Computer Integrated Manufacturing

Introduction

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Introduction and Driving force

Manufacturing engineers/industries are required to achieve the following objectives to be competitive in a global context.

- Reduction in inventory
- Lower the cost of the product
- Reduce waste
- Improve quality

Increase flexibility in manufacturing to achieve immediate and rapid response to:

- Product changes
- Production changes
- Process change
- Equipment change
- Change of personnel

CIM technology is an enabling technology to meet the above challenges to the manufacturing.

Computer Integrated Manufacturing

Computer-integrated manufacturing (CIM) is the manufacturing approach of using computers to control the entire production process.

This integration allows individual processes to exchange information with each other and initiate actions.

Through the integration of computers, manufacturing can be faster and less error-prone, although the main advantage is the ability to create automated manufacturing processes

Computer-integrated manufacturing (CIM) is the use of computer techniques to integrate manufacturing activities.

These activities encompass all functions necessary to translate customer needs into a final product. CIM starts with the development of a product concept that may exist in the marketing organization; includes product design and specification, usually the responsibility of an engineering organization; and extends through production into delivery and after-sales activities that reside in a field service or sales organization

Key Features

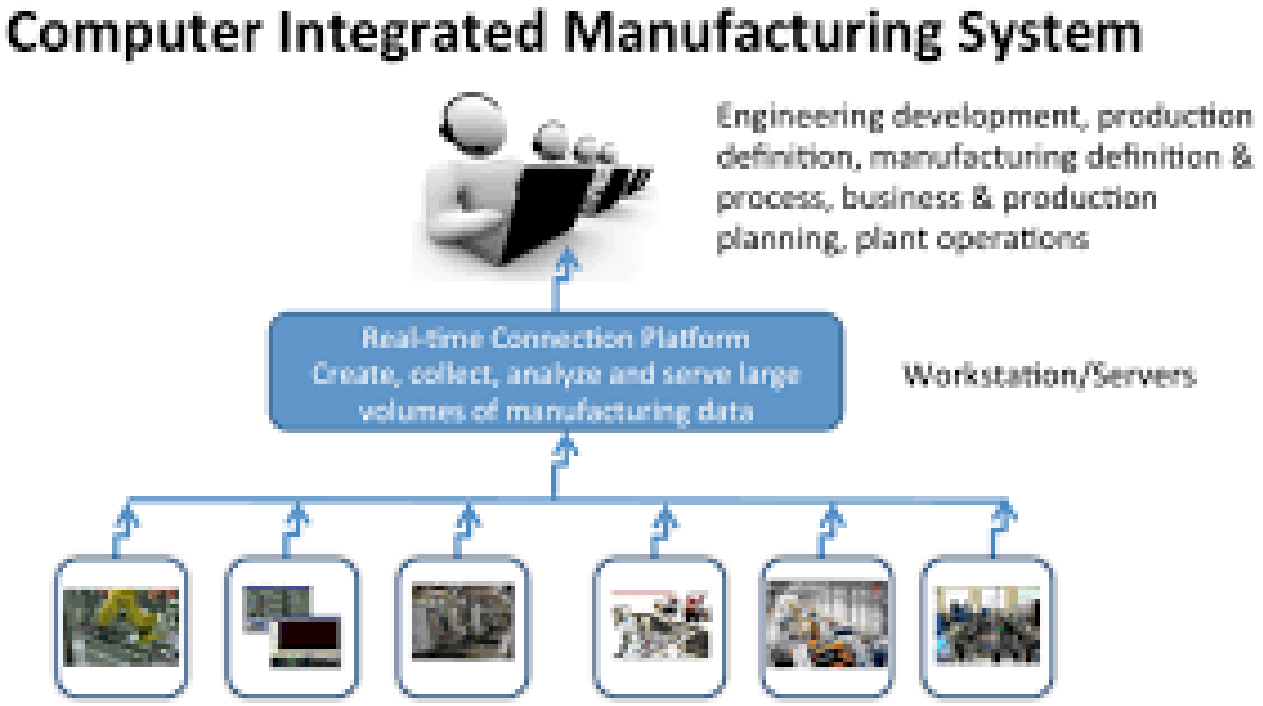
CIM is the integration of all enterprise operations and activities around a common corporate data repository.

It is the use of integrated systems and data communications coupled with new managerial philosophies.

CIM is not a product that can be purchased and installed.

It is a way of thinking and solving problems.

This integration allows individual processes to exchange information with each other and initiate actions.



Potential Benefits of CIM

Improved customer service

Improved quality

Shorter time to market with new products

Shorter flow time

Shorter vendor lead time

Reduced inventory levels

Improved schedule performance

Greater flexibility and responsiveness

Improved competitiveness

Lower total cost

Shorter customer lead time

Increase in manufacturing productivity

Decrease in work-in process inventory

Role of Computer in Manufacturing

The computer has had a substantial impact on almost all activities of a factory. The operation of a CIM system gives the user substantial benefits:

1. Reduction of design costs by 15-30%;
2. Reduction of the in-shop time of a part by 30-60%;
3. Increase of productivity by 40-70%
4. Better product quality, reduction of scrap 20-50%.

Subsystems in Computer-Integrated Manufacturing

CAD (Computer-Aided Design) involves the use of computers to create design drawings and product models.

CAE (Computer-Aided Engineering) is the broad usage of computer software to aid in engineering tasks

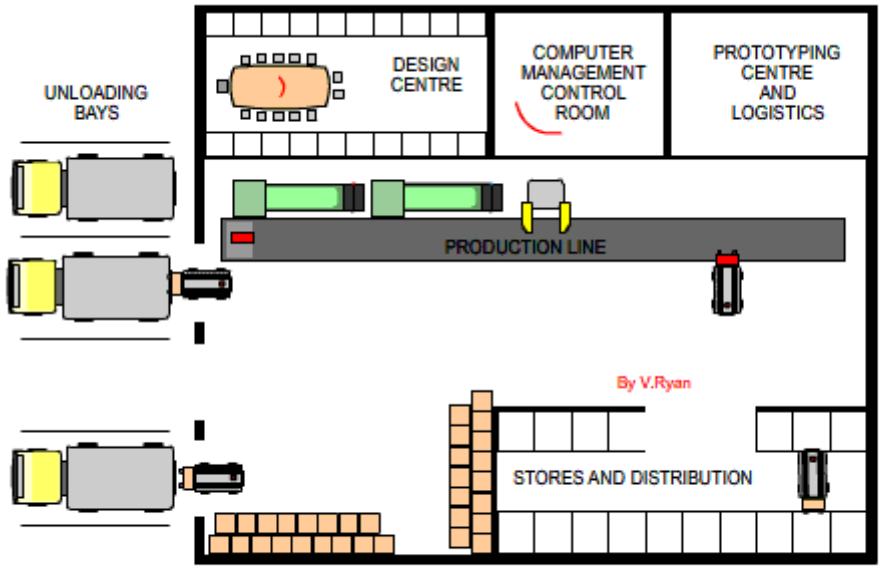
CAM (Computer-Aided Manufacturing) is the use of computer software to control machine tools and related machinery in the manufacturing of work pieces

CAPP (Computer-Aided Process Planning) is the use of computer technology to aid in the process planning of apart or product, in manufacturing.

CAQ (Computer-Aided Quality Assurance) is the engineering application of computers and computer controlled machines for the inspection of the quality of products.

PPC (Production Planning and Control) A production (or manufacturing) planning and control (MPC) system is concerned with planning and controlling all aspects of manufacturing, including materials, scheduling machines and people, and coordinating suppliers and customers.

ERP (Enterprise Resource Planning) systems integrate internal and external management information across an entire organization, embracing finance/ accounting, manufacturing, and sales and services.


UNLOADING
BAYS
DESIGN
CENTRE
COMPUTER
MANAGEMENT
CONTROL
ROOM
PROTOTYPING
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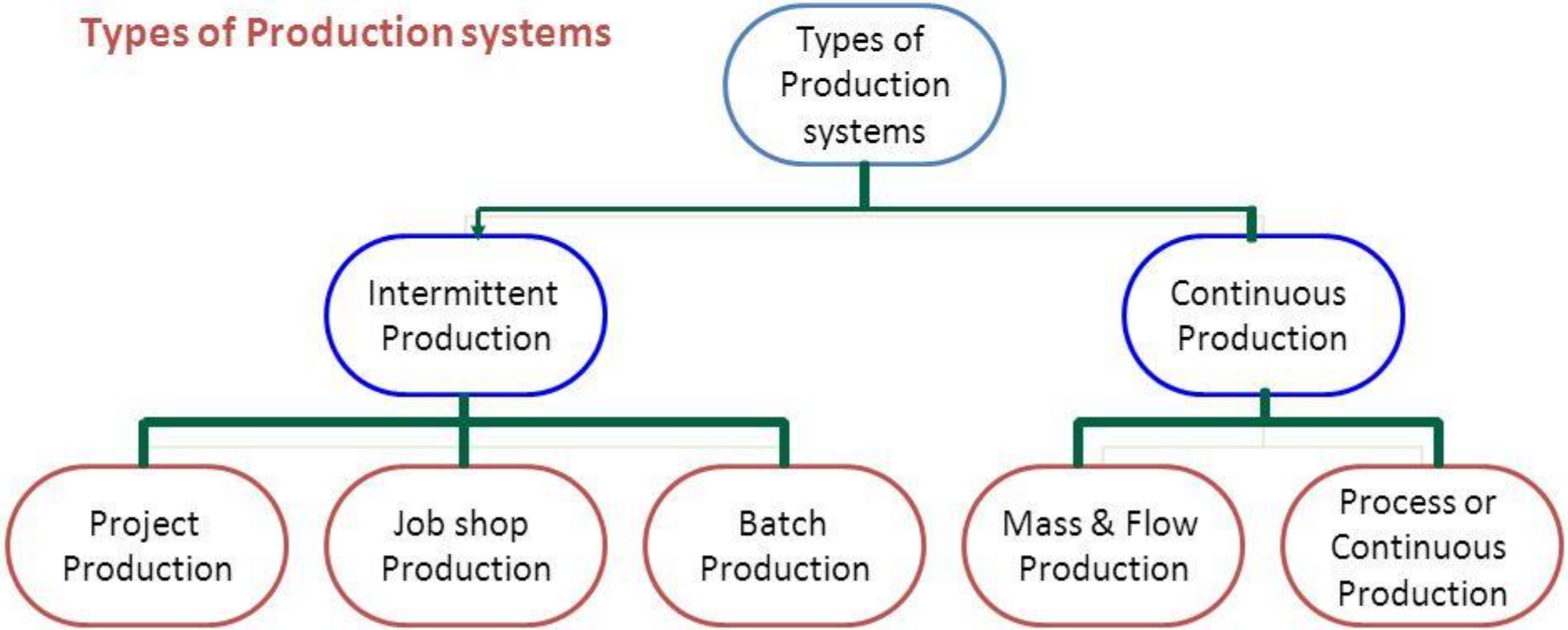
CIM

Types of Production system

- The production system varies from factory to factory and from product to product. However one of the most important issues is production volume.

Types of Production systems



Types of Continuous Production system
Process or Continuous Production

Process production is characterized by tile manufacture of a single product produced and stocked in the warehouses awaiting sales.

- The flexibility of such plants is almost zero as only one type of product can be produced in such plants.
- Special purpose machines with built-in controls are used.
- Materials handling is highly mechanized.
- Typical examples of such plants are sugar, steel, cement, paper, coke, refineries, etc.

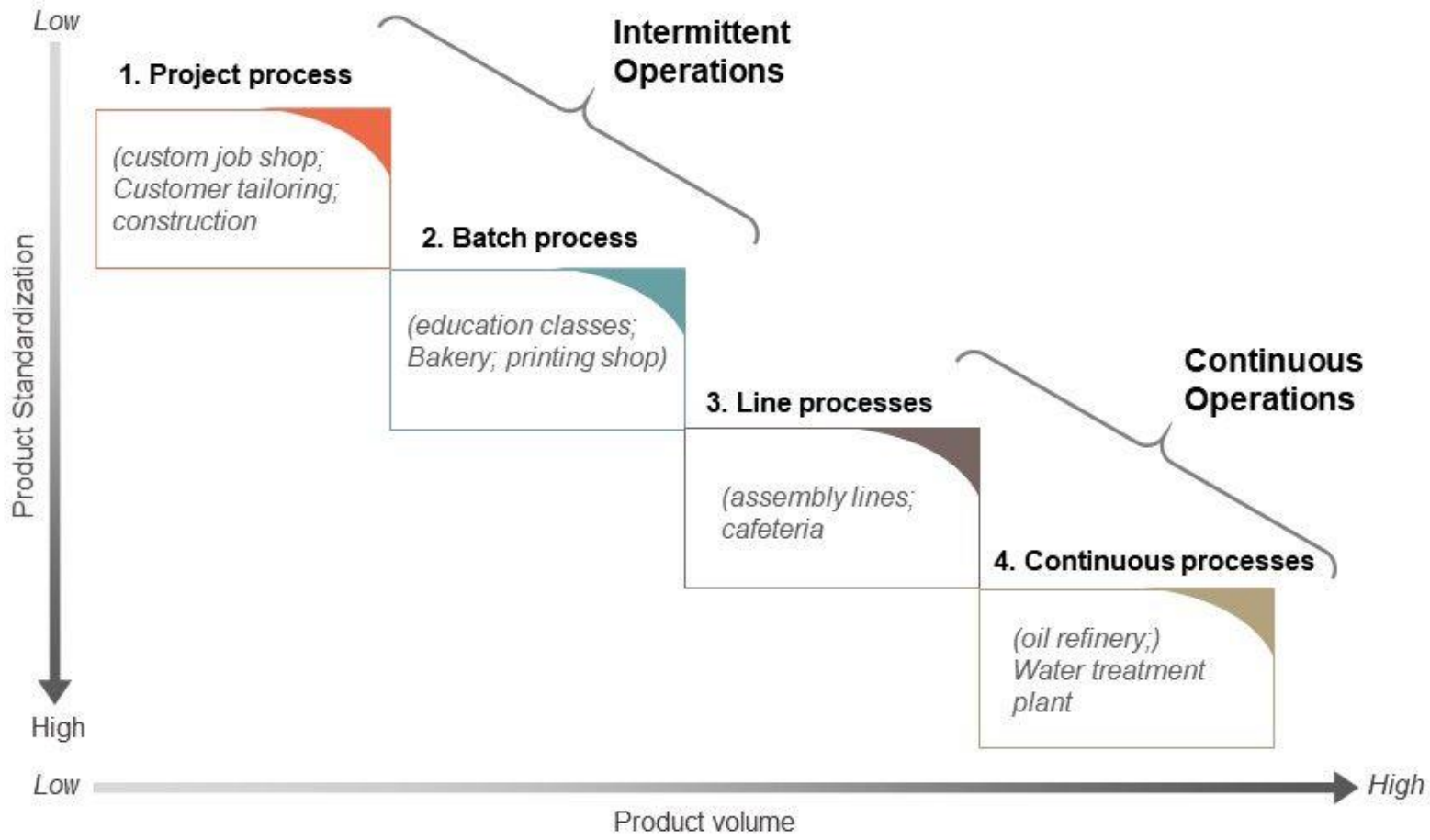
Types of Intermittent Production system
Job Shop Production

In this system products are made to satisfy a specific order. However that order may be produced:

- only once
- or at irregular time intervals as and when new order arrives
- or at regular time intervals to satisfy a continuous demand

- Job shop production is characterized by its low production volume.
- The production lot size is generally small.
- Machines and methods employed should be general purpose as product changes are quite frequent.
- Planning and control system should be flexible enough to deal with the frequent changes in product requirements.
- Man power should be skilled enough to deal with changing work conditions.
- Schedules are actually non existent in this system as no definite data is available on the product.
- In process inventory will usually be high as accurate plans and schedules do not exist.
- Product cost is normally high because of high material and labor costs.
- Grouping of machines is done on functional basis (i.e. as lathe section, milling section etc.)
- This system is very flexible as management has to manufacture varying product types.
- Material handling systems are also flexible to meet changing product requirements

Strategy For Operational Process Types

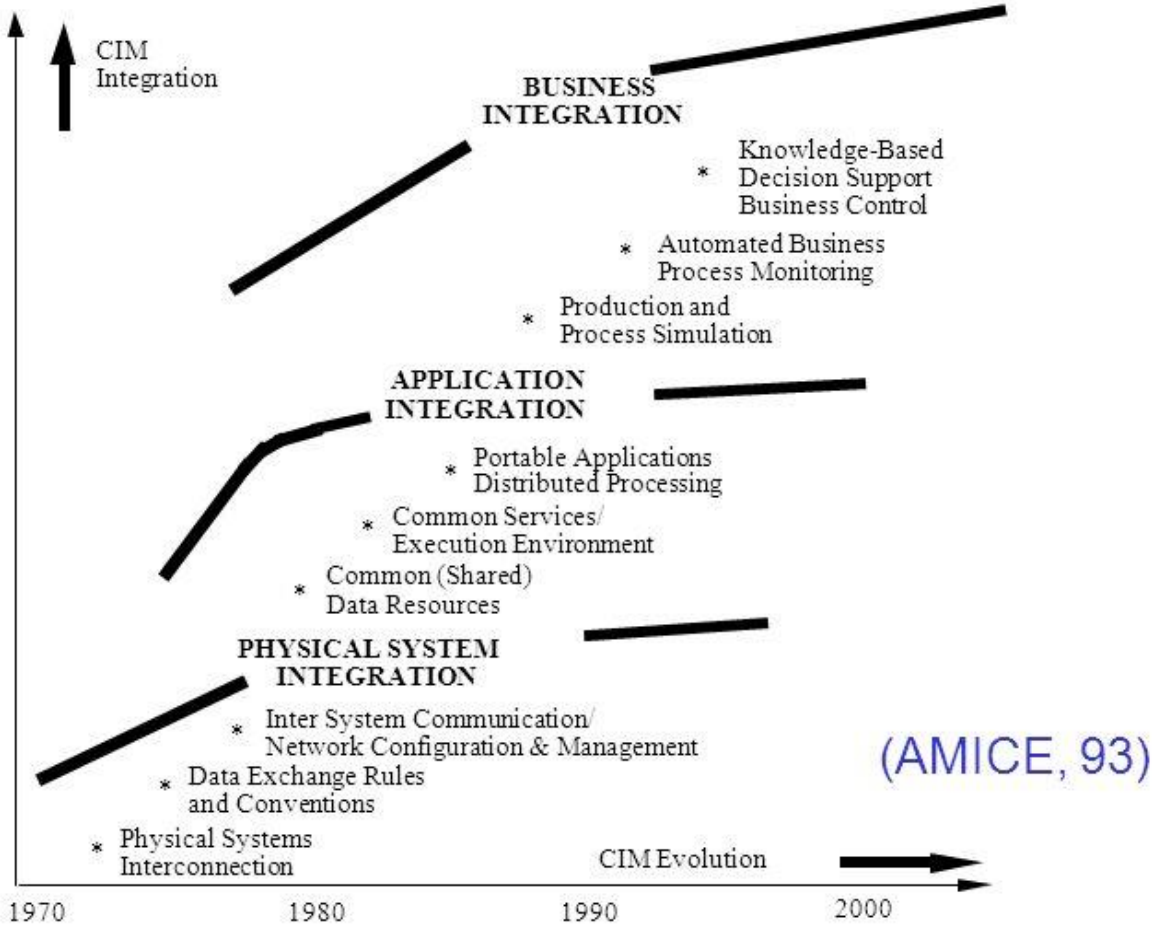


Evolution of CIM

- It started developing as a technology since 1980.
- With globalization of economy, the manufacturing industries all over the world started competing with each other.
- Transformed the market from seller driven to customer driven.
- This led to the emergence of the CIM

- Computer Integrated Manufacturing (CIM) is considered a natural evolution of the technology of CAD/CAM which by itself evolved by the integration of CAD and CAM.
- Massachusetts Institute of Technology (MIT, USA) is credited with pioneering the development in both CAD and CAM.

Integration Levels



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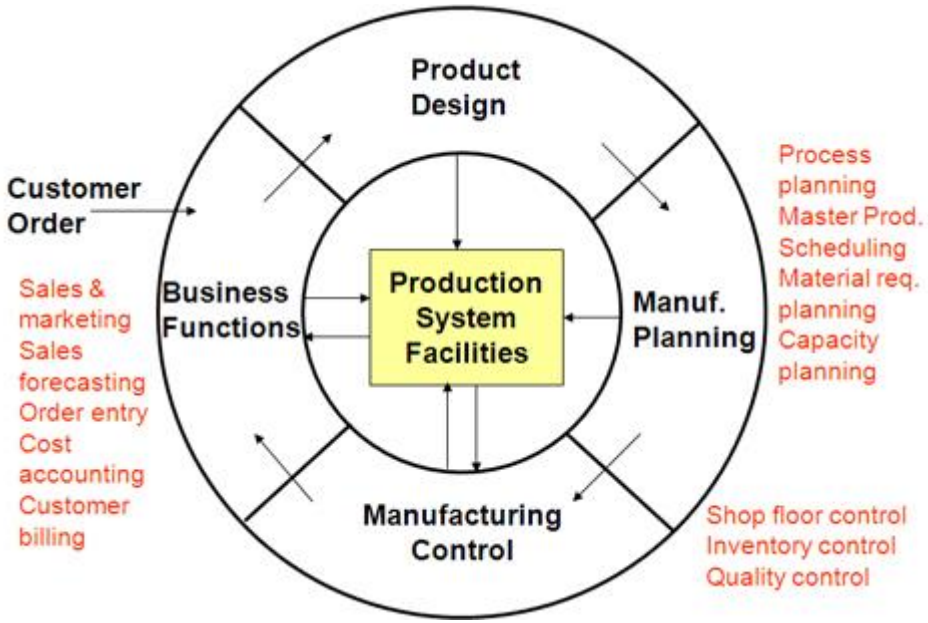


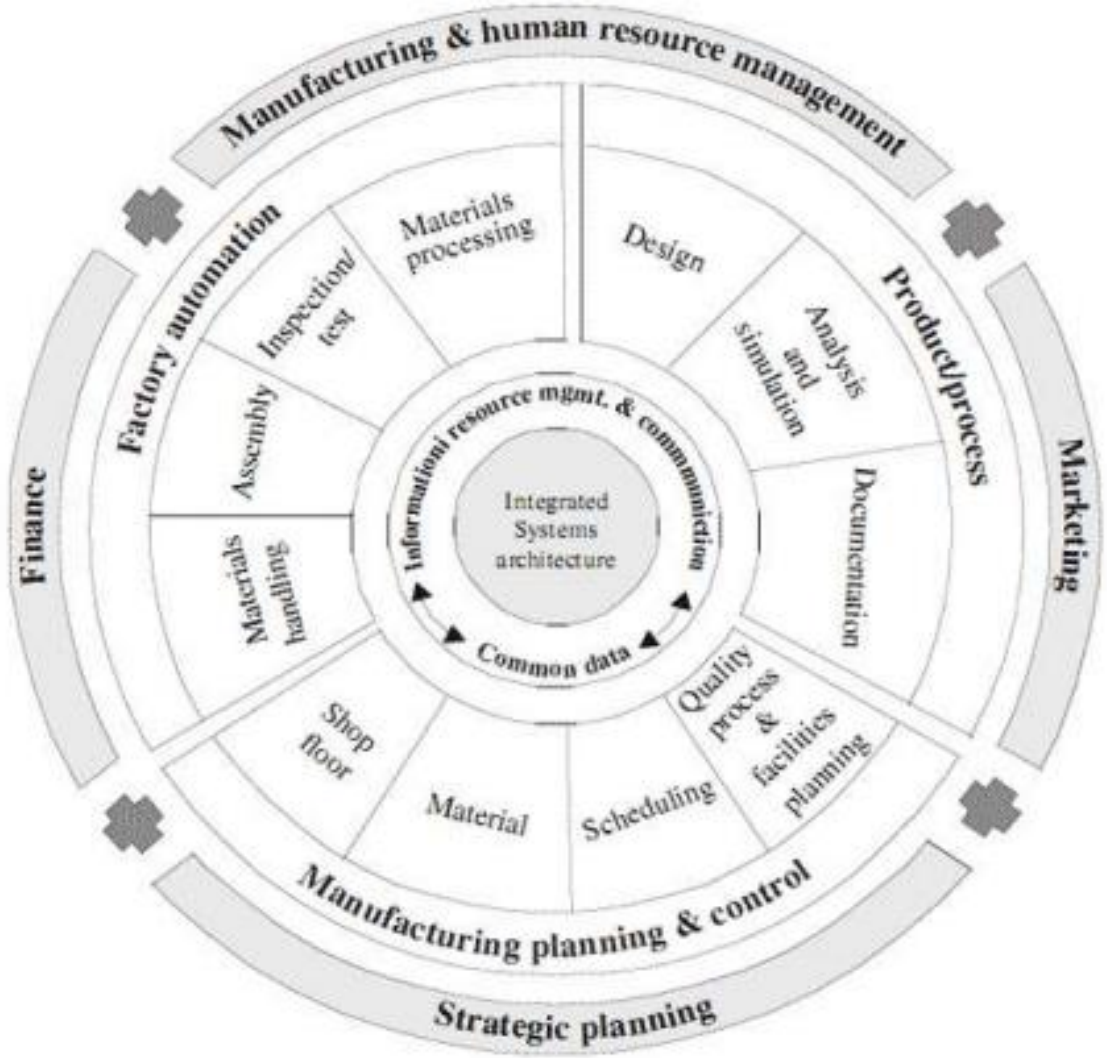
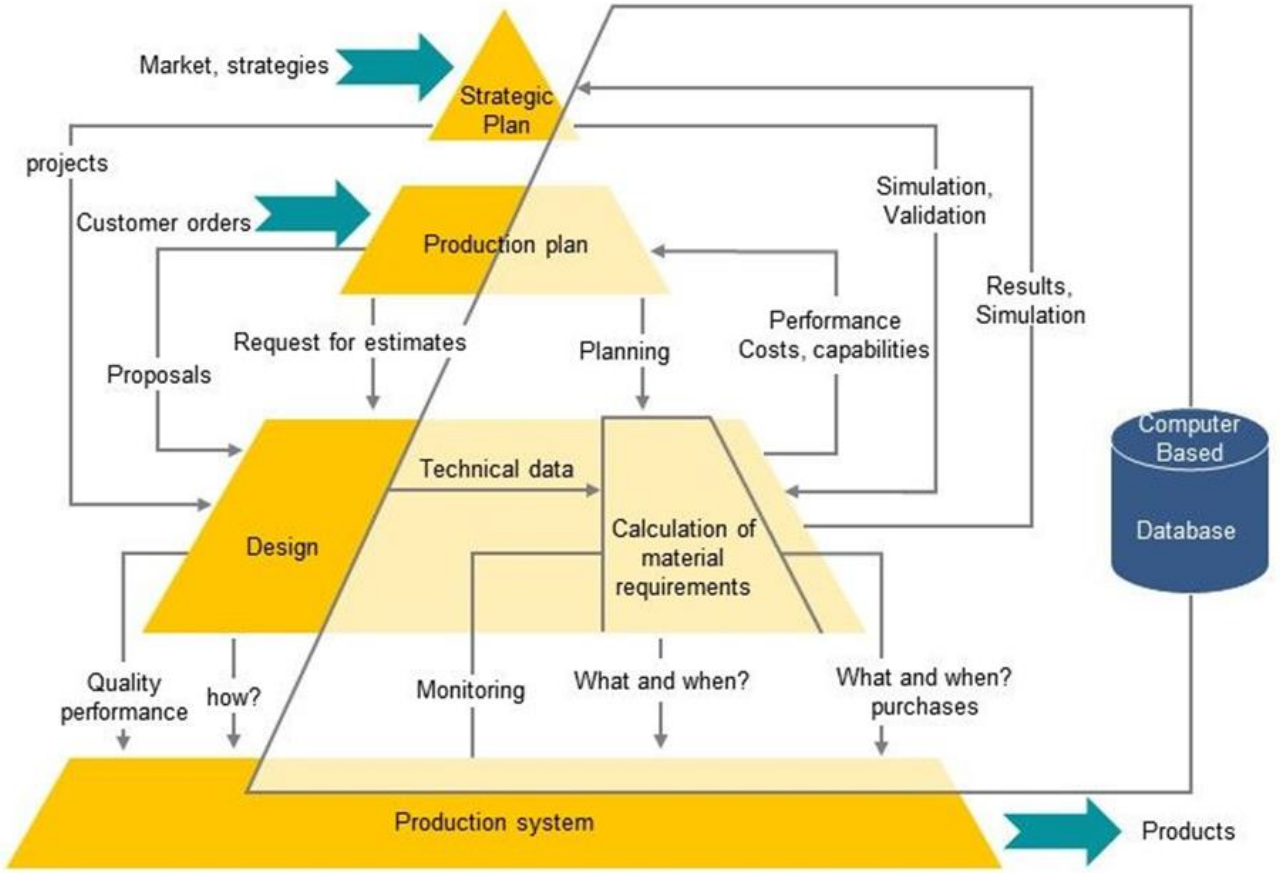


Figure 1: CIM Wheel

Computer-Integrated Manufacturing (CIM) Strategy



CIM refers to a production system that consists of:

1. A group of NC machines connected together by
2. An automated materials handling system
3. And operating under computer control

CIM System discussed:

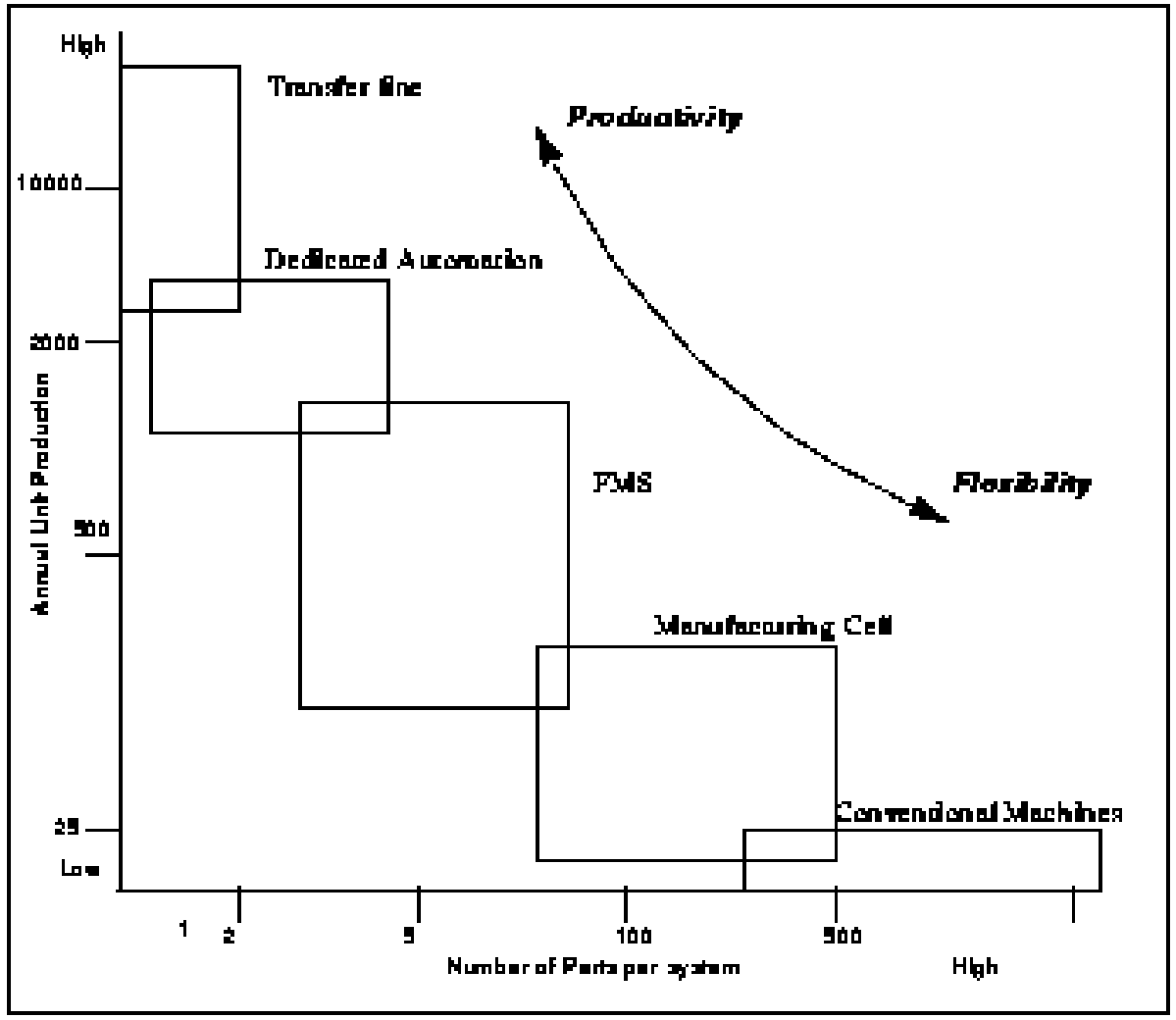
Computer Numerical Control (CNC)
Direct Numerical Control (DNC)
Computer Process Control
Computer Integrated Production Management
Automated Inspection Methods
Industrial Robots etc.

A CIM System consists of the following basic components:

I. Machine tools and related equipment
II. Material Handling System (MHS)
III. Computer Control System
IV. Human factor/labor

CIMS Benefits:

1. Increased machine utilization
2. Reduced direct and indirect labor
3. Reduce mfg. lead time
4. Lower in process inventory
5. Scheduling flexibility
6. etc.


High
Transfer line
Productivity
10000
Dedicated Automation
2000
Annual Unit Production
FMS
Flexibility
500
Manufacturing Cell
Conventional Machines
25
Low
1
2
5
100
500
Number of Parts per system
High