(IJTBM) 2011, Vol. No.1, Issue No. II, Apr-Jun **e-ISSN: 2231-6868, p-ISSN: 2454-468X**

A STUDY OF AUTOMOBILE EFFICIENCY IN QUANTIFYING LEAN MANUFACTURING MANAGEMENT

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ABSTRACT

In the present highly competitive global automotive sector, managing and enhancing efficiency requires these businesses to embrace more flexible and lean methods. The domestic car industry has focused on the establishment of new management techniques to fulfil market needs in the last 20 years in North America. The Toyota Manufacturing Process (TPS) or the Lean Production process includes the instruments and procedures designed to ensure the quickest time of delivery at the lowest cost for the most high-quality product. The following article gives an assessment focusing on the improvement of labour efficiency in one of North America's Big Three (Ford, GM, Chrysler LLC). The project aimed to use many lean management technologies at an engineering and assembly plant in order to maximise productivity, and use levels in the pre marriage chassis area. The study was able to enhance efficiency by 51% by 246% using three distinct lean tools (i.e. labour standardisation, 7 waste and 5S) and to decrease the operation by 14%. The investment return assessed on the basis of the changes was 284%.

Keywords—*Lean Manufacturing, Standardized Work, Operation Efficiency and Utilization, Operations Management.*

INTRODUCTION

Automotive businesses in North America are nowadays obliged to be more inventive and efficient in company management in the highly competitive manufacturing sector. The U.S. automobile market is anticipated to decrease 5 million automobiles today, according to the 2005 Alix Partner Automotive Outlook and examined by the U.S. Oversight Committee and government reform. The survey indicates that the capacity of the foreign firms to apply new procedures which maximise efficiency, increase quality and minimise lead time is one of the main reasons for overspending the Big Three producers. The Big Three improved their market share by 4.3 percent in 2009; it will rely on the following: The sustainability of this rise.

1. Capacity to retrieve foreign enterprises' market share,
2. The capacity of Big Three to create and maintain new creative products that foster efficiency improvement and investment cost reductions in new processes.

Toyota engines, which are one of the world's top car manufacturing and quality firms today, came close to close its doors 60 years ago when it filed for bankruptcy. High investments into new technology that may enhance efficiency, increase quality and decrease cost were its initial move towards improving. The use of the Lean management approach, which Toyota has designed and managed to increase its efficiency and lower its cost, is one of the key driving forces behind Toyota's success. According to currently, the Big Three automotive corporations in North America face various challenges, includingbankruptcy (GM and Chrysler) in 2009.

1. 25% reduction in the car market from 2005
2. Customer want shift,
3. Continuing economic crisis and consumer purchasing power damage,
4. 8.2 percent high jobless rate

The Big Three must commit itself to investing in new technologies in order to solve these issues. The Big Three has to concentrate on the complete application of Lean management within its industry and beyond its limits. The report in the Big Three 10 to 15 years, Lean Management Techniques or Toyota Production System have been developed, adopted and implemented, according to (TPS). Because of various internal problems, including the lack of commitment from the Big Three senior management, and the contract and limitations on the labour union the Big Three were able to achieve a certain increase in process efficiency but not to the same level as Toyota engines. The fundamental weakness of the Big Three was due to the fact that managers saw it as a supplemental instrument rather than a permanent improvement tool, which is accomplished sequentially by deploying lean tools. For example, standardised work analysis (a lean tool) should be performed before line balance (something else that is lean), which is the basis for the effective standardised execution of workplaces (something 5S, 7 wastes, visual management).

AUTOMOBILE ASSEMBLY

The automotive industry's production process goes through three basic phases, as shown in Fig. 1. The phase of the actual building of automobiles is usually referred to as the assembly stage or the production and assembly process. The flow of activities is sequentially planned through the production process. This procedure is called continuous flow or line flow.

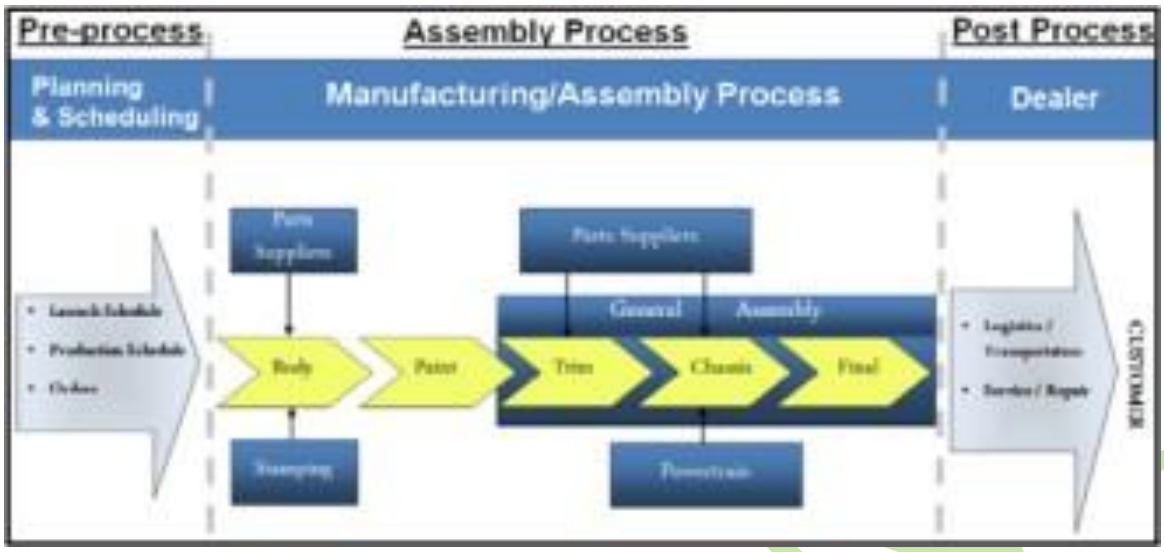

Fig. 1 manufacturing process flow

The automotive facility where the production process is carried out is separated into three primary divisions and is separated into various areas. The following are the sequences and/or departments:

1) The first stage is a department of body shop (Body in White) split into 7 to 9 areas. Stamping pieces arrive from the stamping factory into the factory and are sold together to make up the car coat. This is a very automated sector; the most part is soldering robotic,

2) The paint shop is the second phase and is separated between 6 and 7 zones. After the shell has been constructed by the body shop, the shell is next sent to a paint shop to wash, cover, and paint the shell. It is less mechanised than the department of car body shops,

3) The stage of assembly is separated into three divisions: chassis, trim and final mounting. There are 5 to 7 areas for each department. The inside pieces (i.e. cables, HVAC, tapestry etc) are installed at the trim department. The chassis section, as indicated in Fig. 2, is separated in several zones and subassembly zones. The phases of the chassis are intended to fit all the body parts (i.e. full line, brake line, Axle, engine, prop shaft, fuel tank). The final assembly, when the trim is married with chassis subsystems and other parts are installed, is the last step of the production process (e.g. wheels, doors, moldings).

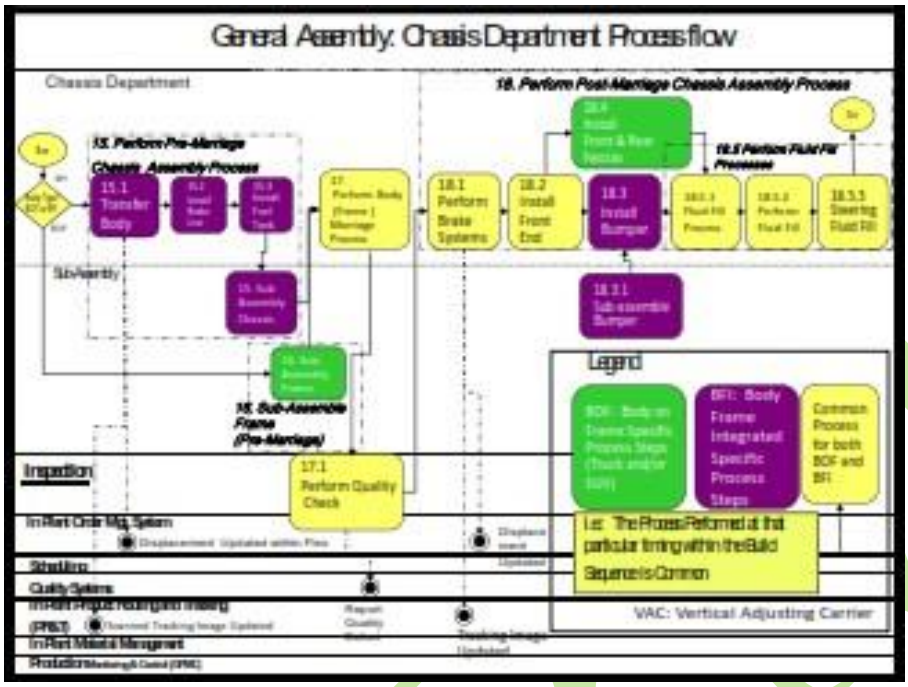

Fig. 2 Chassis department process flow

LEAN MANUFACTURING METHODS AND TOOLS

Lean production offers tools and procedures to efficiently minimise waste as soon as the process is detected. Here is a short list of some of the instruments effectively employed by producers:

• ***Rapid improvement events (also called "Kaizen")*** — In this technique, a cross-functional waste reduction team is put up to concentrate on a single issue area. The team (6 to 10 individuals) normally comprises managers, engineers, sales and employees and production employees at the hourly rate. The team develops objectives and has an expert team member as its guide. The team uses an established approach to discover and remove garbage in a certain area of work over a specified amount of time (typically five days). The team then develops routine work routines to maintain the results. Producer events normally target on various plant or office locations during one or many Kaizen events each month.

• ***Standardized tasks*** — Typically, one method is more efficient for doing a job. The essential milestones of an event in Kaizen are waste, wastes eliminated by better techniques, techniques used to achieve efficient flow and finally tasks and techniques are standardised. For use in training and reference the standardised tasks should then be documented.

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• ***Balanced flow (sometimes called "Takt time")*** **—** once standard tasks are set up, standard personnel and process cycle time may be formed. The balance of manpower and material flows in order to reduce the walking, waiting and repetitive handling of concrete plants is often a key source of improvement. It is a vital purpose to have a balanced flow.

• ***Workplace organization (sometimes called "5-S")*** **—** Many producers know and have attempted this housekeeping and working structure. Sadly, many producers have found it simple to go back into harmful practises. Clutter time waste and uniformity impedes.

• ***Visual controls*** **—** This tool is as simpler to direct the placement and flow of things as drawing lines on the floor. In the absence of language, visual controls provide crucial information. They almost appear to provide a natural procedure for operations and product flow.

• ***Plant layout*** **—** Most manufacturers are able to simplify material flow, limit crane time and decrease walking. This technique comprises a flow analysis and an inventory analysis. The shop is frequently suitable for beginning carpenter and steel workshop. Together with Kaizen's activities, a comprehensive analysis may assist to identify and rectify significant waste possibilities.

• ***Mistake proofing*** **—** All procedures must be designed to make it more difficult to perform them badly than correctly. The design of cast-ins, for example, is useful so that they are not like each other and cannot be inserted backwards or incorrectly. As a second example, conventional practise on shop drawings should include common reference point dimensions.

• ***Lead time reduction*** **—** It is nearly usually a waste of practise to produce a work output in lots unrelated to present requirements. This idea is shown by various cases. Sellers distribute their items in lots sometimes unconnected to manufacturing requirements. Batching in the drawing or approval procedure leads to the late shop tickets. Standard precast concrete goods are constructed to stock rather than client orders, for example, manholes. Finally, when operations are driven closely by client demand, efficiencies are increased.

• ***Inventory reduction*** **—** For the following reason, inventory is waste: it must be processed and stored. It is frequently damaged or out of date. Someone needs to follow the stock and locate it if necessary. It binds money into which an investment should be returned. In addition to the immediate casting demands, to be particular, work-in-process inventory is waste. There are options to lower the inventory of completed products and keep the building schedule expedited for the owner. For example, the same mark number of components is often batched together during production planning. This frequently leads to an enormous inventory of completed items.

• ***Correction at the source*** **—** In the product, quality cannot be assessed; it has to be included. Self checking, accountability and error proofing reduces reprocessing via prevention rather than via inspection and correction. Precast is often prone to repeated mistakes. Non-conforming parts are usually sent to the "Hospital" rather than the casting crew reparable. But has it addressed the core cause? How frequently are parts supplied to the workplace knowing that fieldwork would be required?

Plant systems that remedy infringements through prevention are the most efficient, with the consequence that most producers benefit enormously. Most producers know the 'rule of 10' since the benefit of prevention instead of rectification is spoken about: It costs 10 times more to repair it in the yard than to make right the first time, and fixing it in the yard costs 10 times more.

• ***Bed setup reduction —*** Typically, the timeframe for the production of precast concrete components is limited by bed installation time. Planning, standardisation and material staging may decrease the setup time and intentionally strive to limit the mobility of the team. Most manufacturers discover several possibilities to simplify bed installation and limit the risk of mistake. Simplified bed installation often enhances flexibility and minimises process effort and inventory of completed products. Enhanced bed installation is typically the key to closely match output to customer demand. Here is a sign for administration: If the installation team spreads throughout the length of the casting bed, a waste reduction possibility is available.

• ***Total preventative maintenance (TPM) —*** this reduces downtime incurred via unplanned maintenance. Breakdowns in equipment generate waste, safety hazards and difficulties of quality.

• ***Team problem solving (TPS) —*** the active engagement of the working group demands effective lean manufacturing. Proven approaches and training are available that contribute greatly to team efficiency. This stage needs organised integration into Kaizen events, workgroup problem-solving sessions, training in job skills and the establishment of best practices for normalised activities. The advantage from the use of TPS is higher productivity and lower turnover for employees and retraining cost.

Before implementation of Lean Manufacturing:

Since we have to modify the arrangement of cell and line machines that balance with the needed time. Reduce cycle times for Kaizens' above-mentioned equipment.

1. Capacity enhancement of Hwacheon m/c two spindle with one operation.
2. Capacity enhancement in dovetail milling operation by using Dual spindle for dovetail milling.
3. Setting time Reduction in TT hole drilling & reaming
4. Set up time reduction in TT grooving, Operation integrated in BFW along with TT hole.
5. Quality improvement in Retainer hole drilling &Tapping. Pneumatic Clamping for Fixtures.

After implementation of Lean Manufacturing:

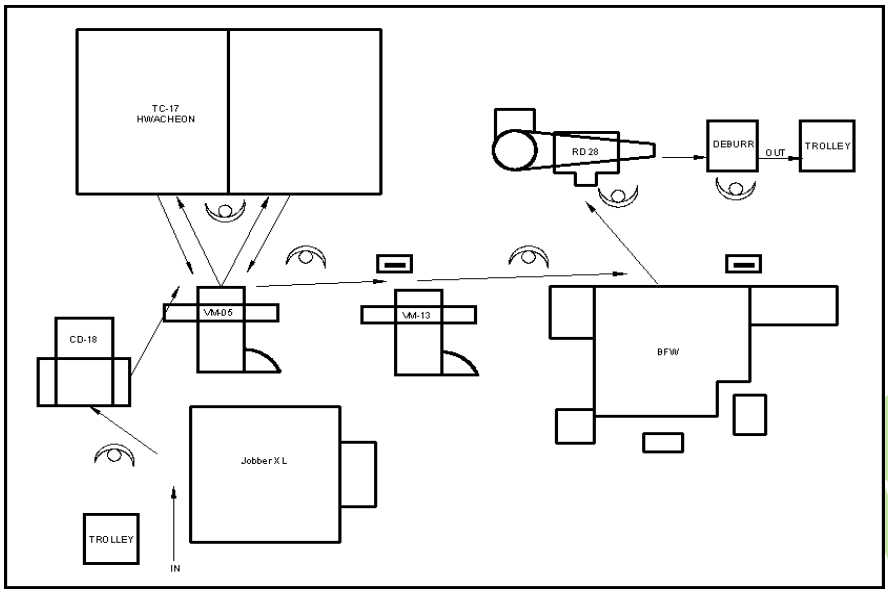

Figure 3, Machining cell layout (After)

STANDARDIZATION OF WORK

The standardised procedure is meant to provide the technician with the best means of doing his/her task safely and effectively at the organization's objective quality level. Work standardisation is the first instrument in the process of continuous improvement. It is regarded as one of the most effective lean management tools. The work process standardisation is split into two elements or phases. In stage one, the goal of work standardisation is to chronicle the existing situation of an employee or workplace for a current best practise study. Two phases or portion of the standardisation of work, in order to produce a new and more efficient state of play to carry out the assigned operation, emphasis on lean manufacturing tools (e.g. 5S, 7 waste and Just In Time) and technical expertise. The following are key points for standardised work:

1. "Synchronize" the machine, workplace, materials and time to generate what is necessary to provide a logical and disciplined Organization in the shortest period possible.
2. Standardization of the work sequence to ensure security, quality and performance
3. Objectives are attained by the participation of staff in improving operations. Technicians are actively involved in the application of the lean tools at their workplace.
4. When a well-specified reproducible process occurs, standard work analysis is applied.

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The process of standardisation in the automotive sector often includes numerous stations at a time or certain areas, which contain many operations and personnel. Initially, the approach concentrates on creating the existing status (baseline) analysis for each station, and before making any improvements. Based on the early findings a team of workers will start to make suggestions on changes (e.g. management and technicians). In some scenario each advice will be tried and, if validated, used at an enhanced new workstation. Each suggestion is examined. The criteria for the new procedure take the following into account in general:

1. Workloads of employees/technicians are balanced to maximize minutes per hour and value added work content,
2. Ergonomics stress for each operation is minimized,
3. Employee work function are organized in a safe manner with awkward movement minimized,
4. All employees perform operation elements in standard sequence each time,
5. Standard work chart elements will be documented and each task and data is detailed. See recommended standardized work analysis (SWA). Time indicated in the SWA is in seconds,
6. The size of employee work envelop is minimized to reduce walking distances,
7. Location Materials, tolls and equipment is as close as possible to use point (operator use point).

CONCLUSION

The following study shows clearly that in the domestic car sector in North America enormous improvement potential exist. This study has clearly shown the role of the lean management tools in delivering this improvement. It was evident that adoption of the lean process should be mutually advanced with the participation of the company at all levels and should be continuously evaluated and updated. Standardization of work is the first and most important stage for implementing the lean. For each technician in a manufacturing process, the standardisation process creates exact processes. The driving factor behind this development is how clearly the sequence of operators' activities, the output rate and inventory necessary for each station can be understood and detailed. The primary idea of standardised work is that it focuses on the provision of a product that fulfils client expectations economically.

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