

A STUDY OF CONCURRENT ENGINEERING PRACTICES IN MALAYSIAN INDUSTRIES

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Abstract

Concurrent engineering is considered as a key concept that enables manufacturing companies to develop new products rapidly with cost saving, without affecting its quality. The purpose of this paper is to report the evaluation of the level of practices of concurrent engineering in Malaysian manufacturing industries. This evaluation was carried out by sending the questionnaire to the appropriate manufacturing companies. The survey results were gathered and transformed into graphs, followed by the discussion in order to provide a clear explanation. From the survey conducted, it was found that most of the Malaysian manufacturing companies were working in line with the concept of concurrent engineering in new product development processes, although they did not understand what concurrent engineering is. Therefore, this concept could be considered new in Malaysian industries.

Introduction

Recently, the manufacturing has entered an era of competition that is unprecedented. There are many foreign and local operations that have cropped up recently. Manufacturing is becoming more and more global every day. As a result, many companies employ a large contingent of highly specialized knowledge workers and use various tools to develop new system or component designs.

A basic premise of manufacturing refers to the best transformation of customer expectations and requirements into useful products and services. Alternately, the identification of the best manufacturing transformation process is that which products satisfied customers recurrently (Prasad, 1997).

The Concurrent Engineering (CE) strategy is essential because today's designers are

confronted not only with the increase of product complexity and variety of products but also the complexity of the design process. In order to improve the manufacturing economics and to maintain competitiveness in the manufacturing industry, it is necessary to consider design, analysis, manufacturing and testing concurrently rather than sequentially. This can be achieved through implementing CE strategy which converts the traditional sequential time phased product life cycle, to the parallel process and concurrently addresses all the influencing aspects of a product covering the disciplines mentioned above, together with marketing, sales, and suppliers (Abdalla and Knight, 1994).

However, it is not certain whether the CE strategy has been properly implemented in Malaysian industries. Therefore, a study of CE

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practices in Malaysian industries is carried out in this project in order to visualize the position or stand of Malaysian industries. The objectives of this paper are:

- To investigate the level of concurrent engineering practices in Malaysian industries; and
- To identify the strategy for implementing concurrent engineering in Malaysia.

Definition of Concurrent Engineering

There are many definitions of concurrent engineering (CE) in the world; one of those definitions is given below:

CE is a systematic approach to integrated product development that emphasizes the response to customer expectations. It embodies team values of cooperation, trust, and sharing in such manner that decision making proceeds with large intervals of parallel working by all life-cycle perspectives early in the process, synchronized by comparatively brief exchanges to produce consensus (Prasad, 1997).

Sequential Versus Concurrent Engineering

The traditional approach to the engineering design of process plants is highly sequential with design tasks being performed without due considerations being given to the final product. Engineers work towards producing the best design from their own viewpoint before passing their design on to other disciplines for further refinement. Concurrent engineering promotes a teamwork approach to design where the team is responsible for ensuring that the decisions made earlier in the design do not have a detrimental impact on the later design stages. The teams made up of engineers involved in each stage of design so that their knowledge and design viewpoint are considered.

In most sequential engineering processes, it is customary for the market research department to determine customer or user needs and throw its sales projection data over the wall to planning. The planning department develops the technical requirements for the product and

throw its specifications over the wall to the product engineering group. This group then designs and develops the product on their own, in the near-complete isolation from the production process. Later, the prototype is handed to manufacturing so that their engineers can arrange to manufacture the product on a large scale.

The essence of concurrent engineering is the simultaneous, rather than serial, execution of various phases in the product development process. Thus, the most important aim of concurrent engineering is shortening the development lead-time. A short development time has to be combined with competitive advantages. Consequently, the better customer orientation is a second goal of concurrent engineering. Most of the time this means improved product quality. Lower development cost is a third goal of concurrent engineering. This, of course, has strong relationship with a shorter development lead-time (Schrijver and de Graaf, 1996).

Methodology for Concurrent Engineering Study in Malaysia

Before designing the questionnaire, a literature review on CE has been carried out. This step is very important to enable the author to understand the concept of CE thoroughly.

Before the questionnaire was prepared, it was necessary to identify the important elements of the CE. Therefore a precise analysis could be carried out according to the received questionnaires. The questionnaire had to be clear and brief so the respondent would not be confused with the questions. The instruction was added in the questionnaire and all the possible answers had to be listed to facilitate the respondent in answering the questions.

After the questionnaire had been prepared, it needed to be reviewed and corrected in terms of contents and grammar. This is to ensure that the respondent would understand the questions. Based on the FFM Directory of Malaysian Manufacturing Industries 1999, the information of the Malaysian manufacturing industries was obtained. This information includes the

companies' name, addresses, number of employees, e-mail address, phone numbers and products being manufactured by the companies. The questionnaires were sent to the selected companies by post. A returned envelope with stamp was attached in the questionnaire to encourage the respondent to send back the questionnaire.

The duration of two months was allocated for receiving the questionnaire. During this period, the companies were reminded of the deadline for returning the completed questionnaire by e-mail and phone call. In order to know and confirm how many of the respondents understood the concept of concurrent engineering and have practiced it, direct questions through e-mail or phone calls were carried out after having received the questionnaire. The data obtained were categorized, calculated and analyzed. After that, the discussion and conclusion were made according to the analyzed results. The data analysis is presented in the next section.

Results and Discussion

The questionnaires were distributed to 120

manufacturing companies in West Malaysia, and 26 questionnaires were returned. However, 4 of the returned questionnaires had no answers at all. Three respondents did not give the reason why they did not answer the questionnaire, and one of them claimed that the questionnaire was not relevant to his company. Thus only 22 (18.33%) questionnaires were analyzed. Each category identified in the questionnaires was counted to determine how many of the 22 respondents identified the same answer to the question. The count was then converted into a percentage of the responses and was plotted as Pareto chart. In this fashion, a Pareto chart was generated for each question in the survey in order to provide a clear comparison for each answer.

Table 1 indicates the various manufacturing sectors, which were involved by the samples in this survey. In order to obtain more representative results, the samples were not limited to one type of industry only. However, there were two basic restriction applied for the samples. First, the samples were restricted to engineering- based industries. Second, the samples were restricted to the companies with 90 or more employees.

Table 1. Various industries sector involved by the surveyed companies.

No.	Sector	%
1	Metal component manufacturing	27.27
2	Automotive engineering / component manufacturing	18.18
3	Electronic / electrical component or device manufacturing	13.64
4	Medical device manufacturing	9.09
5	Transport equipment manufacturing	4.55
6	Aerospace engineering / component manufacturing	4.55
7	Tools, dies & moulds manufacturing	4.55
8	Watch bracelet manufacturing	4.55
9	Household utensil manufacturing	4.55
10	Cranes manufacturing	4.55
11	Furniture manufacturing	4.55
12	Heat elements & thermo sensor manufacturing	4.55
13	Air / water pollution equipment manufacturing	4.55

Product Development Teams

Most of the general feedback that was obtained from the survey showed that the multi-functional management team was being practiced. The practice of multi-functional team is very important because every team members can contribute their specialized knowledge or skill necessary for the company project. Figure 1 shows that 77.27% of the companies have practiced the multi-functional team, and only 18.18% of companies were not practiced. However, 4.55% of companies did not answer this question.

The manager of the product development team (PDT) should provide adequate training / motivation for individual or team. Effective training includes how to solve problems, set goals, think creatively, use standard, utilize experts and work with other disciplines. This survey revealed that adequate training / motivation were regularly provided for product development team in 68.18% of companies, but not provided in 18.18% companies. However, 9.09% of companies were not sure for this question and 4.55% of companies did not give the answer (Figure 2).

CE involves the co-design of the product by all disciplines. Therefore, using the effective communication paths and tools to manage product information, employees, tasks and changes to the product become critical for success. Working product data, lessons learned, decision rationales, and decision sequences need to be tracked so that individuals and teams understand the product development process at any time. Consequently, the teams can quickly improve the process as needed. According to Figure 3, it can be seen that 81.82% of the companies had a communication path between all aspects of the project management and the system requirements; 9.09% of the companies did not have this communication path, and 9.09% of the companies were not sure about this question.

In this survey, 86.36% of the respondents thought that their product development team members could easily communicate with each other while, 9.09% of respondents did not agree, and 4.55% were not sure. (Figure 4).

Supplier

According to the survey results, 31.82% of the companies claimed that suppliers were the members of a new product development team, and involved in all phases of the new product development. 22.73% of the companies involved suppliers in design phase only, 13.64% involved suppliers after the design phase, and 31.82% did not involve suppliers in the product development process at all. (Figure 5).

Figure 6 shows the various tasks of the suppliers who involved early in product development process. 50% of the suppliers' task was designing / planning the machine tools or system for the production, 33.33% was designing / planning the manufacturing process, and only 8.33% of suppliers involved in the new product designing.

Observations

In this paper, the survey results were presented with the objective to identify and verify that the concurrent engineering had been implemented in Malaysian industries. These survey results also provided background information about the requirements of the concurrent engineering implementation.

Based on the survey results, the following observations could be made:

- Most of the companies were reported being aware of the importance of effective communication. They utilized various types of communication path, tools or infrastructure to promote the communication within departments and among the product development team members.
- Most of the companies stress on the importance of the competency or ability of product development team members by providing adequate training and motivation.
- Only 55% of the surveyed companies involved supplier early in the new product development process. Most of these suppliers involved in designing / planning the manufacturing process and machine tools / systems, but fewer directly involved in product designing.

Discussion on The Situation or The Level of Malaysia’s Industry

Since the rough data was taken from the 1999 database, it is worthwhile discussing the current situation or the current level of Malaysia’s industry. The scenario of industry in Malaysia has not changed very much since 1999. The

industrial sector is constantly being developed. The government is going into advanced technology such as aerospace and composite industries. The emphasis is also put on the development of advanced materials such as photonic and nanostructured materials.

The government is also serious about the development of automotive industry. If 1999, Malaysia was proud with the Proton and Perodua cars, nowadays more automotive and similar industries have been developed. New models and transportation system have been developed such as scooters, trucks, vans, lorries, light rail transits, monorail and 2-seater light aircrafts. In

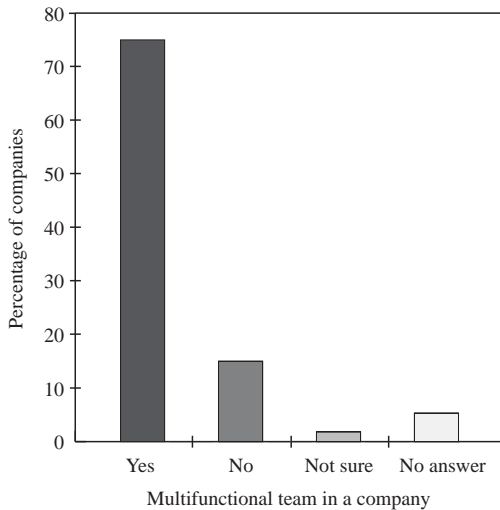


Figure 1. Multifunctional management team in a company.

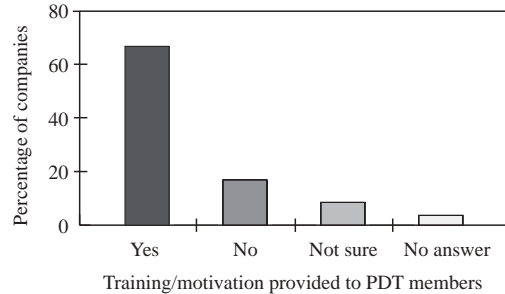


Figure 2. Training/motivation provided to PDT member.

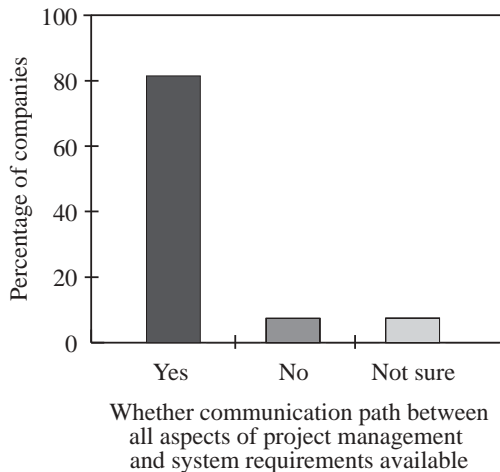


Figure 3. The existence of communication path between all aspects of project management and system requirements.

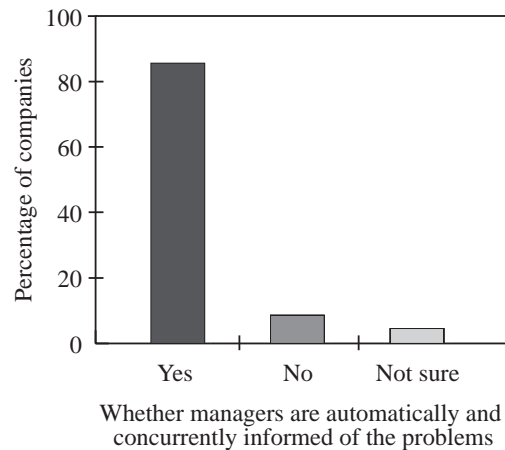


Figure 4. Ease of communication between PDT members within the company.

this type of industry, the concurrent engineering is very likely to be implemented. In fact, in an automotive industry, the technique of concurrent engineering has gained the importance among the engineers and personnel and it is being implemented successfully.

Weakness and Strength

In the author’s opinion, the main weakness in Malaysia’s industry is a lack of intellectual properties awareness. The importance of manufacturing the product only after knowing that it has not been patented elsewhere is a very important criterion in a market place. Other weaknesses could be seen in a lack of research and development (R&D) effort and a lack of understanding on the importance of design for manufacture or concurrent engineering, which is the topic under discussion in this paper.

The main strength of Malaysia’s industry is the political stability. In a stable environment,

investors are confident to invest in the country without the fear of threat of riot, war or terrorism. Another strength could be attributed to the cooperation of the citizen in supporting the industrial development. Universities are very positive in supporting the industries by giving quality education. Of course, among all the research, concurrent engineering research is given a high priority.

Approach of Solution

In order to address some of the above issues, the Malaysian government is taking steps to educate the public on the importance of patenting through seminars, conferences and advertisement on television. To solve the problem of a lack of R&D, the government has recently introduced collaborative research grant between universities and industries to develop mega projects such as a natural gas vehicle, photonics and nanotechnology based products.

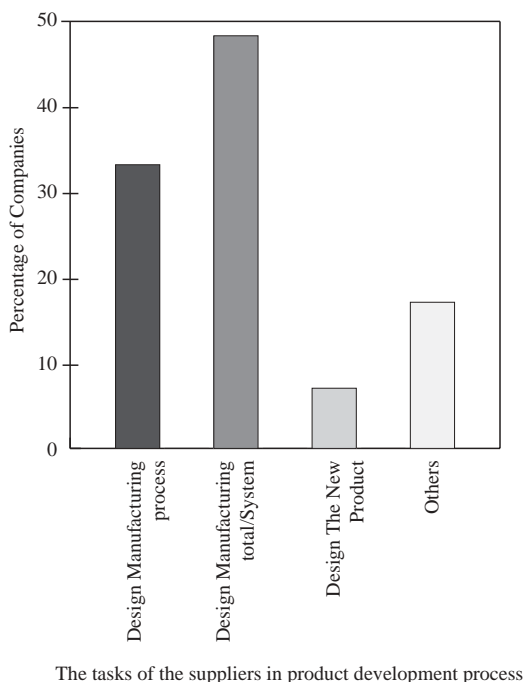


Figure 5. Supplier involvement in product development process in a company.

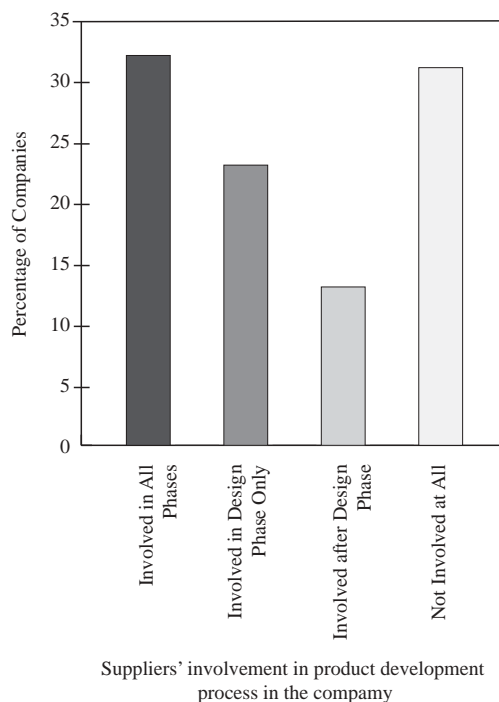


Figure 6. Suppliers' task in product development process for a company.

In order to solve the problem of a lack of understanding in concurrent engineering, the universities are taking steps to educate engineering students through the concurrent engineering teaching and research.

Conclusions

The specific and clear conclusion that can be drawn from this study is that in order to be competitive, Malaysia's industry in particular and the industrial sector in the world should consider the implementation of the concurrent engineering technique. By employing this technique, products can be developed at a high quality, a low cost and at a shorter time. The departmental barrier between the design office and the manufacturing sites can be removed.

References

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