



Robotic Process Automation: A case study for efficient implementation in lean manufacturing environment

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Abstract

In upcoming future uses of robots are very much "operative" tasks in manufacturing industries. Robotic automation and their accessories will be used in the reduction of production throughput time, cycle time and line time to meet the production capacity. Automation will reduce the manpower and reduce the bottleneck of any test stage for the mass manufacturing. Different type of robotic automation and their application and uses. Some of the most significant future uses of robots may be to provide feasible means of providing services or exploiting resources handling dangerous radioactive wastes on a routine basis in a future disposal facility.

Key words: - Robotic, Automation, Manufacturing industries etc.

CASE STUDY INTRODUCTION

In this chapter, the data obtained from VOLVO group of industries, in the area under study will be grouped and analyzed. Robotic automation size and forecast analytical data in various types, applications, and global market.

OBJECTIVES OF THE STUDY

To determine how Industries can implement Robotic automation efficiently in a lean environment.

Guideline for robotic automation Implementation in Lean Manufacturing Environment

In this analysis, we will discuss the VOLVO group of companies. BUS and truck are unit of Volvo Group Operation and that supports Volvo truck, bus, construction equipment. Engines were main products and having high demand, gearboxes and drive shafts. The factory in the foreign country produced marine ships gearboxes. In foreign country VOLVO has three main manufacturing areas: gearboxes to marine drivelines, gearboxes to busses and trucks, and construction equipment; mainly they produce gearboxes for busses and trucks.

VOLVO GTO follows high quality of process which divides company structure into eleven parts and each part of the company shows high-class process way of working culture. Following pillar are shown below:

- Safety- It sees from every aspect of man, machine, and any equipment.
- Operation cost- continual watch the production capex and loss and need to decrease them.
- Paying attention to improvement- continual improvement and advancement of production relating to complete business plan.
- Quality control- Product quality relating to overall business strategy
- Standalone maintenance- Corrective and preventive maintenance is required only.
- Special type maintenance- to facilities the maintenance when the operator is unable to resolve the down equipment.
- Logistics – Logistic facility
- Work cell organization- managing the work place area for machines, robots, and operators with 5S (seiri, seitan, seiso, seiketsu, and shitsuke) tools.
- Environment – Peaceful and healthy environment.
- Before time tools and machines management- managing the latest manufacturing test facility and also aware of that machine and equipment.
- Employee development-make training plan for the operator and assessing the human resource.
- (EEM) Early Equipment Management – evolved to support the association of project team across the end-to-end budgeted project process.

Present scenario

Present soft gear manufacturing cell (K7): At present manufacturing cell which called K7 was situated within tooling area and containing five working stations in which of the few of the workstation were robotized. From station to other station their connectivity through the conveyor. The only gearbox was produced in that cell. Conveyor system was quite capable to handle 50 to 60 work system. With the 2 labour throughput time was 150 second. Initially, there was 52% efficiency in production which was going

to expand in near to 82%. Also, the repairing time were 120minuts to 1000min.. The K7 layout is as shown in Figure 1

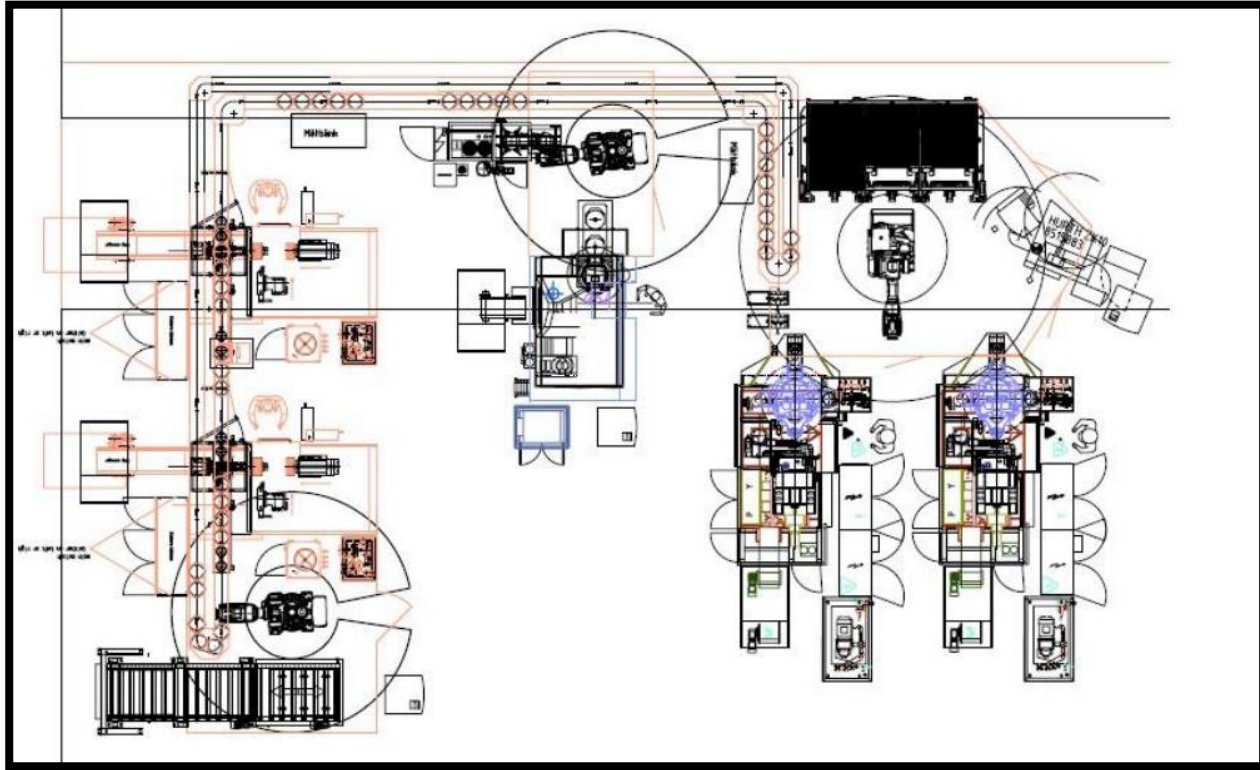


Figure 1 K7 layout, (VOLVO GTO Intranet)

Source:- <http://www.diva-portal.se/smash/get/diva2:640154/FULLTEXT01.pdf>

In the 3 robot cells, all the material handling done with the help of a robot and all robots were fixed type. Initially, parts were transit to first setup and manually fill the turning machine. After the first turning the process continues, a rotator, rotate the parts, pick that material and put the material at a particular place that other feeder automatically loads in next machine. “Turned components went via 4th station which becomes the second robotized station. Here the parts were fashioned, centrifuged and washed”. The movements have been all treated with the aid of the 2nd robot. In the last stop, the 3rd automatic robot picks up the material and put them into the “hobbing –marking -crowning machine”. After the completion of process, final parts were transfer and loaded to the pallet in store and transferred to next process.

The complete entire process is controlled by the quality department and they were responsible for the defect in production and they stop the production in a necessary situation. There was a quality inspection called IQA after 2nd turning machine which was operated manually. The final produced material shipped to next stage by lift.

Figure 2 shows the K7 cell of value stream map, which was containing 11 operations, out of 11, 8 of them were fully automated and operated by the robots. The complete movements of parts from one position to another position were performed by the automated conveyor system. All the robotic machines had been

procured by one supplier and having a similar display for manufacturing ease. All the setups, machines and robotic equipment were maintained by maintenance people. There was a maintenance department which was used to do all such maintenance activities.

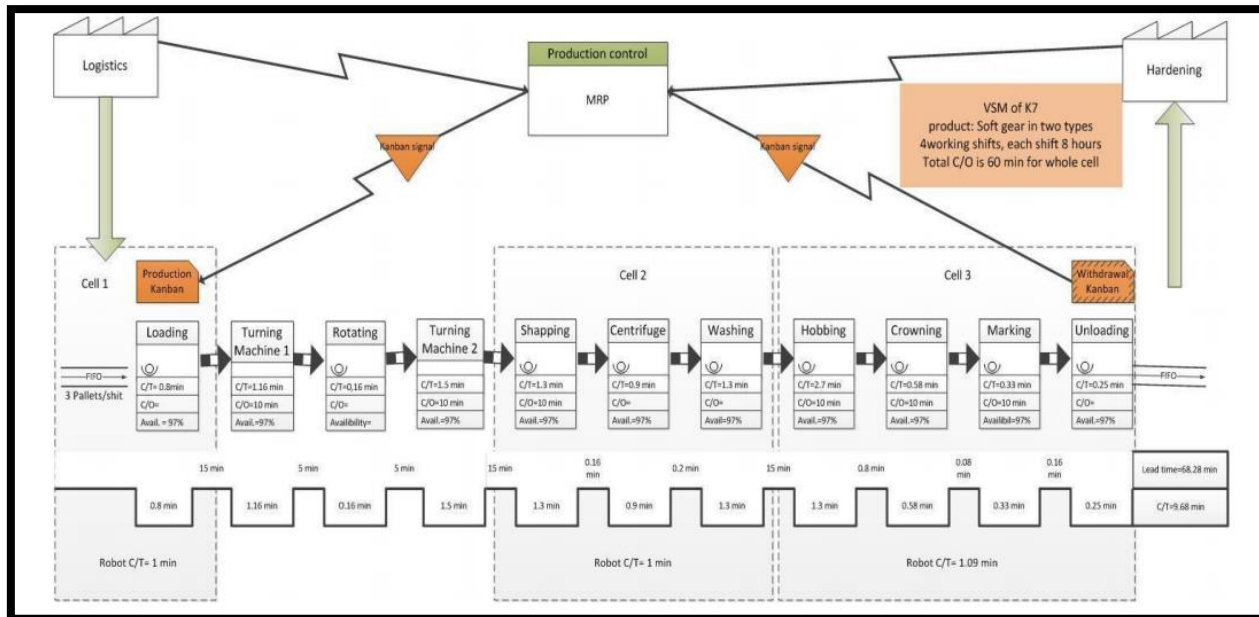
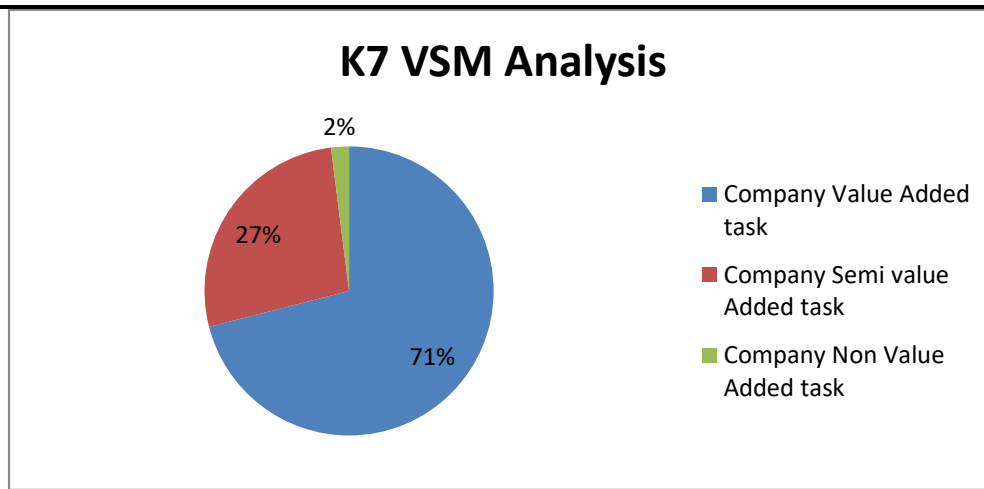


Figure 2 K7 value stream map

VOLVO GTO having a different special process and they follow all process to define the importance of each and every activity and performance. All the process had been followed accordingly by product development start to customer demand. Few of the activities were divided into two groups. Nonvalue added and Semi value added. Non Value-added activities show such activities that do not have any role add value and are not necessary to perform value-added activities. A semi value-added activity is necessary to perform value-added activities.

picture 1- shows K7 VSM analysis graph that only 29% task is non value added and rest were value-added. Few of the activities such as Marking, unloading, and loading were Semi value added. All such activities do not play a role directly in customer requirements with 27%. Likewise, there were 2 auto revolution process one in starting submitted robot cell in a request to put the item in the required area by the robot and furthermore the swinging to up and down the material for up next turning task. picture 1 shows the complete information about value , semi value and non value added.



Picture 1 K7 VSM Analysis

4.5 NEW AUTOMATED CELL WITHIN MACHINING (K8)

Reason for Investment from K7 to K8: **After K7 new automated cell had been initiated to make more advancement and to get high production output i.e K8.** The production for gearboxes was expanded from 2009 and by 2013. To meet the gearbox demand from the customers, a fast pilot to be conducted for the transmission factory.

Development of K8

For the development of K8 cell, there was project development team was initiated and it was consist of 11 peoples from each and every section: project leader, quality, control, maintenance, operator, and safety. The project was initiated in 2011 and going to be completed by summer 2013. Project development follows all the steps, process, compliance and factory product standard. Project lifecycle includes all the general information regarding the manpower, budget, costing, published with the vision and mission of presenting project scope, responsibilities, goals, sources and timeframe. Project assessment was done in 2 phase i.e Plan industrial change and concept study. Failure mode effective analysis (FMEA) was done to find out the risk in going forward with the project and all the activity had been done by the supplier and the project leader. The team studied the previous development of K7, how does it works and to avoid the failure and difficulties in future. In the idea examine stage, more detail targets set, for example, control ON time, generation ease, kind of items, quality targets, timetable, process, wellbeing targets, general issues of design, ecological targets, financial targets, instruction, coordination, upkeep, and documentations were talked about.

Details of layout, manpower, line time, throughput, cycle times, technical specifications, spare part lists, costly items etc. were indicated. Also in this phase, the supplier and the vendor was chosen according to the requirements. The supplier came with a proposal includes price, budget, spare parts, costly parts, maintenance plan, installation of machine time, etc. The strategy of the new expansion of K8 cell is to

minimize the production cycle time. The design team remodified the cell working process workstation layout to meet the best output. See figure 3.

The procedure began with manual took care of stacking of robots. The robot picked the material which was preformed and set it to the transport line in the specific area. The part went to embellishment machine and stacked to the machine consequently via robotized loader, subsequent to trim the material emptied with a similar framework and returned to a hobbing machine with a similar stacking process. The material transferred to washing area where the washing machine is placed. The robotic automated machine picked the washed clean and clear part and loaded it to the crowning machine and then transfer machine which does marking and finally the robotic machine unloaded the parts for final goods.

Now the old K7 cell process was compared with new K8 cell process with the simulation software shown in figure 3. In the new cell the centrifuge was jointly in molding machine and washing machine, for washing the parts they used washing machine on the rotating conveyor with no need of robotic automation, handling with these factors end to decreasing the production throughput compare to K7 cell. As per new design and process, K8 could have the capability and with the help of such capability organization production volume need get fulfill, Due to that another hobbing machine not required.

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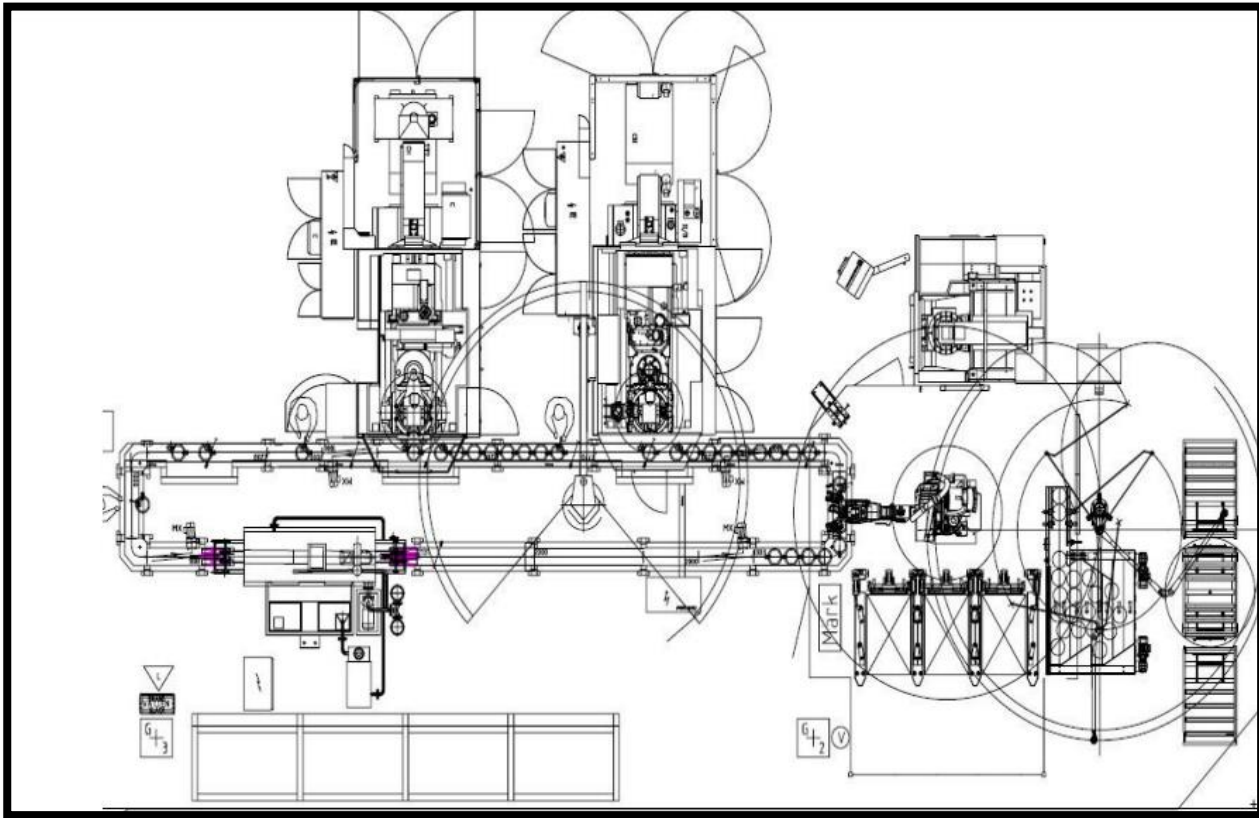
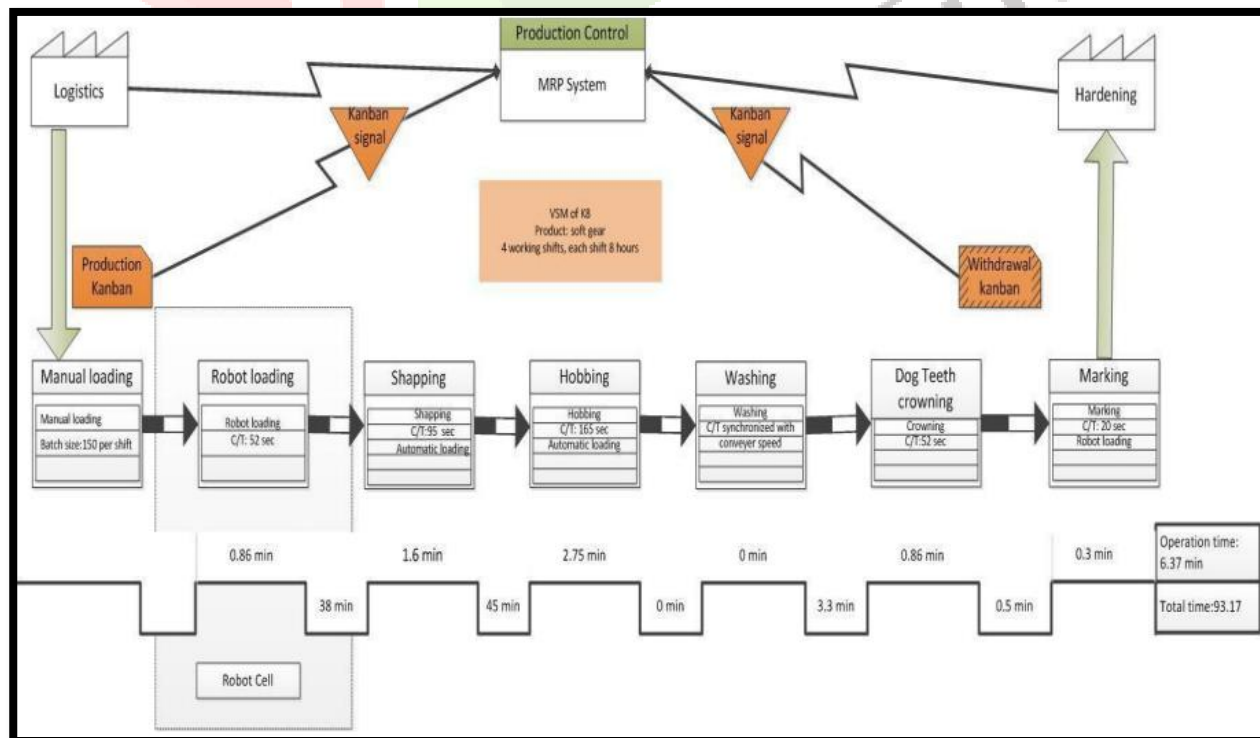


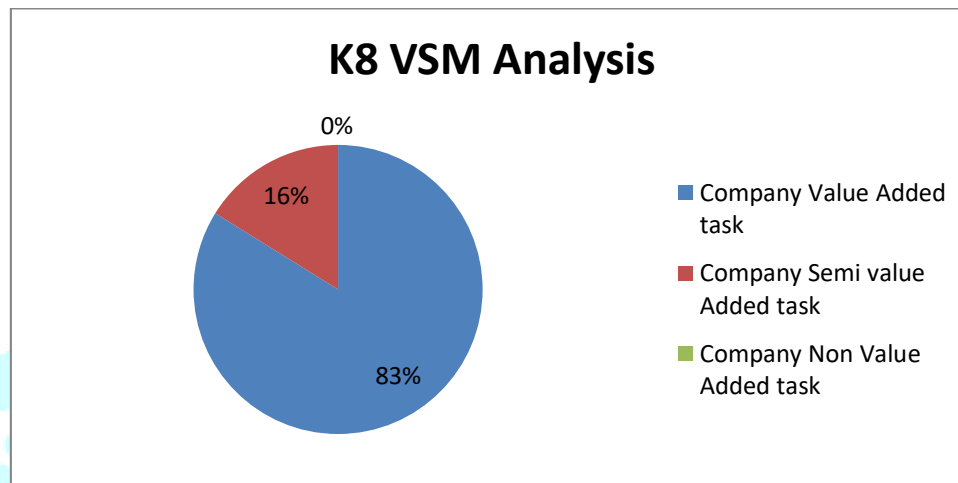
Figure 3 K8 layout, (VOLVO GTO Intranet)

The output of the Simulation software result shows that total cycle time or the throughput time of the workplace process was about “3 minutes and 4800 seconds lead time to compare to 150 seconds for cycle time and 60 minutes for lead time in K7”. After implementation of the another hobbing machine then both the total cycle time as well as lead time will decrease as well.



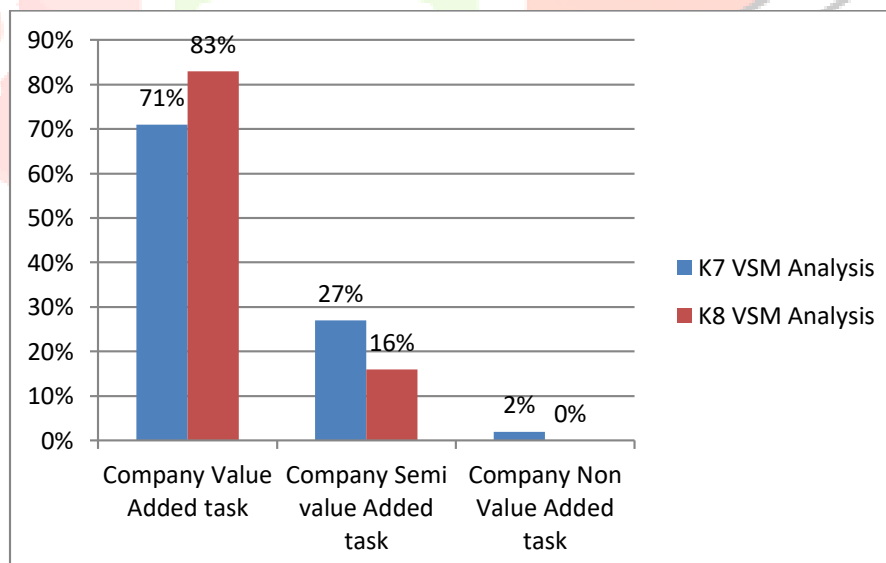
A K8 Value stream map

Picture 2 shows the analysis graph of K8 VSM. 83% of operations were value added and 16% found Semi value added and 0% in value added. By adding the second hobbing machine the result changed. Stacking the trolley by the administrator and robot stacking/emptying were required exercises for assembling which did not increase the value of the item but rather should have been diminished or moved forward. Nonvalue added had zero activity.



Picture 2 K8 VSM Analysis

CONCLUSION



With the help of Robotic Process Automation, Volvo model K7 has been changed into K8 system in lean manufacturing environment. In K7 process Value-added activity 71% semi value added 27% and non value added 2% but after the Robotic Process Automation in the process design, value-added activity has increased. In the K8 process have value added 83 %, semi value added 16% and non value added 0%. It is beneficial for every manufacturing industry which is adopting this automation.

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