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Theoretical Methodology for reduction on industrial waste using JIT

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***Abstract*— Continuous improvement is an important element of modern manufacturing philosophy and a cornerstone to both JIT and TQM. Another cornerstone mentioned is the concept of value added. If something in an organization or process does not add value, it is considered waste. This paper covers these concepts as well as common sources of waste in organizations. In JIT organizations, sources of waste are identified and eliminated through adherence to a number of JIT principles. The first two JIT principles simplification and cleanliness and organization are most important for improvement approaches. Simplification implies eliminations of nonessentials, cleanliness and organization imply thoroughness and attention to details. Visibility the third JIT principle is an aspect of simplification that focuses on data gathering, analysis and reporting to ensure that shop-floor people get the right information at the right time. The fourth principle cycle time, is the idea that production output should be somewhat uniform. This paper concludes with a discussion of JIT practices and philosophy, perceived limitations of JIT**

Index terms - value added, waste, JIT principles, simplification and organization, visibility, cycle timing

I. INTRODUCTION

A. Value added concept

Value added is the concept that every activity and element of a system that is materials, humans, time space and energy should add value to the output of the system. As such, it provides perspectives for determining what needs improvements in manufacturing operations. one best way to do the job is developed in the U.S. and established by the husband wife team of Frank Gilbreth (1868-1924) and Lillian Gilbreth (1878-1972). They thought that the role of management is to find the simplest, easiest way to do the job. Their philosophy of "work smarter not harder" meant that every task should be carefully studied and all wasted motion should be eliminated to arrive at the one best way to do the job. The value added approach classifies activities as either value added or non value added. Within the latter category, the absolute necessary activities are separated out and all the others are eliminated. Distinguishing necessary, non-value added activities from the unnecessary wasteful ones is tricky because an unnecessary activity in organizations often seems necessary. Taking an example purchasing type of task is necessary because they procure the materials needed by value added activities for transformation in to the final output. Activities such as inspecting incoming parts for defects or counting materials in inventory also seem necessary; inspection prevents defects from going in to a product that is a valuable endeavor and counting ensures that inventories are being kept at the right level (also valuable). For example, by requiring vendors to deliver only zero defect part, the need for incoming inspection is eliminated. In summary, the value added concept says to distinguish value added from non value added activities.

II. SUPPORT ORGANIZATION

Support organization accounts for significant proportions of total organizational cost in the form of overhead. Often this cast exceeds by a wide margin the cost of the production organizations.
The following categories give an idea of the expanse of these activities

B. Planning control and accounting activies

Forecasting, production planning and scheduling, purchasing, master scheduling ,production control, customer order processing ,responding to customer inquiries ,and all associated data entry and follow up on errors.

C. Logistic activies

All ordering , execution and conformation of materials movement within an organization, including everything with receiving shipping and follow up on errors.

D. Quality Activity

All quality related work such as definition of customer requirements, assurances that necessary activities have occurred. Defect prevention quality monitoring, and follow up on defects, mistakes or complaints. Support activities can often be eliminated by simplifying products and processes, eliminating product defects at the source, improving integration of steps to remove mistakes and duplication of effort, and improving product design and production planning to reduce the number of changes

III. EMPLOYEE INVOLVEMENT

While the value added approach seems simple in concept, it can difficult to apply. For example, the person best qualified to make the distinction, is the one most familiar with the task, the person doing it. Workers usually know what essentials are and what is not, and given the opportunities, they will share that knowledge. Getting the workers involved is thus fundamental to every continuous improvement effort. While the value added process requires

the workers scrutinize their jobs and suggest ways to replace unnecessary activities with necessary.

IV. TOYOTO'S SEVEN WASTES

1. **Waste from producing defects:** Repair or rework of a product or service to fulfill customer requirements and errors represented.
2. **Waste in transportation:** Any material movement that does not directly support immediate production.
3. **Waste from inventory:** Any supply in excess of processor demand requirements.
4. **Wastes from overproduction:** Producing more than is needed, faster than needed or before needed.
5. **Waste in processing:** Redundant effort (production or communication) which adds no value to a product or service.
6. **Waste of waiting time:** Idle time that occurs when co-dependent events are not synchronized.
7. **Waste of motion:** Any movement of people which does not contribute added value to the product or service and errors represented in table below

Sr. No.	*Waste type*	*Type of mfg. Sector waste*
1	Defects	Scrap, rework, replacement production, inspection.
2	Transportation	Transportation materials long distances around the plant or to and from an off –site storage facility.
3	Inventory	Excess raw materials, WIP, or finished goods. Which than has to be stored, incurving warehouses and warehouses and transport cast
4	Over-production	Making more than required by the next process. Making earlier than required by the next process. Making faster than required by the next process. Overproduction creates inventory
5	Over-processing	Process steps that do not add value or processing on over spaced or unnecessarily complex equipment
6	Waiting	Idle time caused by stock out lots processing delays, equipments downtimes, capacity bottlenecks.
7	Motion	Any movement that doesn't add value to the product –Getting materials or tools, double handling of parts equipments

V. JIT PRINCIPLES

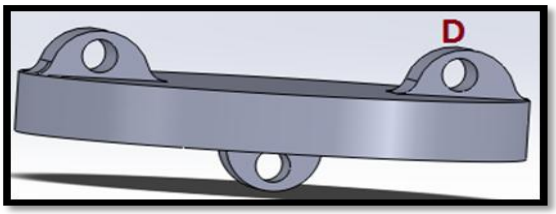
Value added focus and elimination of waste are two cornerstones of JIT management's philosophy. To operationalize JIT philosophy in an organization, however, calls for focus. A large part of that focus is provided by JIT principles. In a sense the principles go beyond JIT philosophy and are prescriptions worthwhile for any manufacturer.

A. Simplification:

In virtually any work situation, an action to reduce waste will result in simplification of whatever existed before

Example 1: Product/Process Simplification

Fig. 1



The component in fig.1 is assembled from three kinds of purchased parts-A, B and C. Part C is a casting, and the decision was made to alter the casting, D, shown in fig.2 Though the new casting is slightly more expensive to produce than the original, it eliminates the need for parts A and B. As a result, the assembly operation is eliminated, and since the number of parts is reduced from three to one, cast associated with materials procurements and processing are also reduced.

Example 2
Process Simplification

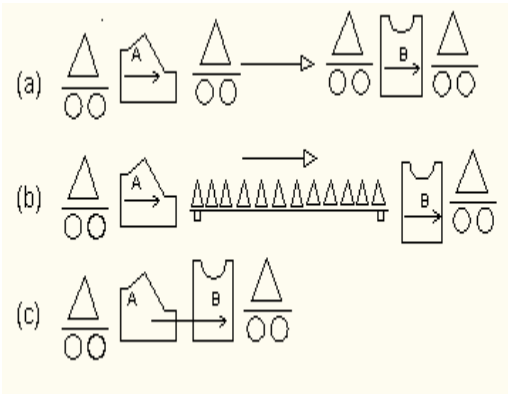


Fig.3

In fig. 3 we see that moving materials between two successive operations involves the steps of unloading materials from operation A, putting them onto a cart, transferring them to operation B, waiting for operation B to be available , taking them off the cart , and loading them into operation
B, The waste in terms of in-process inventory, handling, space ,and waiting time is considerable As shown in fig.3 (b), these wastes could all be reduced if the two operations were synchronized and connected with a conveyor system. A still better approach would be to synchronize the two and locate them immediately adjacent to each other , which would virtually eliminate all in-process inventory, handling ,and lead time between them see fig.3(b)

Example 3
Product/Procedure Simplification

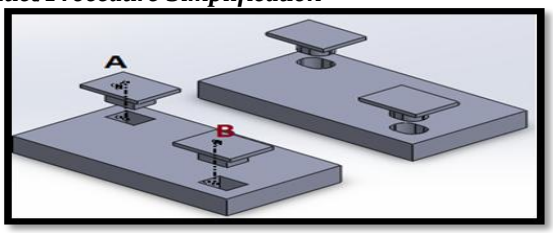


Fig.4

Two different molded plastic parts (A and B) with pegs on the bottom are glued into holes on a board as shown in fig 1.1. The parts look similar so assemblers sometimes glue them into the wrong holes. Also, the parts should be installed with a certain orientation ,but assemblers sometimes put them in pointing the wrong way. The solution is to change the shapes and sizes of the pegs so the parts can only be inserted in the write place and facing the write way (see fig. 1.1).In addition, each part is molded in a different color plastic(one black one white).Though peg size alone would prevent an assembler from putting a part in the wrong place, coloring prevents the assembler from even starting to put a part in the wrong place. These modifications eliminates any possibility of assembly error and, hence for inspection. They also serve assembly time since workers need not scrutinize the parts or think about the direction of installation

B. Cleanliness and organization

Facilities in many organizations are dirty, cluttered, and disorganized. This is always wasteful because it makes doing work more difficult and often results in poor quality work. Cleanliness and organization are important because without them opportunities for improvement and sources of problems are often obscured. Specifically, a clean workplace makes it easier to see cracks, missing parts, or leaks on equipment; reduces the chance of products being contaminated; improves work safety and reduces the chance for accidents; and makes it easier to spot product defects.

C. Five Ss at Canon

Canon Corporation has an ongoing, workplace improvement program called the five -Ss referring to Japanese names. The Five Ss roughly translate into
1) **Seiri** - Proper Arrangement and Organization.
2 **)** **Seiton** -Orderliness
3) **Seiso**-Cleanup (Follow the procedures)
4) **Seiketsu** -cleanliness(dust wash and maintain equipment)
5) **Shitsuke** - Discipline
(At some Canon factories, the English word **"safety"** is added as a sixth S

D. Visibility:

Visibility means knowing what has been, must be, or should be done by seeing it. The best way to communicate information is to send it directly between the sender and receiver with minimal channels or processing to garble or alter the message.

E. Cycle Time:

The time interval that elapses between occurrences is called the cycle time. Cycle time can notes things, depending on the way it is used. It can be the time

- Between placing job orders or performing different jobs.
- Between preparation of business plans or accounting statements.
- For a machine or person to perform a single operation.
- Between completion of units at an operation or an entire process.

In all cases, the concept of cycle timing suggests the regularity of suggests the regularity of timing or manufacturing. Regularity of timing benefits productivity and quality because it reduces production uncertainly and permits managers and workers to better anticipate and prepare for the future. For all these reasons, the cycle time concept is fundamental to JIT manufacturing, removing wastes from work shortens cycle times and reduces work variation.

VI. JIT LIMITATIONS AND PLEMENTATION BARRIERS:

A. Attitudes:

JIT requires a cooperative, participative spirit between managers, workers, suppliers, and their customers. It also requires long term commitment by top management, as well as trust and mutual respect between managers and workers and between customers and suppliers**.**

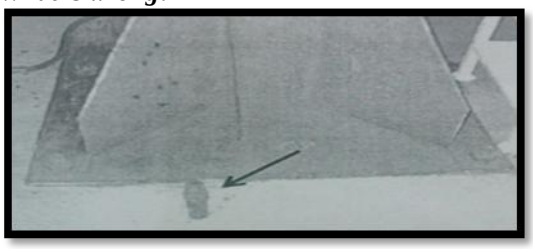
B. Quality Commitment:

Quality must be designed into the product and the production process, and that in turn, requires adopting a new product/process design methodology. Also, frontline workers must be given time to troubleshoot and resolve quality problems at the source.

C. One Case study for 5-s

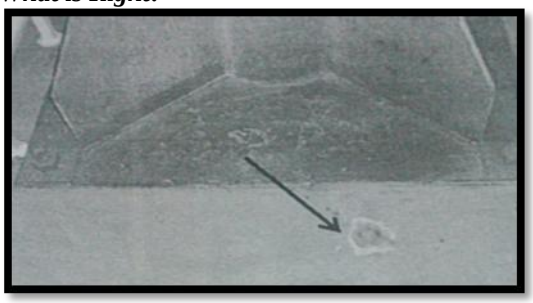
In a company applying 5-S, and Audit is taken than following results are seen for safety are as follows While applying 5-S some photos are here for 5-S improvement is as follows.

What is wrong?



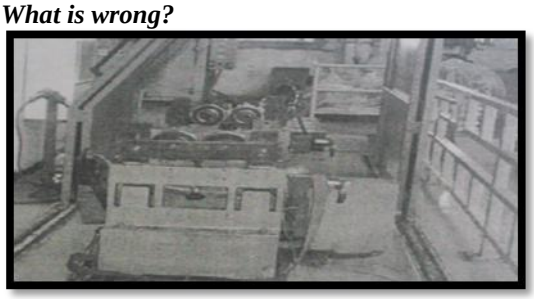
- Pipe above the ground level
- Can cause injury
- Unsafe

What is Right?



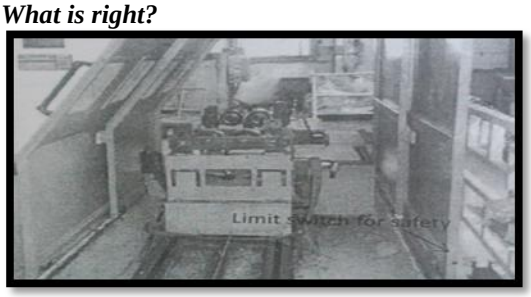
- Pipe above the ground level removed
- Safe

What is wrong?



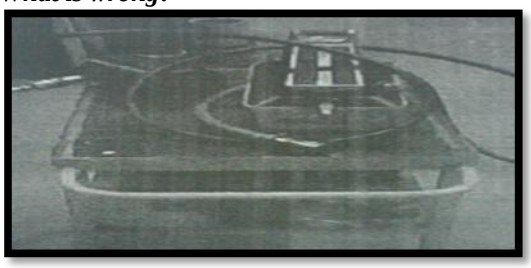
- No safety interlock (If door is open machines rotates

What is right?



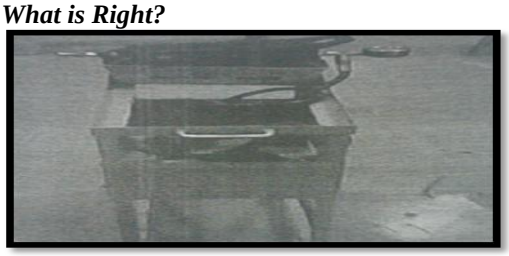
- Safety interlock provided (if door is open machine Will not rotate)

What is wrong?



- No specific trolley made for the bearing removing Machine.
- Wires of the machine are spread all over the place, which is unsafe?

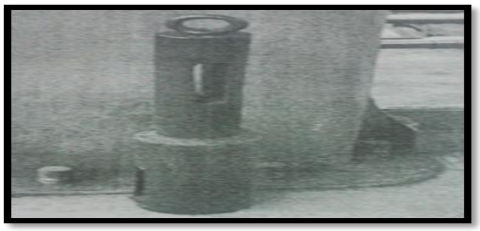
What is Right?



- Customized trolley made for keeping the bearing removing machine.
- Place made for storing the pipe and cylinder of the machine.

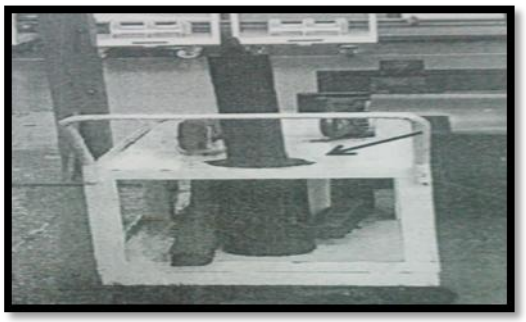
What is wrong?

- Mandrel can topple as it is not placed properly.



- More place is occupied on floor
- Unsafe

What is Right?



- Cut out is provided to trolley to place the Mandrel.
- Eases operator's work
- Safe

5s inspection sheet for safety

5 S inspection Sheet for safety		**Evaluation rank**			**Rank A: Perfect score** **Rank B: 1-2 problems** **Rank C: 3 or more problems**
	Item	**A**	**B**	**C**	
Safety	All the electrical control panels including machines panels, DBs Guarded, Closed &Accessible?			✓	Control panels are guarded and accessible.
	Are loose wiring or electrical cables with joints or hand Tools without 3 pin plugs observed?		✓		Loose wiring. Unused 3 pin plugs not covered with caps.
	Are the operators wearing relevant PPE;s like safety Shoes, nose mask, goggles, ear plugs, etc.?	✓			Everybody follows the standard.
	Do forklifts have front and rear headlights in working Condition. Is the reverse horn operating. Do they have a speed limit?		✓		Standards are observed by the shop floor in charge and Non-conformance reported.
	Are the first aid boxes, Stretchers, fire extinguishers, Eye wash Well maintained & accessible on location?		✓		First aid boxes are adequately stocked but not clean/not Maintained. Stretcher, Extinguishers, eye wash is in a good condition but not accessible easily.

VIII. CONCLUSION

Reduction of waste is an efficient way to increase productivity which leads to increase of profitability. Manufacturing the goods according to the need of the customer , which the customer will pay for it. But wastages occurs when process consumes more resources than what is needed for the customer and the various wastes are, Defects, Transportation , Inventory, Over processing, Over production, Waiting, motion. In this paper we have discussed JIT principles, such as simplification various examples of simplification, Cleanliness and organization, Five- S inspection sheet are carried out to reduce the above waste associated with the process. A case study of safety for 5-S is discussed. This is very important for employee's safety. Hence Identification and modification of the various types of wastes and which leads to increase the productivity of the manufacturing industrial systems and also to increase profitability of the firm.

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