INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 6 - V7I6-1330)
Available online at: https://www.ijariit.com

Lean Thinking approach to improving the performance of an automobile service industry

T. Poojith Kannan
tpoojithkannan@gmail.com
Rajalakshmi Engineering College, Chennai, Tamil Nadu

E. Raghul Yadhav
raghulashwin11@gmail.com
Rajalakshmi Engineering College, Chennai, Tamil Nadu

Ranjit Kumar K.
skumar2586065@gmail.com
Rajalakshmi Engineering College, Chennai, Tamil Nadu

Raghul Anandan
raghull.anandan@gmail.com
Rajalakshmi Engineering College, Chennai, Tamil Nadu

Dineshkumar Lakshmanan
dinesh12296@gmail.com
Apollo Engineering College, Chennai, Tamil Nadu

Karthick S.
karthickq335@gmail.com
Velammal Engineering College, Chennai, Tamil Nadu

ABSTRACT

The study's goal is to discover problems in a car service facility and come up with the best remedies to improve overall performance. The research's specific goals are to: increase productivity using Lean strategy; reduce wastage and non-value added activities; create a simple and easy work environment; develop a 5S Auditing control system to maintain the improved process; and educate Janitorial level people about the benefits of using Lean strategy. The findings of this study are based on a single case study conducted in a company that used the Lean PDCA (Plan-Do-Check-Act) strategy, the 5S tool, and its applications to improve productivity. At various phases of the investigation, the main causes for the problem in automobile servicing were found using data-based analysis. The process parameters have been tuned and monitored to ensure the method's long-term viability.As a result of its lean strategy, the quantity of energy and non-value added activities involved with its manufacturing processes were decreased. In addition, research led to the establishment of a visual workplace, which has improved the production environment, as well as a clear and straightforward process design to build the groundwork for a future of continual improvement. The output of the business would grow by 15 automobiles each day as a consequence of this research, which would be a significant achievement. The study gives companies advice on the application and significance of quality ideas. To survive, instigation must work consistently on development-oriented activities, regardless of how these activities are character. The findings will also serve as a foundation for future study in this field, with an emphasis on practical application of these notions..

Keywords: *Automobile Service Industry, Lean Thinking, PDCA, 5S*

1. INTRODUCTION

1.1. Lean Services

The service sector is concerned with the soft part of the economy; where people render their time, skills and technical know-how to enhance productivity and performance. Producing services require relatively less of natural capital but more of human capital than agricultural orindustrial goods. In line with the global trend, service sectorin India has also grown rapidly in the last decade. Its growthhas in fact been higher than the growth in agriculture and manufacturing sector. It now contributes around 51 percent of GDP. In the trade mode, services trade has also grown at the same rate as goods trade over the 1990s (i.e., about 6.5 per cent) and its share in total trade has reached around 24 per cent [1].

Guiding principles for Lean management include:

- Defining value from the standpoint of the end customer.
- Identifying each step in a business process and eliminating those steps that do not create value.
- Making the value-creating steps occur in tight sequence.
- Repeating the first three steps on a continuous basis until all waste has been eliminated.

Working from the perspective of the client who consumesa product or service, "value" is any action or process that a customer would be willing to pay for. Lean also takes into account waste created through overburden ("Mari") and waste created through unevenness in workloads ("Maura"). Working from the perspective of the client who consumes a product or service, "value" is any action or process that a customer would be willing to pay for. The concept of Lean can be traced back to Japanese industries. Toyota was the first company to successfully implement Lean in their car manufacturing systems [2].

Essentially, Lean is centered on making obvious what adds value by reducing everything else. Lean manufacturing is a management philosophy derived mostly from the Toyota Production System (TPS) (hence the term Hypnotism is also prevalent) and identified as "Lean" only in the 1990s. TPS is renowned for its focus on reduction of the original Toyota seven wastes to improve overall customer value, but there are varying perspectives on how this is best achieved. The steady growth of Toyota, from a small company to theworld's largest automaker, has focused attention on how it has achieved this success [3].

Long cycle times, many complex variables, multiple decision points, and interactions with a variety of computer systems are common in service processes, and much of the value-added work happens out of sight, in people's minds, which makes Lean philosophy and tools a great fit and can be of huge benefit for services industries. Tools like visual management, which make usually unseen work processes apparent, and strategies that explicitly develop a team member's creative problem-solving and critical thinking talents to the maximum are especially effective when service operations are not physically evident [4].

1.2. Background and Motivation

The service sector is concerned with the soft side of the economy, where individuals volunteer their time, talents, and technical knowledge in order to boost production and performance. Compared to agricultural or industrial commodities, producing services requires less natural capital but more human capital. In accordance with global trends, India's service industry has expanded fast in the previous decade. Its expansion has outpaced that of the agricultural and industrial sectors. It presently accounts for roughly 51% of GDP. In terms of commerce, services trade has increased at roughly the same rate as goods trade throughout the 1990s (i.e., around 6.5%), with a proportion of overall trade of around 24% [2].

1.3. Problem Discussionn

Infrastructure requirements in both rural and urban regions are insufficient to meet the needs of various sectors. Power and water shortages are still a problem, and they are limiting the industry's expansion.

The service industry has contributed more than 57 percent of GDP in the last decade, making it the fastest expanding sector. Despite this, it has only been responsible for 25 percent of overall employment creation.

The briquettes and behaviour toward customers have a direct impact on customer satisfaction. These are the characteristics of a successful service industry.

Unfair competition, a lack of incentives, excessive loan rates, and poor forecasting all impede commerce's expansion..

1.4. Problem Formulation

1.5. The problem was defined using Value Stream Mapping. It has been used to assess the existing situation and to provide recommendations for the future. The Value Stream Map considers not only the product's activity, but also the management and information systems that support the fundamental process. This is especially useful when trying to minimize cycle time since it allows you to see both the process and the decision-making flow [3, 5]

1.6. .Aim and Objectives

Aim:
To Apply Lean ideas to the service industry in order to decrease waste and, as a result, enhance production time.

Objectives:

2. To use the Lean Principle to increase the system's productivity and performance.

3. To raise the bottom line of any product that has a negative impact on the system's performance.

2. CASE STUDY

2.1 About the Industry

The company is India's first and largest automobile dealership. Its parent firm has been in the automotive industry for approximately 75 years. In whatever it does, the firm has a strong culture of quality. This has helped it establish enormous customer loyalty, resulting in a substantial amount of its revenue coming from current customers' referrals. With 5 Showrooms and 16 Sales Information Centers, 25 Workshops, and 5 Showrooms for Used Car Sale, it now has the greatest network of all the dealers in Katakana. It employs approximately 2550 people who are dedicated to providing the finest possible service to its clients.

2.2 Process Flow

Arrival of the vehicle:The automobile arrives at the plant's entrance. A Service Advisor is assigned to the vehicle, and he or she logs any client complaints into a logbook known as a Job Card. A test drive is undertaken with the customer to discover vehicle run-time faults. The technical issues are written down in the work card, and the customer is given an estimated delivery time. During its stay in the facility, a supervisor monitors the activities that the automobile goes through.

Washing: The vehicle to be serviced is taken to the first step of the wash process. This accomplishes two goals: I prior to servicing the automobile, scratches and dents may be identified; ii) service can be conducted with relative ease because the whole body of the car has been cleaned free of dirt.
Drying: To speed up the evaporation process, washed automobiles are dried using a high-velocity jet of air. After that, the body and interiors are cleaned off with a clean towel to eliminate any remaining water or dust particles.s.
Process at Bay: The next step is to drive the automobile to a processing bay that is open. The automobile is hoisted up using hydraulic jacks to reveal the under body for individuals who want oil replenishment. After that, further tasks such as wheel removal, axle repair, and leak checks may be completed with reasonable simplicity.
Inspection: The processed cars now need to be scrutinized for errors. Accordingly, the inspectors are assigned to search for any mistakes that may have been overlooked during the bay process. If extensive repairs have been made, a second test drive may be done, necessitating the second-stage wash.

Dispatch: Finally, after the inspector has given his approval, the automobile is ready to be delivered to the buyer within the agreed-upon time frame. The billing and transaction of the customer takes place at the office.

3. RESULTS AND DISCUSSIONS

3.1. Plan

Finding the important areas where modifications and improvements needed to be made was the first step of the investigation. Discussion, observation, and intensive

brainstorming of issues and probable causes were all part of the analytical process. As a consequence, numerous Lean analytical methodologies were used to discover the existing problems and their main causes. The following were the primary areas to focus on, as well as the issues discovered: redundant car movement; excess inventory; and downtime

The initial step was to figure out what was causing the Redundant Motion of Cars. A root cause analysis was produced for this analysis following conversation with the persons engaged in the process. People, Process, Tools, Management, Equipment, and Inventory were the categories for the table [6]. Table 1 shows the Root Cause Analysis. Based on the Redundant Motion of Cars root cause analysis Embargo and brainstorming meetings were held.

This led to the identification of two causes: a lack of lean awareness among workers and car clutter.

The following phase entailed delving deeper into the issue of worker lack of Lean awareness. There was a need to figure out what had led to this situation and what may have caused it. The fish bone diagram was required for this phase (Fig 1, Fig. 2). People, Tools, Equipment, Process, and Management were the categories used. The most likely causes have been identified [6].

The issue of Excess Inventory was the subject of the second emphasis. Why-Why analysis was utilize as a problem-solving strategy to gain a clear picture. Why-Why analysis is a root cause analysis approach that entails asking a series of why questions in order to pinpoint the problem's source. The number of times the inquiry "why" is asked is determined by the time it takes to get a response and has no minimum or maximum restriction [5]. As a result of the investigation, three key explanations for the current difficulties were discovered.

They are

- Space constraint at parking area
- Change in process lead time of the cars

Figure 3 depicts the Why-Why analysis. The third point of attention was on the Spares Shortage. To arrive at the solution, a Why-Why Analysis was undertaken (Fig 4). The graphic shows that spares are not being hoarded in sufficient quantities. Damaged parts must also be checked for warranties, if applicable, and appropriate actions must be made to rectify the problem. This step takes time, which adds to the overall process lag time.

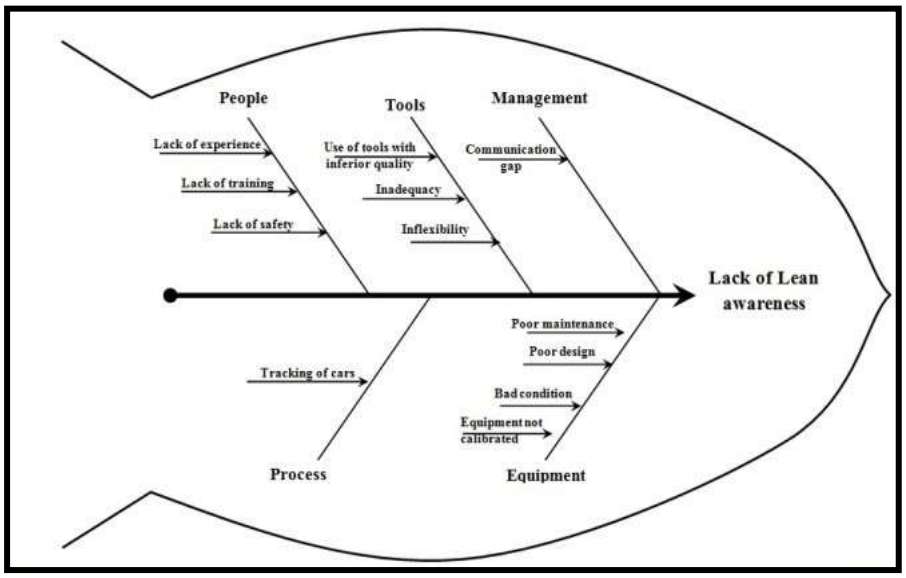

Figure 1. Fish Bone Diagram for Lack of Lean Awareness

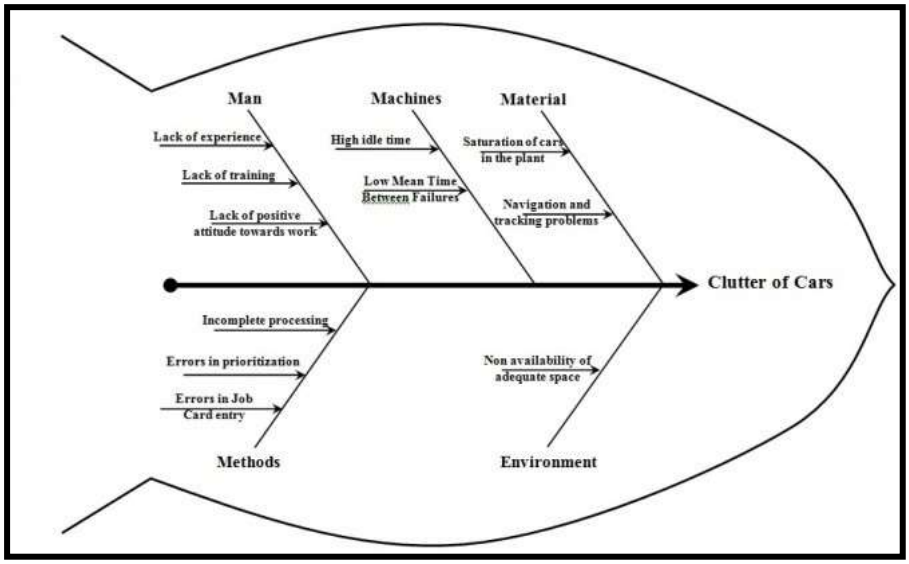

Figure 2. Fish Bone Diagram for Lack of Clutter of Cars

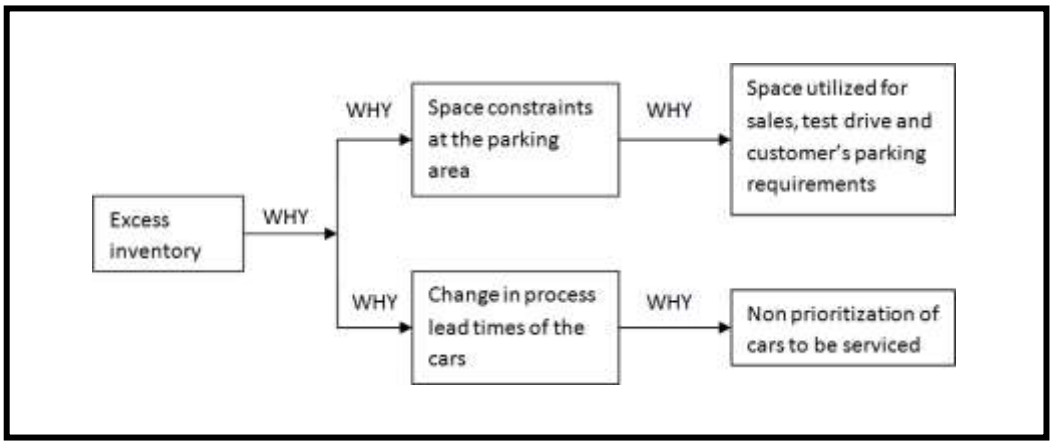

Figure 3. Why-Why Analysis for Excess Inventory

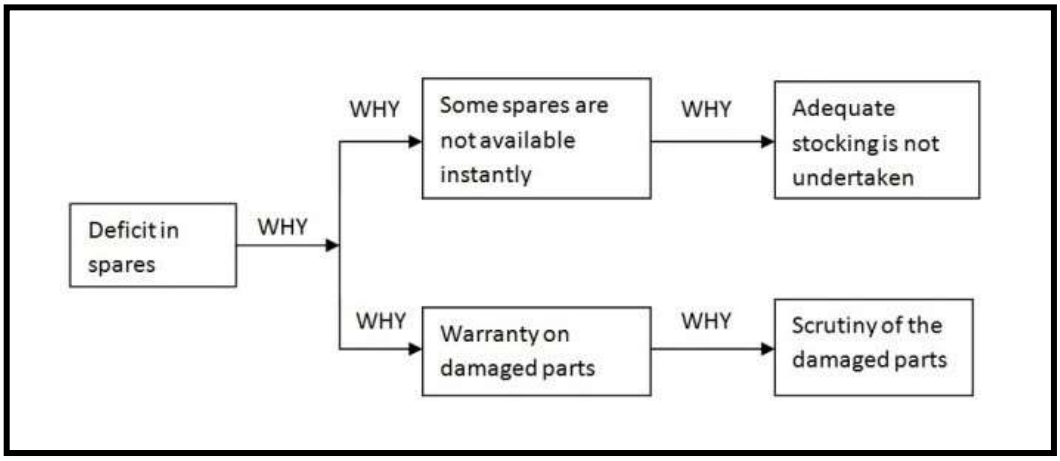

Figure 4. Why-Why Analysis for Deficit in Spares

Table 1. Root Cause Analysis

EFFECTS	CAUSES	SPECIFICATIONS/ DESIRED RESULTS	OBSERVATION	VALIDATION METHODS	RESULT
People	Awareness about Lean methods and principles among the workers	Must have a basic understanding of Lean principles like 5S and PDCA	The workers lack Lean know-how.	Embargo and Why-Why analysis	Root cause
	Training and Experience of the technicians	Must be well trained and experienced	Seasoned and skilful workers have been employed	Brainstorming	Not a root cause
	Safety of the personnel against hazards like fire or falling objects	The organization must ensure the safety of its employees	Adequate safety precautions are taken and are followed as per norms	Embargo analysis	Not a root cause
Process	Clutter of cars at different locations inside the plant	Organized and smooth motion of cars	Disarray of cars inside the plant	Brainstorming and Embargo analysis	Root cause
	Tools used: Quality, Availability and Flexibility	Tools must be of high quality, should be available at all times and versatile	All the aforementioned attributes have been satisfied	Embargo analysis	Not a root cause
Equipment	Design, Calibration and Maintenance of the equipment being used	The equipment must be designed carefully, calibrated accurately and maintained well for flawless functioning.	The equipment design, calibration and maintenance comply with the accepted standards	Brainstorming and Embargo analysis	Not a root cause

Management	Information and communication exchange between the managerial and technical staff	A well grounded information and communication interchange is quintessential for the effortless operation of the plant activities	The established system of communication in the organization is commendable.	Brainstorming	Not a root cause

3.2. DO

The second phase in this problem solving cycle is Do. Following steps were taken as solutions to the causes found in the previous step undertaken The initial stage is to construct a Value Stream Mapping (Fig. 5), current layout (Fig. 6), and start analysis the present condition with the use of 5S and Visual Balkan. It was applied to all of the relevant equipment and automobiles not just in a specific segment, but also in all of the solution processes.

The first S, 5S Sort, is to be implemented throughout the whole plant. This phase is used to separate the things that are needed on the production floor from those that should be stored elsewhere or eliminated. Researchers employed the extremely dependable technique of Red tagging to assist them with this endeavour. This entails making a paper tag with the information about the equipment to be tagged on it. The tag is attached to an object that is deemed to be out of place for a specific amount of time. The procedure' concept is conveyed to all parties involved. The tags must be deleted when the time period has passed [7].Involved in the factory are the Managing Director, General Manager, Service Advisors, Supervisors, Inspectors, and Technicians. The new design incorporates all of the necessary improvements. Separating Free Service vehicles from Paid Service cars, or cars with substantial issues from cars with small complications, is made easier using Visual Balkan. Spares may be acquired in time for an ongoing process by notifying the supervisor, who would fetch the spares instead of the technician, resulting in minimal downtime.

The following are the predicted modifications as a result of the new layout's implementation::

- Motion of the cars within the plant can be brought under check
- Increase in productivity
- Cars with shorter lead times can be clearly distinguished from those with longer lead times
- Possible elimination of night shift with sustained implementation of the suggested measures

The new arrangement (Fig. 7) was also designed to allow for extra floor space to be used for value-added activity. The revised arrangement also resulted in a significant reduction in inventories on the floor. In the following phase, an estimated increase in productivity is reported.

3.3. CHECK

Using a software simulation, researchers validate the modifications made above in the Check step. The process time of the automobile at each bay is determined insisting the notion of "Embargo," or real-time observation. Embargo and Brainstorming are used to determine the decrease in process lead time. These numbers are used as input to a model that predicts a future state (Fig. 8).

Due to resource and technological constraints, the average value added time for each of the processes was calculated using the ARENA simulation programme [6-8]. The flow chart was used to create simulation models. The model was fed the data acquired (inter-arrival time and its distribution, entities per arrival, service rate and its distributions, number of employees and their schedules). The model was then ran for 5 replications of an 8-hour shift each replication.

. Finally, the output of the simulation model was compared with today (because the plant is operative only for two hours per day). Because it is a termination model, there was no need for a warm-up time, and the K Pis (Key Performance Indicators) were defined. To validate the model, the researchers first looked at the animation screen as well as the dynamic statistics to see if the animations were accurate representations of the real system. The panel of experts assembled for the study then tested the model's face validity, and their insightful remarks helped to improve the model.real system output. Thus, a one-day studywas conducted to identify the KPI and which was thencompared with the output of the simulation model. Since thedifferences between the results are less than 10%, which is within the standard total differences allowed, the simulationmodel is considered as acceptable and valid.

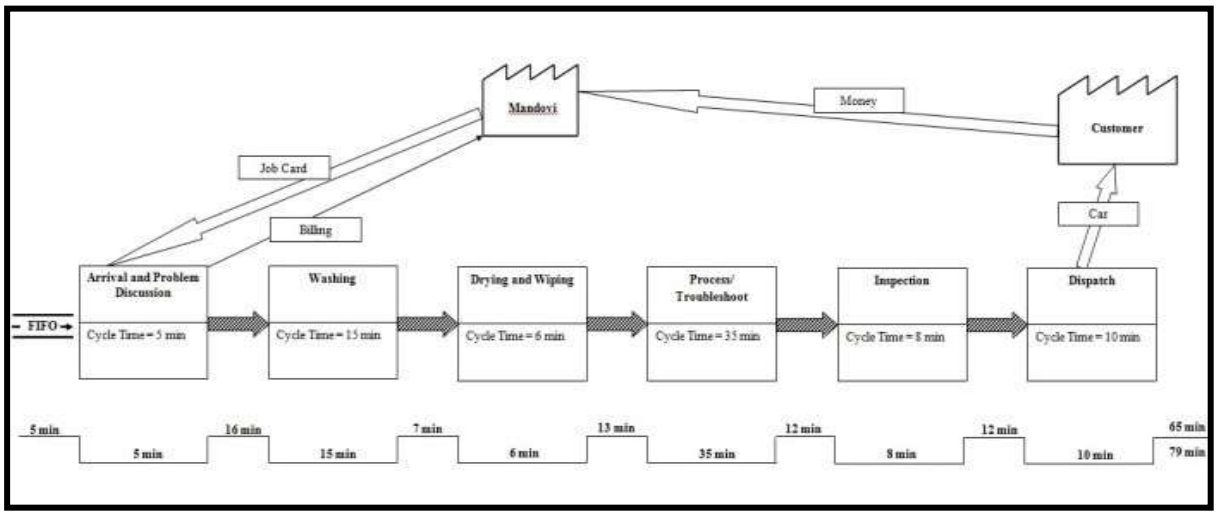

Figure 5. Value Stream Mapping – Current Scenario

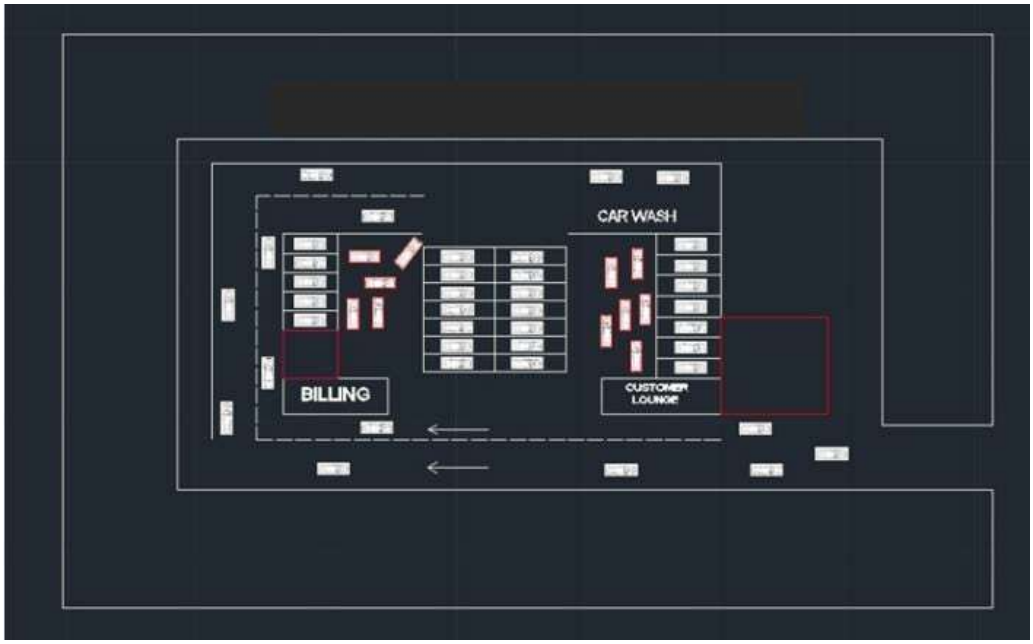

Figure 6. Current layout

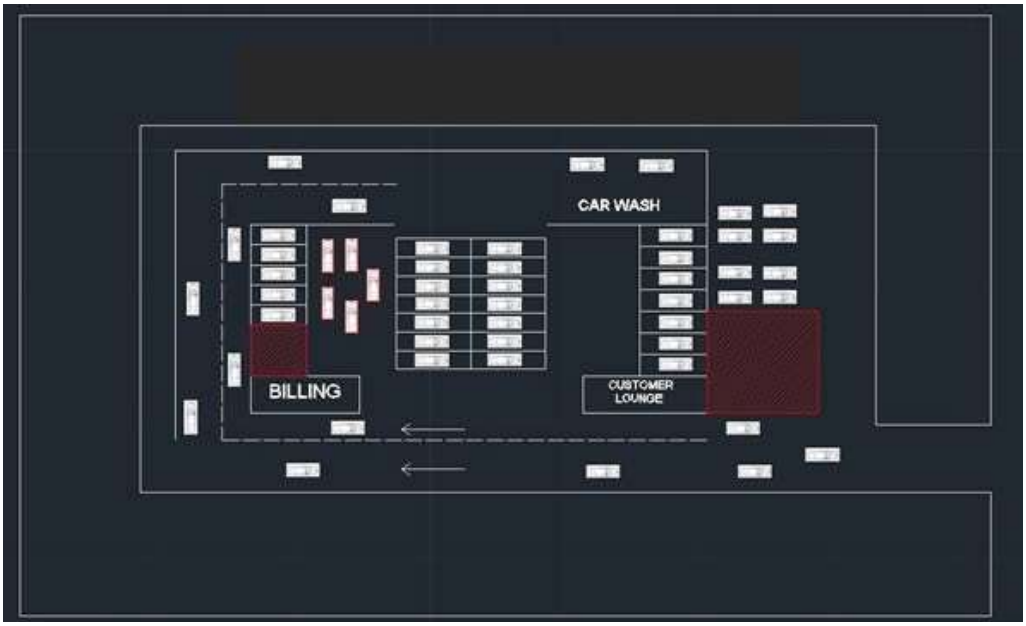

Figure 7. New layout

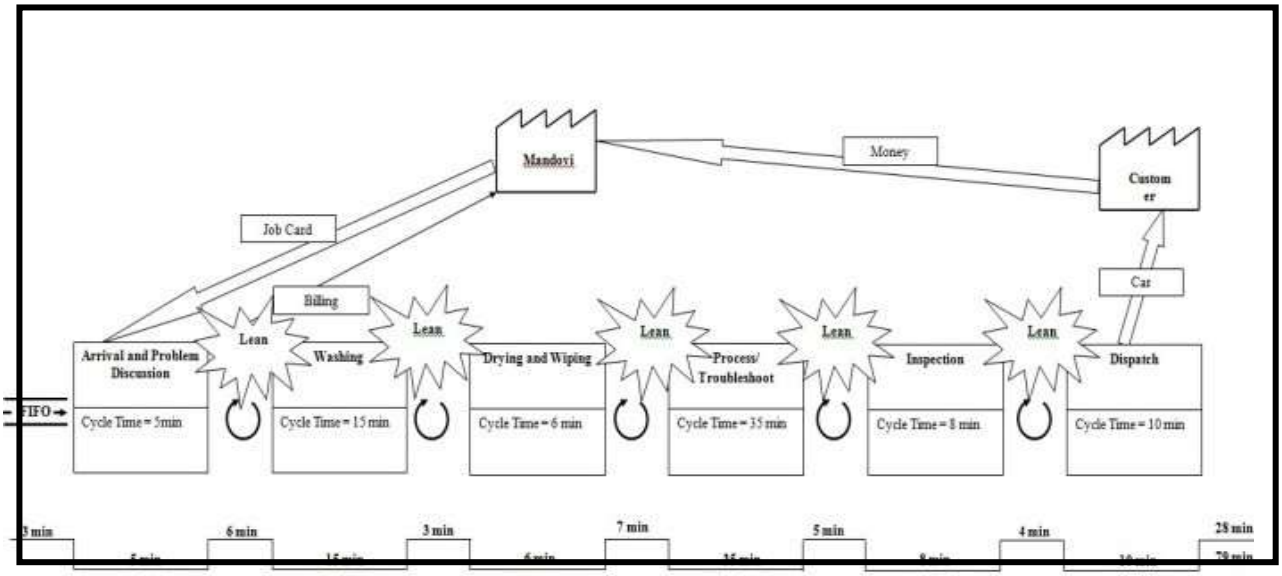

Figure 8. Value Stream Mapping – Future Scenario

3.4. ACT

All of the improvements (Table 2) have been suggested to be applied on a long-term basis. The methods for standardizing the adjustments are being prepared in accordance with the concerned organization's regulations and policies. This phase also entails educating factory employees and all other stakeholders about 5S, correct tool storage practices, bay cleanliness, and simple Lean approaches [9, 10]. The numerous checklists were created to ensure uniformity.

Based on the findings, a better plant architecture is created, as illustrated in Fig 8. The hatching part depicts the area that might be freed for automobile movement. Inside the factory, unwanted furniture items might be eliminated; similarly, the previous GM's office could be repurposed to increase parking capacity if it is not put to any other use. Furthermore, client parking is prohibited within the organization's facilities, and this space might be utilize to store processed autos. Customer parking for four-wheedler is available on the side of the road.

Table 2. Solutions to the Root Causes

Primary Causes	Secondary Causes	Solutions
Redundant motion of cars	Lack of Lean awareness	A training workshop for the technicians and other staff to be conducted by an expert
	Clutter of cars	Improvement in parking layout
		Make the best use of the available space by assigning prioritiesto the cars
Excess Inventory	Space constraints at the parking area	Customer and test drive parking requirements could be broughtunder check by taking the advantage of the parking facility outside the premises of company
	Change in process lead times of the cars	All the cars inside the plant need to be prioritized based on thedelivery time and processed accordingly. Visual Balkan couldbe put to use
Shortfall of Spares	Some spares are not available instantly	Adequate stocking of spares could be undertaken. Nonetheless, proper planning of the same needs to be done to prevent pile up.
	Warranty on damaged parts necessitates the need for testing and inspection. Thisalso increases the lead time	Parts on warranty can take precedence over the others and canbe tested quickly.

4. CONCLUSIONS

- Any sector may benefit from the Lean principles. This study demonstrates that the Lean strategy may be used and implemented in any automotive repair company. The following are some of the most important lessons learn during the research.
- Because it does not require the engagement of highly experienced personnel, the application is quite simple and can be developed at a low cost. A short training of the existing employees is required to raise awareness.
- The 5S principle, which is a Lean tool, is an effective strategy that may lead to continuous improvement. Once you've mastered the five stages, you'll notice an instant difference in your workplace by establishing a visual environment. It employs a multifaceted approach to productivity development rather than a single strategy.
- Lean manufacturing entails a high level of awareness and participation, which leads to a highly productive work environment.

Using computer simulation tools, the findings of the investigation were checked and validated (ARENA)

.

As a result of the investigation, the plant's automobile traffic has decreased. If all of the proposals were implemented, the number of automobiles on the road would grow by up to ten each day. The company's feedback on its operations is overwhelmingly good. Encouraged by its performance, the Company has informed us that they want to pilot some of our other proposals in Toto.

5. REFERENCES

[1] M. L. George, Lean Six Sigma, Data McGowan Hill, New Delhi, 2002.

[2] U. Valentine and M. Stork, 2005, Journal of Food Distribution Research, 36(3), 57-67, The Lean Concept in the Food Industry: A Case Study of Contract a Manufacturer.

[3] S. Chat and N.A. Ganesha, HEF Indian Journal of Higher Education, 3(2), 81-85, 2013, Transforming Higher Education with Lean Six Sigma.

[4] S. Chat, N.A. Ganesha, R. A. Melvin, and R. A. Pound's, 2015, Journal of Mechanical Engineering and Automation, Vol. 5(3B), 81-83, Application of Operations Research Technique to Improve the Performance of a Hospital's HID.

[5] D. Ekes, Root Cause Analysis: The Heart of Problem Solving and Corrective Action, ASQ Quality Press, Milwaukee, 2009.

[6] S. Chat, E.V. GIGO, and N.A. Ganesha, Application of Lean Six Sigma technique in a Hospital Registration Process, International Journal of Productivity and Performance Management, 63(5), 613-643, 2014.

[7] S. Chat, E.V. GIGO, and N.A. Ganesha, 2015, Productivity and Performance Improvement in a Hospital's Medical Records Department: An Application of Lean Six Sigma, 65(1), 98-125, International Journal of Productivity and Performance Management.

[8] S. Chat, and N.A. Ganesha, 2014, Application of lean Six Sigma methodology to reduce the cycle time of out-patient department service in a rural hospital, International Journal of Healthcare Technology and Management, 14(3), 222-237.

