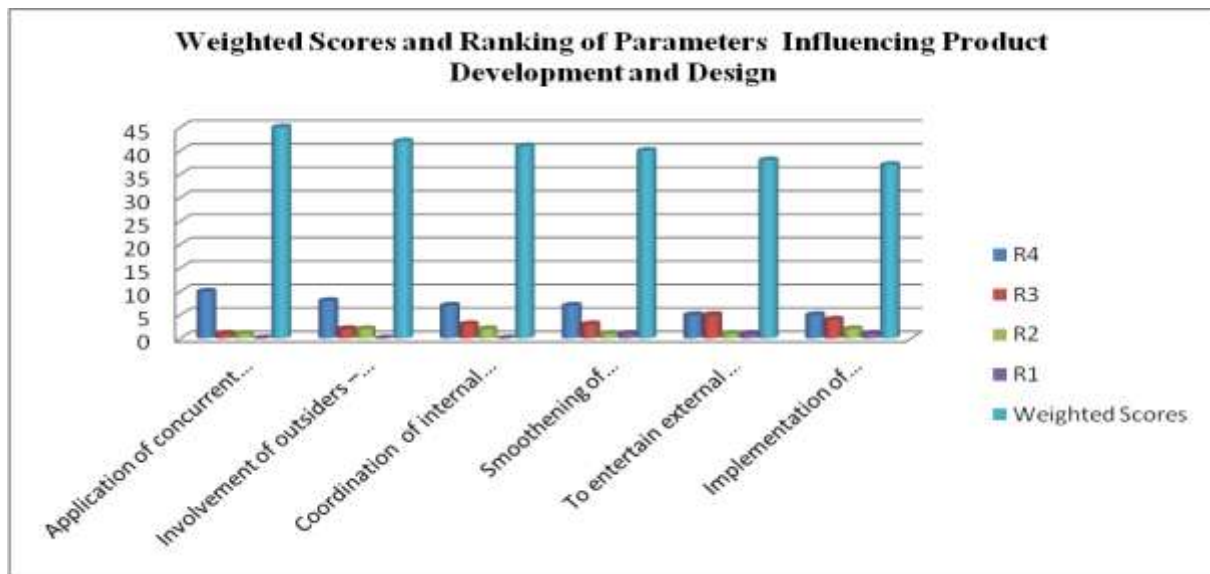


Figure2: Bar chart Showing Weighted Scores and Ranking of Parameters Having Influence on Product Development and Design

VII INTERPRETATION

The scores and the ranking shown in the table2 is very significant and interesting and advocates the application of concurrent engineering techniques is the important parameter in reducing the product development and design time and enables the company to release the product in the market early. Involvement of customers and suppliers i.e., the participation of outsiders in product development and design ranked 2nd by scoring 42 out of total 243 scores. Co - ordination of internal groups such as design, manufacturing etc., was ranked 3rd by the respondents which has score of 41 out of 243 scores. Smoothing organizational barriers got 4th rank with a score of 40 out of 243 scores. Entertaining of external agencies got 5th rank with a score of 38 and implementation of collaboration / partnership of managements got 6th rank with a score of 37 out of 243 scores.

VIII FINDINGS

In ranking the parameters, the industrial managers have opted 1st rank for the use of *concurrent engineering techniques* to show that this is very important parameter in reducing the new / improved product development and design time. Further managers have shown different rankings depending on the nature of their business and expertise for the parameters - *involvement of outsiders such as customers and suppliers in product development and design time, coordination of internal groups such as design and manufacturing departments, smoothing of organizational barriers, to entertain external agencies like research organizations, consultants*. All managers have ranked the parameter expressing the *collaboration / partnership of managements* to reach the market early as the 6th one.

IX CONCLUSIONS

The above said factors are influencing the reduction of new product introduction and development time at local market (i.e., NPID). However, globalization of the world market means that global manufacturing, collaboration is a realign and, the industries must consider global NPID (i.e., GNPID). The producers of products have to strive hard for survival because of growing competition in the market. Also the customer's preferences are changing day by day as the purchasing power of the individuals is growing due to increased level of earnings. In such a situation the managers of product development and design activities have to search for newer ways of cutting the design and development time so as to reach the market early and to grab the market. Concurrent engineering has shown a very positive impact on new product design, development and introduction in two wheeler automobile companies. Though companies are implementing concurrent engineering and realizing maximum benefits, they need to focus their attention in identifying the appropriate revolutionary technologies for proto-typing and thus increase cost savings and reduce time to market eventually satisfying the customer needs.

REFERENCES

Theses:

[1] Nielsen, J., (2003), "Information Modeling of Manufacturing Processes: Information requirements for process planning in a concurrent engineering environment", Doctoral Thesis, KTH Production Engineering, TRITA-IIP-02-09, ISSN 1650-1888.

Journal Papers

[1] Scott S.G Dahne, (1992), "A concurrent engineering Model of the Design and Manufacturing Process for Electronic Assemblies", Westinghouse Electric Corporation.

[2] Harvey Maylor (1997), "Concurrent New Product Development: An Empirical Assessment", International Journal of Operations & Production Management, Volume: 17 Issue: 12 Page: 1196 – 1214.

[3] Ray Gosling, (1998), "The Reality of Concurrent New Product Development", Journal of Integrated Manufacturing Systems, Volume: 9 Issue: 2 Page: 69 – 76.

[4] J.A. Harding, A.R. Omar and K. Popplewell, (1999), "Applications of Qfd within A Concurrent Engineering Environment", International Journal of Agile Management Systems, Volume: 1 Issue: 2 Page: 88 – 98.

[5] Martin Jarvis, (1999), "Concurrent Engineering", Journal of Work Study, Volume: 48 Pages: 88 – 91.

- [6] Shina, S.G (1991) “Concurrent Engineering: New Rules for World-Class Companies”. Spectrum, IEEE Volume 28, Issue 7, Page(s):22 – 26.
- [7] Rob Kinna, (1995) “Team Working and Concurrent Engineering – A Success Story”, Journal: World Class Design to Manufacture, Volume: 2 Issue: 3 Page: 5 – 9.
- [8] David Bradley, (1995) “Concurrent Engineering for Bespoke Products” Journal: Assembly Automation, Volume: 15 Issue: 1 Page: 35 – 37.
- [9] Clark K.B. and Fujimoto T. (1991) ‘Product Development Performance: Strategy, Organization and Management in the World Auto Industry’, Boston: Harvard Business School Press, p.78.
- [10] Schilling M.A., Hill C.W.L., (1998). ‘Managing the new product development process: Strategic imperatives’, Academy of Management Executive, vol. 12, no. 3.
- [11] Clark K.B., Wheelwright S.C., (1993) “Managing new product development - Text and Cases”, Harvard Business School.
- [12] Winner R.J., Pennel J.P., Bertrand H.E., Slusarczyk M.M., (1998) ‘The role of concurrent engineering in weapons systems acquisition’, IDA R-338, Institute for Defence Analyses.
- [13] Noble, J. S., & Tanchoco, J. M. A. (1990) Concurrent design and economic justification in developing a product. International Journal of Production Research 28(7) 1225-1238.
- [14] Noble, J. S., & Tanchoco, J. M. A. (1993). Design for Economics. In Concurrent Engineering: Automation, Tools, and Techniques, (Kusiak, A., Ed.), Chap. 16, pp. 401-461. John Wiley & Sons, Inc., New York.
- [15] Gaynor, G. H. (1993). Exploiting product cycle time: Integrating technologies, products, and markets. EMR Spring, 30-43.
- [16] Knowledge based system integrated in a concurrent engineering environment by M. SOBELEWSKI, Concurrent Engineering Research Centre, West Virginia University, and Morgantown.
- [17] A Concurrent engineering constraint based system by Hassan S. Abdalla De Montfort University Leicester, The Gateway.

Books

- [1] Hojjat Adeli (1999), “Competitive Edge and Environmentally- Conscious Design Through Concurrent Engineering”, Assembly Automation, Volume: 19 Issue: 2 Page: 92 – 94.
- [2] Thurston, D. L., & Carnahan, J. V. (1993) .Intelligent Evaluation of Designs for Manufacturing Cost. Concurrent Engineering: Automation, Tools, and Techniques, (Kusiak, A., Ed.), Chapter 17. John Wiley & Sons, Inc., New York.
- [3] Ullrich K.T., Eppinger S.D., (1995) ‘Product design and development’, McGraw Hill, London.