

# Smt. S R Patel Engineering College, Dabhi

## Cover page of Lecture Notes

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Name of Subject: CIM

Chapter/ Unit No.

**CIM ADVANCES**

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# CIM ADVANCES

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# CIM ADVANCES Intro

- CAD/CAM deals with the integration and automation of the three functions of the factory operations :
  - (i) Design
  - (ii) Manufacturing Planning and Control; and
  - (iii) Manufacturing.
- However, CAD/CAM does not deal with the business functions of the factory.
- In earlier days. the business functions were restricted to the management and kept isolated from the factory operations.
- In a present era of globalization and competitive market, the customer is a center of focus. Therefore, for any manufacturing industry, it is necessary to keep on innovating and modifying the products as per the customer's requirement. At the same time, the product should be cost competitive.

- The business decisions are required to be made on regular basis. This is possible only with the integration of business functions and other functions of factory operations. This has led to the emergence of new concept known as Computer Integrated Manufacturing (CIM).
- Computer Integrated Manufacturing (CIM) is the complete integration and automation of all functions of factory i.e. design, manufacturing planning and control, manufacturing, and business functions.

# EVOLUTION OF CIM CONCEPT

- The concept of CIM has been evolving since the mid 1970s. However, till 1980 it was merely a concept. It started developing as a technology since 1980.
- With the globalization of economy, the manufacturing industries all over the world started competing with each other.
- This has transformed the market from the seller driven to the buyer driven. The customer has occupied the center stage.
- The customers started demanding more product variety, better product quality and low cost products. This has led to the emergence of CIM.

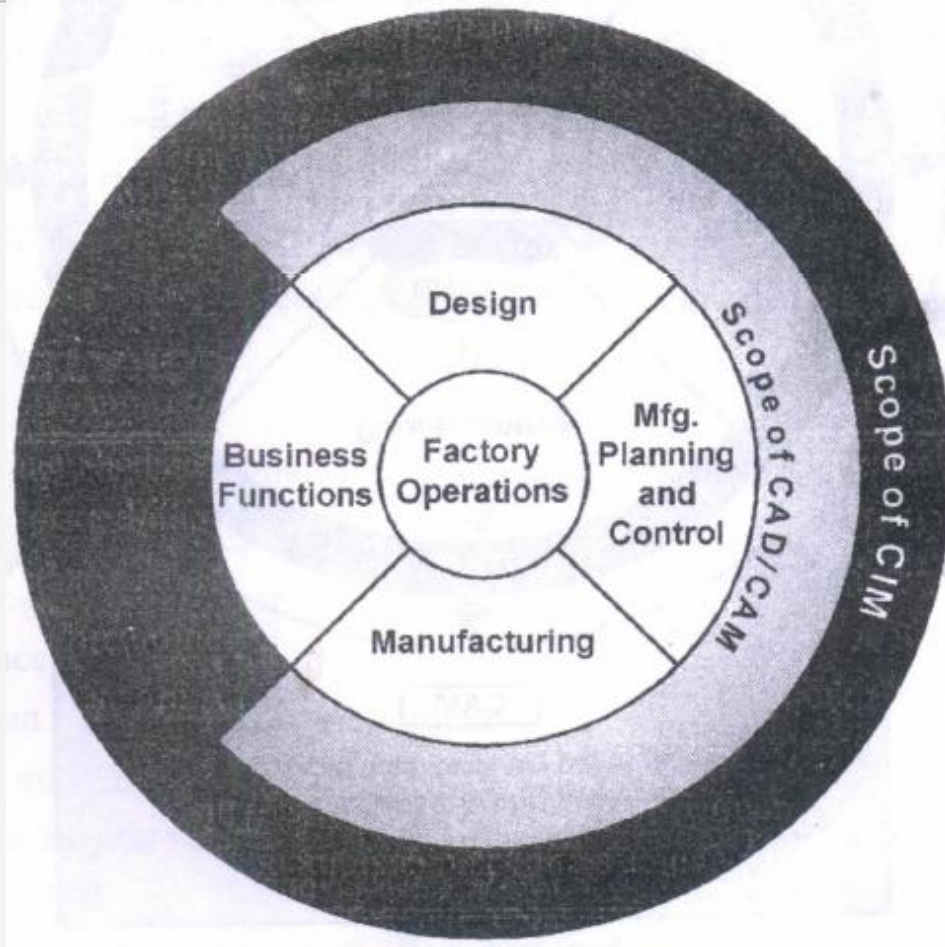
# Prime factors led to the development of CIM

- 1. Development and advancement of CNC, FMS and automation technologies.
- 2. Development of cost-effective and high speed computer systems.
- 3. Market challenges such as high labour cost, global competition, and buyer driven market.
- 4. Customer demands such as product variety, better product quality and low cost products.

# CONCEPT AND SCOPE OF CIM

- Computer Integrated Manufacturing (CIM) is the complete integration and automation of all functions of factory that are related to manufacturing.
- Computer Integrated Manufacturing (CIM) system applies computer and communication technology to completely integrate and automate the following four functions of factory operations :
  - (i) Design
  - (ii) Manufacturing Planning and Control
  - (iii) Manufacturing
  - (iv) Business Functions

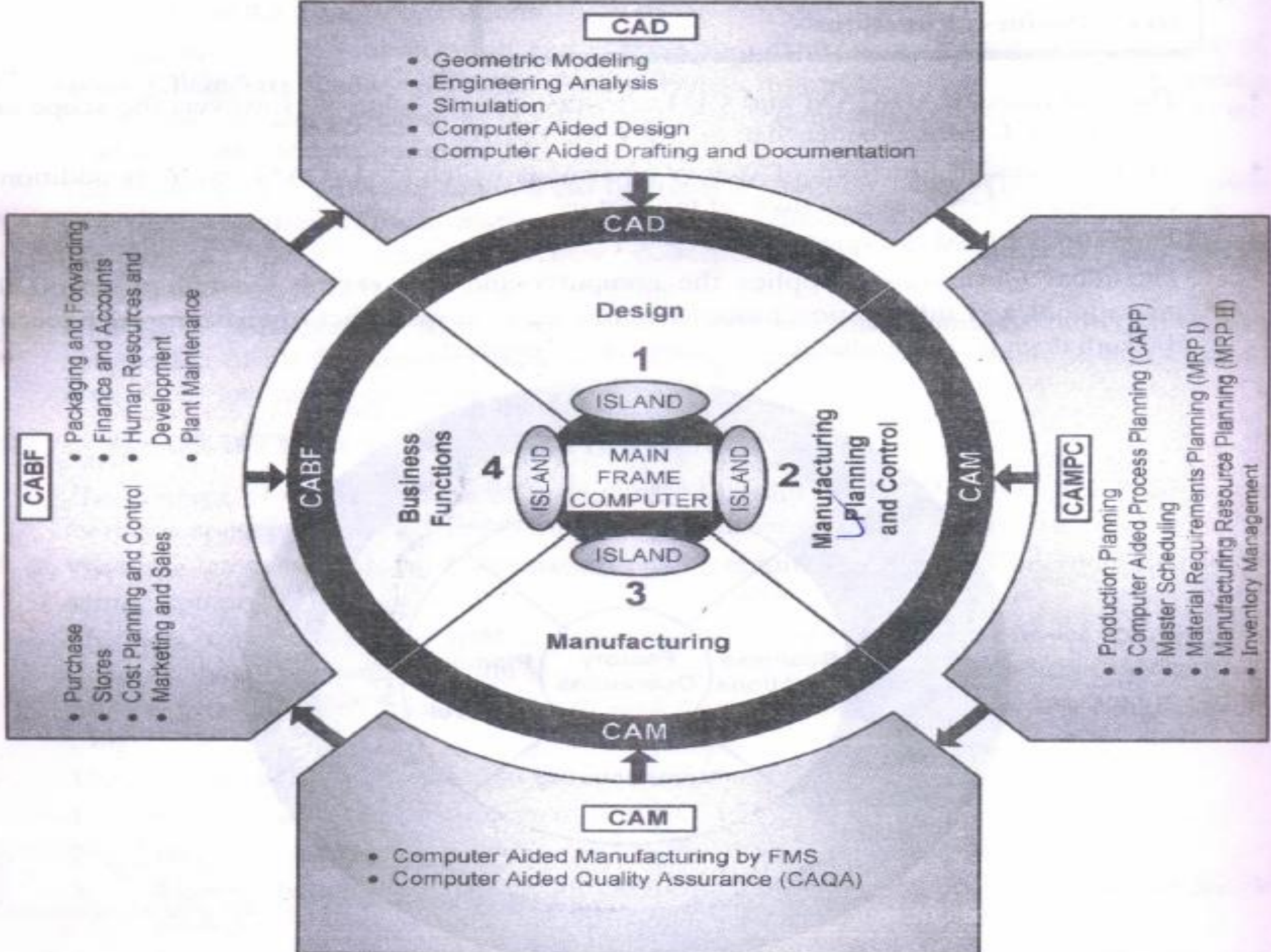
# SCOPE OF CIM





# FOUR ISLANDS OF AUTOMATION OF CIM (CIM WHEEL)

- ISLAND 1 : Computer Aided Design (CAD)
- ISLAND 2 : Computer Aided Manufacturing Planning and Control (CAMPC)
- ISLAND 3 : Computer Aided Manufacturing (CAM)
- ISLAND 4 : Computer Aided Business Functions (CABF)



# ISLAND 1 : Computer Aided Design (CAD):

- ~ Geometric modeling
- ~ Engineering analysis
- ~ Simulation
- ~ Computer aided design
- ~ Computer aided drafting and documentation

# ISLAND 2 : Computer Aided Manufacturing Planning and Control (CAMPC) :

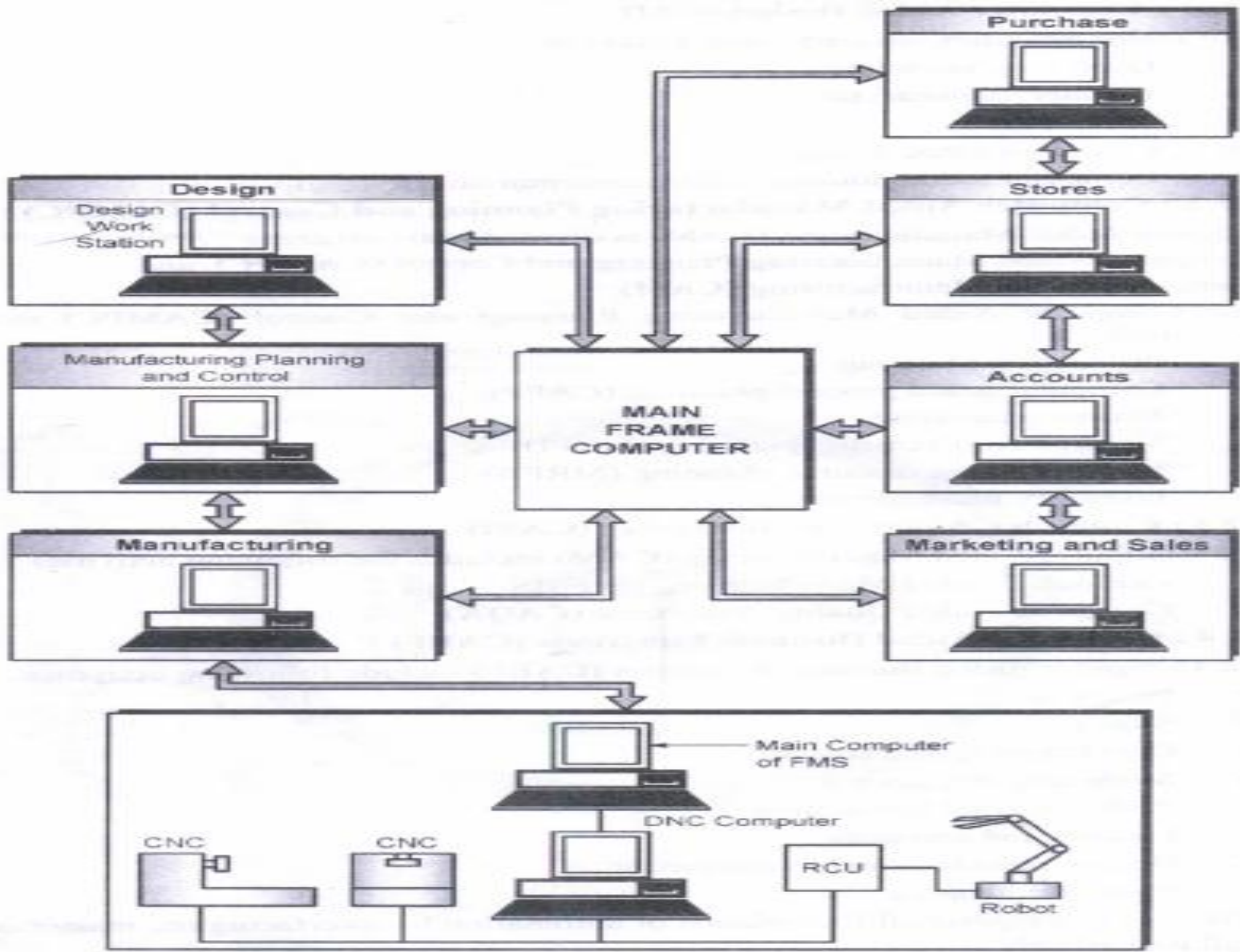
- Divided into two areas :
- (i) Computer Aided Manufacturing Planning and Control (CAMPC)
- (ii) Computer Aided Manufacturing (CAM)
- The Computer Aided Manufacturing Planning and Control (CAMPC) includes the following activity :
- ~ Production planning
- ~ Computer aided process planning (CAPP)
- ~ Master scheduling
- ~ Material requirements planning (MRPI)
- ~ Manufacturing resource planning (MRPII)
- ~ Inventory management

# ISLAND 3 : Computer Aided Manufacturing (CAM) :

- ~ Computer Aided Manufacturing by FMS
- ~ Computer Aided Quality Assurance (CAQA)

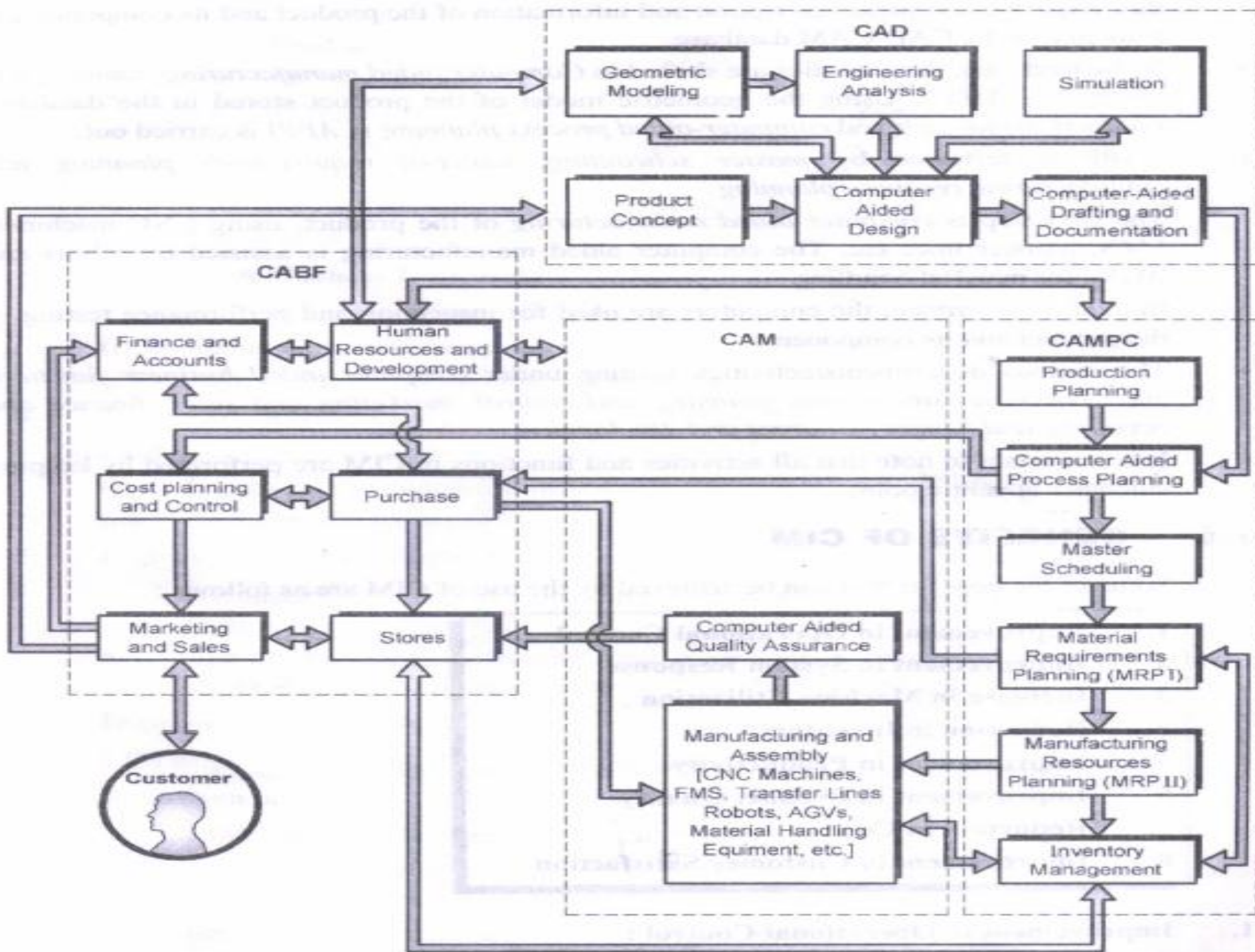
# ISLAND 4 : Computer Aided Business Functions (CABF) :

- ~ Purchase
- ~ Stores
- ~ Cost planning and control
- ~ Marketing and sales
- ~ Packaging and forwarding
- ~ Finance and accounts
- ~ Human resources and development
- ~ Plant maintenance



# CIM PRODUCT CYCLE





# BENEFITS OF CIM

- Improvement in Operational Control
- Improvement in System Response
- Increase in Machine Utilization
- Reduction in Inventory
- Improvement in Productivity
- Improvement in Product Quality
- Reduction in Cost
- Improvement in Customer Satisfaction

# Improvement in Operational Control

- (i) Use of computers for controlling various function/activities,
- (ii) Automation and integration of various functions, and
- (iii) Reduction in human intervention.

# Improvement in System Response:

- (i) Product changes,
- (ii) Process changes,
- (iii) Material supply delay,
- (iv) Machine failure, and
- (v) Cutting-tool failure.

# Increase in Machine Utilization:

- (i) Reducing the machine set-up time, and
- (ii) Automating the machining and handling processes.

# Reduction in Inventory :

- (i) Improving the material flow, and
- (ii) Reducing the work in process.

# Improvement in Productivity :

- Because of the proper co-ordination of the different activities and functions, CIM improves the productivity.
- The productivity of manufacturing operations is increased by 40 to 60%, while the productivity of manpower is increased by 5 to 200.

# Improvement in Product Quality

- CIM helps in improving the quality of product.



# Reduction in Cost

- (i) Waste of processes,
- (ii) Waste of manpower,
- (iii) Waste of material,
- (iv) Waste of machine hours,
- (v) Waste of motion,
- (vi) Waste of transportation and
- (vii) Waste of defective products.

# Improvement in Customer Satisfaction:

- Use of CIM helps in reducing the product cost, improving the product quality, and reducing the delivery period. This helps in improving the customer satisfaction.

# ROLE OF MANAGEMENT IN CIM

- The CIM is not just a technology but it is a philosophy as well. The basic objective of CIM is the complete integration and automation of all functions of factory including the business functions.
- However, for the success of CIM, there has to be a greater integration of the human resources and the factory resources. It may require the dismantling of the inter-departmental barriers and greater co-ordination among the different departments.
- This is possible only with the active involvement of the top management in integration of the human resources.

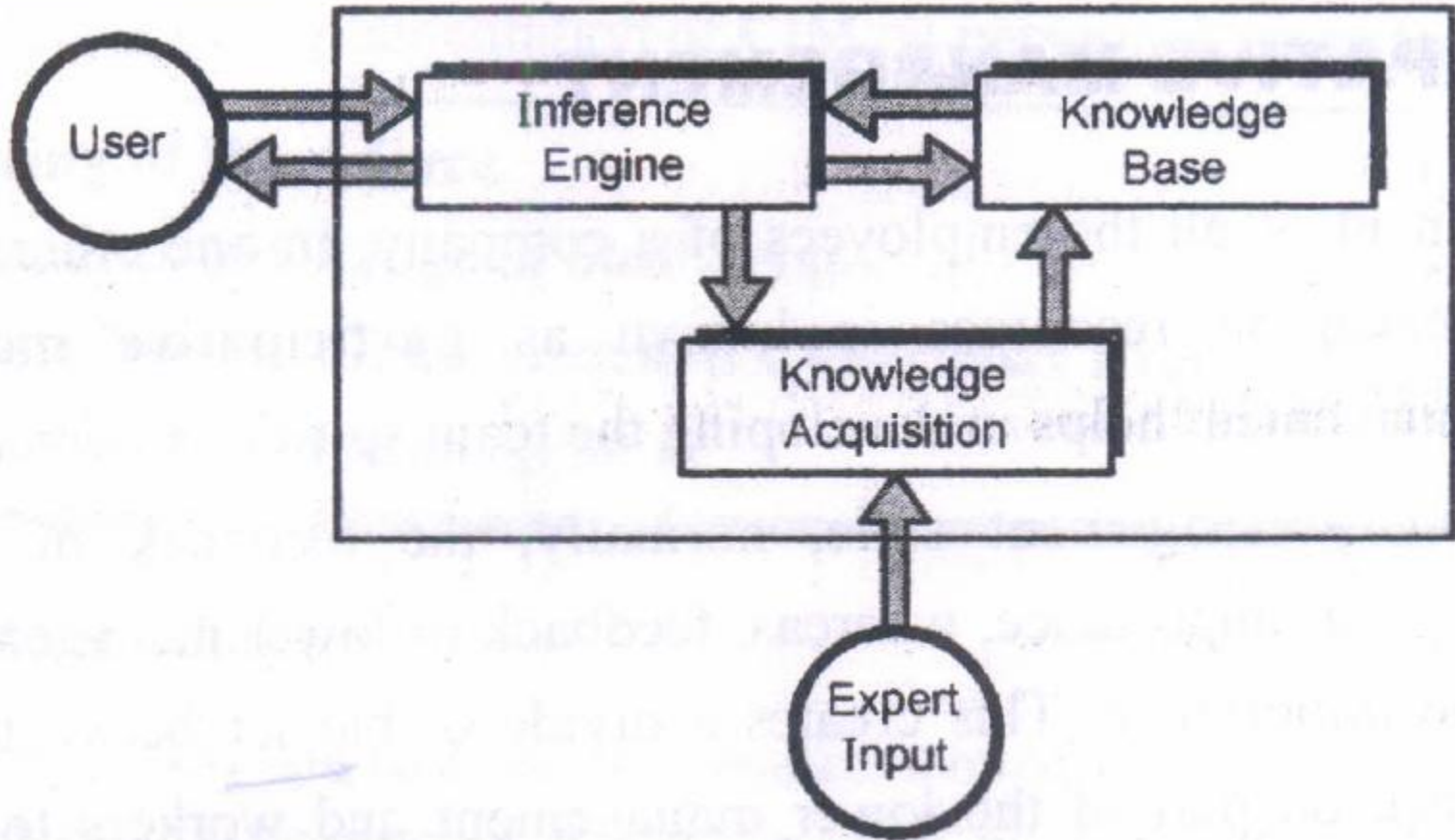
- The strong commitment from the top management helps in creating the atmosphere conducive for the successful implementation of CIM.
- Bringing the human values into organization would help in developing the CIM with human face.
- In addition to above role, the basic six tasks to be performed by the management in implementation of CIM

- 1. Develop a business model for a factory to understand the problems.
- 2. Develop a functional model for the processes, functions and activities.
- 3. Develop an information model for system interfaces, database, information exchange, etc.
- 4. Develop a network model for communication and networking.
- 5. Develop an organizational model for integrating the various islands of automation on the existing organization structure, culture and to safeguard against detrimental effects.
- 6. Develop the implementation plan which takes into account special features of the business and operations.



# EXPERT SYSTEM

- An expert system is a computer Program designed and developed for helping the user to solve the decision making problems.
- Knowledge Base
- Inference Engine
- Knowledge Acquisition



# Knowledge Base

- The knowledge base is the part of the software system which contains the facts, and the thumb rules a human expert would use in taking the decision.
- The knowledge base can be created in two ways :
  - (i) If-then-else : A set of rules of 'IF-THEN-ELSE' type are entered in the knowledge base. Such a knowledge base system is called as rule-based system.
  - (ii) Condition result combinations : A series of 'CONDITION-RESULT' combinations are entered in knowledge base. Such a knowledge base system is called as decision tree. In this system, a decision tree is used to predict the possible result. For example, such a system is used in machine diagnostics by relating symptoms with causes.



# Inference Engine

- An inference engine extracts the information from the knowledge base so as to help the user in making the decision.

# Knowledge Acquisition

- The continuous updating of the knowledge base is the basic requirement of the good expert system.
- The knowledge acquisition unit acquires the knowledge from the outside experts as well as from the output of the inference engine and adds it to the knowledge base.
- In CIM, due to the integration of all functions, even the smaller decisions can have the greater repercussions on the working of the company.
- Therefore, the decision making is more demanding.
- Hence, the expert systems are used as 'advisors' to the management in making the right decisions.

# PARTICIPATIVE MANAGEMENT

- Some of the parameters to be considered in developing the participative management culture are as follows:
- 1. Organizational Goals
- 2. Organizational Structure
- 3. Management Inputs
- 4. Employee-Employer Relationship
- 5. Employee Issues and Problems
- 6. Defining Teamwork
- 7. Definition of Team
- 8. Forming Teams
- 9. Characteristics of Teams
- 10. Degree of Empowerment
- 11. Rewarding Teamwork
- 12. Rebel Issues

# IMPACT OF CIM ON PERSONNEL

- The computer integrated manufacturing has affected all' the company personnel from the lowest rank operator to the CEO of a company. The impact of CIM on the workforce is more than that on the technology itself.
- 1. Downsizing of Workforce
- 2. Requirements of Change in Skill Sets-
- 3. Specialists Need to Generalize and Generalists Need to Specialize
- 4. Cultural Change in Management

# Downsizing of Workforce

- Implementation of CIM has reduced the requirement of workforce drastically and hence there is a need of downsizing of a workforce at all levels from bottom to top.
- The downsizing has hit the people with lesser skills.

# Requirements of Change in Skill Sets

- The implementation of CIM has created a need for change in skill sets of a people.
- For example NC machine operators need additional skills in CNC technology.
- The designers need additional skills in the area of modelling, finite element analysis, simulation, manufacturing, etc.

# Specialists Need to Generalize and Generalists Need to Specialize

- The CIM needs more flexible manpower. It demands that specialists must understand functions outside their areas.
- The CIM also demands that the general purpose manpower of each department must specialize in their area.
- Thus the implementation of CIM expects that specialists need to generalize and generalists need to specialize.

# Cultural Change in Management

- The CIM demands the cultural change in management at all levels : lower, middle and top.
- This is necessary to bring the change in work culture and compartmentalized behaviour of the people.
- This cultural change must start at the top management level so that they can convince the middle and lower management.



# ROLE OF MANUFACTURING ENGINEERS IN CIM

- In CIM environment, the role of manufacturing engineers is versatile in nature.
- *In CIM culture, there is a continuous upgradation and modification of the products,* Therefore, there is a greater need for manufacturing engineers to interact closely with the design engineers.
- The manufacturing engineers need to understand design process, especially CAD tools.
- The manufacturing engineers also need to develop the certain degree of experty in the area of maintenance of their own machines. Therefore, they must understand the various systems of machine tools like : hydraulic systems, pneumatic systems, electrical systems, electronic systems and computer systems.

- The study was conducted by the 'Society of Manufacturing Engineers (SME), in USA to predict the role of manufacturing engineers in 21st century. The findings of filC study are documented as 'Profile 21'.
- • The profile 21 predicts that the role of manufacturing engineers will change in 21<sup>st</sup> century due to following factors:
  - (i) increased product variety and sophistication;
  - (ii) globalization of manufacturing; and
  - (iii) socio-economic changes.

# Some of the findings of 'Profile 21'

- 1. Function as Integration Engineers
- 2. Function as Business Administrators
- 3. Function as Effective Team Leaders

# Function as Integration Engineers:

- The manufacturing engineers will function as integration engineers with the duties of coordinating people, information and technology.
- They must pass managerial, business, technical, scientific and mathematical skills.

# Function as Business Administrators

- The manufacturing engineers will function as business administrator for their unit.
- They will carry out planning of logistics, work flow, and human resources.

# Function as Effective Team Leaders

- The profile 21 predicts that manufacturing engineers will need to have man management skills and technical skills. They will have to function as an effective team leaders.