

by providing right product at the right time in the right quantity and the right quality at a reasonable price. This can be achieved greatly by adopting lean manufacturing system which is more than a cost reduction program. It aims at eliminating wastes which could be in the form of excess production and inventory, redundant movement of material, waiting and delays, over processing, excess worker motion, rework and corrections.[7]

Various processes conducted in an industry

Rope Recoiling In this process the coir rope can be recoil with the help of motor and for coir rope can be recoil in opposite way for removing moisture at few percent.

Rope Vulcanization: In Rope vulcanization process coir rope can be stored into the vulcanization chamber at 24 hours at temperature 120 to 130. This process can be used for removing the moisture from coir rope.

Fiber Separation: This process coir rope can be separated by the use of MultiMate machine to get fiber and this fiber passes with the help of conveyor belt to the sheet machine.

Fiber Feeding: The fiber can be fed into conveyor belt with the help of rotor or fan having high power with required amount of fiber can be supplied to the sheet machine. The arrangement in a machine to supply required fiber.

Rubber Spraying: The rubber can be sprayed into fiber with automatically and fiber passes to sheet machine having a heater to remove moisture. Fiber can change side with help of roller and rubber spray opposite side again pass to sheet machine to remove moisture up to 10 percent from coir sheet.

Lamination: In this process the coir sheet can be passed to lamination. In this process the weight of sheet can be measured and accordingly it can be cut the sheet with 10 percent extra laminated. It can be passed into drum press for pressing the sheet.

Hydraulic press: The Mattress Hydraulic Press application is when the rubberized coir sheet is being manufactured from the Rubberized Coir Sheet plant, the coir sheet is being sprayed before they are put on the pressing bed into the hydraulic press to attain the desired thickness of the mattress. It has a capacity to press 12 mattresses of size 2 meter x 1 meter or 6 pieces of size 2 meter x 2. The pressing plates have heat in them and the mattress gets its desired shape and thickness into the hydraulic press.

Problem Definition

Various problems are observed during our case study:

- The lamination section in which the worker has to pull the lamination sheet which may result in the tearing of sheet which leads to the loss of material as well as time.
- There are chances of accidents with the workers working on the cutter.
- There is a misobservation of the temperature reading by the worker as the panel is situated far away from the working area.
- The worker needs to access the lamination sheet of various sizes which are placed together and it consumes lots of time and misoperation.

Various Suggestions Given to an Industry

KAIZEN

- During lamination the worker has to pull the lamination sheet through a roller but the improper pulling causes tearing of the lamination sheet as well as an increase in delay time. Thus, by fixing the bearing to the rolling shaft by which we eliminated tearing and saved time shown in **Fig - 1**.



Fig -1: KAIZEN on rolling shaft.

- The workers working on the sheet cutting machine have chances of accidents that are more and it is required to be as safe as possible. Thus, a sensor and relay circuit is designed for the blade where the process became more safer and efficient, as shown in **Fig - 2**.



Fig - 2: KAIZEN on cutter machine.

POKA-YOKE

- Every time worker have to move close to the temperature indicator placed every production section in plant. Thus We have placed magnifying screen on the front side of panel as shown in **Fig3**.



Fig - 3: POKA-YOKE on temperature panel.

- Various partitions are provided to the lamination sheets so that worker can access the correct sheet from the rack this lead to minimize cycle time required for laminating single mattress. as shown in **Fig - 4**.



Fig - 4: POKA-YOKE on lamination section.

VALUE STREAM MAPPING (VSM):

The value stream mapping helped to reduce the inventory, total lead time and man power used.

Current state map:

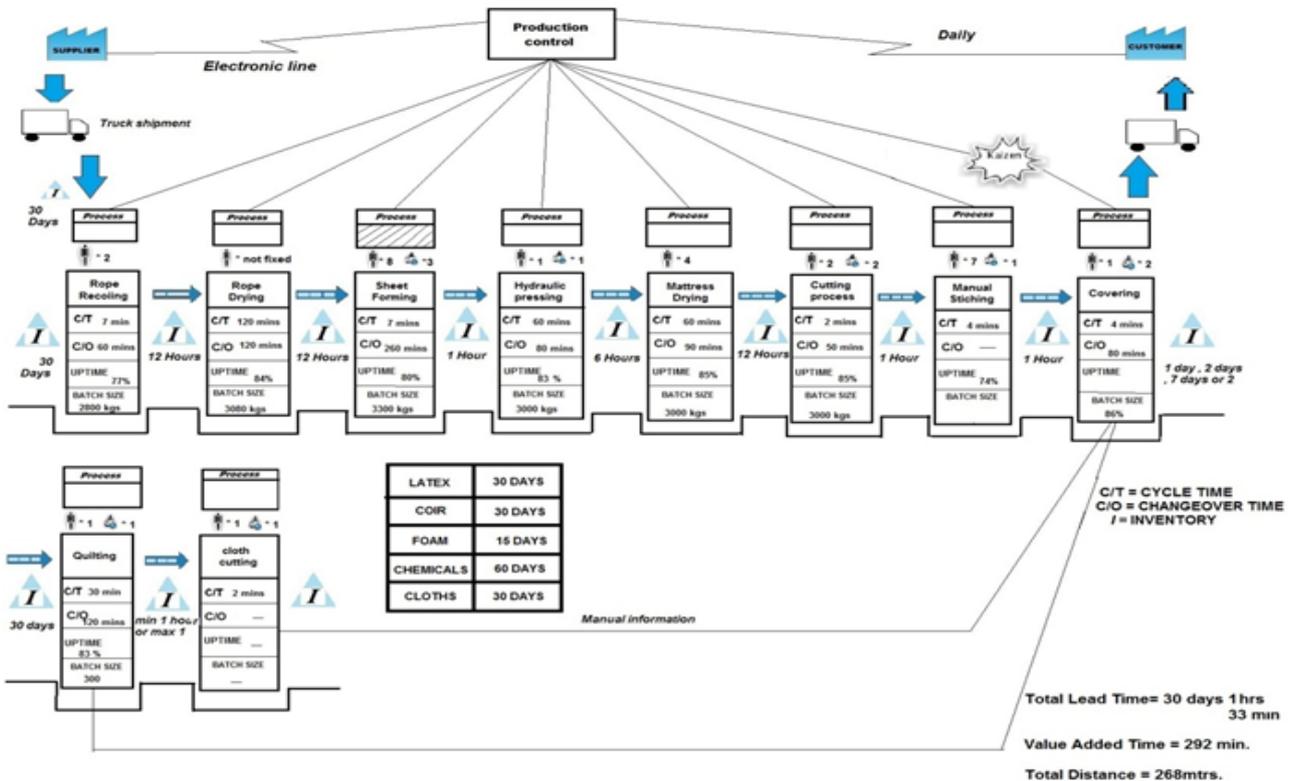


Fig-5: Current state value stream map

Future state map:

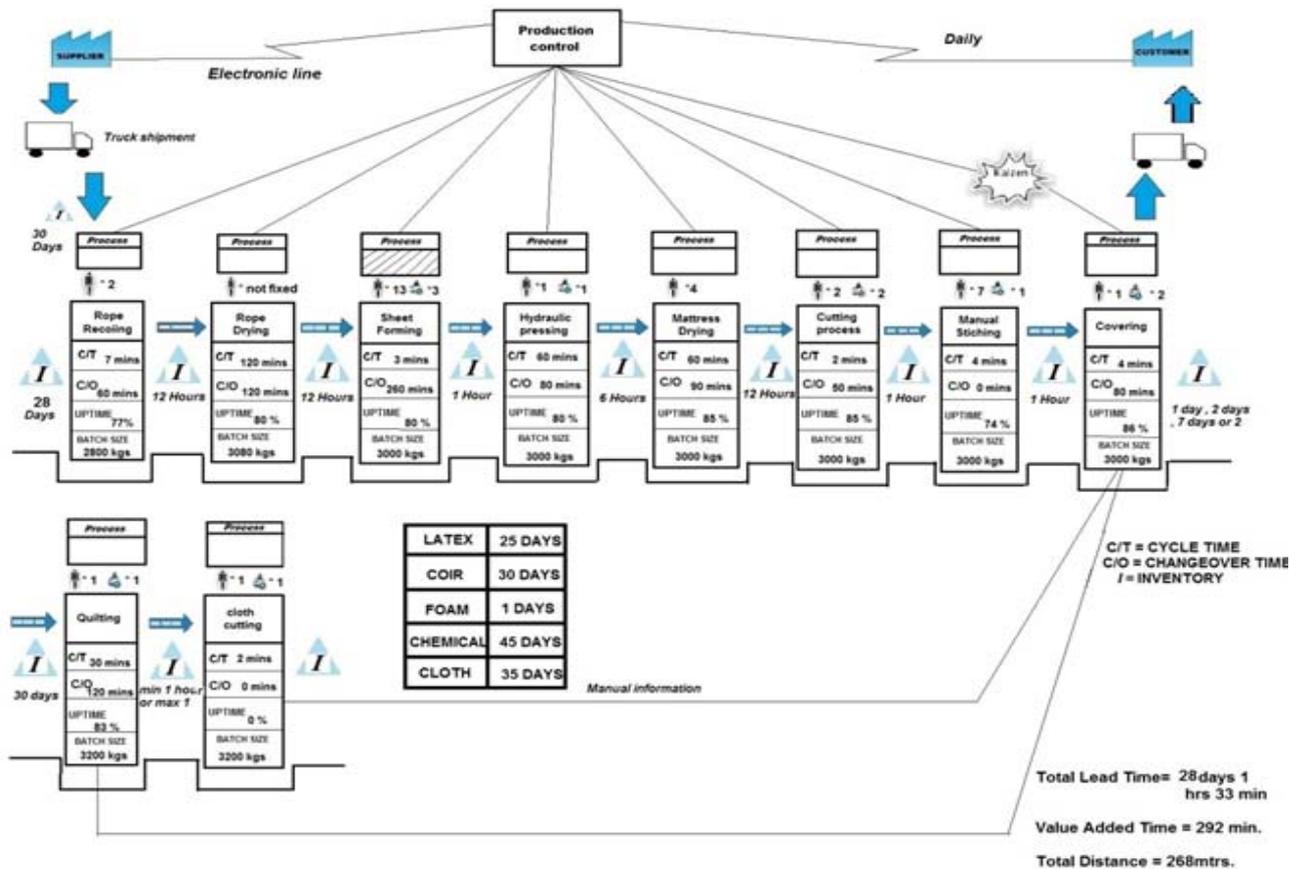


Fig-6: Future state value stream map

Results and Discussions

- KAIZEN reduced the time required for the process by 2 seconds which is approximately 16.69 minutes per day. It also prevent tearing of lamination sheet And also the safety of the workers increased.
- By applying POKA-YOKE the process time is reduced to 3.5 seconds which is approximately 29 minutes per day. And it also reduced the chances of mistakes committed by the worker.
- With the help of Value stream Mapping(VSM) the inventory time is reduced by 5 days and the total lead time is also reduced by 5 days and which leads to the augmentation in productivity.

Conclusions

The lean principles and techniques implemented and suggested, future state map is created and the total lead time is reduced. Also is enhanced the quality of the product, helped in reducing the waste and overall increase in productivity.

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