ISSN-1997-2571 (Online) & ISSN-2075-1648 (Optical)
J. Innov. Dev. Strategy 4(1):5-11(August 2010)

A STUDY ON COMPUTER INTEGRATED MANUFACTURING METHOD IN BANGLADESHI TEXTILE INDUSTRY

C.J. MOIN[1], R. HAQUE[2] AND A.K.M. MAHABUBUZZAMAN[3]

[1]Senior Lecturer, Southeast University, Banani, [2]Lecturer, Primeasia University, HBR tower, Banani, Dhaka-1213 and [3]Principal Scientific Officer, Mechanical Processing Division, Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka-1207, Bangladesh.

Corresponding author address: Dr. A.K.M. Mahabubuzzaman, E-mail: dr.mahabub@hotmail.com

Accepted for publication on 15 July 2010

ABSTRACT

Moin CJ, Haque R, Mahabubuzzaman AKM (2010) *A study on computer integrated manufacturing method in bangladeshi textile industry. J. Innov. Dev. Strategy* 4(1), 5-11.

For small and medium enterprises the long-term goal is to stay in business and make profit. For small companies to remain competitive they must deliver products to customers, at the minimum possible cost, the best possible quality and minimum lead-time. Small and medium enterprises (SMEs) can achieve this by implementing Computer Integrated Manufacturing (CIM). A methodology for introducing computer integrated manufacturing (CIM) technology in small companies has been developed in this paper with the aim to assess the capabilities in real applications. The case study refers to a small dyeing company (Gungeetal Thread). The main benefit arising from the implementation of the proposed CIM system is the abrupt reduction of lead-time because of introduction of effective scheduling technique, which will finally, brought up customer satisfaction.

Key words: *computer integrated manufacturing, textile industry*

INTRODUCTION

Computer Integrated Manufacturing (CIM) is a term, which is broadly applied to the set of computer, and communication technologies employed in manufacturing industry. It provides companies with an excellent opportunity in order to compete in the present global context. Developing and implementing CIM applications favours companies due to many concurrent factors. According to de Venuto *et al.* (1994); Gupta and Brennan, (1995) the factors are following:

• Availability of low cost hardware and software tools, with better performance and quality makes CIM solutions accessible even to limited budget companies;
• Technical improvement in the fields of networking and personal computers allows for reliable distributed information systems, providing the opportunity to use an affordable step-by-step approach while safeguarding integrity;
• Increased awareness, at management level, of the competitive potential offered by CIM solutions;
• Actual turbulence of markets requires small companies to continuously increase performance, such as production flexibility, timely purchasing and delivery, process and product quality, in order to avoid the risk of quickly being overshadowed by more far-sighted competitors.

So the introduction of Computer Integrated Manufacturing (CIM) can help a company to maintain a competitive verge from product developing to marketing and distribution as well as in production planning & control.

Nagalingam and Grier (1999) suggested present market condition in the following figure (Figure1). The characteristics of the present world market include higher competition, lower product life cycle, greater product diversity, fragmented markets, variety and complexity, and smaller batch sizes to satisfy a variety of customer profiles. Furthermore, non-price factors, such as quality, product design, innovation and delivery services are the primary determinants of product success in today's global arena.

The motivation of CIM has been based on the perceived need for the manufacturing industry to respond to changes more rapidly than in the past. CIM promises many benefits including increased machine utilization, reduced work-in-progress and inventory, increased productivity of working capital, reduced number of machine tools, reduced labour cost, reduced lead time, more consistent product quality, less floor space, and reduced set-up cost.(A. Gunasekaren 1997)

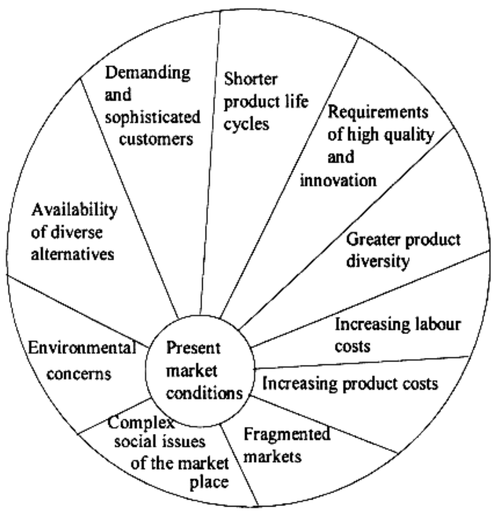

Fig. 1. Present market condition.

Attaran M (1997) found the following benefits:

Table 1

Ranking of CIM benefits

Benefits	%
Lower Cost	53.9
Quality Improvements	50.0
Production Control	44.6
Responsiveness to the market	41.0
Flexibility	37.4
Reduced Inventories	37.1
Small lot Manufacturing	25.9

Source: Sheridan (1994)

In this paper it would be studied a textile industry in Bangladesh which has applied CIM in their production process as well as in the information flow from product design to product marketing. Also it will be checked what the benefits was found after implementing CIM and it will be also discussed about further development which can be implemented in that particular company.

DEVELOPMENTS IN CIM AND RELATED STRATEGIES

Now a day's research trends are focusing on the application of CIM in manufacturing industries to satisfy the competitive and conflicting market. Today the product development times are increasing due to complexity of products but on the other hand, the product life times are reducing due to the change in peoples life style (Figure 2).

To adopt the present competitive market it is necessary to reduce the product delivery time and the concept of concurrent engineering (CE) was developed. However in 1987, the concept was given the name "concurrent engineering" with an appropriate definition by the United States Defence Advanced Research Projects Agency. CE involves, a systematic and simultaneous approach to the integrated design of products and their related processes including marketing, manufacturing, sales and purchases [Nagalingam and Grier (1999)].

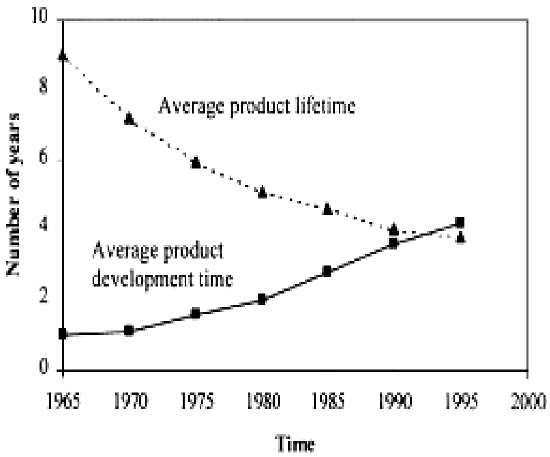

Fig. 2. Product development time vs life time of product [Nagalingam and Grier (1999)]

To reduce the labour cost many companies are relocating offshore. If manufacturing companies applied CIM this phenomenon can be avoided and also companies can face the local and global competitions with high level of confidence if successful implementation of CIM is possible. the global application of CIM. To facilitate the investment in CIM and to help manufacturing industries, many researchers are seeking solutions in application of CIM. Some of the research trends in CIM which are evolving today can be categorised as follows Nagalingam and Grier (1999):

- Justification of CIM and management strategies for CIM.
- Enterprise integration for CIM beyond and within geographical boundaries.
- Network communications for the implementation of CIM.
- Advanced tools and technologies for the application of CIM.
- Manufacturing system modelling.
- Application of artificial intelligence (AI) such as fuzzy logic, neural network, genetic algorithms and intelligent agents for fully integrated intelligent manufacturing systems.

Again with the application of internet the application of CIM can avoid the geographical boundaries as well as it helps to implement CIM globally.

Elements of CIM such as computer-aided design (CAD), computer-aided process planning (CAPP), group technology (GT), concurrent Engineering (CE), flexible manufacturing systems (FMS), material requirement planning (MRP), automated guided vehicle systems (AGVs), enterprise resource planning (ERP), electronic commerce, internet, multimedia (MM), electronic data interchange (EDI) play a key role in effectively influencing the benefits achieved by implementing CIM Marri *et al.*(2003). All the elements of CIM should include the role of human resource in the successful implementation and operations of such a system. Human resource factors such as training and education have tremendous influence to decide about the outcomes of CIM, but many companies failed to address this important issue.

PRODUCTION SCENARIO

The methodology for developing CIM application is being proposed in a small dyeing company (Gungeetal Thread). The company is in operation from 1993 and has a workforce of more than 60 employees. The production volume is 1 ton/day and forecast to triple in the next five years.

The factory is vertically integrated with the space of 1650 square feet. There are two types of dyeing machines: Package dyeing machines and Hank Dyeing machines. Batch wise production usually done with maximum machine capacity or batch size 75 kg and minimum 10 kg. Company usually practices exhaust dyeing procedure which vary as per materials i.e. polyester sewing thread and filament, nylon filament, cotton yarn, cotton polyester mixed yarn (PC, CVC) and viscose yarn etc.

Since erection with only one floor the factory has developed four production floors within fifteen years. The ground floor is used only for dyeing whereas 1^{st} and 2^{nd} floors are used for soft winding and finishing. In the 1^{st} and 2^{nd} floors paper cones are converted to soft package with specific volume and density, which is known as preparatory process for dyeing and soft winding. For this purpose, there are 8 machines total of 240 spindle. After dyeing in the ground floor, dyed materials are again converted to package/cone and hank where it gives some lubricating finishes, it is called finishing for both and hard winding only for package/cone. For this purpose, there are also 4 machines total of 100 spindle. This is performed in 1^{st} and 2^{nd} floors. In case of customer demand sometimes the yarn or filament length in package or cone is specific; this is mainly practiced for sewing threads. The production flow as bellow:

Undyed yarn ► Soft winding► dyeing ►hydro extraction ►drying ►hard winding ►packing ►delivery.

The well-equipped laboratory is used to ensure the quality of products by performing the necessary tests. This is used for formulation of dyeing recipe and process depending on the materials to be dyed.

Though it is a small factory, the management is very conscious about environment. The effluents (waste water) of dyeing process are very harmful for the living beings as BOD (biological demand of oxygen) and COD (chemical demand of oxygen) are increased. To make the effluents environment friendly an ETP (effluent treatment plant) with the capacity of 5000 litre is run during production hours.

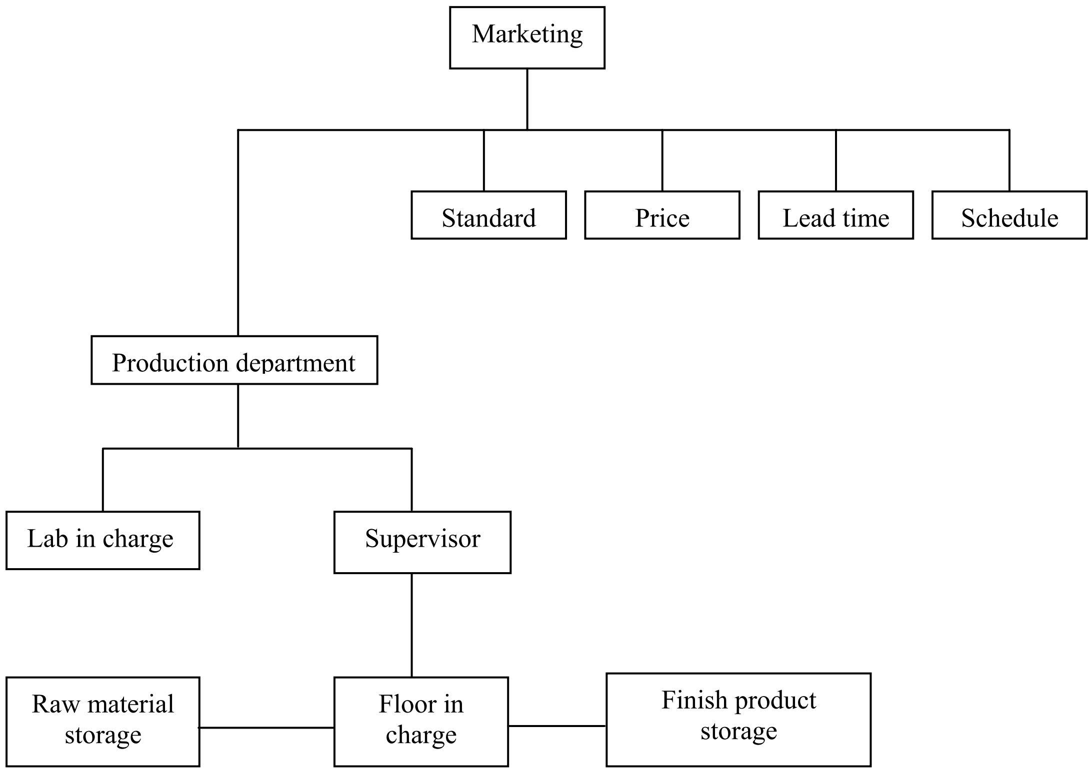

Fig 3: Current Information Flow

The current information flow is described in figure 3. It is based on a mane frame (Top management) which carries out usual administration and accounting task as well as a support to the production and inventory management. The production manager identifies the production order to be released and their due date on the basis of customer order and inventory. The production planning function receives production order and carries out a manual scheduling activities based on both due dates and minimizations of number of machine setup, providing the shop floor with manufacturing orders. Lab in charge will do a sample production if it is ok then floor in charge will go for batch production.

MAIN PROBLEMS

From the above description it follows that company essentially suffers from a lack of information exchange and integration between the various functional departments, which needs to be filled on a limited budget. The main problems characterizing the production scenario can be summarized as follow:

•Low level of process control
•Excessive reliance on paper support for in formation exchange
•Production management practically characterized by no scheduling
•Stock level are not optimised
•Information gap between shop floor and purchase department.

Another important factor should be taken into account is the market demand increase foreseen. So in near future the company will face the increased market demand and it will be compensate by means of significant extension of production capacity.

PROPOSED SOLUTION

The main objective to perform a CIM application can be summarized as follows:

•Lead time reduction, which will increase customer satisfaction.
•Reduce the work in progress time.
•A real time information distribution.
•Introduction of standardization i.e. ISO9001

The proposed CIM solution is a twofold approach (de Veneto *et al.*1994) a top down approach, which will define the global strategy and will point out the areas interested in CIM introduction, followed by a bottom-up phase, where the overall CIM concepts are gradually implemented, which will create the desired scenario. In particular the approach to be followed in the implementation of CIM project is based on four main phases (Caputo *et al.* 1998):

1. development of a general concept considering a top-down approach, aimed at outlining a consistent overall scheme;
2. breakdown into modules, still based on a top-down approach but managed by tackling limited problems and operating areas;
3. gradual implementation based on bottom-up approach, having computerization as a goal;
4. integration based on a bottom-up approach, aimed at recreating the initial innovation framework.

The proposed CIM solution is schematised on Figure 4.

In this solution Production Supervisor (PS) is linked with Top Management (TM) in the upper side and in the lower side TM is linked with various department (Assembly line, testing, warehouse). Again PS keeps communication with Production Director (PD) and Scheduling Personal computer (SPC). PS receives the production order to be filled from TM (Figure 5), which can be classified on forecast and on demand. In the return PS will send back to TM about the production advancement. The orders which PS receives from TM are classified and then send to SPC which has a scheduling software to obtain a real time updating production Planning (PP).

The SPC in return, transmit to PS the operating schedule approved by production Planning Manager (PPM), together with possible alternatives (Figure 6). These schedules are visible to Production Director (PD). Production Director also informed about the production advancement by PS. The PD integrates all the information with his Computer and then he can modify the production Schedule (Figure 7).

Production schedule, which has modified and approved PD then send to assembly line through PS. A supervisor may supervise the assembly. He will inform PS about production advancement, scrap, and machine status (Figure 8). And finally PS will interact with Testing Department (TD) and Warehouse PC (WPC) for the total integration.

CONCLUSION

The case study on the dyeing company “Gungeetal Thread” to implement CIM represent a proposal to increase the efficiency and to compete the present global competitive market. The main benefit arising from the implementation of the proposed CIM system is the abrupt reduction of lead-time because of introduction of effective scheduling technique, which will finally, brought up customer satisfaction. Elimination of paper based information flow will reduce the use of tangible product, which has a very important impact on environment and sustainability. With the proposed CIM greater control and visibility of the whole production system can be achieved. Execution of priority jobs, which can't be scheduled with respect to due date of delivery in manual system can be achieved easily with the proposed CIM system.

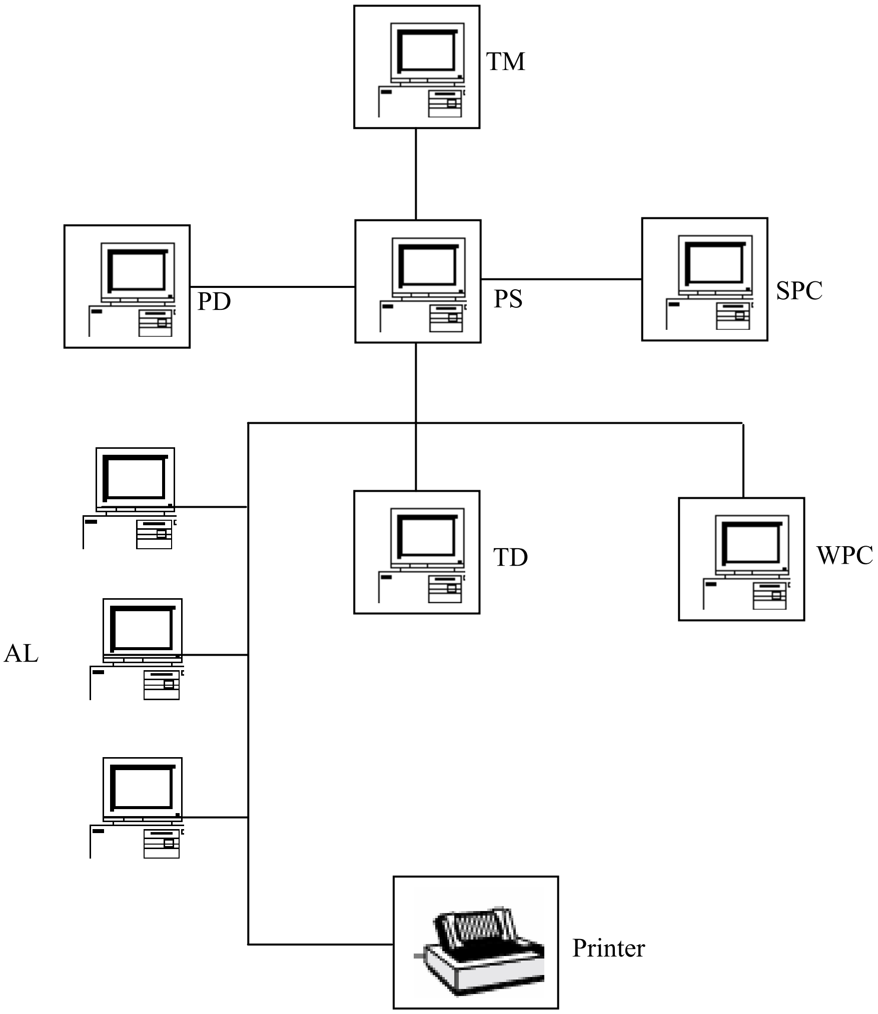

Fig 4: Functional scheme of the proposed CIM solution

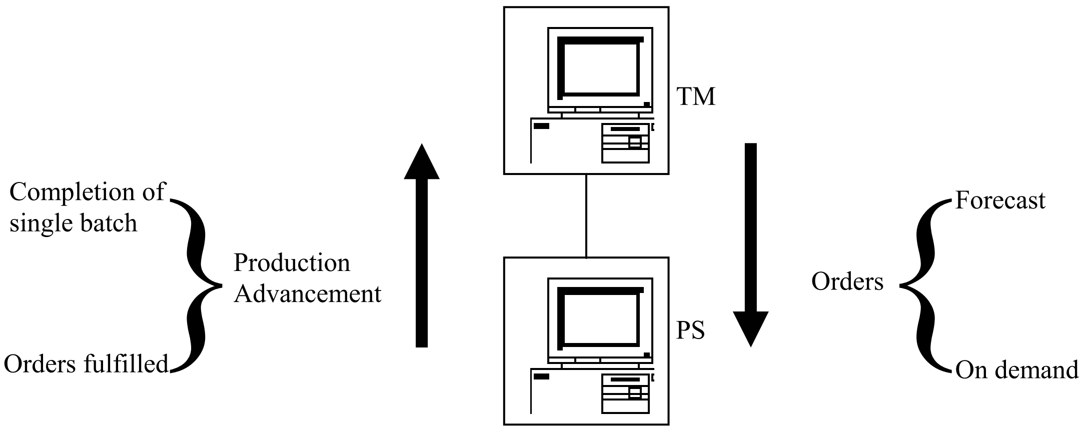

Fig 5: Information flow between TM and PS

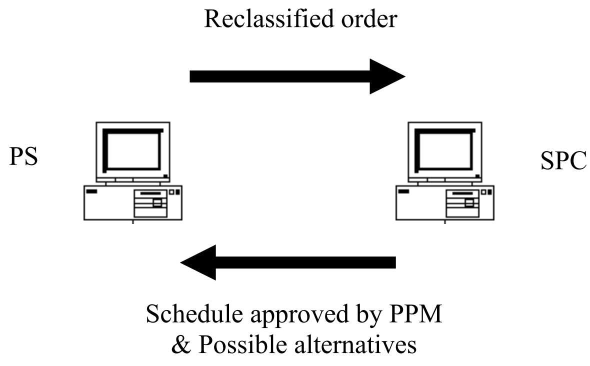

Fig 6: Information flow between PS and SPC

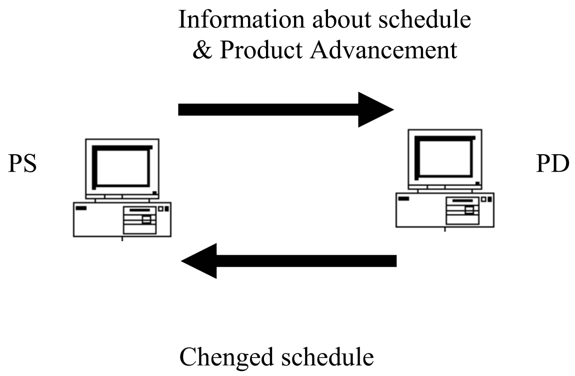

Fig 7: Information flow between PS and PD

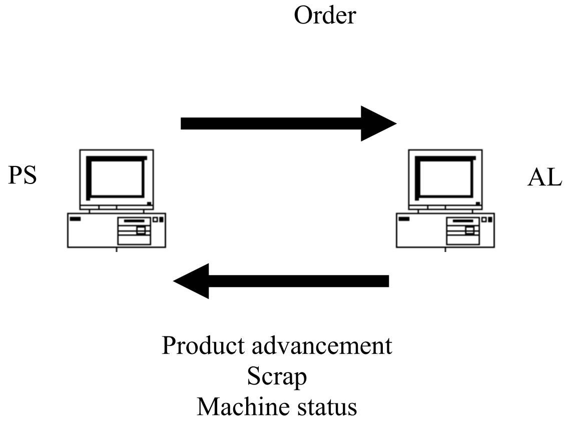

Fig 8: Information flow between PS and AL

In this proposed study the CIM implementation was based on the establishment of an effective information exchange structure between high level corporate management, assembly line, scheduling department centred on a single production supervisor node. As a result a low cost solution was developed with the aim to reduce production cost, throughput time and to reduce inventory levels. By adopting the proposed CIM flexibility, quality and good logistics can be achieved.

REFERENCES

Caputo AC, Cardarelli G, Pelagagge PM (1998) "Computer integrated manufacturing in small companies: a case study", Industrial Management & Data Systems 98/3[1998] 138-144.

Gunasekaren A (1997) "Implementation of computer-integrated manufacturing: a survey of integration and adaptability issues", Int. J. computer integrated manufacturing, 1997, 10(1-4), 266-280.

de Venuto G, Garetti M, Monti G, Pozzetti A (1994) "A low cost approach to computer-integrated manufacturing in a small chemical unit", Production Planning and Control, 5(4), 409-18.

Marri HB, Gunasekaran A, Kobu B (2003) "Implementation of computer-integrated manufacturing in small and medium enterprises", Emerald research, Industrial and commercial training, 35(4), 151-157.

Mohsen A (1997) "CIM: getting set for implementation", Industrial Management & Data Systems 97/1 [1997] 3–9 © MCB University Press [ISSN 0263-5577].

Nagalingam SV, Grier CI Lin (1999) "Latest developments in CIM". Robotics and Computer Integrated Manufacturing 15 (1999) 423-430.

Sheridan JH (1994) "How do you stack up?", Industry Week, 21 February, pp. 53-66.