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AN INNOVATIVE APPROACH TO INTEGRATED OPTIMIZATION PRODUCTIVITY IMPROVEMENT THROUGH CIM

PRAVEEN.T[*1], Dr.B.KUMAR

[*1] RESEARCH SCHOLAR, DEPARTMENT OF MECHANICAL ENGINEERING, SUNRISE UNIVERSITY, ALWAR, RAJASTHAN, INDIA

[2] RESEARCH SUPERVISOR, DEPARTMENT OF MECHANICAL ENGINEERING, SUNRISE UNIVERSITY, ALWAR, RAJASTHAN, INDIA

ABSTRACT: This paper emphasizes the many role of computer Integrated manufacturing (CIM) to the economic system. Ranges of topics are lined during this paper: CIM definition, history, necessities in post WTO state of affairs, organization, and application. Today's business competes during a really international marketplace. economical transportation networks have created a "world market" during which we tend to participate on a each day. For any industrial country to contend during this market, it should have firms that give economic high-quality products to their customers during a timely manner. The importance of group action product style and method style to attain a style for production system can't be overemphasized. However, even once a style is finalized, producing industries should be willing to accommodate their customers by permitting unpunctual engineering -design changes while not touching shipping schedules or sterilization product quality. Therefore, Most U.S.-based producing firms look toward CAD/CAM and CIM to produce this flexibility in their producing system. The Republic of India business would have to be compelled to modification from a standard producing vogue to computer integrated manufacturing style so as to deal with the post World Trade Organization necessities. The paper discusses productivity improvement by using computer integrated producing in Republic of India

KEYWORDS: Productivity Improvement, Computer Integrated Manufacturing [CIM], WTO

1. INTRODUCTION

"Computer Integrated Manufacturing (CIM) is an administration theory in which the elements of plan and manufacturing are supported and composed utilizing computer, correspondence, and data advancements" as indicated by Bedworth et al. (1991). CIM has the capacity to a great extent or totally robotize adaptable manufacturing by organizing work cells, robots, programmed capacity and recovery offices and material dealing with frameworks.

"CIM is another sort of scholarly hypothesis utilized as a part of arranging, overseeing, and running the endeavor's creation; it exploits computer programming and equipment, artificially utilizes present day overseeing innovation, manufacturing innovation, data innovation, programmed innovation, framework building innovation, and it coordinates naturally the three relative components of Person, Technology, Running Management in

the entire procedure of big business' creation, and also data stream and material stream, and runs them ideally, to make benefit brilliant, put up items for sale to the public opportune, and understand item's fantastic, ease, with the goal that endeavors will win the market rivalry".

It is proverbial that computers, computer applications and integrated, (for example, endeavor and esteem chain wide) computer frameworks will be connected in cutting edge manufacturing organizations. The key issue that remaining parts to be settled is to characterize where we will apply these frameworks, how we will apply these frameworks, and how these frameworks will be made and how the division of undertakings between the "general population framework" and the CIM framework is chosen. The paper talks about such issues.

Basically, CIM is the utilization of computer frameworks to incorporate a manufacturing venture. CIM gives the devices to empower the utilization of hierarchical projects, for example, Total Quality Management, Continuous Improvement,

Simultaneous Engineering, and Design for Manufacturability, Design for Assembly, and simple idea of "Do it right the first run through". Coordinating data and associations will diminish the calculated size of an organization, influencing it to seem, by all accounts, to be little once more in any event from the administration, organization, and data sharing perspectives. The objective of CIM is to give the computer applications and correspondences expected to achieve the joining (with coordinating authoritative changes) that will enable an organization to exploit these new abilities. The CIM advancements may include:

- Computer-helped outline
- Computer-helped produce
- Computer numerically controlled machines
- Flexible manufacturing frameworks
- Robotics
- Automated material taking care of frameworks
- Group innovation
- Manufacturing asset arranging

2. PRODUCTIVITY IMPROVEMENT THROUGH COMPUTER INTEGRATED MANUFACTURING

2.1. Historical developments in advanced manufacturing technologies

Historical developments in advanced manufacturing technologies can be outlined as Exhibit 1:

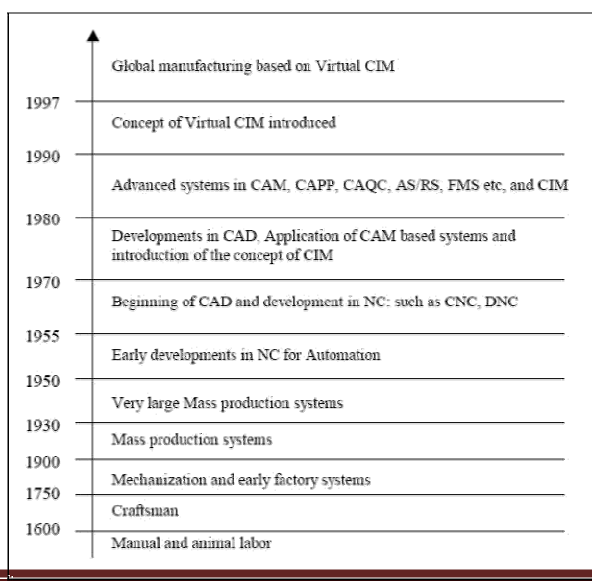

Exhibit 1: Developments in Manufacturing Technology

2.2. The causes of the slowdown in US manufacturing industries

The requirement for combination has developed because of the issues looked by the customary manufacturing procedure of mechanical mechanization. Singular computerization in each utilitarian unit made islands of mechanization. These islands of computerization did not encourage correspondence between the useful units. Blunders in information sharing and different confuses with these islands of robotization persistently tormented the Manufacturing business. The many-sided quality of new manufacturing advancements, financial matters, expanding human restrictions, computer improvements, and rivalry from abroad has constrained the start of integrated computer helped manufacturing (ICAM) program by the United States of America Air compel. The ICAM program led in 1983 found the accompanying basic issues in modern computerization:

1) Information couldn't be controlled by clients,

2) Changes were too exorbitant and tedious,

3) Systems were not integrated, and

4) Data quality was not reasonable for incorporation.

Manufacturing directors consider and embrace creative and propel advances because of the worldwide rivalry, which exists today, from Japan and Europe, as well as shape low work cost nations, for example, China. The manufacturing engineer today should comprehend and have the capacity to get ready for these new advances to get by in the present world condition. They ought to have an unmistakable idea of mechanizing the manual and self-loader hardware to receive the rewards of these rising advances. Execution of CIM could enable organizations to accomplish their focused objectives to make due in the worldwide market condition as long as the advancements picked are fitting to meet their targets.

2.3. Benefit from CIM

The integration of the technologies brings the following benefits:

1. Creation of a truly interactive system that enables manufacturing functions to communicate easily with other relevant functional units.
2. Accurate data transferability among the manufacturing plant or subcontracting facilities at in-plant or diverse locations.
3. Faster responses to data-changes for manufacturing flexibility.
4. Increased flexibility towards introduction of new products.
5. Improved accuracy and quality in the manufacturing process.
6. Improved quality of the products.
7. Control of data-flow among various units and maintenance of user-library for system-wide data.
8. Reduction of lead times which generates a competitive advantage.
9. Streamlined manufacturing flow from order to delivery.
10. Easier training and re-training facilities.

2.4. Why is CIM very important to National Economy

In today’s competitive international business environment, companies are calling for new approaches to manufacturing. Also, the growth in computer-based technology during the 1980s, coupled with the emergence of flexible manufacturing systems (FMS) and just-in-time (JIT) inventory control forced movement away from the traditional product focused manufacturing paradigms of the mass-production era to that of a process-focused paradigm. Through the use of various computer-aided technologies, computer integrated manufacturing (CIM) attempts to pull all of the functional areas of a business into a cohesive, interconnected, interactive, self-aware whole. CIM includes such activities as product/process design, manufacturing technology, material acquisition, information resource management and total quality management. CIM utilizes enterprise-wide computer-aided technologies to maintain quality, speed new product development, minimize costs and maximize flexibility to respond to ever-changing customer desires. Thus, the competitive advantage of CIM in industry comes from its ability to:

Develop a large quantity of new products quickly;

Produce small production runs of custom-made items efficiently; and

Maximize the flexibility of the manufacturer in responding quickly to changes in the environment.

Verifiable manufacturing ideal models can't convey every one of these objectives at the same time, however CIM holds the possibility to do as such. The present condition of desires is that Computer Integrated Manufacturing (CIM) will at last decide the modern development of world countries inside the following couple of decades. Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), Flexible Manufacturing Systems (FMS), Robotics together with learning and Information Based Systems and Communication Networks are relied upon to create to a develop state to react adequately to the administrative prerequisites of the plants without bounds that are winding up profoundly integrated and complex. CIM speaks to another generation approach that will enable the industrial facilities to convey a high assortment of items effortlessly and with short creation cycles. The new advances for CIM are expected to create manufacturing conditions that are more astute, quicker, close-coupled, integrated, streamlined, and adaptable. Advancement and a high level of specialization in materials science, counterfeit consciousness, and interchanges innovation and learning data science strategies are required among others for the improvement of feasible and workable CIM frameworks that are equipped for changing in accordance with unpredictable markets. CIM plants are to permit the creation of a wide assortment of comparative items in little clumps through standard yet multi-mission situated outlines that suit adaptability with particular programming. CIM manufacturing plants are to work as per such qualities as decentralization, integration, adaptability, and fast change of product offerings, reaction to advancement, creation attached to request, and numerous capacities. Different necessities for CIM are insignificant downtime and support, greatest item family extend, capacity to adjust to fluctuation in materials and process conditions, the capacity to deal with progressively complex item outlines and advancements inside the current frameworks with least interruption and least cost.

2.5. Barriers to CIM adoption

Despite all the money, energy, and time spent by companies trying to automate their factory, CIM is still an unfulfilled promise for many. Managers have continually struggled with the problem of successfully putting the pieces together to get the most out of CIM technology. In the past few years, several surveys have attempted to investigate the problem and identify the primary obstacles to more rapid adoption of CIM technology. Some of the findings are identified below.

2.5.1. Management perception and attitude

In late 1970s and early 1980s, as CIM advanced quite rapidly in the USA, disillusionment with automation has surfaced. Frequently, top executives viewed CIM as just technology – a master computer controlling many robots and automated machines. They are wrong; if CIM were just technology, there would not have been as many companies having difficulty implementing it. CIM is the management of technology rather than a technology itself. It is the integration of people and functions utilizing the computer and communication networks to transform automation into interconnected manufacturing systems.

CIM requires a new perspective on the part of management – maybe even a new philosophy. Top management, manufacturing and industrial engineers must change their way of thinking and develop new skills.

2.5.2. Top management commitment

In many companies where CIM does not fail to realize its potential "top management's commitment and ongoing support" is cited as a major reason. The magnitude of undertaking can be a great problem if there is not major and absolute commitment by management of the necessary time and resources. CIM installation must start from the top with a commitment to provide the necessary time; money; and other resources needed to make the changes that CIM requires.

2.5.3. Lack of planning

CIM success requires deliberate and careful planning of the technical element in conjunction with training from day one. Lack of understanding of the technology and suitable infrastructures to support the new technology, inappropriate matching of technology to organizational strengths and weaknesses will all contribute to top management's failure to appreciate the promise of CIM. Organizational design is an integral part of CIM, promoting or inhibiting the implementation.

2.5.4. Integration challenge

Experts agree that the important issue to be addressed before CIM can become a reality is integration. The ultimate objective of CIM is the integration of all parts of the organization across the major functional boundaries. If the company environment is right, CIM can even assist in pulling together teams of people to work on project. To take full advantage of CIM's benefits, the entire manufacturing process from product design to procurement, production scheduling, management, production and delivery must be integrated.

2.5.5. Organizational structure

CIM requires flexible organizational structure. There is a growing consensus that old fashioned approaches to manufacturing and rigid corporate rules are a significant barrier to CIM. The majority of manufacturing organizations in this country were designed to support specialization as opposed to integration.

In summary, the following are the major problems faced by manufacturers that may lead to failure in CIM (or FMS) implementation.

- Inadequate measurement system.
- Partially obsolete facilities.
- Inadequate database.
- User hostility.
- Shortage of technical skill.
- Incompatibility between systems.
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- Management generation gap.
- Changes in management philosophy.
- Facilities with mixed processing.
- Dynamic volume and mix.
- Outdated organization.
- Varieties of process options.
- Loss of superior/subordinate support.
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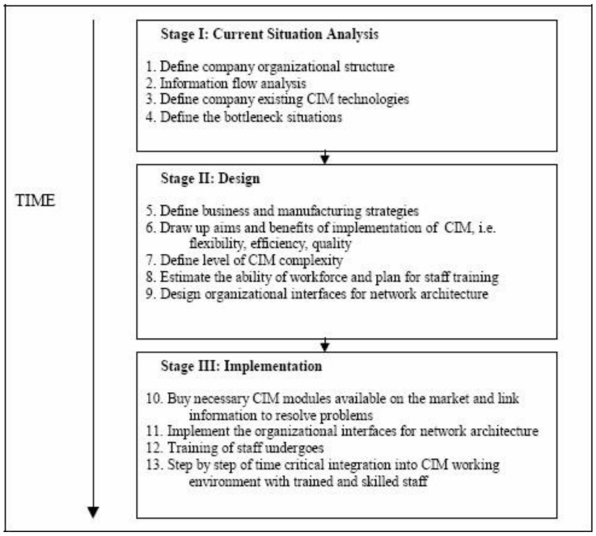
2.6. Design of the CIM System

The following business and manufacturing objectives should be considered in the design of the CIM system:

1. To maintain the consistency of the quality of products.

2. To deliver products on time.
3. To offer more products to customers.
4. To design products that will improve performance.
5. To design electronic devices that can be made on the shop floor.

for manufacturing industry to respond to changes more rapidly than in the past. CIM has potential applications in the manufacturing strategies such as agile, lean and virtual enterprises. Therefore, there is a need to investigate the areas of further development, applications and implications of CIM in the next generation manufacturing organizations. Rather than CIM, today's concepts seem to center more on ERP (Enterprise Resources Planning, but not really restricted to planning) and MES (Manufacturing Execution Systems).



2.7. Rising Needs

CIM is the concept of a totally automated factory in which all Manufacturing processes are integrated and controlled by a CAD/CAM system. It enables production planners and schedulers, shop-floor foremen, and accountants to use the same database as product designers and engineers. It is one of the most advanced tools for improving the economic performances. It is also becoming a fundamental base for designing and building the next even more advanced generation of manufacturing systems presently called as Intelligent Manufacturing Systems (IMS) . It offers a number of useful and potential opportunities for improving the competitiveness of manufacturing. The motivation for CIM has been based on the perceived need
Exhibit 3: A Proposed CIM Industry

2.8. Working principles

The following working principles may lead towards implementing CIM for productivity improvement:

- ¾ Guiding by application, driving by technology, adopting finite targets, stressing the main points, combining with the situation in India, paying attention to practical results and forming business.
- ¾ Adopting expert leading mechanism under the leadership of Ministry of Science and Technology.
- ¾ Emphasizing on Team Work, which cooperates multi-disciplines to work and system integration.
- ¾ Paying attention towards building CIM groups, especially training of youth in this subject.
- ¾ Strengthening international cooperation.

3. IMPLEMTING COMPUTER INTEGRATED MANUFACTURING

3.1. Proposed Research Environment

To better explore the avenues of CIM technology in India, setting-up of the subscript research laboratories is the need of the hour. The subscript proposal was first presented by Mr. Tariq Masood during ISCON-2002 at Lahore [5].

Table 1: Proposed CIM Research Labs

Proposed Laboratory	Main Tasks	Proposed Location	Proposed Commencement	Tentative Completion
Product Design Automation	R & D of technology and products for CAD/CAM/CAE in CIMS	NWFP Univ. of Engg. & Tech., Peshawar	2002	2005
Process Planning Design Automation	R & D of technology and products for CAPP in CIMS	NUST, Rawalpindi	2002	2005
Integrated Management Decision Information	R & D of technology and products for Computer Aided Management and Decision in CIMS	LUMS, Lahore	2002	2005
Flexible Manufacturing Engineering	R & D of technology and products for FMC/FMS/FME in CIMS	Univ. of Engg. & Tech., Lahore	2002	2005
Quality Control Technology	R & D of technology and products for CAQ in CIMS	NED Univ. of Engg. & Tech., Karachi	2002	2005
Database and Network	R & D of technology and products for Network and Database in CIMS	GIK Institute of Engg. Sciences & Tech., Topi	2002	2005
System Theory and Technology	R & D of technology and products for theory, simulation, and AI in CIMS	Univ. of Engg. & Tech., Taxila	2002	2005

3.2. Application Basic Research

The research task on application basic technology is a kind of technology-driven research under certain application background. This task develops necessary explorations, verifications, and new ideas in the concepts, principles, and methodology suitable for the forward development of worldwide CIM science and technology. This task can be divided into following sub-topics:

¾ Management Information System (MIS)

¾ Design Automation and CAD/CAM Integration
¾ Shop floor Automation
¾ Quality, and others

3.2.1. Proposed Application Basic Research Topics

The subscript is a short list of potential topics for further research in the field of Computer Integrated Manufacturing in India:

- ¾ Experiences with the implementation of integration in Computer-Integrated Manufacturing Systems (CIMS) in different countries.

- ¾ Design methodologies of integration systems including architectures and evaluation of adaptability.

- ¾ Object-oriented modeling methods for the design of CIMS.

- ¾ Knowledge-based decision support system for CIM.
- ¾ Human role in Computer-Integrated Manufacturing.
- ¾ Quality management in CIMS

- ¾ Strategic and organizational adaptation of Computer-Integrated Manufacturing Systems (CIMS) for 21st century manufacturing competitiveness.
- ¾ Implications of lean and agility on CIMS.
- ¾ Design methodologies for CIM systems including architectures and evaluation of adaptability for the lean and agile manufacturing, and value chain integration.

- ¾ CIM in a Physically Distributed Manufacturing Environment.
- ¾ Enterprise integration and environmental issues as the main objectives in the design and implementation of CIMS.

- ¾ Rapid prototyping, virtual design, manufacturing, enterprise and CIM.

- ¾ Investment Justification in the future CIMS.
- ¾ Operations Control (productivity, quality, flexibility, cost and dependability) in the future CIMS.

- ¾ CIM in Small and Medium Enterprises as the Qualifying Criterion to become a Partner of Virtual Enterprises.

- ¾ Human factors and CIM in 21st Century Manufacturing Environments.

3.3. Pre-Research and Development

This is the kind of product pre-research with major study and development for the market requirement after 3 to 5 years, on the base of product and achievement technology combining with new ideas, concepts, and principles of product developed in the world.

3.4. Applied Engineering

Applied Engineering should be one of the important considerations while implementing laboratories concept. The reasons for setting up applied engineering are listed in the following text:

- ¾ CIMS is an integration or optimization system of people, organization, technology, management, and administration; therefore it is necessary to master CIM technology completely by typical enterprise practicing.

- ¾ The works of typical enterprises practicing can guide the carrying out of CIMS in other enterprises of India.

- ¾ The practice of applied enterprises and research labs. will counter check each other for better results.
- ¾ There should be more than seven enterprises to be declared as role models.

4. INTERNATIONAL ASPECTS OF CIM IN POST WTO SCENARIO

4.1. THE INTERNATIONAL ROLE MODELS

Today, Japan is one of the more advanced countries in implementing CIM in the world. Nevertheless, the implementation of CIM in Japan has some differences to that of Western countries. Among these companies we have Hitachi Ltd, Mitsubishi Electric Corporation, Toyota Motor Corporation, Toshiba, Toyo Engineering

Corporation, Omron Corporation, Tokyo Electric Corporation, Fanuc Ltd., Shimizu Corporation and Nippondenso Corporation. The CIM study concerning Intelligent Manufacturing Systems (IMS), and the basis for preparation of the so-called Future Generation of Manufacturing Systems (FGMS) permits a better understanding of Japanese competitiveness using advanced technology. This is an important point when the economies enter in the global world market, and when Japan is passing to the so -called "Open-CIM", a new CIM generation that combines the classical CIM and the more advanced technological advantages offered by theadvances in information technology and telecommunications.

General Motors replaced the dissimilar hardware and software that existed throughout the corporation and created an integrated system known as C4 (computer-aided design, computer-aided manufacturing, computer-integrated manufacturing and computer-aided engineering). As part of its C4 program, GM linked the design, manufacturing and assembly teams that were previously unable to communicate with each other. GM made the decision that although its legacy systems represented a sizable capital investment, it was important that the entire manufacturing process be overhauled to ensure interoperability and interconnectivity among all the players on the new network, including suppliers.

4.2. International Cooperation Required

The national and international conferences in India should include CIM as the topic of the day for research papers and discussions. Scholars should be invited to deliver lectures in India from USA, Europe, Australia, Japan, China, Taiwan, and other capable countries in this subject. We should strive to achieve great successes in the main cooperative topics and to open up actively the new prospect in order that the international academic exchanges become one of the important means for promoting the development of our CIM technology. Development of regular links with related international societies is an ample need of the hour. The list includes Society of Mechanical Engineering-USA, Society of Manufacturing Engineering-USA, and Society for Computer Simulation International-Belgium, International Fuzzy System Association-Canada, and many more.

5. FUTURE DIRECTIONS OF CIM

In the present focused worldwide market survival of any industry relies upon its capacity to impart and exchange the correct data at the ideal time to the opportune individuals. Manufacturing can't escape from this present prerequisite. Having a capacity to convey for elective administration and manufacturing exercises over the topographical limits among the comprehensively appropriated assets will essentially profit manufacturing businesses. Today various worldwide combinations are shaped in numerous features of industry. A virtual endeavor is characterized as a system of interconnected worldwide combinations in this paper. Anticipating the future research course of CIM and related regions is a troublesome errand in consistently extending and developing innovative advancement time. In any case, an endeavor is made to anticipate the future bearing, which will command the scientists' brain for the following decade, in light of the ebb and flow advancements in CIM investigate. The present focused and deftness prerequisites of the worldwide market can be just met by virtual ventures. To give a superior future in the present market necessities investigate in virtual CIM and its utilization in overall manufacturing businesses are starting to rise. Use of virtual CIM has been proposed as a fundamental advance towards the future in manufacturing to confront aggressive difficulties. Be that as it may, numerous advancement works should be completed to confront challenges looked by virtual undertakings. Henceforth, the exploration ought to be additionally fortified towards building up a virtual CIM to fulfill the globalized and dispersed manufacturing ventures of today keeping in mind the end goal to meet the aggressive and spryness necessities of present economic situations. In a virtual endeavor the coordination of data is lauded, as just through data can a virtual association end up significant, and just by choosing another age of data innovation would this be able to vision be figured it out.

CONCLUSIONS

In rundown, CIM is a methods for utilizing computer frameworks to coordinate a manufacturing venture. The extent of CIM ranges from item configuration, process outline, item booking and control, to cutting edge integrated capacities inside a generation office. It is imperative that all elements of an organization be a piece of a CIM design. Capacities from business arranging, key arranging, and preparing to client ought to be incorporated. There is no single meaning of CIM since CIM is intended to fit the requirements and utilizations of a particular circumstance. In this manner, each organization will execute CIM in a somewhat unique manner. The paper tries to edify the rising needs of setting up ventures taking a shot at CIM in India of 21st century. These frameworks are unavoidable to enhance productivity in post WTO situation.

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