Study of Concurrent Engineering Practices: A Case of Rice Industry **Er. Ankur Bansal¹ Er. Deepak Gupta² Dr. Rajkumar³** ¹M.Tech Scholar ²Assistant Professor ³Director & Professor

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Abstract— The objective of this paper is to present a case study of rice mills of north India and to maintain the productivity of medium scale rice mills. The paper reflects the concept of concurrent engineering. The study has been carried out over a rice production industry which intends to invest on upgrading some of the production stages or by constructing another plant in the nearby future. This study aims to define the requirements and methods of concurrent engineering implementation for this selected case to improve its throughput and delivery performance in batch production. Increasing productivity and quality are both mutually interrelated to each other which require continuous improvement in present working model. Maintained production and quality of rice along with higher profit earnings were the results obtained through successful implementation of concurrent engineering.

Keywords- Bucket Elevator, Review, Quality, Bran, Husk, Productivity

I. INTRODUCTION

Lots of industries stated to feel the effect of some influences on their product development: innovative, newer technologies, increase in product complexity, and larger industries. Therefore industries were forced to look for production improvement methods or alternatives. Population growth is rapidly increasing till the extend that companies cannot meet up with the demand. Customers are also having a high taste for new and advanced products which are health wise good. This demands a lot to the companies as they would have to improve on their quality, produce different variety of products at same time or concurrently, so as to meet the customers taste and demand.

In developing countries, most companies do not meet the customers or market demand. This is due to the fact that the conception, design of product and production cycle time is long and time consuming. Rice has been the staple food for more than half of the humanity in the world or two-third of the World's population. The input to the Rice mill is paddy whereas the output is parboiled rice and raw /white rice depending upon whether the pretreatment is given to paddy or not. Rice is the seed or kernel of paddy, which is covered by two different layers, namely- bran (inner layer) and husk (outer layer). Literally, paddy becomes rice only when the two layers are removed properly through different milling processes. In the first step, brown rice is extracted by removing hull/husk from the paddy, which contains bran layer still intact around the kernel. In the second step, the bran layer is removed by polishing machine that rubs the grains together under pressure, and the output is the polished white kernel or fine rice, which is ready for cooking. The former process is known as hulling and the latter is known as milling of paddy. But, in short, it is the conversion ratio from paddy to rice, or one can term it as hulling and milling ratio.

The main objective of this study is to examine the existing system before designing the proposed model and to

propose the best alternative by using applications of concurrent engineering and thereby contribute to improve the productivity and quality of the rice. This study is related with the development of a new model for a production industry which is an agro-industrial medium size rice production industry, performing mass production of rice for a variety of customers in India, Iran and Dubai as a whole.

II. LITERATURE SURVEY

This chapter is an overview of the current research in areas relevant or important to this dissertation. This dissertation could be viewed in three areas and the literature relevant to each view was examined. The first is the production, followed by Concurrent Engineering (CE). Several pieces of literature from which no specific ideas were used or drawn for this dissertation, but which were extremely necessary to gain the background needed to understand other work being done.

Concurrent engineering has been developed and practiced by large multi-national companies working in oriented industries. As a result, consumer the implementation methods, tools and techniques have been geared towards these industries. Some of these methods, tools and techniques, cannot be easily applied in small to medium sized companies in traditional industries. During the world recession of the early 1990s, it became clear to the 600 Group management that the company must adopt a market led approach and that it must have the ability to react quickly to the market needs. Concurrent engineering was recognized as the philosophy that would enable rapid new product introduction. Three issues were fundamental to 600 Lathes Concurrent Engineering practice, project initiation, involving all functional disciplines, teamwork, and risk management. It was necessary to adapt the general principles to use them in a medium sized manufacturing company. None of the concurrent engineering techniques were used formally. However, the underlying philosophies were informally used to good effect. Teamwork made the most significant contribution. Inspite of not formally using some of the recognized tools and techniques of concurrent engineering, for example, quality function deployment (QFD) and failure modes and effects analysis (FMEA), the application of the generic principles resulted in significant benefits. The use of parallel work philosophy in a team environment reduced the product introduction lead-time by 30% and the cost by a third.

Concurrent engineering is a keyword in today's enterprises. Almost every enterprise parallelizes its engineering processes to reach a higher efficiency in designing their products. Unfortunately, the time and cost saving potential of concurrent engineering cannot be used to its full capacity. In fact, design problems arise and lead to a lot of rework.

Concurrent engineering is defined as a systematic approach to create a product design that simultaneously considers all elements of the product life cycle, from

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conception through disposal. It is a critical part of the rapid application development technique as well as the joint application development technique.

Concurrent engineering is a means to shorten product development times. Information systems supporting concurrent engineering must facilitate the exchange and unambiguous interpretation of product data from various design and manufacturing stages, the collaboration of geographically dispersed experts in a complex design process, and the use of diverse computing platforms and tools. Department of Mechanical Engineering, builds an integrated information system for concurrent engineering applications. The system is based on a single, integrated object-oriented data model and schema, the so-called product and production model, which covers all phases of the product life cycle.

Klaus et al. (1996), presented a holistic approach to concurrent engineering and its implementation which is under development by the Brite-EuRam funded PACE consortium. PACE stands for a 'Practical Approach to Concurrent Engineering'. It is a pan-European project consisting of a consortium of eight partners (four industrial and four academic research institutions) from four European countries (UK, Germany, Denmark and Portugal). The primary aim of PACE is to provide a holistic technology transfer infrastructure enabling the effective and efficient change and improvement of present engineering practices towards concurrent engineering principles.

At the outset the question of what is meant by a conceptual model is discussed, together with what it should contain and how it should be structured. This is followed by a description of how the PACE conceptual model was derived and why the consortium considers that it encapsulates the pertinent issues of CE. The most wellknown existing models are reviewed, examined and critiqued. Through analysis of previous case studies and in the authors experience, many companies consider that there are difficulties with existing models for CE implementation. It was felt that none of them presented the full picture in terms of what constitutes CE and what bearing it will have on companies that decide to go ahead with implementation. The authors and the PACE consortium believe that the conceptual model will be unique due to its high level of industrial relevance. This section is augmented by the developments to date on the Knowledge Platform environment and its user interface.

The final section of the paper focuses on the issues relating to a generic concurrent engineering implementation support framework. A methodology defining the introduction of CE based product engineering processes is outlined. This is generic in nature but designed to be adaptable to specific company needs. Implementing CE successfully requires a huge cultural change in an organization. The framework presented in the paper is especially aimed at showing how to implement CE in an ordinary company i.e. not using a 'super-motivated' project team. It provides a structure for implementation, drawing on literature and experiences of the PACE industrial partners.

Implementing concurrent engineering successfully requires a significant cultural change in an organisation. This paper has provided a structure for implementing concurrent engineering within PACE, drawing on literature and experiences of the industrial partners. An in-depth study of the situation within the industrial partners with respect to CE attitudes was both useful and revealing. A generic methodology has been proposed to help companies achieve the change towards concurrent engineering.

Dr. David M. Anderson (2008), described concurrent engineering as the practice of concurrently developing products and their design and manufacturing processes. If the existing processes are to be utilized, then the product and the processes must be developed concurrently. Here, this requires knowing much about manufacturing processes and one of the best ways to do this is to develop products in multifunctional teams. He shows how to design products for all aspects of manufacturability and use multifunctional product development teams and Concurrent Engineering principles to achieve the goals of Design for low cost. He presents many effective methodologies to design low-cost products by concurrently engineering products in multifunctional teams that will simplify concepts, optimize architecture, optimize the use of modules and off-the-shelf parts, have pre-selected vendors help design custom parts, understand and avoid previous problems, and then thoroughly design for manufacturability for quick launches without expensive change orders. He shows how to design quality and reliability into the product and thorough up-front work is the key to quickly developing products, avoiding changes, and achieving fast ramps.

Sandra et al. (2009), defined concurrent engineering (CE) as a systematic approach to the integrated, concurrent design of products and their related processes, including production and support. Winner et al. (1988) stated that one of the widest known definitions of CE is the one given by the American Institute for Defense Analysis, which considers it to be a systematic approach to the integrated, concurrent design of products and related processes, including manufacturing and support. This approach is intended to cause the developers to consider all elements of the product life cycle from conception through disposal, including quality, cost, schedule, and user requirements

Portioli et al. (2003) examined the extent to which Concurrent Engineering best practices are being used effectively in companies. Companies in India were investigated using a Concurrent Engineering compliance checklist. The concept of concurrent engineering (CE) has been known for quite a while now, and it has been widely recognized as a major enabler of fast and efficient product development and examines the extent to which CE best practices, as obtained from a broad literature review, are being used effectively in companies. Companies both in Belgium and in Italy were investigated using a CE compliance checklist. Specific information per sector is also included. Finally, the positive impact of formal Concurrent Engineering programs is proven by the data.

According to Pennell and Winner, (1988), "Concurrent Engineering is a systematic approach to the integrated, concurrent design of products and their related processes, including, manufacturing and support. This approach is intended to cause the developers from the very outset to consider all elements of the product life cycle, from

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conception to disposal, including cost, schedule, quality and user requirements". 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 also enhances productivity and leads to high class designs.

Shina S.G. in his paper "Concurrent engineering: new rules for world-class companies" (1991) discussed how concurrent engineering technique is best suitable for manufacturing of high quality products by companies highlighting the benefits such as shorter time for product introduction, improved design quality, reduced design iterations, and shorter production time. Also enlightened the effects of multifunctional teaming which include design for manufacturing (DFM) continuous process improvement (CPI), total quality management (TQM), and quality function deployment (QFD) i.e., product development with concurrent engineering involves all parts of organization.

Rob Kinna, in his paper "Team working and Concurrent Engineering – A Success Story" (1995) has discussed the experiences and success of adopting concurrent engineering highlighting the criticality of team selection, building and empowerment. He is of the opinion that the concurrent engineering team must include both internal group and external group such as customers, suppliers.

David Bradley in his paper, "Concurrent Engineering for bespoke products" (1995), discussed the

disadvantages of traditional design techniques and shown how concurrent engineering benefits the organization. He says that concurrent engineering will advocate building teams working together from initial phase and in close contact with the customer.

Alireza Aslani (2012) studied that different definitions have been used for concurrent engineering (CE). For instance, Pennell defines CE as a systematic approach to integrated design of products and related processes. This approach is considered in three different frames; people, process and Technology. Recent evidences show that CE can cause 30% to 70% less development time, 65% to 90% fewer engineering changes, 20% to 90% less time to market, 200% to 600% higher quality, and 20% to 110% higher white collar productivity. Basically, there are some gaps and challenges in team working that is noticeable in CE project teams too. Since in CE projects members from different disciplines with specific goals are engaged, and they might have never worked on teams, managers face with several challenges to keep the performance of the team in desirable expectation level. In this condition, some suggestions are encouraged to improve the team performance such as; sharing of knowledge, engaging in social interactions, and training in CE teams.

III. SUMMARY OF LITERATURE REVIEW

Engineering for bespoke products" (1995), discussed the				
Sr. No.	Researcher	Year	Definition	
1	Sandra et al.	2009	Concurrent engineering (C.E.) is a systematic approach to the integrated, concurrent design of products and their related processes, including production and support.	
2	Dr. David M. Anderson	2008	Concurrent engineering is the practice of concurrently developing products and their design and manufacturing processes. If the existing processes are to be utilized, then the product and the processes must be developed concurrently.	
3	Alireza Aslani	2012	Alireza Aslani studied that different definitions have been used for concurrent engineering (CE). For instance, Pennell defines CE as a systematic approach to integrated design of products and related processes. This approach is considered in three different frames; people, process and Technology. Recent evidences show that CE can cause 30% to 70% less development time, 65% to 90% fewer engineering changes, 20% to 90% less time to market, 200% to 600% higher quality, and 20% to 110% higher white collar productivity. Basically, there are some gaps and challenges in team working that is noticeable in CE project teams too.	
4	Portioli et al.	2003	He examined the extent to which Concurrent Engineering best practices are being used effectively in companies. Companies in India were investigated using a Concurrent Engineering compliance checklist. Finally, the positive impact of formal Concurrent Engineering programs is proven by the data.	
5	Rob Kinna	1995	Rob Kinna, in his paper "Team working and Concurrent Engineering – A Success Story" (1995) has discussed the experiences and success of adopting Concurrent engineering highlighting the criticality of team selection, building and empowerment. He is of the opinion that the concurrent engineering team must include both internal group and external group such as customers, suppliers.	
6	Klaus et al.	1996	He presented a holistic approach to concurrent engineering and its implementation which is under development by the Brite-EuRam funded PACE consortium. PACE stands for a 'Practical Approach to Concurrent Engineering'. It is a pan-European project consisting of a consortium of eight partners (four industrial and four academic research institutions). The primary aim of PACE is to provide a holistic technology transfer infrastructure enabling the effective and efficient change and improvement of present engineering practices towards concurrent engineering principles.	
7	Shina S.G.	1991	Shina S.G. in his paper "Concurrent engineering: new rules for world-class companies" (1991) discussed how concurrent engineering technique is best suitable for manufacturing of high quality products by companies highlighting the benefits such as	

	shorter time for product introduction, improved design quality, reduced design iterations,
	and shorter production time. Also enlightened the effects of multifunctional teaming which
	include design for manufacturing (DFM) continuous process improvement (CPI), total
	quality management (TQM), and quality function deployment (QFD) i.e., product
	development with concurrent engineering involves all parts of organization.

Table 1: Literature Review

IV. PROBLEM FORMULATION

From the literature survey it is clear that the medium scale rice milling industries are facing the problem of low productivity and sometimes the problem of low quality.

For present work, a rice production industry from Haryana (India) has been selected. The industry is facing the problem of low productivity.

Now while implementing the concurrent engineering in an industry the study would be based on:

- 1) Identification of various stages in rice industry from the dryer of paddy to the milling of rice.
- 2) Identification of the problem or technical errors in the machine.
- 3) Identification of main causes of low productivity and delayed time delivery of rice.
- 4) Recommendation of methods and means to improve the production of rice.

Throughput is the maximum overall equipment effectiveness (OEE) that a line can produce, based on the performance of each station on the line. If any station is constrained and delivering less than optimum output, the throughput capability of the entire line cannot exceed the throughput capability of that particular station.

V. OBJECTIVES

- To maintain the productivity of the rice.
- To maintain the quality of rice extracted from the paddy.
- To minimize the percentage of delayed delivery of rice.
- To improve the percentage of on time delivery of rice.
- To maximize the milling hours.

VI. METHODOLOGY

- 1) **REQUIREMENTS**
- 2) DESIGN
- 3) IMPLEMENTATION
- 4) VERIFICATION
- 5) MAINTENANCE

The authors describe a methodology for making the decisions associated with the concurrent engineering of a product and its downstream held support. They adopt, for the overall metrics for evaluating these decisions, long run system availability and life cycle cost. The decisions that constitute the concurrent engineering effort can be categorized into three phases: designing the product, designing the production and logistics systems, and setting operations control policies for production and field support. As an enhancement to well established methods of coordinating decision makers in concurrent engineering and sharing data across different phases of design and deployment, they have developed a methodology that simultaneously makes the decisions that constitute these

phases. This methodology is based on a dynamic model of these decisions which is robust and efficient when compared to manual methods of coordinating the concurrent engineering effort. They recommend its use as a decision support mechanism, not as a substitute for interaction among design-team members.

VII. RESULT OBTAINED

Following are the results obtained after the successful implementation of concurrent engineering concept in the rice industry:

A. Results in terms of maintained productivity

The productivity can be maintained by implementing concurrent engineering in the rice industry. Whenever a technical fault comes into the huller, polisher or bucket elevator, then the production of rice stops due to increased broken in the rice or improper removal of the bran layer from the rice, which causes the low quality of rice. So, we uses the another huller, elevator or polisher, which remains under the normal working conditions.

B. Results in terms of maintained quality of rice

Whenever a technical error comes into a huller, polisher or elevator then we can use another one which remains ideal during normal working conditions. So, the quality of rice can be maintained.

C. Results in terms of on time delivery of rice

Whenever a technical error comes into the huller, elevator or polisher i.e. the polisher starts producing more broken rice, then we have to shut down the machine which increased the delivery time of rice to the market. But with the help of one extra elevator and polisher, the production continues and the rice can be delivered on time to the market.

D. Results in terms of reduction of broken rice

Whenever an elevator or polisher starts producing more broken rice, then by shutting down them we can use another elevator or polisher, which we have employed in parallel with another polishers which stops the increment of broken in the rice.

E. Results in terms of increased milling hours

If a problem comes into the buckets of the elevator or polisher, then we have to shut down the machine which results in minimizing the milling hours and increased labour cost as the production stops during that time and the foreman starts repairing it which can take a no. of hours to repair. But the production continues with one another elevator and polisher, which results in the increased milling hours.

VIII. CONCLUSION

The rice industries are facing the problems of low production and poor quality of finished products. The

industries are interested to gain higher production, good quality and at the same time the higher profit margins. While reviewing the literature we have found some factors which critically influence the production and quality in rice industry. The analysis done in this study demonstrates that the factors like technical errors in processing, fault in the hullers, polishers and bucket elevators becomes the cause of low productivity and quality. If all these factors are balanced in a systematic way, the concept of concurrent engineering will provide a competitive edge to the Indian rice industries resulting in higher productivity, less time to market and maintained quality and hence higher revenue and profit.

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