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CONTEMPORARY PRODUCTION MANAGEMENT CONCEPTS – AN OVERVIEW

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Abstract: ***Production control and management is very important aspect for any manufacturing industry. There are many activities necessary to manage production, planning and control. The Production Planning and Control (PPC) is a traditional approach where infinite activities are carried out. These activities includes planning and procurement of raw materials, scheduling of processes, batch quantity determination, inventory management, material movement, manpower planning, machine utilization, manufacturing wastes, inspection, quality control etc. Managing all activities and smooth streamlining of production process is very difficult task and it involves huge manpower for planning and coordination of these activities.***

The modern trend of production management includes newer concepts to be adopted for the manufacturing of the products. They are Computer Integrated Manufacturing (CIM), Flexible Manufacturing System (FMS), Just In Time (JIT), Concurrent Engineering (CE), Business Process Reengineering (BPR), Benchmarking, etc. These contemporary trends are not only adoption of new concepts, but it improves the production planning, makes production system more effective and it also results in quality improvement of the products. This paper discusses about the scope and application of modern process improvement production management techniques. This analysis is useful for entrepreneurs of small scale industries to appreciate the newer concepts, and definitely helpful in up-gradation of these industries. Adoption of these concepts will stabilize the manufacturing process, and will offer better quality products to customers.

Key Words– **Computer Integrated Manufacturing (CIM), Flexible Manufacturing System (FMS), Just In Time (JIT), Concurrent Engineering (CE), Business Process Reengineering (BPR), Lean Manufacturing.**

I. INTRODUCTION

The most desirable and common goal of all manufacturing industries is to manufacture products according to need of the customers with better quality, minimum manufacturing cost and effective utilization of physical and human resources. The long term objective of majority small scale industries is to sustain in the market for longer period of time and to satisfy customer needs. In the current scenario of globalization and modernization, this is only possible by adoption of modern concepts of production management concepts.

Many large scale industries are adopting new technology machineries and modern production management tools because they are relatively established and stable in the business, but this is always difficult task for small and medium scale industries. There are many modern production management methods and which are beneficial in several aspects.

These production management tools can be broadly classified as following.

Manufacturing Process Improvement Tools	Design Improvement / Product Development Tool	Quality Improvement Tools	Overall System Improvement Tools
1. Computer Integrated Manufacturing (CIM), 2. Flexible Manufacturing System (FMS), 3. Just In Time (JIT), 4. Business Process Re-engineering (BPR), 5. Concurrent Engineering 6. Lean Manufacturing	1. Poka Yoke; 2. Quality Function Deployment (QFD); 3. Concurrent Engineering (CE) 4. Failure Mode & Effect Analysis (FMEA)	1. Total Quality Control (TQC), 2. Statistical Quality Control (SQC), 3. Six Sigma Strategy, 4. Cost of Quality, 5. Standardization, 6. Value Engineering, 7. Bench Marking.	1. Total Quality Management (TQM) 2. ISO 9000 standards, 3. Enterprise Resource Planning (ERP), 4. Supply Chain Management (SCM),

These concepts are not used according close tight compartment of classification, but can be used across the classified groups. For example, Concurrent Engineering may be used for process improvement as well as design performance area of product. Similarly, Benchmarking technique may be used for either process improvement or any other quality criteria. Additionally, these concepts should be used in customized way according to need of the industries.

Literature Survey:

Ali Yassine and Dan Braha (2003) have focused their study on four critical problems that challenge management while implementing Concurrent Engineering in complex Product Development (PD) projects. They refer to these problems as: iteration, overlapping, decomposition & integration, and convergence problems. They describe these problems proposing a unified modeling and solution approach based on the Design Structure Matrix (DSM) method, which is an information exchange model that allows managers to represent complex task relationships to better plan and manage Concurrent Engineering initiatives.

The strength of DSM models comes from their usefulness in: (1) reducing the complexity of product development by providing managers with a comprehensive analytical tool-set; (2) revealing easily and clearly the information flows between the tasks of a complex system. This allows for a simple visual display and analysis of potential iterations. (3) allowing development managers to discover previously unknown process, product and organizational patterns, which opens new avenues for improvement; and (4) understanding the dynamics of

the total number of design problems being solved at any time point; thus, suggesting ways to mitigate the slow convergence or divergence of PD processes.

Dr Kulwant S Pawar, Helen Driva e:tal (1996) have suggested 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'. 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.

Just-in-time (JIT) manufacturing system received considerable attention since the early 1980s. Some of the main benefits of JIT such as inventory reduction, quality improvement and quick delivery are well documented by Temponi and Pandya(1995); Deshpande and Golhar (1995); Handfield (1993); Lawrence and Hottenstein (1995); Golhar, Stamm and Smith (1990); Moras and Dieck (1992).

Jayanta K. Bandyopadhyay (1995) has stated that Just-in-time (JIT) philosophy is increasingly occupying a significant place in the operations strategy of companies. Although there is less controversy about the choice of selecting JIT, as a mode to adapt to the changing business environment, there is a lot of confusion as to how to organize an effective JIT system. Even in companies that have started JIT implementation, the short term visible benefits of lot-size reduction, down-loading of inventory etc., have wrongly lead to the belief that an effective JIT strategy is in place. In reality, the JIT strategy is not a one-shot effort, but an ongoing long term process. During the course of the JIT implementation and control, constant fine tuning at various levels in the organization is required to put in place the desired setting for a more effective operations strategy.

Mohammad Z. Meybodi has focused in his article that the principles of just-in-time (JIT) in manufacturing can also be used to improve New Product Development using Simultaneous Engineering (NPDSE) process. Five tests of hypotheses were developed to compare new product development performances before and after JIT implementation. Statistical results also showed that compared with the period prior to JIT implementation, successful JIT organizations are able to develop new products with 67% fewer design changes, 61% less development time, 74% more frequency, 45% less development cost and 36% less manufacturing cost. In summary, the statistical significance of NPD performances before and after JIT is a clear evidence of the possible links between successful implementation of JIT in manufacturing and successful management of NPDSE.

Bo Hou, Hing Kai Chan, and Xiaojun Wang (2011) Just-In-Time (JIT) has been a very popular operations strategy partly because of its success in the Japanese industry. Various benefits, for example, inventory reduction, improved in operations efficiency, and faster response, have been studied widely in earlier research. Therefore, successful implementation of JIT is vital to many companies. The research reveals some key findings in implementing JIT systems under five themes. They are Information system, Production planning, Inventory management, Quality management, and Suppliers management. In supplier management, the whole logistics system and the relationship with suppliers are of vital importance. In addition, this research also supports the benefits of applying JIT systems as advocate in many studies.

Computer Integrated Manufacturing:

Production management (main function area) and various sub systems (planning, scheduling, designing, purchasing, etc.) are interconnected by powerful computers for the purpose of data

transfer and information flow is recognized as Computer Integrated Manufacturing. This is the complete automation of a manufacturing facility of an industry. All functions are under computer control. This starts with Computer Aided Design, followed by Computer Aided Manufacture, followed by Automated Storage and Distribution. One integrated computer system controls all activities.

The main thrust of implementing CIM is productivity improvement. The data transfer through paper work is eliminated and computers are used to accelerate the production management system.

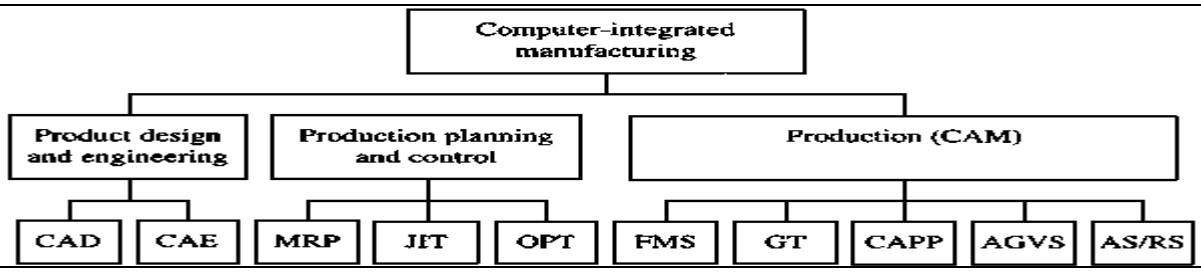

Figure 1: Computer Integrated Manufacturing

There are two aspects of CIM. They are organizational part and operational part. The organizational part includes planning, finance, marketing and corporate services. The operational part includes Computer Aided Planning, Computer Aided Design, Computer Aided Manufacturing, etc.

Flexible Manufacturing System:

A Flexible Manufacturing System (FMS) is a manufacturing system in which there is some amount of flexibility that allows the system to react in case of changes, whether predicted or unpredicted. FMS is the latest level of automation to achieve higher productivity and flexibility from manufacturing system. FMS is implemented by collection of production equipment logically organized under a host computer and physically connected by a central transport system. The objective of FMS is to simultaneously manufacture a mix of piece part types. Here, system should be flexible enough to manufacture different piece part type mixes without time consuming and costly change over.

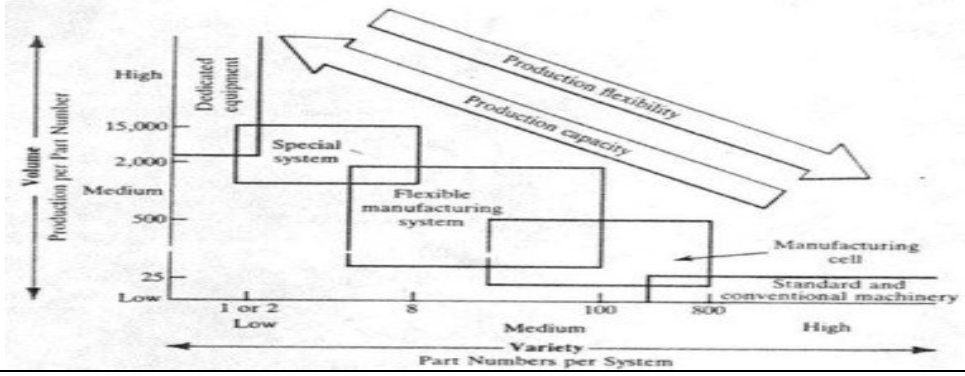

Figure 2: Comparison of Flexible Manufacturing System with other systems

FMS includes various primary equipment as work centers (machines) and process centers (robots). It also includes secondary equipment like Support stations (pallets, tool setters, tool stores, raw material stores etc.).

Concurrent Engineering:

Concurrent Engineering is a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. Typically,

concurrent engineering involves the formation of cross-functional teams, which allows engineers and managers of different disciplines to work together simultaneously in developing product and process design. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from concept through disposal, including quality, cost, productivity, speed (time to market & response time), and user requirements (include functional and reliability).

Concurrent engineering is a management and engineering philosophy for improving quality and reducing costs and lead time from product conception to product development for new products and product modifications. CE also means that the design and development of the product, the associated manufacturing equipment and processes, and the repair tools and processes are handled concurrently.

The concurrent engineering idea contrasts sharply with current industry sequential practices, where the product is first designed and developed, then manufacturing approach is established, and finally the approach to repair is determined.

Benefits of Concurrent Engineering are reduces time from design concept to market launch, reduces Capital investment, supports total quality from the start of production with earlier opportunities for continuous improvement, simplifies after-sales service etc.

Just in Time:

Just in Time is an integrated set of activities designed to achieve high volume production using minimal inventories of raw materials, work in process, and finished goods. Raw materials are arrived at Just in time, and parts are processed at just in time. JIT is based on the logic that nothing is produced until it is needed. Need is created by actual demand of the product. When item is sold, the market pulls another unit from last position of the system. Therefore, JIT is called Pull system.

Just in time is reducing the inventory of the organization drastically, hence it is also known as an inventory reduction technique. KANBAN system is used in JIT which is a novel concept of Pull system instead of conventional Push system. Just in time is not limited to these, but it is beyond everything. Just in time is a production control technique for elimination of waste.

There are seven elements which addresses elimination of waste are

1. Focused Factory Network
2. Group Technology
3. Quality at the source
4. JIT production
5. Uniform plant loading
6. Kanban Production Control system
7. Minimized setup times

JIT requires certain changes in the manufacturing process from conventional manufacturing system. They are stabilized production schedules, higher plant capacity, cross training of force, reduction in equipment breakdown, long term supplier relations and respect for people.

Benefits of JIT are reduced inventory levels drastically, less space required, customer responsiveness increases, reduction in total product cycle time, improved product quality, reduced scrap and rework costs, etc.

Business Process Reengineering:

Business Process Reengineering is defined as the fundamental rethinking and radical redesign of business processes to achieve dramatic improvement in critical, contemporary measures of

performance such as cost, quality and speed of product delivered by an organization. This can be applied to manufacturing as well as service organizations.

The pioneer in this filed is Michael Hammer, an eminent management consultant. The dominant performance measures of any organizations are cost, quality and speed of production. This means that the product / services delivered by the organization to its customer should have the utmost quality with the least cost and lead time. These are areas where, improvement is always possible infinitely.

For many organizations, achieving a desired target may be easy, but to sustain the new level of its operation is more difficult. In the competing global business environment, sustenance of the current level of operation of the organization alone will not be sufficient because there should be continuous significant growth of the organization to compete with their co-organizations in the market. Under such circumstances, implementing BPR is beneficial to utilize its strength for betterment.

Steps of BPR:

1. Development of process vision and determination of process objectives
2. Definition of process to be reengineered
3. Measurement of existing processes
4. Identification of information technology applications
5. Design prototype and implementation

Lean Manufacturing

Lean Manufacturing is a systematic approach to identify and eliminate wastes of all non-value added activities through continuous improvement that is being adopted by world class high performance firms to produce remarkable results. It is also called as a manufacturing system in which friction is absent. Massaki Imai calls this friction as muda (waste); which consists of all non-value adding activities.

The focus is not on the department, area of process, but on the optimization of the entire value stream which is the series of processes between receipt of customer order and delivery of finished products.

Lean manufacturing is targeting….

1. Reduction in cycle time
2. On time deliveries
3. Reduction in work process inventory
4. Improvement in quality
5. Increase in the availability of machines
6. Reduction in rework and scrap

Benchmarking:

This is a process based approach. Any manufacturing industry at any stage has to compare the manufacturing process of the product with the other organization, who has achieved better position in the market. The main aspect is the way we are manufacturing the product, should be compared with other company product and making attempts to improve the existing product or manufacturing methodology.

Summary:

1. Modern production management methods are not only adaptation of new method or concept, but they bring drastic improvement in the product performance and manufacturing process.

2. Adaptation of modern concepts makes production process faster, accurate and efficient depending on scope of implementation.
3. Usually, once the product is established sufficiently in the market, industries are aimed to business targets and focus is shifted to marketing instead of manufacturing process. Implementing modern concepts in industries increases focus on manufacturing aspect and improves stability in manufacturing process.
4. Use of CE improves design, improves process, reduces lead time, and brings faster product improvement.
5. Implementing CIM increases productivity and consistency of products, maintains quality, accelerates internal communication, reduces paper work, and increases customer satisfaction.
6. Implementing FMS is advantageous in reduced manufacturing cost, lower cost / unit, greater labour productivity, greater machine efficiency, improved quality, etc.
7. Implementing Just in time benefits in several ways like reduced inventory level, space saving, increased customer responsiveness, reduced product cycle time, improved product quality, reduced scrap and rework costs, etc.
8. Implementing BPR bring change the process drastically and improves process in accuracy, speed, smoothness, and reduces errors.
9. Implementing lean manufacturing reduces the cost of production and overall cost of product due to reduced wastes.

	FMS	CIM	CE	JIT	BPR	Benchmarking
Principles	• Flexibility	• Combination of CAD, CAE and CAM	• Product Development	• Pull Approach • Single unit flow	• Dramatic improvement in operational effectiveness	• Achieving high performance level
Objectives	• ability to deal with • mixed parts, • allow variation in parts assembly • variations in process sequen. • change the prod. volume • change in design	• To streamline mfg. process • To integrate them with business functions like accounts, marketing etc.	• To improve design, process, performance • To improve engineering process • Product Development time reduction • Cost reduction	• Elimination of waste • Quality at source • Simplification • Cellular Manufacturing • Respect for people	• Quantum gain in performance process in time, cost and output • Breakthrough change in process	• To determine what and where improvement called? • Comparing with other brands and improving performance
Methodology	• Integration of robots, CNC m/cs, instrumentations, computers, sensors etc.	• Integration of MIS, ERP, CAD, CAPP, CAM, QMS, DBMS.	• Continuous improvement	• Cellular manufacturing	• Introducing Information Technology	• Comparison of design, process, performance
Advantages	• Reduced mfg cost • Lower cost / unit • Greater labour productivity, • Greater machine efficiency, • Improved quality, • Increased system reliability, • Reduced parts inventories, • Shorter lead times	• High Productivity and consistency • Better quality control • Faster communication • Reduced paper work • Customer satisfaction	• Improved design • Improved process • Reduction lead time • Better product performance	• Efficient mfg. process • Inventory control • WIP control • Reduction of waste	• Improved process • Accurate process • Faster process • Smooth process • Errorless process • Also useful in Service sector	• Direction to improve • Achieving excellence • Using modern concepts

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