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Analysis of Factors Causing Wastes in FMCG Using Lean Tools

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Abstract :In this research paper, we have used lean tools that are applicable in various faster growingindustries like FMCG, pharmaceuticals; hospitality, manufacturing etc are used. The tool that is given the priority over others in identifying the waste is Value stream mapping. Value stream mapping is a lean tool that is used to translate both information and flow of data through which those processes that are not adding any positive value in our study can be easily eliminated. This paper is an effective effort to find out the waste production during manufacturing of a perishable goods in discrete manufacturing system. Pareto chart has been used to categories the factors that are responsible for the 80 percent of waste. Here Ishikawa diagram has played a vital role for finding of their possible causes and effect. Other contemporary lean tools like Kanban, Kaizen, and FIFO are used for future state map processing. The result obtained through the future state value stream map states the changeover time of various processes, the cycle time near to the takt time, improvement in lead time and total cycle time of the manufacturing process.

Keywords:Lean manufacturing, Value Stream Mapping, Takt time, Kanban, Pareto chart

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1. INTRODUCTION

Lean manufacturing is a philosophy which was initially developed by Toyota, it is views as an approach to systematically identify the waste generating factors in the organization and remove the waste through continuous improvement and synchronizing the product flow at the pull of the customer. The process and material which are not adding any value to the product is a waste as per customer perspective so the motive of lean is to remove this non-value adding process and material from the system. The lean manufacturing system is comprising of many tools which help in to detect the waste and also try to mitigate the effect of factors causing waste. Lean works with the integration of all the employees in an organization so the involvement of each employee in the organization is necessary for the successful implementation of tools. Nowadays lean is use with six sigma for reducing the variability in process.

2. LEAN MANUFACTURING TOOLS USED FOR REDUCING WASTE

During a process by eliminating waste, quality is improved; production time and costs are reduced. To solve the problem of waste through the instrumentality of lean manufacturing can be use several tools, such as:

a) KAIZEN

Kaizen (pronounced ki-zen) is the Japanese word for continuous improvement. As we use the term, it is a method that strives toward perfection by eliminating waste. It eliminates waste by empowering people with tools and a methodology for uncovering improvement opportunities and making change. Kaizen understands waste to be any activity that is not value-adding from the perspective of the customer. By value-adding, we mean any work done right the first time that materially changes a product or service in ways for which a well-informed and reasonable customer is willing to pay.Waste consumes resources— both human and material— pointlessly. People implementing wasteful processes are themselves wasted. They are robbed of the satisfaction of engaging in meaningful tasks that produce outputs customers' value. Moreover, they are degraded as humans because engaging in activities that are not meaningful treats their energies and earnest efforts as commodities of

little value. When constrained to execute these imperfect processes without the opportunity to make them better, people are denied the exercise of their capacity to learn and improve and thereby grow to the full measure of their capabilities. As for material resources, the financial and material investments in enterprise are prevented from achieving the greatest returns possible.

b) POKA-YOKE

Poka-Yoke is a method of preventing errors coming from mistakes. The main principle in the system Poka- Yoke is that the errors are to blame processes, not the employees. Poka- Yoke solution is characterized to prevent any errors in the process. With Poka-Yoke is also possible to obtain reduced time required for training employees, eliminating many qualility control operations (or its total elimination), reducing the number of defects and a 100% control of the process. An example of a Poka-Yoke solution is a SIM card, which can be put on the phone only one way through the angled corner.

c) KANBAN

Kanban is a Japanese method of production control, which assumes control not based of the production schedule and through events occurring directly on production. The use of Kanban allows for almost total elimination of pre-magazines (the stock is on the workstation), interoperable, and finished products. The raw materials are delivered from suppliers with hourly precision, , and thanks to reserves, production capacity and flexibility of the production process it is possible to produce almost any product at any time. In contrast, production orders are closely synchronized with orders received from customers

The Fast-Moving Consumer Goods (FMCG) industry covers the family things that you purchase when shopping in the grocery store or a drug store for example, those utilized as a part of cleaning and clothing, over the counter prescriptions, sustenance things and individual care products make up most of the FMCG business. The product produce by FMCG's are perishable and have very short live so their consumption should be fast. So here we determine those factors which are causing waste in the value stream by mapping the discrete process of the value addition chain, evaluating the bottleneck process and calculating various time like cycle time, changeover time etc. and then using Pareto chart to find the factors which hare causing almost 80 percent of the waste. The major factor is then evaluated to find the possible causes of the factor using cause and effect diagram. The FMCG which we target is Haldiram, we value stream map the process of producing sweet like kaju katli and rasgullas at the manufacturing plant then we find the possible factors which are contributing for the production of waste in the process. The data obtain is through physical observation which is required for the application of the lean tools.

In lean, the waste is divide into three types generally known as 3M which are MUDA, MURA and MURI. The main aim of lean tools is to remove this 3M from the organization [1].The first step to implement lean manufacturing tool in any organization is to apply Value Stream Mapping (VSM) [2]. A value stream is a combination of value added and non-value added activities that are required bring a product through the essential flows; starting with raw material and ending with the customer for reducing the production wastes[3].

MUDA, waste, can be put into eight kinds, seven presented by Toyota and 'non-used abilities'. Theseare: Defects, Waiting, Overproduction, Transport, Inventories, Motion Non-Utilized Talent and excess preparing. As Mnemonic gadget, the primary letters of these squander frame acronym is DOWNTIME [4]. **MURI,** overburden, can come about because of Mura, and from expelling excessively Muda (squander) from the procedure [4]. Whenever administrators or machines are used for over 100% to complete their errand, they are overburdened. This implies breakdowns with regards to machines and non-appearance with regards to workers. To improve the utilization of machines and ensure they work appropriately, safeguard and self-sufficient support can be executed. **MURA**, variability occur in the system due to variation in client demand, cycle time of differentoperator, uneven production strategy, non-standardized work, poor quality component will lead to mura which have further tendency to create muri and hence muda [4].

3. CALCULATIONS

The value stream mapping of discrete production line of rasgullas and kaju katli. The various data obtain is through physical observation and some question at the workplace.

	A	B	C	D
1	**Cycle time calculation**			
2				
3	Activity	Ball making (s)	Heating (s)	Packaging (s)
4	Attempt 1	6	60	26
5	Attempt 2	5	58	24
6	Attempt 3	5	56	25
7	Attempt 4	5	58	25
8	Average	5.25	58	25

Fig 1: Cycle Time Calculation for rasgulla

The various parameters necessary for the value stream mapping is calculated through physical observation. The parameter includes cycle time, process time and change over time.

The cycle time is the ratio of process time to the number of product produce in that time by having various attempts the cycle time is calculated at various processes on the shop floor.

$$cycletime = (processtime) / (productproducedinthattime)$$

Activity	process time (min)	change over time (min)
Boiling	8	15
Filtering paneer	7	6
Mixing with maida	5	10
Sugar solution	9	10
Ball making	0.088	10
Heating	0.96	15
Packaging	0.416	15

Fig 2: Process time and change over time for rasgullas

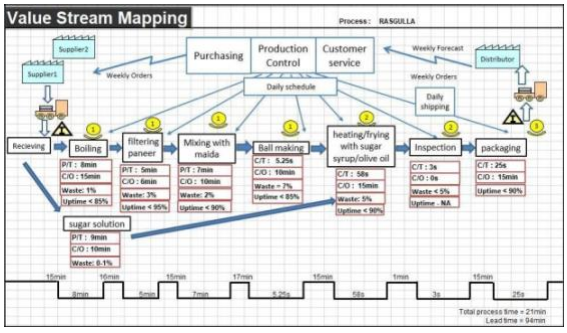

Fig 3: current state value stream

The above figure showing the current state value stream mapping of rasgulla making in the shop floor. The customer demands for the making of rasgulla are 4300kg which is the weekly demand has to be fulfilled by the plant. The rasgulla manufacturing unit work for 8hr in a day and to 6 days per week. The supplier delivery mainly consists of sugar and milk. The manufacturing is done in batch starting with 200 liters of milk various process on the raw material is performed generally due to the difference in process time of each the accumulation of large WIP take place.

The process lead time is found out to be 94 minutes while the total value adding time is 21 minute hence large amount of waiting is happening between the different processes. Sometimes the manufacturing units do not able to understand the demand of the customer and hence lead to overproduction. The machines are underutilizing and it is necessary to match the customer demand without producing waste using pull system.The Takt time shows the consumption rate of product so the manufacturing process should be alignedto produce the product in that rate so as to satisfy the customer demand.

Total weekly time available = 6 × 8 × 3600s = 172800s
Weekly customer demand = 4300kg
By using the above data and the equation the takt calculated as = 172800/4300 = 40.18 s/kg

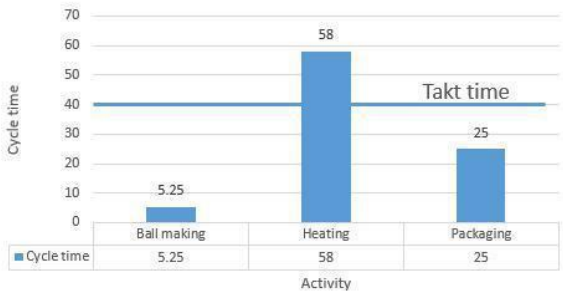

Fig 4: cycle time and activity

From the diagram between cycle time and activity shown it is clear that the heating of the rasgullas take more time than the takt time so to mitigate the effect of this proper change in value stream map should be taken.

4. THE FUTURE OF VSM

The motive of VSM is to show source of Muda and their remove by implementation of a future state value stream which could be came to reality within short duration. The goal of this chapter is to design a future state value stream map for the production of rasgullas in manufacturing plant of Haldiram. This is make possible by linking the value stream with customer either by continuous flow or pull so that each process in value stream come close as possible to produce under the desire of customer need.

5. FUTURE STATE VSM OF RASGULLA

The above figure showing the future state map of Rasgulla making in this map various implementation of supermarket Kanban and FIFO is done so that continuous production between the different processes is possible and combining of two processes is done by which there is high reduction in lead time occur also the system created a philosophy of customer pull system by using the supermarket concept. The Kanban cards are control by production control so that the customer demand is met by the manufacturing unit. It has also been observed that heating of sweet balls take more time then the takt time, by combining the two processes ball making and heating a reduction in the cycle time of process occur also great reduction in changeover time happen which further reduces the lead time.

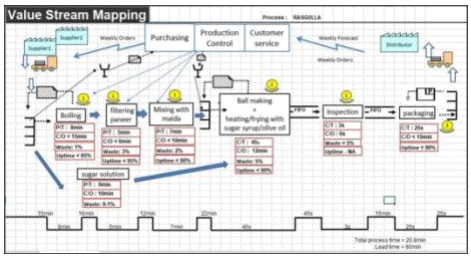

Fig 5: Future state(Rasgulla)

6. VSM FOR KAJU KATLI

The various parameter for the making of VSM is observed and recorded as shown below then the VSM is drawn in MS excel for kaju katli

Table 1:Parameters Considered

Activity	process time (min)	change over time (min)
Washing	10	12
Grinding with sugar	15	14
Cooking	12	4
Cooling	18	1
Making dough	15	15
Rolling and cutting	10	5
Inspection	0.16	0
Packaging	0.5	10

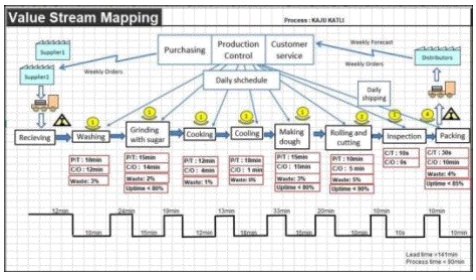

Fig 6: VSM

7. TAKT TIME FOR KAJU KATLI

By using the equation, the takt time for kaju katli is obtain but as mostly the process time is use to depict the time taken by process as there is no discrete product produce during the production. Total weekly time available = 6 × 8 × 3600 = 172800s

Weekly customer demand = 4800kg
Takt timing = 172800/4800 = 36 s/kg

Mainly takt time is use to determine the rate of production so if cycle time is greater than takt time than proper measure should be taken to counteract this but in the value stream mapping of kaju katli process time at various process is use which is consider to be less than takt time. The takt time for packaging is 30s which is very much less than the takt time but the waste of time and overburden of machining is occur while making kaju katli.

8. FUTURE STATE VSM OF KAJU KATLI

The below figure showing the future state value stream mapping the same thing done for kaju katli mainly the implementation of Kanban supermarket pull system, FIFO lane and combining two process so that the environment of customer pull system is created in the manufacturing process and there is significant reduction of lead time occur by which there is high impact on process efficiency of the process. The FIFO lane is implemented between dough making with cutting, inspection and packaging for the continuous flow of material from one process to another and with the fusion of supermarket pull system at shipping side and between cooling and making dough there is continuous customer pull of the product.

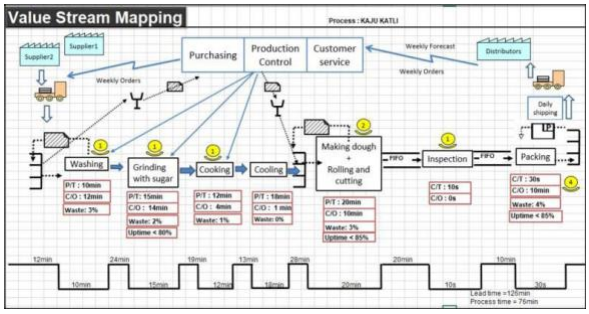

Fig 7: Future state(Kaju Katli)

9. PARETO CHART

Pareto chart is based on the rule of 80-20 which depicts that in a system 20 percent of the factors cause 80 percent of waste. We try to use this technique to find out the

dominating factor in the value stream mapping which are responsible for 80 percent of the factors.

Table 2:Frequency and cumulative frequency for plotting Pareto Chart

Activity	Frequency of defects	Cumulative frequency	Cumm. Percentage
Ball making	120	120	69%
Rolling and cutting	28	148	85%
Packaging	17	165	94%
Inventory	10	175	100%
	175		

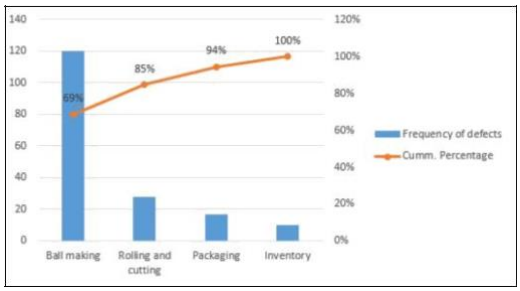

Fig 8: Pareto Chart for Rasgulla

By seeing the above diagrams, we are to able conclude that ball making and rolling and cutting together contributes the 84 percent of waste so by controlling the waste production through these factors we will be able to reduce those 80 percent of waste producing.

10. CAUSE AND EFFECT DIAGRAM

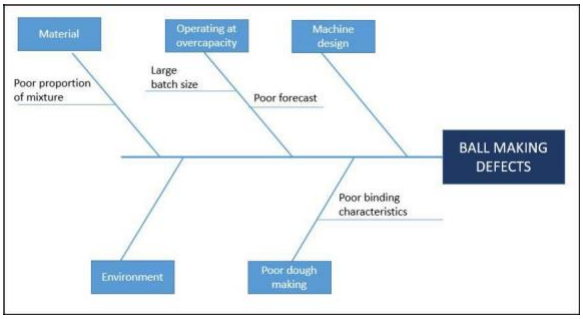

Fig 9: Cause and effect diagram for Rasgulla product

11. ADVANTAGES OF LEAN MANUFACTURING

- The inventory levels can be brought down to nearly nil, thus reducing costs.
- Transitions between various designs take only a few minutes.
- This enables an increased flexibility and better response to customer requirements.

12. CONCLUSION

Applications of lean tools have been vast field in FMCG's but its implementation in mass production is great for the food industrial company for waste management. The applications of VSM in the organization lead us to find out the various factors causing waste in the industry by using the current state map of value stream. The Pareto chart guides us to the major factor for the production of defect in the organization while the cause and effect diagram leads us to the possible causes. The future state map is drawn by utilizing the lean tools like supermarket Kanban pull system, FIFO lane for creating a continuous production governed by customer pull and utilizing the resource at their high capacity leading to zero overproduction. The possible reduction in lead time and cycle time is proposed by using future state map and the involvement of employee for making the process less prone to defect using Poka yoke and kaizen.

FUTURE SCOPE

The FMCG sector have mass production characteristics having this feature it is very much important to implement the lean tools in this sector to reduce the perishability affect in the production of waste and producing which is mainly governed by the customer pull. Computer based simulation models could help in speeding up of lean foundation and planning the procedures relying upon the cluster size and process duration (C/T). To validate the immediate relationship of utilizing VSM as an enabler in lean change, Cost-Benefit Analysis could likewise be performed to examine the direct fiscal advantages of VSM's application.

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