CHAPTER-6

JUST IN TIME SYSTEMS

J I T

- JIT is called a philosophy because it goes beyond inventory control and encompasses the entire system of production
- To sum up
- ‘JIT is an approach that seeks to eliminate all sources of waste in production activities by providing the right part at the right place and at the right time

JIT types

- **i-Romantic JIT-Consists** of various slogans and idealistic goals such as lot size of one, zero inventories and zero defects

- **ii-Pragmatic JIT-Consists** of a set of techniques, some fairly technical that relate to machine change overs,layout design, product simplification, quality training, equipment maintenance etc.

LEAN PRODUCTION & JIT

- Avoidance of waste
- i-The waste of time caused by having to repair faulty products
- ii-The waste of investment in keeping high inventories
- iii-The waste of having idle workers

Lean Production & JIT (contd.)

- **Elements of Lean production**
- i-Consider organization in terms of supply chain of value streams which extends from suppliers through the final customer
- ii-Organize workers to form teams
- iii-Produce products of perfect quality through continuous improvement
- iv-Doing operations by product\cellular manufacturing
- v-Operate facility in JIT mode

J I T

- Just in time is a key element of Lean production
- JIT means
- i-Producing the quantity of units that is needed
- ii-Producing them on the date\time required
- iii-Supplier delivers the exact quantity demanded at the scheduled time and date

Concepts of JIT

- Three fundamental concepts of JIT
- are
- i-Elimination of waste and variability
- ii-’Pull’ verses ‘Push’ system
- iii-Manufacturing cycle time (throughput time)

Concepts of JIT (Contd.)

- i-Elimination of waste and variety reduction-Products being stored ,inspected \delayed, products waiting in queue and defective products do not add value and are waste.

  Variability is any deviation from the optimum process that delivers perfect product on time, every time .Inventory hides variability and results into waste

Concepts of JIT(contd.)

- ii- **Pull vs. Push system-Pull** system results into material being produced\supplied only when requested and moved forward only when needed
- Push system pushes material into downstream workstations regardless of their requirement and hence encourages waste
- **iii-Manufacturing cycle time** is the time between the arrival of raw materials and the shipping of final product.JIT helps in reducing the manufacturing cycle time.

Little JIT and Big JIT

- **Little JIT-It** is a form of production scheduling and inventory management whereby products are being produced only to meet actual demand and materials for each stage are received\produced just in time for next stage of production
- **Big JIT** -Encompasses the full range of organizational and operational improvements and seeks to eliminate waste in all aspects of firm's production activities-human relations, vendor relations, technology and the management of materials and inventories

Objectives of JIT manufacturing

- i-Produce only the products\services that customer wants.
- ii-Produce products only as quickly as possible as customers want to use them
- iii-Produce products with perfect quality
- iv-Produce in minimum possible time
- v-Produce products with features only what customer want
- vi-Produce with no waste of labour \materials\equipments
- vii-Produce with methods that reinforce the occupational development of workers

Overview of JIT manufacturing

- **i-Inventory reduction-Reduce** inventory at all levels of production
- **ii-Quality improvement-** JIT provides procedure for improving quality both within\outside the firm
- **iii-Lead time reduction-** With JIT ,lead time components such as set up time and move times are reduced

Overview of JIT (contd.)

- **iv-Vendor control-** Deal with only few suppliers to improve on organization strength on price, delivery and quality
- **v-Continuous improvement-** Existing problems are corrected and new problems are identified in never ending improvement process.
- **vi-Total Preventive Maintenance-** JIT reduces the risk on equipment breakdowns
- **vii-Strategic gain-** JIT provides the management with means of developing, implementing and maintaining a sustainable competitive advantage in the market place.

Ideal production system and JIT production

- i-Only one type of product is produced
- ii-Demand for the product is constant at the rate of one unit every ‘t ‘ units of time
- iii-Customers purchase the product at the production facility
- iv-All resources needed to produce the product are available at the production site
- v-All materials are without defect and will be delivered only when needed and only the amount needed will be provided.

An ideal production system and JIT Production(contd.)

- vi-The amount of processing time required to make one unit of the product is ‘Nt’ where N is a positive integer
- vii-There is no randomness in processing times
- viii-No defects are produced
- ix-Machines never wear out or breakdown
- x-Employees always show up for work and never make mistakes.

Characteristics of JIT system

- **i-Pull method of material Flow-** The customer demand activates production of item and produced in small lots just as needed.
- **ii-Constant high quality-** Efficient JIT system operations require conformance to product\service specifications and controls quality at source and workers acting as their own quality inspector

Characteristics of JIT system(contd.)

- **iii-Small lot sizes-** JIT system maintains inventory with small lot sizes giving advantages of reduction of cycle inventory, reduced lead time, and create uniform operating system workload. To overcome disadvantage of increase frequency in set up time and hence operations must reduce set up time to realize benefit of small lot production.

Characteristics of JIT system(contd.)

- **iv-Uniform work station loads-** JIT system works best if the daily load on individual work station is uniform. this can be achieved by assembling the same type and number of products each day, thus creating a uniform daily demand at all work stations.
- **v-Standardized components and work methods-** is called part commonality \modularity.Standardisation of components and work methods aid in achieving the high productivity, low inventory etc

Characteristics of JIT systems(contd.)

- **vi-Close Supplier ties-** Close relationship with suppliers is necessary due to low stock of inventories. Stock shipments must be frequent with short lead times, arrive on schedule and be of high quality
- **vii-Flexible work force-** Workers in flexible work force can be trained to perform more than one job. High degree of flexibility in the work force can be achieved with little training.

Characteristics of JIT system(contd,)

- **viii-Line Flow strategy-** A line flow strategy can reduce frequency of set ups.Group technology can be used design small production lines that manufacture in volume, families of components with common attributes.
- **Ix-Automated Production-** Benefits of automated production include greater profits\market share.
- **x-Preventive maintenance-** Preventive maintenance can reduce the frequency and duration of machine down time.

JIT Manufacturing Vs. JIT Purchasing

- The essentials of JIT purchasing
- **i**-Supplier development\relation-Supplier\customer build up co-operative relationship and suppliers are referred as co-producers with assistance in reducing costs and improving quality.
- **ii**-Purchase develop long term relationship with few suppliers.
- **iii**-Though price is important, delivery schedules, product quality and mutual trust\cooperation becomes the basis for supplier selection.

JIT manufacturing Vs. JIT purchasing(contd.)

- **iv**-Suppliers are encouraged to extend JIT methods with their suppliers.
- v-Supplier,s are located near the buyer's factory.
- vi-Shipments are delivered directly to buyer's production lines.
- vii-Parts are delivered in small \standard containers with minimum paper work.
- **viii**-Delivered material is of near perfect quality.

Pre-requisites for JIT manufacturing

- Before implementing JIT system, certain changes to the factory and the way it is managed must occur before benefits of JIT are realized.
- i-Stabilize production schedule
- ii-Make the factories focused.
- **iii**-Increase the production characteristics of manufacturing centers.

Pre-requisites for JIT manufacturing(contd.)

- **iv**-Improve Product quality.
- v-Cross train workers so that they are multiskilled and competent in several jobs.
- vi-Reduce equipment breakdowns through preventive maintenance.
- **vii**-Develop long term supplier relationship that avoid interruptions in material flows.

Elements of JIT manufacturing

i-Continuous improvement- Continuous improvements can be enforced by reducing in process inventories, machine set up time, using SMED etc.Continuous improvement is central to the philosophy of JIT and is a key factor in its success.

ii-People involvement and employee empowerment- Is essential to have dedicated work force committed to working together to solve production problems and to develop an open and trusting organizational culture together with an attitude of loyalty to the team and self discipline.

Elements of JIT manufacturing(contd.)

- **iii-** Enforced problem solving-Every material is expected to meet quality standards, arrive exactly at the time promised and at the nominated place. Each worker is expected to work productively and every machine is expected to work without breakdowns, reducing WIP inventories.

Elements of JIT Manufacturing system(contd.)

- iv-Eliminating waste-Eliminating waste of all kinds is the main principle behind JIT.Examples of waste are
- Inspection of incoming material
- Illogical paper trails for material orders
- Excessive handling of work on shop floor
- Confusion on the shop floor
- Sequential design process
- Some inventories
- Continuously working to correct acute problems in process
- Excess idle capacity.

Elements of JIT manufacturing system(contd.)

- **v-Total quality management-** For successful JIT manufacturing system, total quality management system must be in place. Like JIT every one must be involved in TQM
- **vi-Parallel processing-** There are various operations which can be done in parallel instead of doing in series ,thus saving manufacturing time. Concept of Concurrent engineering can be applied.

Benefits of JIT system

- **i**-Inventory levels are drastically reduced
- **ii**-Throughput or manufacturing cycle time is greatly reduced,
- **iii**-Product quality is improved and cost of scrap is reduced.
- iv-The causes of production problems ,manufacturing operations are streamlined and problem free.
- **v**-With less WIP,less space is occupied.

Benefits of JIT system(contd.)

- **vi**-Multi skilled, flexible work force bring benefits such as less worker idle time, reduced overheads, fewer layoffs and increased responsiveness.
- **vii**-Elimination of unnecessary suppliers(late deliveries, poor quality)
- **viii**-Reduction in customer related problems. Improvements in communication\quality

Benefits of JIT system(contd.)

- ix-Reduction in floor space due to less WIP,smaller lot sizes.
- x-Shorter lead time of suppliers
- xi-Improvement in employee morale due to higher employee involvement
- **xii**-Reduced pressure on inward goods receiving and incoming inspection areas.

Major tools & techniques of JIT manufacturing

- **i-Kanban system\Pull scheduling-** To build only what customers demand & when they demand. JIT manufacturing needs a scheduling system that can immediately and clearly communicate the demands of the customer to the delivery system. Parts are transferred from one stage to another in rigid containers containing only small\fixed quantity.

Major tools & techniques of JIT manufacturing(contd.)

- **ii-SET Up time reduction\SMED** –To produce just what customer want in desired quantities ,a manufacturing system must build up products in small lots. Requirement of reduced set up time is essential, An effective set up reduction program should pursue four major o0bjectives
- a-Evolve towards lot size of one
- b-Run every part every day
- c-Make right every time
- d-Keep set up time to 10 minutes.

Major tools &techniques of JIT manufacturing(contd.)

- **ii-Set up time reduction(contd.)-** To achieve 4 goals ,set up reduction program should be put in place, such as
- #Process flow analysis of set up times
- #-Housekeeping
- #-Practiced team work.

Major tools and techniques of JIT manufacturing(contd.)

- **iii-Single minute Exchange of Dies(SMED)-** Can be reduced by
- Locating required inventory\machine tools close to the operating area.
- Standardize the set up function
- Improve tool preparation procedure
- Eliminate unnecessary machine adjustments
- Synchronize operator jobs
- Automating set up procedure using computer control, if feasible

Major tools & techniques of JIT manufacturing system(contd.)

- **iii-Lean Production** –Lean production incorporating JIT implies being rigorous, organized and efficient. The Japanese culture of 5 ‘S ‘should be applied i.e. Seiro(remove),
- Seiton(organize), Seiso(keepclean),
- Seiketsu(standardise),
- Shitsuke(respect the rules)

Major tools & techniques of JIT manufacturing (contd.)

- **iv- PokaYoke (fool proofing)** –To produce perfect quality the first time every time, operations manager must identify all opportunities for error elimination. They must design parts and processes that make the desired results inevitable. Poka-Yoke tries to change either the process or its resources to eliminate the need to rely on human experience and accumulated knowledge.

Major tools & techniques of JIT manufacturing(contd.)

- **v-Quality at source** –It is an orientation within JIT manufacturing towards targeting efforts to improve quality at the activities that produce it. Quality at source reinforces the major principal of JIT manufacturing that promotes respect of human beings through three techniques such as
- Jidoka means autonomation
- Stop-and-fix\line-stop system
- Andon means visual signals to identify exact location of problems.
- The above when followed make problems highly visible, allowing workers to develop visual control of process.

Major tools & techniques of JIT manufacturing(contd.)

- **vi-Standardize and simplification** –Two major factors viz waste and variance need to be controlled in any manufacturing system. This can be done by above techniques.
- Standardization requires JIT initiative to replace inconsistent methods with standard routine for process tasks.
- Simplification is the JIT initiative to identify and eliminate any unnecessary process steps through process analysis techniques.

Major tools & techniques of JIT manufacturing(contd.)

- **vii-Supplier partnership** –JIT system encourages close relationship with vendors who are expected to provide small deliveries of high quality goods Buyers take measures to reduce number of suppliers, concentrating and maintaining close working relationship with few good and reliable suppliers. Suppliers expertise must be utilized at the design stage itself to ensure the desired quality of materials.

Major tools & techniques of JIT manufacturing(contd)

- **viii-Reduced transaction processing** –JIT system cut transaction costs by reducing the number and frequency of transactions i.e. suppliers delivering directly to production lines. Vendors are certified for quality, eliminating the need for inspection
- **ix-Kaizen (continuous improvement)** – Workers in JIT system are expected to be involved in problem solving through continuous improvement. IT workers receive extensive training in statistical process control, quality improvement and problem solving.

Effect of installation of a JIT system

- The effect of installation of JIT system is on
- i-Layout and equipment
- ii-Workers
- iii-Suppliers
- i-Layout and equipment-The installation of a JIT system has a natural effect on layout and equipment .The Plant evolves towards a more streamlined flow and automated plant because lot sizes are reduced and problems are constantly resolved making automation possible.

Effect of installation of JIT system(contd.)

- ii-Effect on workers- JIT system need ‘multifunctional ‘ workers. The workers must be able to set up machines, do routine maintenance and inspect the parts. New pay schemes are needed that reward workers on the basis of different jobs they can perform and also based on their seniority and job skill level. This will encourage workers to learn more skills and become more flexible.

Effect of installation of JIT system(contd.)

- iii-Effect on suppliers- With the JIT system, single source suppliers are encouraged and long term relationship is established to ensure availability of quality parts.
- ‘Integrated supplier program’ should be established, the features of which include early supplier selection, family of parts sourcing, long term relationship, cost based price negotiations and paper work reduction in Receiving and Inspection.

JIT implementation approach

a-Obtain commitment from the top management for providing Leadership to adopt JIT approach and prepare a plan with the help of cross functional teams.

b-Gain the cooperation of work force.Guaranted stable employment ,engaging workers in training and participation will help. Cross training and small group activities should be initiated for worker participation.

JIT implementation approach(contd.)

- **c**-Start implementation of JIT system with the final assembly line. Reduced set up time and small batches should be encouraged. use standard containers.
- d-Work backwards from final assembly ,reduce set up times and lot sizes in fabrication areas.
- **e**-Balance fabrication rates with final production rates. Correct capacity short falls to facilitate balancing.

JIT implementation approach(contd.)

- **f**-Extend JIT to suppliers. First stabilize suppliers delivery schedules, change over to frequent deliveries. Help suppliers with quality assurance to meet your specifications.
- Negotiate long term contracts with suppliers.

Problems in implementing JIT

- **i-**JIT is applicable repetitive production situations involving standard products. IT requires frequent set ups,shipments and reciepts.It may not work in custom built\project type situations.
- **ii**-JIT demands discipline. The production system must operate correctly and employee must do their job right.

Problems in implementation JIT (contd.)

- **iii**-JIT is based on cooperation and trust between people,workers,managers,suppliers,
- customers etc.In environment of suspicioun,distrust and competition ,it will not work.
- **iv**-The concept of JIT must be understood fully in the same meaning by all concerned and then attempt implementation.

Problems in implementing JIT(contd.)

- **v**-Implementaing JIT is often very expensive, when the training ,preventive maintenance and consulting costs are factored in. But the long term gains must not be ignored.
- **vi**-Implementation of JIT must be balanced. Cutting inventory beyond a certain point may cause more harm than good.
- **vii**-JIT environment often place additional stresses on the shop floor workers.

Planning a sucessful JIT system

- **i**-Make sure that the top management is commited.They should be involved in the process and must know the costs, time and expected results.
- **ii**-Study the operations carefully and decide which parts will be needed in terms of the most effort to convert.
- **iii**-Obtain the support\cooperation of workers, train them in set up, equipment maintenance, multiple tasks, cooperation ,problem solving etc.

Planning a sucessful JIT system(contd.)

- iv-Begin by reducing set up times,maintainig the current system. Enlist the aid of workers for identifying\eliminating existing problems.
- v-Gradually convert operations, beginning at the end of the process and working backwards.
- **vi**-Convert suppliers to JIT and work closely with them. Reduce the list, identify those who are willing for JIT.Establish long term commitment with vendors.

Obstacles to JIT conversion

- i-Management may not be fully committed
- **ii**-Management may resist because JIT shifts some responsibility from management to workers.
- **iii**-Suppliers may resist due to
- Buyers may not be willing to commit resources.
- Avoid long term commitments
- Frequent\small deliveries may be difficult.
- Quality becomes suppliers responsibility.
- Frequent engineering changes.

JIT in Services

- **i-Consistently high quality-** Service employees can be taught the value of providing defect free services.
- **ii-Uniform facility loads** -Reservation system and differential pricing are two ways in which service providers can level the load on their facilities.
- **iii-Standardize work methods-** In highly repetitive services operations, high efficiencies can be achieved by analyzing work methods and standardizing improvements for all employees to use.

JIT in services(contd.)

- **iv-Close supplier ties-** Volume services, (fast food restaurants, mass merchandisers) require close supplier contacts to ensure frequent short lead time and high quality shipments.
- **v-Flexible workforce –**The more customized the service, the greater is the need for a multi-skilled workforce

JIT in services(contd.)

- **vi-Automation** –Automation can play a big role in providing JIT services e.g. ATM,s
- **vii-Preventive maintenance-** Services that are dependent on machines can ensure regularly preventive maintenance.
- **viii-Pull method of material flow-** Service operations where tangible items are processed can utilize Pull method.
- **ix-Line flow strategy-** Managers can recognize their employees\equipments to provide uniform flows through the system and eliminate employees waste time.

Implementation of JIT in services

- i-Eliminate disruptions in work of employees
- ii-Make the service system flexible. Train workers so that they can handle more variety
- iii-Reduce set up times. Have frequently used tools and spare parts ready

Implementation of JIT in services(contd.)

- iv-Eliminate waste. This includes errors and duplicate work.
- v-Minimize WIP .Examples include orders waiting to be processed, calls waiting to be answered, trucks waiting to be loaded.
- v-Simplify the process, especially when the customers are part of the system-retail operations, ATM and Vending machines and service stations.

Strategic implication of JIT system

- JIT system form an integral part of corporate strategies. Emphasizing time based competition-focusing on cycle time reduction, improving inventory turnover and increasing labour productivity
- **Competitive priorities-** Low cost ,consistent quality and ability to provide variety are the essence of JIT
- **Flow strategy-** A JIT system involves a line flow strategy to achieve high volume, low cost production. Workers\machines are arranged around product flow.

Operational benefits of JIT systems

- **i-**Reduce space requirement
- ii-Reduced inventory investment in purchased parts, raw materials WIP and finished goods.
- **iii**-Reduce manufacturing lead times
- **iv**-Increase the productivity of direct labour employees, indirect support employees and clerical staff

Operational benefits of JIT systems(contd.)

- **v-**Increase equipment utilization
- **vi**-Reduce paperwork and require only simple planning systems.
- vii-Set valid priorities for production scheduling.
- viii-Encourage participation by the workers
- **ix-**Increase product quality.

Beyond JIT to time based competition

- Time based competition demands that companies compete on time as well as on quality ,cost and flexibility.
- Can be done in following ways
- i-Through faster introduction of new products.
- **ii**-Through faster throughput of existing products

Beyond JIT to time based competition(contd.)

- Time based competition is a state of mind and a new way of thinking about competing .It also broadens the concept of new product introduction and JIT outside of the factory context into white collar areas of manufacturing and service industries.

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