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Performance analysis of cotton processing small scale industry by using stock simulation method

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ABSTRACT

Today's Industry is regarded as a secondary sector of Indian economy. The economic development of a nation depends on the stage of industrial development. The industry is the greatest sector that can be provided employment to the mass people which help to increase per capita & reduces the poverty. Now a day's cotton textile industry in India has been facing many odds & the survival of the industry is in danger. Due to the continued uneconomic working, the industry financial viability has been deplorably shattered. Many mills in the industry have already reached a stage of financial post ration with the complete exhaustion of reserves surplus & their finance, raw material idle capacity, technology, marketing, infrastructure, underutilization of capacity, project planning, skilled manpower, managerial etc. This study has to cover XYZ small-scale industry. Its points out the weakness and strengths of production & marketing system thus enabling the entrepreneurs & policy makers to take corrective action. I have worked on just in time for performance improvement of a semi-skilled worker, reduces wastage and running cost. I have worked also on the simulation of production. The measures to reduce the identified wastes have been pointed out. It has been proposed to better integrate the key actors into the JIT & simulation. Adopting the cellular layout in the mechanical workshop has been found beneficial as well as the orientation of production on customer orders rather than on forecasting.

Keywords— *Enterprises, Investment, Origin product, excluding land and building*

1. INTRODUCTION

Just-In-Time (JIT) manufacturing has been implemented successfully in Japan for the past 20 years. It is a philosophy as well as a technique that guides a manufacturing company in organizing and managing its business more effectively, and in planning and controlling its operations more efficiently. It is a way to achieve high-velocity manufacturing.

1.1 High-velocity manufacturing

Traditionally, a manufacturing business competes on price, quality, variety, after service, etc. Now, these conditions are merely prerequisites. Few businesses exist today without offering low prices, high quality, and good service. The key competitive factor has become speed. All else being equal, the faster a business responds to its customers, the more profitable it is. The shorter the lead-time in which a manufacturer can supply its products, the higher the probability that it will survive. High-velocity manufacturing is a common goal for all manufacturing businesses. In high-velocity manufacturing, everything is moving. Machines, people, funds and materials are constantly moving. Therefore, inventories in storage or on the shop floor are moving inventories rather than sitting inventories. Inventories are stocked only for a very short time and will move to other locations only moments after being stocked. The conditions of high-velocity manufacturing include flow manufacturing, line balancing, level schedule, and linearity.

1.2 Flow manufacturing

A product or a group of similar products are processed through a series of workstations arranged in a fixed sequence. The materials flow through each workstation at a constant production rate.

1.3 Objective of JIT

JIT Manufacturing tries to smooth the flow of materials from the suppliers to the customers, thereby increasing the speed of the manufacturing process. The objectives of JIT is to change the manufacturing system gradually rather than drastically:

- To be more responsive to customers,
- To have better communication among departments and suppliers,
- To be more flexible,
- To achieve better quality,
- To reduce product cost.

1.4 JIT concept

The operations planning and control system is an information system running throughout the manufacturing environment. Although there is a common system framework discussed in Chapter one, systems run in different ways in different environments. For example, dedicated special facilities are used in make-to-stock environments; general purpose machines are used in make-to-order environments. Dedicated production lines can be designed in a balanced way with minimal setups in order to maximize the flow rate of the materials, while a general purpose machine must be set up before producing a specific item. In setup operations, the material flow is interrupted.

Manufacturing environments can be changed to make planning and control systems simpler and more effective. For example, products are designed to have high similarity in processing and are mixed in a dedicated production line with negligible setups. Since lead-times are shortened, this turns a make-to-stock product into a make-to-order product. Just-in-time is not only a control technique but also a way to improve the manufacturing environment. JIT control systems are only effective in JIT environments. Introducing kanban systems into a non-JIT environment means nothing to a company.

JIT Control can be incorporated into an ERP system as a control part with a condition that the system has to be in a JIT environment. The JIT philosophy guides the development of the JIT environment. The JIT environment provides the foundation for implementing the JIT control techniques. The JIT philosophy, JIT environment, and the JIT technique can be expressed in the figure.

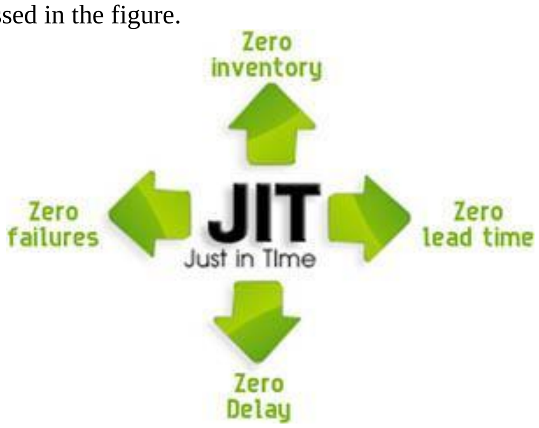

Fig. 1: JIT Concept

1.5 Total Quality Management (TQM)

Total quality management is a management approach used to achieve quality improvement and long-term success through customer satisfaction. TQM involves all members of the organization and is meant to improve the quality of all processes, products, services, operations, and corporate culture.

TQM activities follow a plan-do-check-action (PDCA) cycle to improve the quality. In the "plan" step, the problem is defined, the symptoms are explained, and the key performance measures are determined. In the "do" step, the cause of the symptoms is identified. The causes of the causes are also investigated until the root cause is uncovered. Then, an approach to solve the problem is developed and implemented.

The performance measures can be changed in this step. In the "check" step, the effectiveness of the proposed approach is observed by using the performance measures. In the "action" step, the results are studied to determine what was learned and what can be predicted. The improvement process is standardized to apply to similar problems. In the PDCA cycle, the steps are not necessarily followed strictly sequentially. For example, if we find a proposed approach is not affirmative in "check" step, we may jump to the "do" stage to revise the approach.

1.6 Total Productive Maintenance (TPM)

"Preventive maintenance" is a restrictive term which mentally prohibits us from thinking more broadly. TPM means preventive maintenance *and* continuing efforts to adapt, modify, and refine equipment in order to increase flexibility, reduce material handling, and promote continuous flows. It is operator-oriented maintenance involving all qualified employees in all maintenance activities. (Apics, 1995)

Table 1: Evolution of investment limits for small scale industries

Year	Investment Limits	Additional conditions
1950	Up to Rs. 0.5 Million in fixed assets	Less than 50/100 persons with or without power
1960	Up to Rs. 0.5 Million in fixed assets	No condition
1966	Up to Rs. 0.5 Million in fixed assets	No condition
1975	Up to Rs. 1 Million in plant and machinery	No condition
1980	Up to Rs. 2 Million in plant and machinery	No condition
1985	Up to Rs. 3.5 Million in plant and machinery	No condition
1991	Up to Rs. 6 Million in plant and machinery	No condition
1997	Up to Rs. 30 Million in plant and machinery	No condition
1999 to onward	Up to Rs. 10 Million in plant and machinery	No condition

Source: Udyog Yug (July 2004 issue)

Table 2: Investment ceiling for small scale industries (1999)

Type of industry	Investment Limit	Remarks
Small scale industry	Rs. 10 Million	Historical cost of P and M
Ancillary	Rs. 10 Million	At least 50% of its output should go to other industrial undertaking
Export oriented	Rs. 10 Million	Obligation to export 30% of productions
Tiny Enterprise	Rs. 2.5 Million	No location limit
Service and Business	Rs. 6.5 Million	No location limit

1.7 Types of small scale industries

Before explaining the types of small business I would like to throw some light on the term "small business". A business is said to be small when it is:

1. Small in size,
2. Employee small number of workers,
3. Require low capital investment,
4. Value of output is low.

Are the general parameters for measuring a business enterprise? We may define a small business as a business which is actively managed by its owners, operating within the local area and relatively small in size. However, the Government of India has considered the fixed capital investment in plant and machinery as the only criteria to define a small industrial unit in our country. As per the latest changes with effect from 21 December 1999 the investment limit in plant and machinery of the small-scale sector has been raised up to Rs.10 million (one crore). The limit of rupees one crore is subject to the condition that the unit is not owned, controlled or subsidiary of any other industrial undertaking.

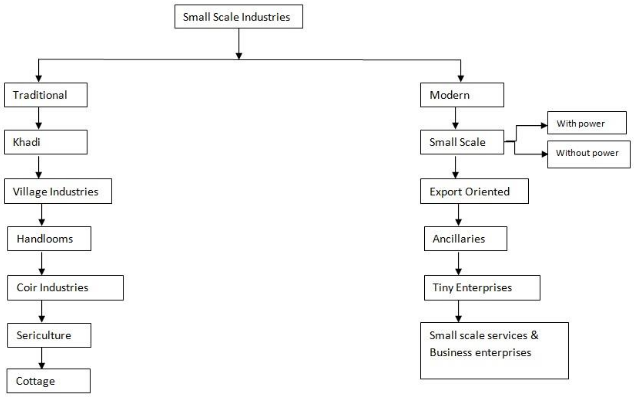

Fig. 2: Types of cotton industry

2. PROBLEM DESCRIPTION

Our research is based on cotton processing small-scale industry. It is based on the conversion of cotton into Knit dyeing, dewatering, drying, compacting & calendaring and final inspection & packing. These are then colored or printed, invented into clothes and also involve many variable procedures available at the spinning and fabric-forming stages. There remains a large industry that uses hand methods to achieve the same outcomes.

There are ten stages:

- Grey fabric inspection
- Batching
- Fabric turning
- Loading to the m/c
- Pretreatment (Scouring & Bleaching)
- Dyeing
- Dewatering
- Drying
- Compacting & Calendaring
- Final inspection & Packing

2.1 Problems in industries

The main issue in textile is.

1. Waste of overproduction.
2. Waste of waiting.
3. Waste in transportation activities.
4. Waste in processing itself.
5. Waste of stocks.
6. Waste of motion.
7. Waste of making defective products.

The waste of overproduction is the mother of all wastes. It overproduction occurs when a company produces more than its customer needs. It is the reason for overproduction wastes is the birth of another kind of wastage. The is also the worst kind of a waste because it causes other wastes and obscures the need for improvement and also results from producing more or faster than required. Waiting is another productivity killer and is a major source of frustration for customers. It does not matter if the waiting occurs in the manufacturing area, doctor's office, and airport etc.

2.2 Causes

1. Shortages & unreliable supply chain
2. Lack of multi-skilling/flexibility.
3. Downtime/Breakdown.
4. Ineffective production planning.
5. Quality design issues.
6. Black art process.

The most basic cause of the wait time is an unbalanced process. When one part of a process runs faster than a previous step. There will be waiting in the process. Another common cause of waiting is when materials are not available. This can be due to material handling process not operating effectively or due to stock out as when replenishment inventory is out of with production. The most basic cause of wait time is poor communication and poor decision-making process. When employees do not have sufficient information and are not empowered to make decisions. This more organization is wait time due to slow communication and decision making.

The most common form of transportation waste occurs when the material is transported across the plant with forklifts. Additionally, conveyor systems are nothing more than elaborate and space consuming transportation waste creators.

Causes:

1. Badly designed process/cell.
2. Poor value stream flow.
3. Complex material flows.

When our layout is not systematic, then the time being waste while process, when our operator I do not skill as well as semi skill then our production is affected in this case the productivity of plant decreases. Processing beyond the standard required by the customer for improving processing efficiency we ultimately useless resource to achieve the same customer satisfaction. Due to seventh major problems to reduce production, increases delay time and created losses in cotton industry and then to give the improvement and performance is a downward track so, we will try to take a positive way on this research.

3. METHODOLOGY

In methodology, we are applying this for the increasing manufacture with the help of major tools.

1. VSM (Value Stream Mapping)
2. TPM (Textile Production Management)
3. Transportation Management
4. Textile Chain
5. Simulation

Our research is based on cotton processing small-scale industry. It is based on the conversion of cotton into Knit dyeing, dewatering, drying, compacting and calendaring and final inspection & packing. These are then colored or printed, invented into clothes and also involve many variable procedures available at the spinning and fabric-forming stages. There remains a large industry that uses hand methods to achieve the same outcomes. The problem formulation is combined both theoretical and empirical approach. Data collected in interviews with sub-contractors and suppliers, and observations at the mechanical workshop and warehouse, have constituted the input for the value stream mapping method. The value stream mapping method has been applied to construct the current state map of the Origin value stream and identify the wastes. Furthermore, other methods including the decision point analysis, the postponement theory, and the supplier/buyer dependence grid have been subsequently applied to analyze the company relationships with key business partners and assist in designing a draft of the future state map.

3.1 VSM (Value Stream Mapping)

The textile industry value stream map is a representation of the flow of materials from supplier to the customer through our organization as well as giving the flow of information.

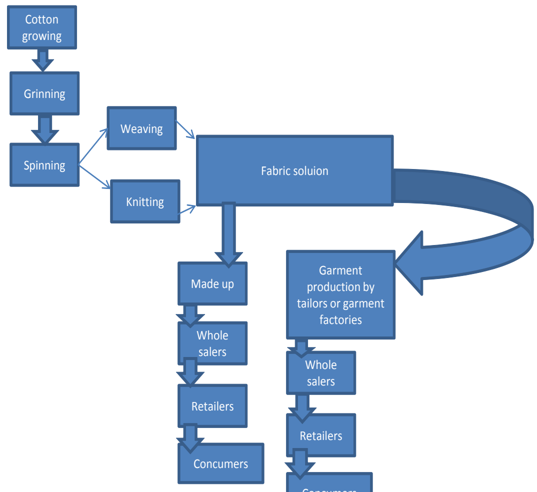

Fig. 3: Value Stream Mapping

3.2 TPM (Textile Production Management)

Textile production management is a term of textile and garments industry. In the international textile and clothing market an engineer, who has a degree in textile engineering and management hold a great demand. If you have not enough knowledge about production management then you will fail to give a desired output of the industry.

1. To get basic knowledge about management and production management.
2. To make plant layout of a textile and clothing industry.
3. To discuss the factors behind plant layout.
4. To ensure the desired product and control the production planning.
5. To control inventory management.
6. To know lean production and management.
7. To ensure the desired product with a maximum profit.

3.3 Transportation Management

Table 3: Minimum requirement of waste transportation

S. no.	Subject	Minimum requirement
1.	Qualification	If a waste is held at a storage site for a period exceeding three months, the site automatically qualifies as a waste disposal site and must be registered as such and meet all the requirement of a disposal site.
2.	Temporary storage area	This area must have a firm, waterproof base and drainage system.
3.	Documentation	The transport operator must be provided with the relevant transportation documentation for the consignment.
4.	Vehicle Roadworthiness	The responsible person must ensure that before the vehicle leaves the consignor's premises it is no overloaded or showing any obvious defect that would affect its safety.
5.	Protection against effect of accident	The transporter must ensure that adequate steps are taken to minimize the effect an accident or incident may have on the public and on the environment.
6.	Notification	In case of an accident, a full report, containing all the information listed in must be sent to the local authorities, the competent authority and the department.

3.4 Textile Chain

The textile chain is a very important part for the development of the textile industry and to run smoothly working operations.

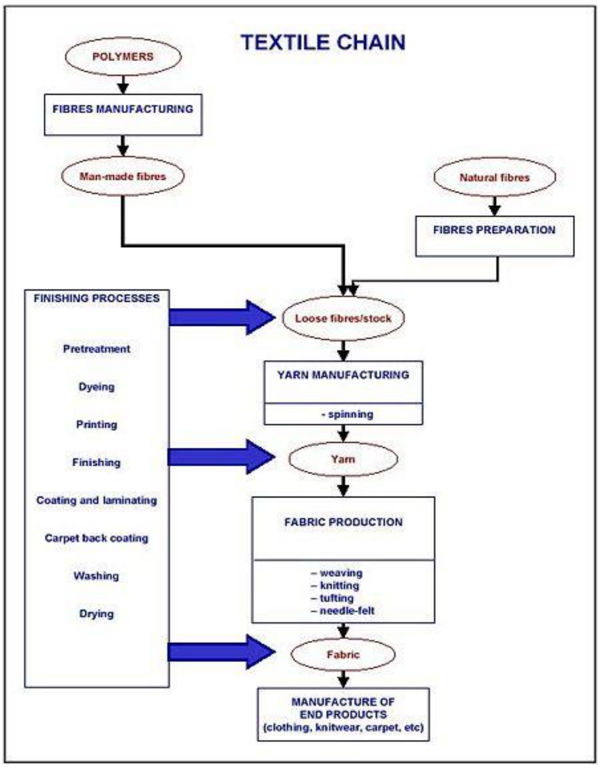

Fig. 4: Textile Chain

3.5 Simulation

Simulation is the limitation of the operation of a real-world process or system. The act of simulating something first requires that a model is developed. This model represents the key characteristics, behaviors, and function of the selected physical or abstract system or process. The model represents the system itself, whereas the simulation represents the operation of the system over time.

The simulations are carried out by the following steps:

1. Determine the input characteristics.
2. Construct a simulation table.
3. For each repetition, I generate a value for each input, evaluate the function, and calculate the value of the response Y_I.
4. Simulation examples will be given in queuing, inventory, reliability and network analysis.

- A queuing system is described by its calling population, nature of arrivals, service mechanism, system capacity and the queuing discipline.
- In a single-channel queue:
  - The calling population is infinite.
  - Arrivals for service occur one at a time in a random fashion. Once they join the waiting line they are eventually served.
- Arrivals and services are defined by the distribution of the time between arrivals and service times.
- Key concepts:
  - The system state is the number of units in the system and the status of the server (busy or idle).
  - An event is a set of circumstances that causes an instantaneous change in the system state, E.G., arrival, and departure events.
  - The simulation clock is used to track simulated time.

4. RESULT AND DISCUSSIONS

The simulations are carried out by the following steps:

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  - An event is a set of circumstances that causes an instantaneous change in the system state, E.G., arrival, and departure events.
  - The simulation clock is used to track simulated time.
- Single-channel queue illustration:
  - Assume that the times between arrivals were generated by rolling a die 5 times and recording the up face then input generated is:

Customer	Interarrival Time	Arrival Time on Clock
1	-	0
2	2	2
3	4	6
4	1	7
5	2	9
6	6	15

- The first customer is assumed to arrive at clock time 0. The second customer arrives two-time units later (at clock time 2), and so on.
- Assume the only possible service times are 1, 2, 3 and 4-time units and they are equally likely to occur, with input generated as:

Customer	Service Time	Customer	Service Time
1	2	4	2
2	1	5	1
3	3	6	4

Resulting simulation table emphasizing clock times

Customer Number	Arrival Time (clock)	Time Service Begins (Clock)	Service Time (Duration)	Time Service Ends (clock)
1	0	0	2	2
2	2	2	1	3
3	6	6	3	9
4	7	9	2	11
5	9	11	1	12
6	15	15	4	19

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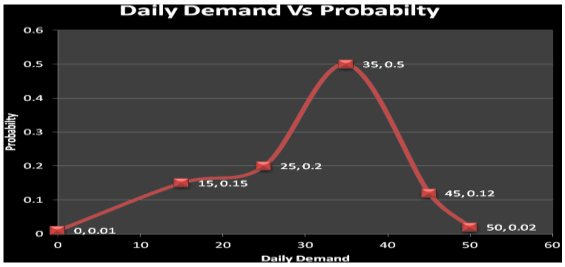

Fig. 5: Graph showing daily demand vs. probability

5. CONCLUSION

JIT is the better concept for every industry point of view by which company's production may be increased but JIT must not be seen that only apply & use through which company is started to improve production, this is not possible even a company or enterprise will have to implement techniques after which company will be able to get good production.

We have tried to make new techniques by which company production may be increased. Thus, JIT is one of the important aspects to be considered by SMEs in today's competitive world where the purchase of extra inventory will block the money, as the small enterprise is not financially solvent enough to invest a huge amount of money while running the enterprise. So if the SMEs are continuously improving at all dimensions by stabilizing the schedule & developing long-term supplies customer relationships along with focusing a new purchasing philosophy supporting JIT system while encouraging the skilled labor in a disciplined manner by providing adequate training, then the future of SMEs is very bright and it can compete globally with any MNCs. This approach utilizes the full capacity of workers & enables then to systematically analyze the hidden causes of quality problems by making small enterprises.

6. FUTURE SCOPE

- Buffer Stock Removal.
- Lead Time Reduction.
- Productivity improvement.
- Product cost reduction

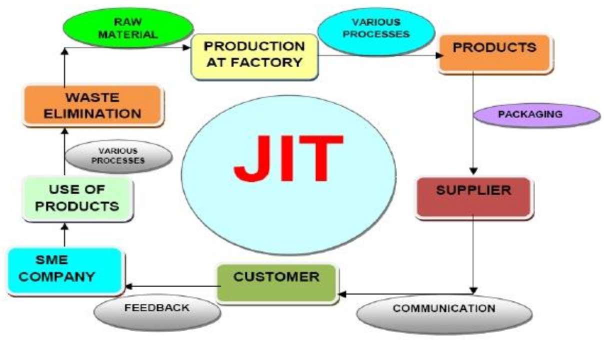

Fig. 6: Proposed Model of JIT

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