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# UNIT 19 COMPUTERS IN OPERATIONS MANAGEMENT

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## Objectives

After studying this unit, students will be able to:

- Appreciate the strategic role of computers in operations management
- Learn the impact of computers - in - manufacturing for restructuring operations management in the coming years
- Comprehend strategies for information systems (applications), information management (monitoring and control) and information technology (delivery) in operations management in future
- Understand the impact of integrating information technology (IT) in all facets of operations management
- Visualise reconfiguration of operations management to meet changing needs and wants of the customers who would demand increasingly highly differentiated and customised products.

## Structure

- 19.1 Introduction
- 19.2 Continuous Performance Improvement
- 19.3 Computers in Demand Forecasting and Order Processing
- 19.4 Computers in Design and Drafting
- 19.5 Computers in Purchasing and Outsourcing
- 19.6 Computers in Materials Management
- 19.7 Computers in Operations Planning, Scheduling and Control
- 19.8 Computers in Manufacturing
- 19.9 Computers in Process Control and Quality Management
- 19.10 Computers in Technology and Productive Maintenance
- 19.11 Computers in Automatic Assemblies
- 19.12 Computers in Finished Product Warehouses
- 19.13 Computers in Distribution (Outbound Logistics)
- 19.14 Future Trends in Operations Management
- 19.15 Emerging Importance of Information Technology
- 19.16 Summary
- 19.17 Self-Assessment Exercises
- 19.18 Further Readings

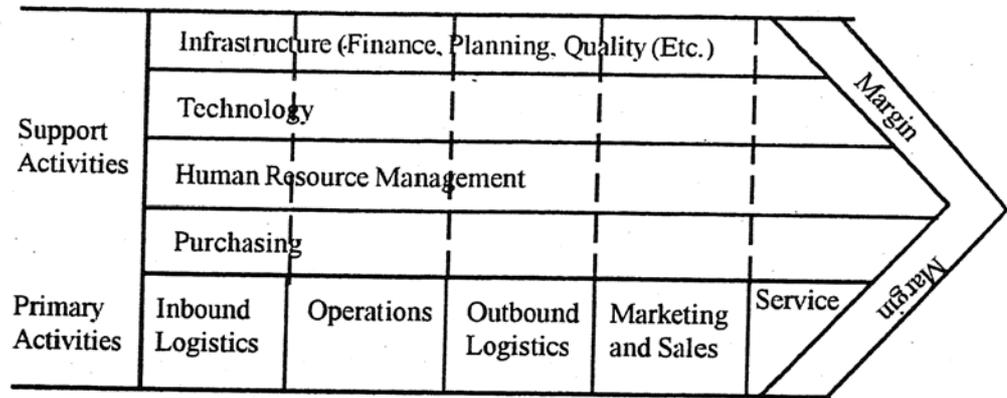
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## 19.1 INTRODUCTION

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The role of computers have gone much beyond debates, discussions and doubts. Computers and its latest *avataar*, Information Technology, has already arrived and should encompass the overlapping technologies of computing, micro-electronics, robots and telecommunications capabilities.

Operations management has been undergoing a metamorphic change in its philosophy, content and approach ever since Michael A. Porter, the *Guru* of strategy, has propounded the Value Chain Analysis (VCA), which is a whole new way of looking at a company's functions and structures. Porter has visualised a firms structure as below :



An organization's functions can be grouped as below:

- a) Primary Activities
  - i) Inbound logistics
  - ii) Operations
  - iii) Outbound logistics
  - iv) Marketing and sales
  - v) Service
- b) Support Activities
  - i) Purchasing and Outsourcing
  - ii) Human Resource Management
  - iii) Technology (or knowledge base)
  - iv) Infrastructure comprising of finance, planning, quality etc.

Subsequently Porter and many other researchers have argued that it is not only important to develop competence in these individual functions, but also build strong links among them so that they function in tandem to one another and harmonize their activities to deliver higher real and perceived value(s) to the customer. It is almost impossible to visualize strengthening links among individuals, functions and companies without learning to use computers imaginatively and integral with telecommunication, micro-electronic and information technology capabilities.

## **19.2 CONTINUOUS PERFORMANCE IMPROVEMENTS**

Operations management plays a pivotal role in the overall business strategy of an industrial enterprise and although it is more focused in manufacturing industry, it is becoming equally relevant in the service industry despite its spread, variety and complexity.

The approach towards effective operations management has been in flux for quite some time. Japanese management practices have brought into the centre of the radar screen of operations management, following seven issues, represented by the ultimate performance standards by moving towards -zero' progressively and positively:

1. Zero Defects
2. Zero Set-up Time
3. Zero Handling
4. Zero Batch Size
5. Zero Breakdown
6. Zero Lead Time
7. Zero Surging

These may not be attainable in practice but they do provide a guiding framework for continuous improvement in performance.



The above seven-pronged approach in improving effectiveness of operations management can be realised by increasingly integrating computer and information technology with all facets of working of the conversion process viz.

- Computers in marketing (or more specifically in demand forecasting and order processing)
- Computers in design and drafting
- Computers in purchasing and outsourcing
- Computers in materials management, including inward logistics and stores
- Computers in operations planning, scheduling and control
- Computers in manufacturing
- Computers in process control and quality management
- Computers in zero technology and productive maintenance systems
- Computers in productivity measurement, performance evaluation and reward systems
- Computers in automatic assemblies
- Computers in finished product warehousing
- Computers in distribution or outbound logistics

We would now describe role of computers now and in future, in the above twelve functional areas:-

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### **19.3 COMPUTERS IN DEMAND FORECASTING AND ORDER PROCESSING**

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Listening to the voice of the customers means analysing his needs and wants in a systematic manner. The approach would be monitoring these so closely and frequently that we can forecast the trend in his needs and preferences over time. This leads to more reliable decision in the choice of products and its features.

Similarly if it is a customized product, it is important that the order is processed expeditiously over the computer network to the manufacturing units without any delay or detention. This is possible to achieve by installing appropriate computer systems which are on-line, real-time systems.

In the case of fast-moving consumer goods (FMCGs) the preparation of the invoice at the departure counter of the retail store itself, triggers off flow of information to the concerned wholesaler and/or manufacturer instantaneously through computer networks.

#### **Activity A**

Think of an order processing system when a large number of sales orders are to be delivered from stockable items in finished product warehouses. Draw up a suitable reporting system, on a weekly basis, to highlight the volumes processed and level of service, in terms of delays in executing delivery from the firm's warehouse.

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### **19.4 COMPUTERS IN DESIGN AND DRAFTING**

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Computers are being used extensively in the computations of design, evaluating alternatives etc, in hard engineering areas to developing computerized textile, fashion or film animations. Computers are playing a role of underpinning technology in multimedia creations and have ingressed into almost all walks of life.

Local Area Networks (LANs) and Wide Area Networks (WANs) have made it possible for designs of various specialist functions to work concurrently and simultaneously on their



areas instead of working sequentially. This has reduced the cycle times significantly.

Besides, design offices, Computer Aided Design/Drafting (CAD) systems have been linked to Computer Aided Purchasing, Materials Management and Manufacturing Systems. As and when the design of the product is completed, designers of jigs, fixtures, tools, gauges, punches, dies etc. get into stride simultaneously to preparing the Material Requirement Planning (MRP), triggering off purchasing and manufacturing activities.

**Activity B**

Think of a number of functional specialists working as a team, on a product design in a totally computerised environment.

Can you visualise a method by which they interact frequently on the computer network so that the overall time duration for launching a new product is substantially reduced.

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## 19.5 COMPUTERS IN PURCHASING AND OUTSOURCING

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Owing to greater emphasis on core competence, companies are going virtual by outsourcing a large number of jobs and functions. This has increased the relevance and importance of building long term relationships with your suppliers and vendors of materials and services. Computers have made it possible by improving the access, reach and spread of purchasers.

Besides, we can install computer hook-up with most of the ancillaries who would make available complete data on the availability, price, delivery of components they make on a long-term basis for the purchaser, who can access this data and dispatch the purchase order electronically to the supplier.

Purchasing procedures have been re-engineered to speed up the entire process. Purchasers no longer wait for invoice to be received and advise preparation and dispatch of payment cheques, as per the terms of payment, no sooner the quantities received are matched with quantities in purchase order. This is done through computerized system.

Add to this the possibility of automatically advising your banker to electronically transfer the payment to suppliers' bank account (Electronic Clearance Service has already been introduced by the Reserve Bank of India albeit for a few selected cities).

**Activity C**

If your firm is hooked onto the suppliers of most of the components and sub assemblies, can you describe a system of telepurchasing.

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## 19.6 COMPUTERS IN MATERIALS MANAGEMENT

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Computers have been used extensively in operating inventory control systems in warehouses for raw materials, for packaging materials, for maintenance parts and spares, for petrol, diesel, oil and lubricants, for consumables, for laboratory chemicals, for safety equipment, for various stationery etc. Usually fixed order quantity review system comprising of minimum stock, ordering level and economic order quantity is operated. The moment stock of an item depletes to the ordering level (OL), the computerized schedule triggers off the indent for, purchasing the net lot - Order Quantity (OQ) which should generally arrive before the stock is exhausted. A buffer of minimum stock is maintained to



provide for fluctuations higher than the mean rate of consumption and/or a mean lead time of the supplier.

Computers are also used for preparing purchase orders and currently; thanks to advances in telecommunication, purchase orders can electronically be dispatched to the supplier.

Similarly, computer systems are used to support progressing and inspection at vendors works, tracking materials in transit from different locations, reporting arrival, arranging acceptance with or without the assistance of inward inspection, binning etc. Similarly in the event of any consignments being rejected on arrival suppliers are advised to collect the same back. Computers keep a tab on the movement of materials until these have been physically put into the designated location and taken into computerized inventory control mechanism.

During the last ten years, organizations have installed total material requirement planning-MRP systems which maintain total control on the out-sourced materials and services as well as in-house manufactured components, sub-assemblies and final assembly, packaging and transfer into finished product warehouses.

The framework of MRP usually extends cover the finished product warehousing including dispatches to various destinations within the organisation as well as direct dispatches to customers, wholesalers etc.

Computers have already become indispensable in this area and it is becoming rather difficult to visualize how companies could operate a reasonably efficient materials management without computers. With the continuing drop in prices of personal computers, it is almost becoming clear that hardly any company's operations are small enough to exclude the use of computers.

#### **Activity D**

Briefly describe the technique of Material Requirement Planning and highlight how computerisation would help in better co-ordination and control of material flow.

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## **19.7 COMPUTERS IN OPERATIONS PLANNING, SCHEDULING AND CONTROL**

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Conversion process is rather complex as a large number of variables come into play and can influence the planning and scheduling of individual operations of each component. It is rather difficult to visualise operations in the present day world without the use of computers.

Scheduling high volume (mass) production systems represented by continuous production processes or assembly lines is perhaps the simplest. However, assembly line manufacturing is, in turn, dependent upon production of large number of components and subassemblies which are the result of batch production system and/or job shop production systems. Operation Planning and Scheduling and Control of these type of manufacturing systems is rather complex and cannot be done within the constraints of time available, without imaginative use of computers in material requirement planning (MRP), Manufacturing Resources Planning (MRP-II) or its latest and increasingly popular version of Enterprise Resource Planning (ERP).

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## **19.8 COMPUTERS IN MANUFACTURING**

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When Computerised Numerically Controlled machine tools originated in 1970s. these were rather expensive and it was thought that, to get the most of these CNC machines, we have to operate them in three shifts (round the clock) and go in for longer runs (larger batch sizes) to economise on unit cost of production. However, technology developed so rapidly that we were able to integrate computers into not only the process of manufacturing, but also in shorting the time involved in setting up and changeover. This meant that CNC



machining centres could be set up very quickly for new jobs. In many cases, the changeover time reduces from days to hours and hours to minutes. This imparted the much needed flexibility and reduced the response time for manufacturing units to changing customer demands. Thanks to these advances in Computer Aided Manufacturing (CAM) systems, move to Flexible Manufacturing Systems became a reality. Today this very technology is helping to changeover to Just-in-Time (JIT) technology and even batch or job-shop production systems are approximating to assembly line ones i.e. reducing the lot size of production between different work stations to one - similar to what is obtained on an assembly line or conversely, production patterns will move towards job-shop production systems.

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## 19.9 COMPUTERS IN PROCESS CONTROL AND QUALITY MANAGEMENT

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As the focus shifted to manufacturing products correctly first time, it became clear to forward thinking managers that quality cannot be inspected into a product - instead it is a very basic feature of a product and should be designed into the product at the first stage itself. It was also revealed that cent percent inspection is neither required nor reliable - doubts were expressed about the consistency of performance in human inspections. Today increasingly human intervention for inspection of products is being replaced with electronic measurements through better design of measuring instruments and equipment. The philosophic approach has shifted to monitoring and management of process conditions; consequently, what would ensue from the process - the final product, will be consistently of the right quality. Computers are playing increasingly important role in continuously monitoring, supervising and managing critical process conditions without relief, without tea, coffee and lunch breaks, without getting tired, withstanding heat and cold, rain and dry weather, in polluted stinking or nuclear hazardous working environments. For example, the plant availability of thermal power plants can be substantially enhanced by installing micro-processor based Flame Safeguard and Supervisory System (FSSS), A computer aided scanner maintains round-the-clock vigil on the size of the flame in the furnace (the very heart of thermal power plant). With the help of the basic capability of computers of comparing, a digitized size of the flame is stored in the computer memory permanently. When the size of the flame increases beyond the upper limit of the specified flame size, the microprocessor activates and reduces the flow of fuel in the pipeline until its flame size returns to normal permissible size. Conversely, when the flame in the furnace shrinks in size below the lower desirable size of the flame, the microprocessor actuates the fuel lines again and increases the flow so that the size of the flame returns to its normal size i.e. within the upper and lower permissible limits. This precludes the possibility of fission or bursting of tubes in the boiler and consequently prevents breakdown of thermal plants, reduces thermal shocks to the tubes and prolongs the operating life of the equipment.

Besides, electronics, in particular, industrial electronics, will play greater role in measuring process variables on a continuous basis, monitoring and managing the process conditions and keeping them within the desirable limits. Just as it is possible to control space aircraft from central station on earth, we are able to fly aircrafts without pilots, railway trains without drivers etc. Similarly, in coming years, it would be possible to monitor and control centrally the entire manufacturing unit (cybernated factories) from computerized control rooms.

With the continuous increase in computing capabilities of the chip, the heart of the computer, it has already become feasible to obtain solution to scheduling the next job on the machine while previous one is being worked upon, by taking into account all the variables of availability of materials, tools, jigs and fixtures, drawings, operator, machines etc--a task that, until recently, has been baffling production planners and schedulers.

Computers in manufacturing will be able to co-ordinate different computer aided functions and take a wholistic decision, taking into account all the contingent factors.

### Activity E

Can you think of any household or office equipment, which cuts in and cuts out at two extreme limits of specifications on higher and lower side automatically.




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## 19.10 COMPUTER IN TEROTECHNOLOGY AND PRODUCTIVE MAINTENANCE

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History repeats itself. Maintaining history cards of each equipment was a herculean task when done manually. The entire process of maintenance management from the task actually performed to the time spent by persons of different skills as also the individual and aggregate downtime of the equipment (and consequently, the plant availability for production) can be computerized. Teroteclinolog<sup>3</sup> relating to the total information on machines and equipment, was a good concept but Could not be successfully organized owing to a large variety of information and data needed to be captured, recorded and analyzed manually, can now be computerized. Similarly advancing technology and availability of good, reliable and fast diagnostic tools and kits are helping to monitor the conditions of equipment at regular intervals - temperature, pressure, vibration, noise level etc. and has increased our capability to predict machine failures. Supported by advances in electronic diagnostic tool kits and computer-aided-terotechnology, it is now much easier to install total productive maintenance (TPM) systems, which is a happy mix of preventive maintenance (on-line maintenance), predictive maintenance (scheduled maintenance) and breakdown maintenance. A small fraction of breakdown maintenance is perhaps unavoidable and even desirable, with the advances in on-line maintenance technologies, it would be possible to further enhance plant availability and reduce overall costs per unit of output, for it is possible now, not only to "look, feel and listen" to the equipment while it is engaged in useful, productive work but also carry on maintenance of its various component, subsystems without impairing its operational capability.

### Activity F

Justify the economics of maintenance management - how it reduce s the cost of production per unit of output?

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## 19.11 COMPUTERS IN AUTOMATIC ASSEMBLIES

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Although still a few years away, computers will be increasingly used in organizing assemblies of components -automatic movement of materials through robots, positioning of components in correct place for assembling, screwing or fastening sub-assemblies to main frame of equipment, testing them etc. will be done through suitably programmed computers who would perform the operations repeatedly and consistently without feeling dejected, or distracted, devoted as they would be with discipline to their duty without demur and disillusion.

Obviously, there systems will call for fail-safe, foolproof design of assembles and also very reliable (pokayoke) production systems which will be laced with audio and light signals (andon) for attracting the attentions of few technicians who may not be nearby to check and ensure that systems are running faultlessly

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## 19.12 COMPUTERS IN FINISHED PRODUCT WAREHOUSES

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Computers are already being used extensively in computerized inventory control and order receiving, processing, filling, invoicing and trucking of finished goods to various destinations. Computerized inventory control system are so detailed that a sales person, with the help of wireless modem of his/her lap-top PC, check back the availability of product while sitting and negotiating in customers' premises and can even relay the order booked to the warehouse so as to preclude the possibility of it being sold and dispatched to a different customer at the instance of an other sales person negotiating and booking



order at the same time elsewhere.

Similarly, orders booked can now be processed at electronic speed and customers invoice can be sent electronically to cut out the delays.

Computerized system of finalized product warehouses also transmit information of quantities of various products actually packed and dispatched to manufactured facilities for reordering and replenishment.

These computerized systems are also linked to computerized accounts receivable which, in recent years, have received much attention and has improved company's performances in debt collections, write-offs of bad debts etc.

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### **19 13 COMPUTERS IN DISTRIBUTION (OUTBOUND LOGISTICS)**

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A few manufacturing firms have own fleet of trucks and tankers for moving and transporting their finished products throughout the length and breadth of the country. Owing to increasing emphasis in favour of core competence, companies are already outsourcing distribution of their finished products to trucking and transporting firms. A large number of established and new foreign companies operating in India are appointing clearing and forwarding agents (including warehousing) for distributing their finished products in different regions of the country.

Movement of goods and logistics in emerging as a well organised industrial sector. Most of the well established operators have installed computers at their regional offices with inter-office connectivity though fax machines and/or electronic mail. Consequently, there carriers have developed a reliable system of information gathering and dissemination to their customers. In the past, inter-city transportation of small lots or partial truck loads was very tricky and painstaking. It would take weeks for the cargo to travel, say, from, Coimbatore to New Delhi. The carriers could not inform the status of movement of the consignment to their customers - most often, this small lot would get unloaded in one of the numerous godown of the carrier company and would reach its destination, say, in five to six weeks. It is no longer so, thanks to the introduction and use of computers in the business of trucking and transportation. For example a small time merchant exporter had to urgently lift a consignment weighing about 40 kgs (inclusive of packaging) from Coimbatore, bring it to New Delhi and then air freight it to an overseas destination along with other cargo. The carrier had promised door-delivery an the fourth day of its dispatch from Coimbatore. Since it was an urgent consignment for meeting a delivery deadline to an overseas customer, the exporter was marking regular inquiry with the transporter local office at New Delhi. It was a pleasant experience when the carrier advised that the consignment had arrived at Hyderabad on the first day along with the truck number and that it has arrived at Indore at the end of the second day in the same truck, where there will be a transshipment: (a number of truck owners from south India operate between Indore and down under). On the third day, carrier informed that the consignment has arrived into their New Delhi godown and in response to previous enquiries suggested that the consignee could collect it on the third evening from the local godown or alternatively, as committed, they will effect door delivery in the forenoon of fourth day.

This would not have been possible if the trucking company did not employ computers and inter-office connectivity. Today large truckers are going in for satellite tracking and monitoring for their fleet and are arming themselves with the capability of knowing where (location) the truck is at present with your cargo.

#### **Activity G**

Study further the satellite tracking system and how this can be used for monitoring movement of entire railway network.

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Even in the past, the writer can quote a number of occasions when carriers informed the consignor about the date and time of receipt of materials by designated store personnel



much before the formal, internal confirmation of receipt of the same material was received in a routine manner.

As companies reconfigure their business activities and go in for outsourcing these specialist activities of clearing, warehousing and forwarding, computers and on-line information management will be the key factor and it cannot be achieved without computers, without telecommunications and without wide area networking.

## 19.14 FUTURE TRENDS IN OPERATIONS MANAGEMENT

The rapid changes in technologies, largely owing to integration of computers, will impose new and different ways of managing operations. It is not just a cost-reducing technique or tool. It will significantly improve time, quality and level of service i.e., the response and responsiveness of the entire operation.

New manufacturing facilities would be general-purpose machines with computerized numerical controlled operations, automatic material handling systems manned by robots, CAD capability for designing parts and components, but this new job-shop will be able to take up manufacture of a large variety of jobs very quickly.

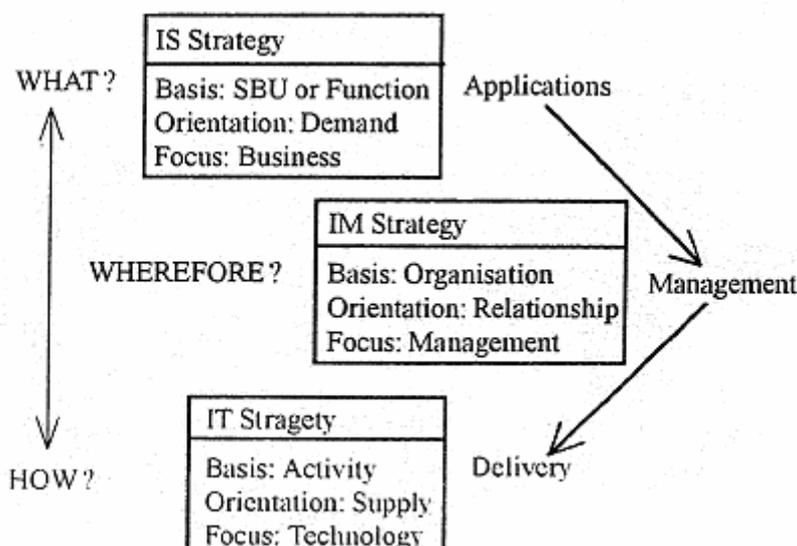
Another area which will undergo rapid change is the ability to compile a bid for a new product in a very short time and then proceeding to secure the contract electronically. This would be possible despite the fact that in future many facilities will not be located within one premises. Most of the operation facilities will in fact, be a well lubricated network of suppliers who would synchronize their respective operations so that the moment CAD design is ready, orchestration of all the activities in house and with ancillaries and suppliers would commence immediately to complete and deliver the product with just the right machines and capacities available to minimize the overall cost and time, with maximum level of quality and service.

All this would be possible by integrating information technology (IT) into the operations. IT is much more than computers and computing; it should cover micro-electronics, robots, telecommunications and satellite technologies.

## 19.15 EMERGING IMPORTANCE OF INFORMATION TECHNOLOGY

Many of us are not fully aware of the impact of IT on every thing we would do in the next century. M.J. Earl (1989) has elaborated it in his book "Management Strategies for Information Technology": he distinguishes three levels of strategies viz.

- Information Systems (IS) strategies
- Information Management (IM) Strategies
- Information Technology (IT) Strategies





IS strategies emphasized spread out to a large number of individual applications suiting business needs. IM strategies inevitably ensued from the need to co-ordinate control and manage diverse applications without knowing how these will be delivered. Now, with the advances in a wide array of related technologies of robots, micro electronics, telecommunications and satellites, we are able to integrate our capabilities and ensure delivery with total IT strategies.

M.J. Earl has pointed out nine key aspects of IT strategies as below:-

- 1) It is a high expenditure activity
- 2) It is critical to many organizations
- 3) It has become a strategic weapon
- 4) It is needed in our economic context
- 5) It is effecting all levels of management
- 6) It implies a revolution for management information systems
- 7) It involves many stakeholders
- 8) IT matters matter
- 9) IT management makes the difference

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### **19.16 SUMMARY**

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Computer and Information Technology have taken a leading position in business today. Operations Management is noway different in this regard. Manufacturing technologies like CAD, CAM, CIM, FMS, JIT and TQM etc, have taken the major advantages by using computers. One can say that computer and related softwares can change a total setup of an organisation by effectively utilising the information sharing among different functional areas of management. In today's liberalised environment if an organisation wants to be competitive, then adoption of new technology is inevitable with computer as a part of the system. The effective interactions among the social sub-system, the technical sub-system and the environmental subsystem is only possible if computer interact effectively with all subsystems.

Computerization of operations management helps in continuous improvement moving towards zero defects. Understanding the customer need and forecasting the requirement of the future help is taking decision is capacity planning process selection and new technology, and facility planning, Obviously computers come into action. Computers are playing a role of underpinning technology is multimedia creation, designing and evaluating the alternatives. One cannot overlook computers in purchasing & material management functions, planning, scheduling & control of projects and manufacturing of products & services. Industrial electronics will play a greater role in measuring process variables on a continuous basis, monitoring & managing the process conditions. Computers will be increasingly used in organising assembling of components automatic movement of material through robots, positioning of components in correct place for assembling, screwing, or fastening sub assemblies. The rapid changes in technologies mainly integration of computers, will change the ways of managing operations. IT is much more than computers & computing, It covers the micro electronics, robots, telecom & satellite communication and interacting with different operations.

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### **19.17 SELF-ASSESSMENT EXERCISES'**

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- 1) What is Value chain analysis and what are its main elements?
- 2) What are seven critical variables which production personnel should zero on?
- 3) How computerisation can aid development, analysis and forecasting?
- 4) Describe the role of supporting computerised systems in booking, processing and delivery of orders from customers.
- 5) Describe the CAD and CAM systems in Operations Management. Can they be integrated? If so give details of its working.



- 6) Describe the technique of Materials Requirement Planning (MRP). Can it be used effectively without the use of computers?
- 7) What are Flexible Manufacturing Systems? Can the use of computers facilitate it and why?
- 8) What is Just-in-time management systems? What is the philosophic approach in terms of batch size?
- 9) Is JIT system utopian or can it be made to work?

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## **19.18 FURTHER READINGS**

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1. Michael Hammer & James Champy, Re-Engineering The Corporation, Nicholas Brealey Publishing.
2. James Champy. Re-Engineering Management, Harper Business.
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4. Manohar Gulati, Business Process Re-Engineering, All India Management Association.
5. Bill Gates, The Road Ahead, Microsoft.
6. Garry Hamel, C.K. Prahalad, Competing for the Future, Harvard Press.