Project Report on

"LEAN MANUFACTURING IMPLEMENTATION IN MACHINING AND LABELLING INDUSTRY USING VALUE STREAM MAPPING"

Submitted in partial fulfilment of the requirement of degree of

Bachelor of Engineering

In

MECHANICAL ENGINEERING

By

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Under the Guidance of

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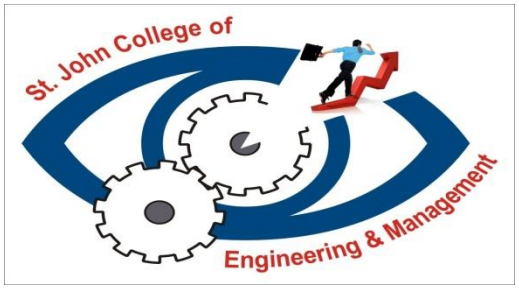

DEPARTMENT OF MECHANICAL ENGINEERING
ST. JOHN COLLEGE OF ENGINEERING & MANAGEMENT
UNIVERSITY OF MUMBAI

2019-2020

CERTIFICATE

This is to certify that it is a bonafide record of project work entitled

"LEAN MANUFACTURING IMPLEMENTATION IN MACHINING AND LABELLING INDUSTRY USING VALUE STREAM MAPPING"

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Submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of "Bachelor of Engineering" in "Mechanical Engineering".

Mr. Vinod Surange	**Mr. Rajesh Bisane**
(Guide)	(Project Coordinator)
Dr. Ajoy Kumar	**Dr. G. V. Mulgund**
(Head of Department & Vice Principle)	(Principal)

ACKNOWLEDGEMENT

This successful implementation and progressing of my project synopsis for the partial fulfilment of Degree of Bachelor of Engineering in Mechanical Engineering would remain incomplete if we fail to express my sincere thanks and affectionate acknowledgement to certain people who had given their valuable time apart from their regular schedule and helping us for completion of this project work.

First of all, we are grateful to our project guide **Mr. Vinod Surange** Assistant Professor Mechanical department SJCEM Palghar and **Mr. Vinod Vazhapulli** Managing Director Skanem India Pvt. Ltd. for suggestions and providing us the opportunities to conduct our project on lean manufacturing implementation in machining and labelling industry.

We express our deep sense of gratitude to **Mr. Sujesh Pandalangat** (General Manager – Labels Business), **Mr. Ashish Patkar** (HR Manager), **Mr. Nilesh Paralkar** (Head of Maintenance), **Mr. Mukesh Sonawane** (Production Supervisor), **Mr. Ganesh Bait** (Asst. Manager Production – Machine Business Unit) for their time to time intimation, guideline and valuable suggestions throughout this project work.

We are very much thankful to **Dr. Ajoy Kumar**, HOD Mechanical Engineering Department SJCEM Palghar for his valuable support and departmental facilities provided for completion of project work.

Last but not least we would also like to thanks to our **Friends** and **Family** who directly and indirectly involve to the work co-ordination, financial co-operation and encouragement for completion of our project.

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DECLARATION

We hereby declare that

a. The written submission represents our ideas in own words and where other ideas or words have been included.

b. We have adequately cited and referenced the original sources.

c. We have adhered to all principles of academic honesty and have not misrepresented or fabricated or falsified any ideas/data/source in our submission.

d. We understand that any violation of the above will be cause for disciplinary action by the institute and can also evoke penal action from the sources which have not been properly cited or from whom proper permission has been not taken when needed.

_____	_____
Mr. Manas Patil	**Mr. Neeraj Salunkhe**
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APPROVAL

This project work entitled

"LEAN MANUFACTURING IMPLEMENTATION IN MACHINING AND LABELLING INDUSTRY USING VALUE STREAM MAPPING"

By

Mr. Manas Patil	**[PID EU1165009]**
Ms. Mrunal Rane	**[PID EU1165012]**
Mr. Neeraj Salunkhe	**[PID EU1165054]**
Mr. Vinit Padia	**[PID EU1165056]**

Is approved for degree of "Bachelor of Engineering" in "Mechanical Engineering" from University of Mumbai

Examiners

1. ----------

2. ----------

Date: _____

Place: _____

Collage Stamp

Certificate of Joining

Skanem Interlabels
INDUSTRIES (P) LIMITED

Date: 01/06/2019

To,
The Principal
St. John College of Engineering & Management
Dist Palghar – 401 404

Subject: Internship Training

Dear **Sir,**

We would like to congratulate the following students, who have been selected for internship with **Skanem Interlabels Industries Pvt. Ltd.** based at **Vasai.** They have been given project in our company on topic **"IDEAL & ACTUAL VSM"** for a period of 2 months and will be starting the project from **10th June, 2019** under the guidance of Mr. Amol Sawant (AGM - MBU) & Mr. Krishnamurthy Hegde (Director – Production).

1. Manas Patil
2. Neeraj Salunkhe
3. Mrunal Rane
4. Vinit Padia

They should report for training at the following address:

Skanem Interlabels Industries Pvt. Ltd.
Survey No 59. Nandan Estate,
Maljipada, Opp Krishna Resort,
Vasai - 401210

Contact Person: Ashish Patkar – Manager – HR & Admin

Yours sincerely,
For **Skanem Interlabels Industries Pvt Ltd.**

VASAI

Ashish Patkar
Manager – HR & Admin

Certificate of Completion

Skanem India Pvt. Ltd.

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Mr. Manas Patil (1165009), Mr. Neeraj Salunkhe (1165054), Mr. Vinit Padia (1165056) and Ms. Mrunal Rane (1165012) have completed their project titled **"Lean Manufacturing Implementation in Machining and Labelling Industry using Value Stream Mapping"** in Skanem India Pvt. Ltd. Vasai East, Under the guidance of **Mr. Vinod Surange** (St. John College of Engineering and Management), **Mr. Sujesh Pandalangat** (General Manager – Labels Business), **Mr. Ganesh Bait** (Asst. Manager Production – Machine Business Unit) from 10th June 2019 to 4th March 2020.

In this project they observed, worked and suggested us few improvements that need to be done in our industry in order to improve the efficiency of the company.

During this period we found them sincere, hardworking and regular in attendance. We wish them best of luck for all future endeavors.

Mr. Vinod Vazhapulli
(Managing Director)

Mr. Sujesh Pandalangat
(General Manager – Labels Business)

Mr. Ganesh Bait
(Asst. Manager Production – Machine Business Unit)

Mr. Ashish Patkar
(HR Manager)

SKANEM INDIA PVT. LTD.

ABSTRACT

Value Stream Mapping is lean-management method for analysing each and every series of events of current state and designing an ideal state which can be useful for other lean strategies within an organisation. Value Stream Mapping begins right from the start where the order of the product or service is received till it is delivered to the customer through all the manufacturing process steps, this all steps are mapped down physically in a chart. Its main objective is to identify and eliminate all non-value-added activities (waste). Mapping down all the steps followed in the production and doing time and motion study, helps us to know the exact state and find out the places where we are going wrong and helps us to improve them by either reducing the wastage or by eliminating it. In this project we have done a case study of a machining and label printing industry and recorded information for the same, here we have identified non-value-added activities like waiting time, wastage of materials, etc. and suggested ideas in order to overcome it. By implementing these ideas, it will decrease the lead time of industry, reduce the wastage of labels, reusing the wasted ones, thereby increasing the company's efficiency in terms of money and time.

Keyword: Value Stream Mapping, Non-Value-Added Activities

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CHAPTER 1

INTRODUCTION

1.1LEAN MANUFACTURING

Lean manufacturing is an initiative followed by various organizations in the recent years which mainly focus on improving the efficiency of operations by eliminating and reducing waste [17]. This system is applied in order to meet the optimum quality of product, reducing the cost and deliver the targets in the most efficient way. The main objective of lean manufacturing is to identify as well as eliminate waste. Its main focus is to eliminate or reduce non-value-added waste. To achieve the goal of lean manufacturing, lean fundamental principles are implemented to construct VSM for identification and elimination of wastes by using team formation, product selection, conceptual design, and time-frame formulation through TAKT time calculation. Based on the future VSM, final results are then showed by implementing some lean thinking techniques. The concept of LM was proposed by a Japanese automotive company, Toyota, during 1950's which was famously known as Toyota Production System (TPS). The first goal of TPS was to improve productivity as well as to decrease the cost by eliminating waste or non-value-added activities [16]. Lean manufacturing tools and techniques such as just-in-time, cellular manufacturing, total productive maintenance, 5S and production smoothing have been consistently applied in different discrete manufacturing systems involving automotive and electronics. Lean tools acts as a coordinated approach, along with the lean thinking provides administrators with reliable, accurate and timely information for decision-making. Hence implementation and control, of lean system as new approach becomes for strategic management approach. It is called "Lean" because this technology, or a process, helps manufacturers to produce more with less time, inventory, capital and fewer resources. The concept of Lean manufacturing is to eliminate waste in the production that does not create value for the products or customers. The implementation of Lean requires management to grasp current processes so that problems and opportunities for improvement can be identified. Poor implementation or partial vision of the situation may lead to an unsuccessful journey.

There are five steps to implement lean thinking in company:

1. Define value from the perspective of customer
2. Determine the value streams
3. Achieve flow
4. Schedule production
5. Seek perfection through continuous improvement (Kaizen)

Seven types of waste can be considered in Lean manufacturing process. The types of waste are as follows:

- Waiting
- Over production
- Unnecessary motion
- Extra processing
- Inventory
- Extra movement of employees and equipment
- Defects

While eliminating waste from manufacturing process it is necessary to focus only on waste elimination, as it may cause the value flow to come to a halt since only one small part of the value stream is taken into consideration. Therefore, improvement goals should be applied to the whole flow.

1.2SIX SIGMA AS LEAN MANUFACTURING TOOL

For the improvement in process six sigma techniques are implemented. Six Sigma strategies improve the quality of the output of a process by identifying and removing the causes of defects and minimizing defects variability in manufacturing and business processes. It uses quality management methods, mainly empirical, statistical methods, and creates a special organization of people within the organization who are experts in these methods. Six Sigma project carried out within an organization follows a sequence of steps and has specific targets, for example: reduce process cycle time, reduce pollution, reduce costs, increase customer satisfaction, and increase profits. In the context of supply chain as well as hospitals, local government, public sectors and because of that growth has increased, six sigma principles have also been implemented in service industries. Not only in the area of products but also in processes and has increased pressure of globalization upon the world market but also business competitiveness is currently dependent upon the innovative abilities of companies. As its implementation has achieved significant cost reductions, mainly in the machine, automotive, and electric and technical industry, six Sigma methodologies (SSM) is used as the process quality assurance and improvement method. Not only in the industrial enterprises but also in the area of the services, health, and public administration, both in the private and public field but also Six Sigma has been applied where there is a strong orientation on the customer, quality, time, and performance. Leading to the reduction of defects in the products using the same labour, technology, and design, while consuming less cost, the application of SSM brought about changes within a short time, Six Sigma processes show a proven approach for businesses and organizations to improve their performance and that sustainability programs are in need of this operational approach and discipline. Business leader can design a sustainable program for value creation with the help of six sigma. In Six Sigma projects true and quantum gains can be achieved by customizing the problem and paying attention to each and every variable which is responsible for manufacturing the desired product/services at minimum possible cost. The integration of Six Sigma with lean manufacturing and supply chain management and other innovative management techniques will be ideal solution for achieving maximum productivity.

1.2A DMAIC as an integral part of Six Sigma

DMAIC is a five-phase cycle focused on the ability to define, measure, analyze, improve, and control processes. It is designed to help a project run more efficiently and provide structure. Using this method, each change throughout a project is carefully analyzed based on relevant data. If a new change or opportunity arises during a project, the DMAIC cycle is repeated. The purpose of this step is to clearly pronounce the business problem, goal, potential resources, project scope and high-level project timeline.

1. **Define:** The purpose of this step is to clearly pronounce the business problem, goal, potential resources, project scope and high-level project timeline.
2. **Measure:** This is a data collection step, the purpose of which is to establish process performance baselines.
3. **Analyze:** The purpose of this step is to identify, validate and select root cause for elimination.
4. **Improve:** The purpose of this step is to identify, test and implement a solution to the problem; in part or in whole.
5. **Control process:** The purpose of this step is to embed the changes and ensure sustainability

Key Principles of DMAIC are:

- Focus on the customer.
- Identify and understand how the work gets done (the value stream).
- Manage, improve and smooth the process flow.
- Remove Non-Value-Added steps and waste.
- Manage by fact and reduce variation.
- Involve and equip the people in the process.
- Undertake improvement activity in a systematic way.

1.2. B LEAN KAIZEN A TOOL OF SIX SIGMA

Kaizen is referring all the business activities which includes continues improvement right from the upper management to cleaning team. Regularly small improvements are suggested to everyone. Kaizen can be applied to any area where improvement is needed.

Kaizen is an approach that,

- Starts with people
- Focuses its attention on people ‘s efforts
- Processes are continually improved
- Improved processes will improve results
- Improved results will satisfy the customers

For betterment of the processes kaizen technology is an inspiration. It can be implemented to any area where there is need for improvement. There are no specific instruments or techniques for implementation of kaizen. Many companies in India are improving their ability to compete globally. Improving customer service, making operation faster, more operation and reduction in costs are some of the challenges faced by manufacturers today. Just in Time (JIT), Total Quality Management (TQM), Total Productive Maintenance (TPM), Kaizen etc. are different techniques of waste reduction. Improving the productivity and quality of the products are lead roles shown by kaizen technology. First the whole process is observed carefully and noted down where the errors/ improvements are to be done so that there will be no issue in the further process because of previous changes in the process. The aim of this study is to provide a framework for management teams to utilize kaizen as a learning tool for making decisions, assessing events, and determining the resolution for moving forward. In addition, it would help members of the management team to completely reflect and set the next course for kaizen activities in becoming much more effective and efficient in attaining the stated objectives as well as helping to reach the goal. Kaizen teaches us on how to divide the processes and analyse them instead of wholly concentrating on improving the process of production and marketing (quality control), or focusing on quality by restructuring the processes in order to avoid reworking (six sigma), or meeting the speed by cutting down on complexity, redundancy, and non-value added steps. The ultimate objective of Small medium manufacturing industries today is to increase productivity through system simplification, organizational potential and small incremental improvements by using modern techniques. Respond to rapidly changing customer needs, desires and tastes are encountered by many of the manufacturing industries. For industries, to remain competitive in market, continuous improvement of manufacturing system processes has become necessary.

1.3 VSM AS A MAJOR TOOL OF SIX SIGMA

Value Stream can be defined as visualization of all the processes going on in an industry in form of map with use of symbols, metrics and arrows. A value stream map gives us a complete idea of all the processes right from the start till the order or service is being delivered; in other words, it is a sketch of a production line. Value stream map is techniques that bring the all processing steps at one place. It shows the big picture of shop floor rather than individual processes and improving each area at the production line, by physically mapping/measuring all the processes it becomes easy for us to find out the faults or our drawbacks where we are lacking and we can focus on those areas and improve. It is similar to that of lean Kaizen methodology that states continuous improvements, eliminates waste and boost efficiency. During the implementation of VSM the managing staff needs to completely identify the processes and wastages going during the production which can be anything that does not add value to our product, VSM involves both value-added activity as well as non-value-added activities. Value-added activities are those in which the customer is willing to pay for it and it focuses on process variation resulting in waste whereas no non- value added services are those which does not add value to our product i.e. waiting time, wasting of resources etc. a failed implementation of VSM can lead to loss of time as well as money. In today's world there is no manufacturing industry without waste so reducing it is very crucial process in lean manufacturing and just focusing on a single process isn't going to help in order to reduce it, hence there should be a complete study of all the processes and reducing waste from each and every place should be the main motive. VSM is ideally used in order to represent the actual and ideal state of the processes going in industry. In order to implement a proper VSM we need to follow following stages:

I. Collecting and measuring the data require for mapping the ongoing process in industry and drawing an actual map.
II. Identifying drawbacks and wastages.
III. Developing ideas which will help us to improve and overcome drawbacks and wastages.
IV. Making of ideal state map.
V. Implementation of ideas.
VI. Calculating the expected outcome.

It is necessary that every process as closely as possible produces only what its customers need when they need it. The existing processes have some types the waste in production line which is the result of product design and machinery. Value stream management is the discipline of measuring, evaluating, and integrating activities in the value stream to achieve a competitive advantage. VSM is a specific methodological tool for studying the value stream and identifying nonessential activities that do not add value. VSM has been described as one of the most powerful lean tools for an organization wanting to plan, implement and improve on its lean journey and is considered a critical step in the lean management process because it "allows a company to document, measure, and analyse a complex set of relationships as well as plot a course to create an improved operating strategy and organizational design.

1.4 SYMBOLS USED IN VSM

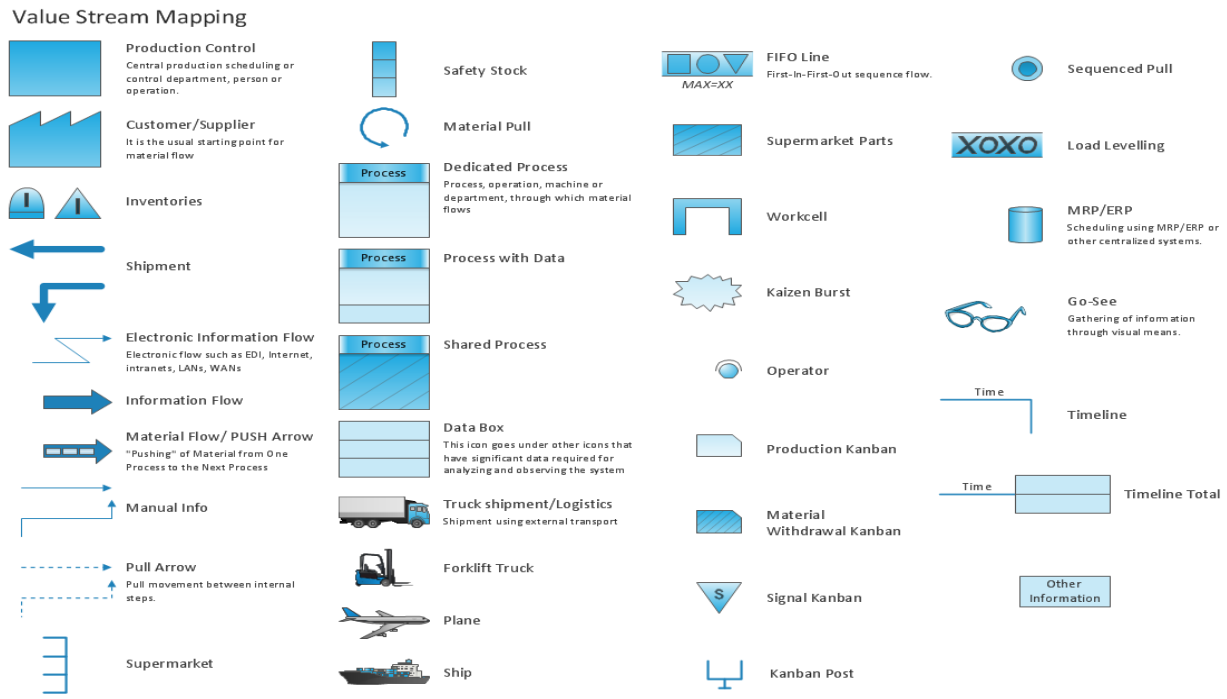


Fig 1.4Symbols used in Value Stream Mapping

Process: A process is represented with a rectangle and the word "Process". To make the value stream map more readable, a process will often represent the collective processes of an entire department.

Inventory: A triangle with an "I" inside represents the exchange of inventory during the process.

Shipment: Shipments of raw materials from suppliers are represented with blank wide arrows. A pushing of materials from one step in the process to another is usually marked with a black arrow with three white squares inside. Shipments made using external suppliers are represented with a truck or another vehicle where applicable such as boat or train.

Supplier and Customer: Suppliers and customers share the same symbol that looks like an abstract, geometric representation of a factory. A supplier usually will mark the beginning of a process and will be found to the left of the value stream, while a customer is often found as the last step, to the far right of the value stream map.

Supplier/Customer

Electronic flow: A line with a zigzag in the middle refers to electronic information and data exchanges. While a lot of value stream mapping focuses on raw materials and products, electronic exchanges should also be checked because they can be the root of delays and waste.

Electronic flow

Kaizen burst: A Kaizen burst, also known as a Kaizen blitz, refers to a short burst of activity that solves a problem with intensity and urgency. Appropriately, it's represented with what looks like a cartoon explosion.

Kaizen burst

Go see: A go see refers to confirming something visually during the process and it's often represented with a pair of glasses.

Go see

Quality: A quality problem anywhere along the chain can be marked with an octagon, like a STOP sign, with the letter Q inside.

Quality problem

1.5 COMPANY VISION AND PROFILE

Skanem is one of the leading producers of self-adhesive labels with 11 production sites across 8 countries in Europe, Asia and Africa. Skanem India Pvt. Ltd. produces customized labels and label applicator machines. They provide high quality Labelling solutions, adding value to the customers supply chain through professional handling of the design, printing, stock management and logistics.

Here solutions are proposed for different market sections like food beverages, personal care, and home care, automotive, industrial and pharmaceutical industries. Mission is to add value to our customers' supply chain. Smarter labelling solutions means that they work closely with customers to understand their specific needs and then offer a customized solution which is best suited and most cost efficient for them. At Skanem they keep their customers ahead, by ensuring the right design, the correct printing process and the best materials.

In Machine Business they make label applicator machines according to customer's requirement. They make 6 types of label applicator machines such as top Labelling, front and back Labelling, hologram, customized Labelling, special purpose label applicator machine.

Labels Business has all print technologies available including flexo, offset, letterpress, screen and digital, with all decoration possibilities including Gravure, hot and cold foil. Digital technology is part of their offering in order to make sure that they can offer a competitive solution for smaller volumes.

Fig 1.5 Industry Name and Logo

CHAPTER 2:

LITERATURE REVIEW

2.1 Process Improvement Through Lean-Kaizen Using Value Stream Map a Case Study in India.

- **Author(s):** Sunil Kumar & Ashwani Kumar Dhingra & Bhim Singh.
- **Publication:** The International Journal of Advanced Manufacturing Technology, 30 January 2018.
- **Abstract:** Lean-Kaizen consists of two words lean means elimination of non-value added activities (waste) and Kaizen means continuous improvement. The fundamental aim of Kaizen is to improve operations. Hence, Lean-Kaizen means continuous elimination of wastes through small-small improvements. This paper presents implementation of Lean-Kaizen concept in a small- and medium-scale enterprise (SME) at a non-capital region in India. The study demonstrates the identification and implementation of Kaizen events and its associated benefits. It is a straightforward improvement technique that assists in eliminating different inefficiencies in the organizations. It follows an umbrella concept which focuses on the process improvement by eliminating wastes in process; thus, it provides base for lean manufacturing (LM) that directed towards achievement of continuous improvement. Methods are applied for improving product quality to attain continual improvement with process safety. The existing situation of the shop floor of selected SME was recorded, and current state map was prepared. The takt time was calculated, and bottlenecks were identified. Finally, a future state map was developed and gap areas were identified that served as a guide for determining the future lean activities. The "5-why" method was employed for identifying root causes in order to bridge the identified gap, and Kaizen events were proposed as solutions. In this study, two Kaizen events were proposed. In the first Kaizen event, the poka-yoke technique was used to control the variation caused by the slide of cylindrical grinding machine which eliminated wheel touch mark problem on the selected product. In the second Kaizen event, the brainstorming technique was applied to clamp the work-piece on the serration side rather than the slot side which eliminated the roughness on outer diameter. The study proposed Kaizen events to bridge the gap between current and future state of the fabrication process and after applying Taguchi experiment design and rabbit chasing techniques. The study concluded that VSM can reduce all system wastes, minimize resources and optimize organizational performance level.
- **Conclusion:** After having gone through the extant literature, it is observed that the lack of understanding of lean in Indian SMEs is still deprived of many lean benefits. A few studies of successful lean implementation were recorded in the literature in context to Indian organizations. This case study is an attempt to implement the Lean-Kaizen concept using value stream mapping in order to reduce wastes that existed in processes and procedures of the selected company. The study demonstrates a road map to tackle the various wastes. The results of case study conducted in Indian manufacturing industry demonstrate the effective way to identify and eliminate waste. The study reported benefits such as reduction in machine setting time by 65.85%, manpower by 40%, production lead time by 69.47%, and value added time by 75.25% which smooth production and ease working condition of the industry. The case study can help the managers and the practitioners in order to identify wastes in the procedures and processes of their organization. Further comparison with other waste elimination technique and cost-benefit analysis of future state map can be made.

2.2 Review Paper on Productivity Improvement by Value Stream Mapping

- **Author(s):**Pradip Gunaki, S.N. Teli, Fauzia Siddiqui.
- **Publication:** April 2015, Volume 2, Issue 4Journal of Emerging Technologies and Innovative Research (JETIR) (ISSN-2349-5162).
- **Abstract:** Value stream mapping (VSM) is a lean manufacturing tool, which originated from the TPS, is known as "material and information flow mapping." This mapping tool uses the techniques of lean manufacturing to analyze and evaluate certain work processes in a manufacturing operation. VSM it has been used to re-engineer businesses because it identifies unnecessary effort and resources to permit simplification and streamlining of operations. Aims to achieve the same output with less input; such as less time, less space, less human effort, less machinery, less material and less cost. Any variation in the material flow in the shop floor sections effect on the productivity of the company so VSM can be used where such deviations are present. VSM of a process serves to describe a highly complex real system in a less complex 2-D format. Standard terminology, symbols, and improvement methods allows VSM to be used as a communication tool for both internal communication and sharing techniques and results with the larger lean community. This tool is used primarily to identify, demonstrate and decrease waste, as well as creates flow in the manufacturing process. VSMs can be created merely using paper and pencil. It helps to identify and eliminates non-value added activities. The process is analyzed for opportunity to drastically reduce and simplify it to the fewest actions necessary. After drawing current state map, the cycle time, cost, quality, wastes and productivity with respect to current state map are calculated and reasons behind the problems are found out. By reducing wastefulness, the proportion of value adding time in the whole process rises and the process throughput speed is increased. Besides shortening of lead time, cost reduction is also imperative for every company, so monitoring and control of manufacturing cost over the time can be driving force for improvement. This paper discusses the utilization of lean manufacturing techniques in Manufacturing Industry. The VSM used to improve the flow of information and materials thereby improvement in the productivity eliminating wastes. The process analysis is carried out by collecting the data from various enquiries with expertise in shop floor, workers and directly participating in measuring the time of various processes. Mass production era is over and new accounting systems are needed for modern manufacturing strategy, such as lean manufacturing.
- **Conclusion:** VSM is continuous improvement process; we must keep on changing future state into current state that will not end during our life. VSM have been proven to be a greatly useful tool to eliminate some waste in a cycle and find there are more waste for us to eliminate in next cycle, during which lean becomes a habit or culture. The technique of lean tool can be applied to every situation in a company by finding out what customer wants and eliminating waste. The idea is to create culture in which people at various levels of an organization are continuously improving their production every day & in every way.

2.3 Application of Value Stream Mapping for Reduction of Cycle Time in a Machining Process

- **Author(s):** K. Venkataraman, B.VijayaRamnath, V. Muthu Kumar, C. Elanchezhian
- **Publication:** 3rd International Conference on Materials Processing and Characterization (ICMPC 2014)
- **Abstract:** Value stream mapping is a method of lean manufacturing which uses symbols, metrics and arrows to show and improve the flow of inventory and information required to produce a product or service which is delivered to a consumer. Lean manufacturing initiative is being followed by various organizations in the recent years which mainly focus on improving the efficiency of operations by eliminating and reducing wastes. VSM tool is used to identify and reduce defects, unnecessary inventory, and motion Lean manufacturing enhances production processes and boosts the employee's job satisfaction. This paper aimed to explain the implementation of lean manufacturing techniques in the crankshaft manufacturing system at an automotive manufacturing plant located in south India. A multi criteria decision making model, analytical hierarchy process is applied to analyze the decision making process in the manufacturing system. The objective of the case industry was to increase the export sales. Lean manufacturing system was selected to meet the company's quality, cost and delivery targets. The project findings are that the entire crankshaft manufacturing system was established using lean manufacturing tools. Crankshaft was manufactured in a single piece flow system with the low cost machines developed indigenously and the results are that the crankshafts have passed the testing, validation and approval by the customer to produce any variant in the company. Wasteful steps that have to be eliminated and flow can be introduced in the remaining value-added processes. The cycle time refers to the time it takes an operator to go through all of their work elements before repeating them. The lead time refers to the time it takes one piece to move all the way through the process from start to finish. It is total of all value added time and non-value added time. After identifying the non-value added steps in the current state, a future state value stream map is developed which acts as blueprint for lean activities. The future state value stream map often represents a significant change compared to the way the company currently operates. After implementing lean manufacturing system, the manufacturing lead time reduced by forty percent, defects were reduced, higher process capability achieved, quick response to the customer demand in small lots were achieved.
- **Conclusion:** Lean manufacturing system implemented in this paper is done in a crankshaft manufacturing cell to eliminate the 8 non-value adding wastes like over production, waiting, unnecessary transport movement, defects and unused employee creativity from the manufacturing system and also to create product mix flexibility in the manufacturing cell. The limitation in this research is that the crankshaft manufacturing cell set-up changeover between the crankshaft variants is not within the takt time of 126 seconds and the agreement with the customer is also to produce one variant for one week and changeover to the next variant, will not have an impact on the project.

2.4 Does Value Stream Mapping Affect the Structure, Process and Outcome Quality In Care Facilities?

- **Author(s):** Holger Pfaff, Marina Novak and Ute Karbach.
- **Publication:** Cross mark, August 2017.
- **Abstract:** The VSM method represents the work flow, quantification of the resources needed and restructuring of the workflows into an improved version with focus on the patient's needs. Therefore, VSM aims to reduce unnecessary process steps and time. As they create no value for the patients, these aspects are non-value adding. Simultaneously, process steps and time which improve quality of the process for patients, like face-to-face contact with the physician, are aimed to be increased. These are services which patients would be willing to pay for are called value adding.VSM can be described in six phases. In the first phase of the VSM method, a current state map of all processes is developed, including a pre-measurement. The second phase follows with identifying wastes based on this map. Solution approaches for improvements of the process are developed in the third phase, being converted into a future state value stream map in the fourth phase. Subsequently, in the fifth phase, implementation of the new process begins, finishing with an outcome measure with all findings as the sixth and last phase. Studies from various settings within care facilities are proposed by this approach. In the application areas as well as the accuracy in describing the setting differ between the studies. VSM is applied to the emergency department in four of the 22 studies. Five studies are conducted in surgical services or operating theatres directly. In five studies, the authors carry VSM out to improve administration processes, whereby one of these studies is also applied in a surgical service department. Pharmacy or medication operations are examined in three studies. Two further studies are conducted within outpatient units. The setting of the remaining four studies cannot be categorized as inpatient rehabilitation unit or complex chronic care management.
- **Conclusion:** The search strategy identifies 602 peer-reviewed articles after removal of duplicates. After title screening, 329 articles proceed to abstract screening. This further reduces the number to 230 relevant for full-text screening whereby 7 are not available. Finally, 22 studies full fill the inclusion criteria for the qualitative synthesis. This review concludes that a final and evidence-based evaluation of VSM in health and social care organizations cannot yet be made. However, it is assumed that an application of VSM has a positive effect on the process and outcome quality of health care organizations on a time dimension. Specifically, it seems to be able to reduce non-value-added time such as waiting time and length of stay of patients, increasing value for the patient. Further research with high methodological quality is needed with respect to the study design. This should especially be performed with a focus on statistical analyses and within logical and contextual models to fulfill the guidelines concerning evaluations of complex interventions.

2.5 Production Line Analysis Via Value Stream Mapping: A Lean Manufacturing Process of Colour Industry

- **Author(s):** Jafri MohdRohania, Seyed Mojib Zahraee
- **Publication:** 2nd International Materials, Industrial, and Manufacturing Engineering Conference, MIMEC2015.4-6 February 2015, Bali Indonesia.
- **Abstract:** Lean manufacturing is one of the important steps in order to carry out processes in industry smoothly. The main motive of this paper is to increase the output and reduce the cost of product by using lean manufacturing. The main goal of lean manufacturing approach is to reduce the cost by eliminating waste and non-value added activities. Value stream mapping (VSM) is a tool of lean manufacturing which focuses on value added activities and non-value added activities. It includes all the activities that are essential to bring a product through the main flows, starting with raw material and ending with the customer. The first step is to select a specific product or products the target for improvement. The second step is that to develop a current state map of all the processes capturing how processes are currently being done. The third step is to develop future state map that is a picture how the production process should be done after the wastes and inefficiencies have been removed. The future state map is created based on answering a collection of questions on topics relevant to efficiency as well as implementing technical issues related to the application of lean techniques. Finally, the suggested map is applied as a basis for making essential changes to the system. Mainly the techniques which are followed by VSM is Just-In Time(JIT) production where by a visual signal helps flow by 'pulling' product through the process as required by the customer, a changeover reduction technique (5S). 5S concentrates on efficient workplace organization and standardized work events, it is a housekeeping method which entrusted control to the shop floor. In the current state map of this paper the issue of the material flow data collection began in the distribution section and also worked rearward for the stamping development collecting image data like catalogue levels earlier than beginning every process, cycle times (CTs) process, quantity of employees, and convert (CO) times and in the future state map bottlenecks were identified, 5s principles were implemented to eliminate waste that results from a poorly organized work area. By implementing these ideas, the map was prepared on the basis of improvements.
- **Conclusion:** The goal of this paper was to develop a value stream map for a colour industry to determine and eliminate the wastes that did not add value to the final product. It also aimed to reducing lead time and value added time to increase the total throughput. Based on future VSM, final result showed that by implementing some lean manufacturing techniques such as 5S, Kanban method, Kaizen and so on Production Lead-time (PLT) decreased from 8.5 days to 6days, and the value added time decreased from 68 minutes to 37 minutes. More investigation can be done by combining the VSM and computer simulation to evaluate more effective factors that have a significant effect on the total throughput based on decreasing wastes.

CHAPTER 3

AIM AND OBJECTIVE

AIM: Executing ways to improve the efficiency of industry with the help of Value Stream Mapping.

OBJECTIVE:

1. Time Saving.

The time required to deliver a service is comparatively more, hence to reduce the lead time and focus on the areas where one can actually save which will increase the company's efficiency in terms of time was our major objective.

2. Identify and Reduce Waste.

The wastage of labels is major issue as it can affect environment in some or other way, it even causes wastage of money and hence identifying the reason for waste i.e. either because of labour or machine and then developing ideas in order to decrease the wastage of material thereby saving money is our other objective.

CHAPTER 4

PLAN OF ACTION

Plan of Action

	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20
Literature Review										
Recording Data										
Preparing Charts										
Verifying with Supervisors										
Discussion of our Ideas										
Presentation of Data										
Modification and rectification of errors										
Output Analysis										
Final VSM Charts										
Report Generation										

Table no. 4.1 Plan of action

CHAPTER 5

METHODOLOGY

Methodology

The major aim of Value Stream Mapping is to increase the organization efficiency in terms of time and money. In this we recorded the data for each and every process that takes place in industry and developed current VSM charts there after identified the places on which we can work so that the lead time can be reduced and developed ideas for the same.

- **Selection of Process Flow:** Initially we need to select a process flow and track it down.
- **Collection of Relevant Data:** Related data was collected by observation, through questioning people working in that area.
- **Create Current VSM Chart:** After recording data a current state map is obtained.
- **Identify the Nature of Waste:** After observing closely each and every process waste is identified.
- **Analysis of Current State Map:** Looking for places where we lag and developing ideas in order to improve it.
- **Create Future State Map:** Creating a Future State Map.
- **Suggestion for Improvements:** Suggesting ways in order to improve machinery and flow.

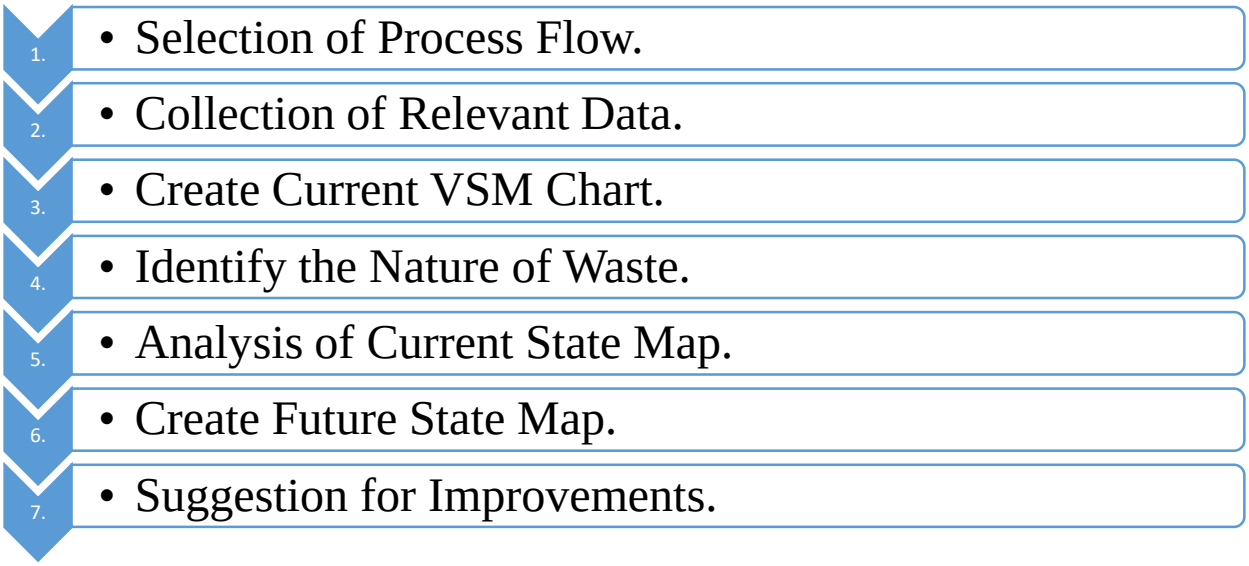


Fig 5.1.1 Methodology

CHAPTER 6

CASE STUDY

6.1 LABELS BUSINESS

6.1.1 Current State Map of Labels Business

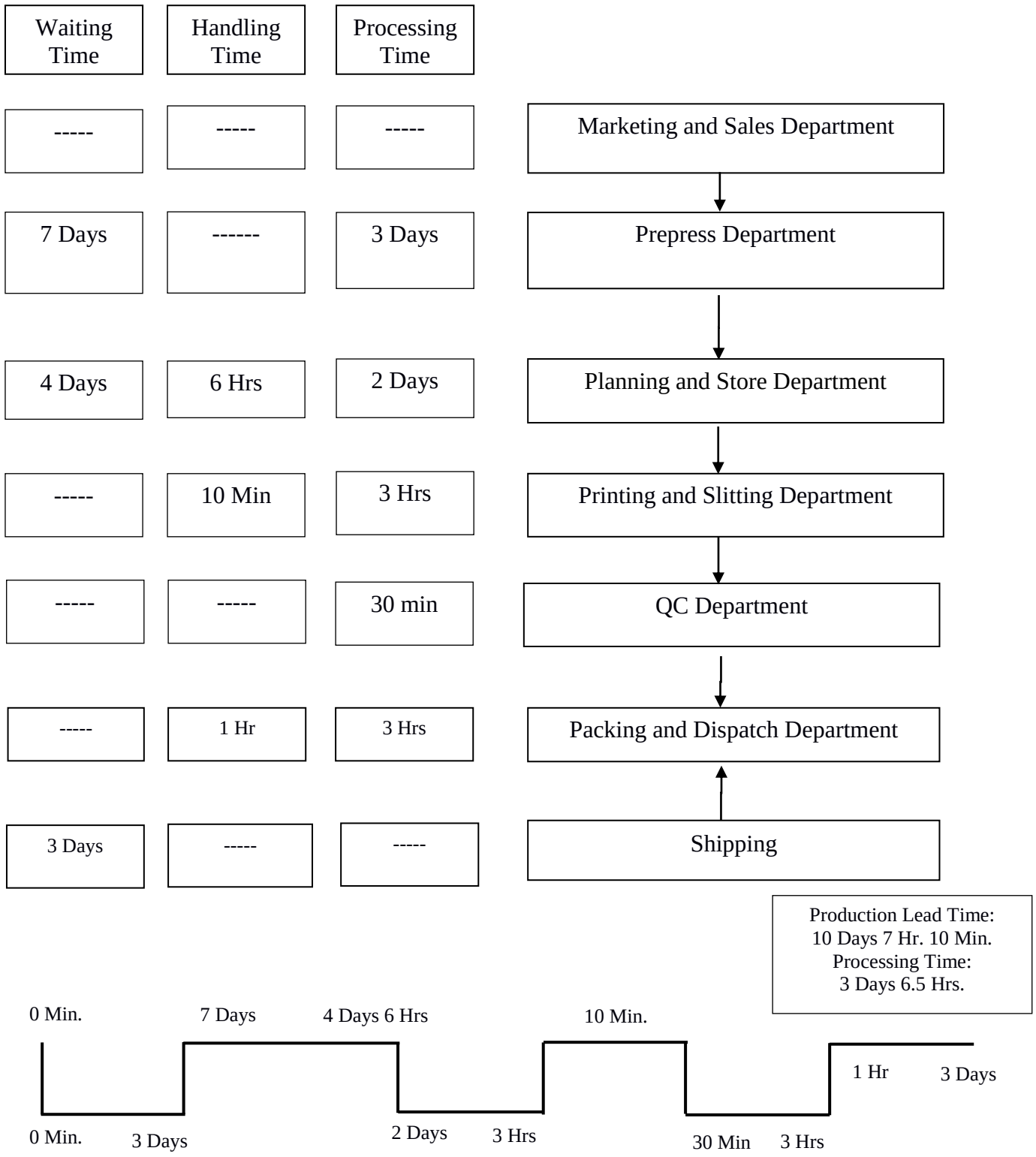


Fig 6.1.1 Current State of Labels Business

a. Marketing and Sales Department

The work of marketing and sales department is to work for the promotion of the company and get orders. Each and every person coordinate with the respective customer for the orders, the orders is usually received via emails along with their artwork and material requirements. The time required can't be specified as it completely depends on customer. Then the artwork is then forwarded to prepress department.

Usually the orders are of 3 types:

i. New Order
ii. Repeat Order
Proofing Order

According to it the time required for production varies.

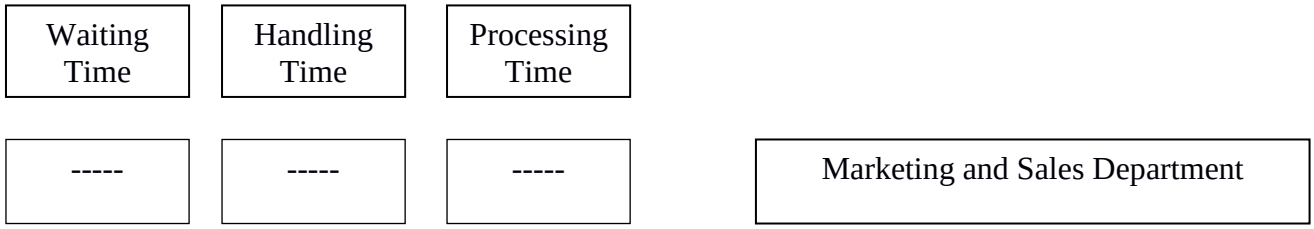


Fig 6.1.1.a Current State Map of Marketing and Sales Departments

b. Prepress Department

After receiving the order from the sales department the prepress department starts working on the artwork and develops it, with shade and other requirements of the label and then send it to the customer for verification, after confirmation from the customer they start processing the plates of printing cylinder and thin die plate which does the work of blanking and is mounted on magnetic cylinder. After completion of designing the plates a Purchase Order is send to planning department. Fig (6.1.1.b) shows the current state of prepress department along with the time taken to complete the whole process.

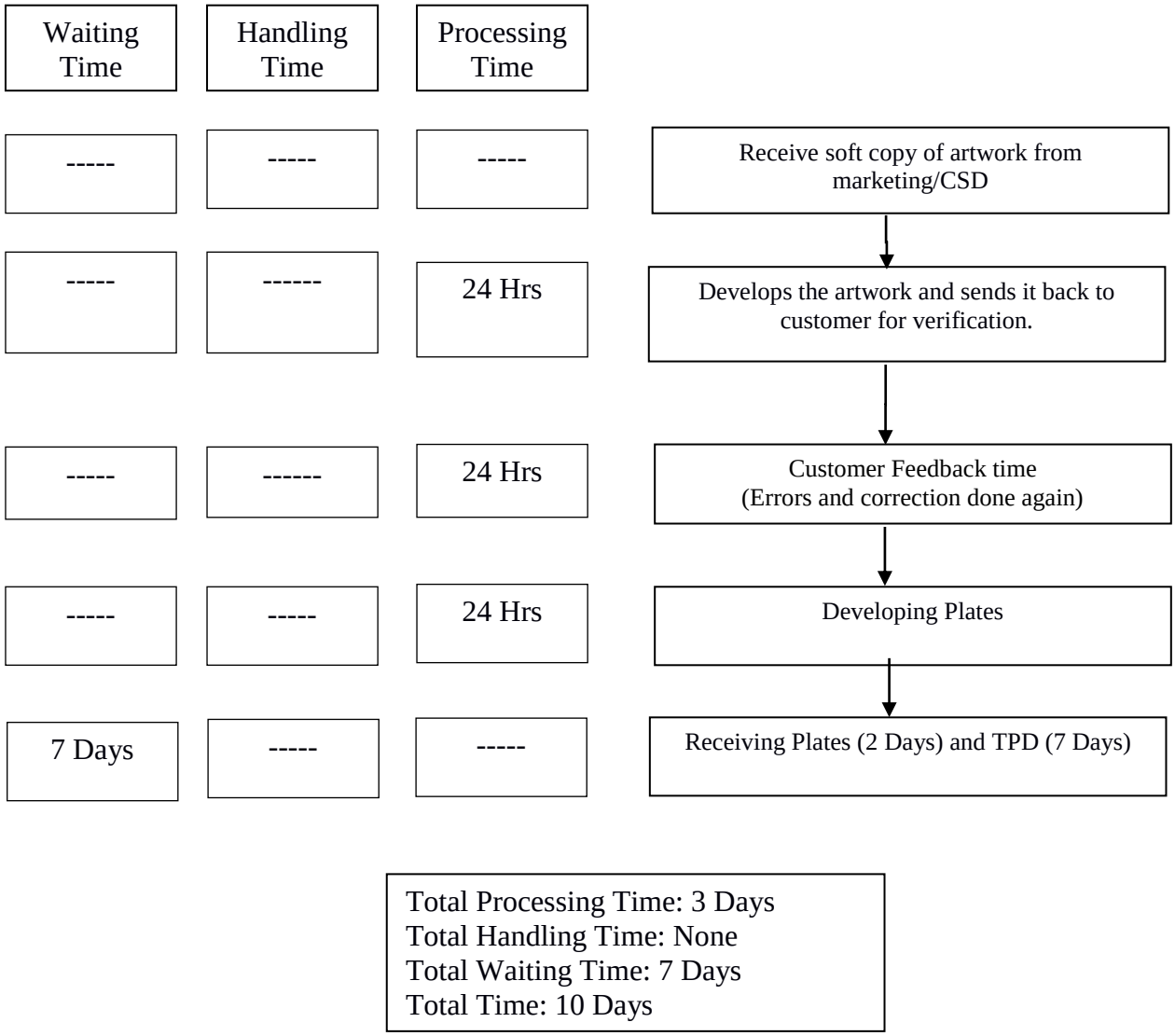


Fig 6.1.1.b Current State Map of Prepress Department

c. Planning Department and Store Department

After the finalization of artwork and ordering of plates, the planning department orders the required raw materials from the vendors which takes them 1 day to complete the procedure and they even keep a track on the delivery of those materials which are usually delivered after 4 days from order, once the raw materials are received the store department updates them about the arrived material and segregate it accordingly it takes 6 hours for the segregation process to get complete. Planning department then schedules when the job has to be taken for printing, they plan for daily basis according to the customer requirement and hence the process takes 1 day.

Both prepress and planning department start working on same day as soon as the order is received.

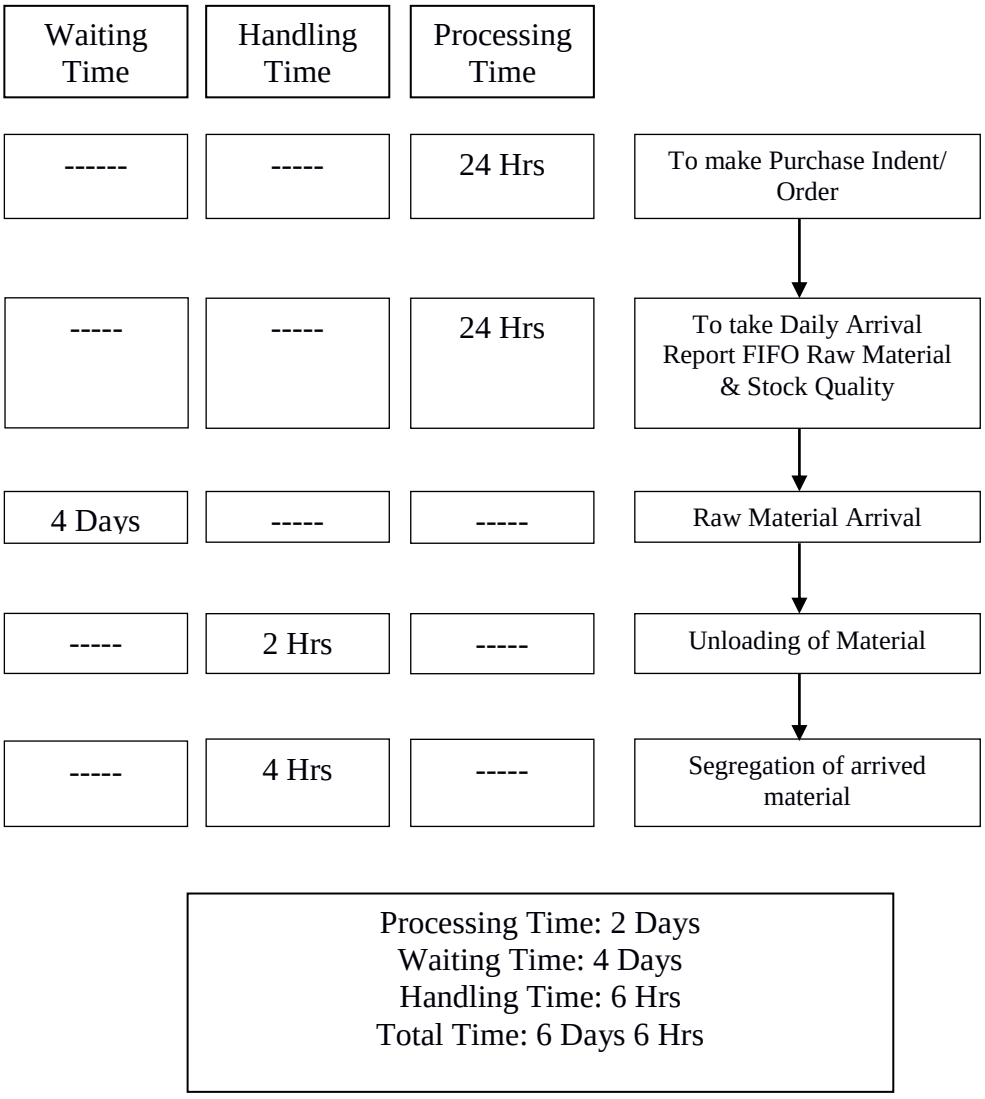


Fig 6.1.1.c Current State Map of Planning and Store Department

d. Printing Department and Slitting Department

Once the job is being scheduled the raw materials are transferred to the shop floor from store then the changeover of the previous job takes place, the average time required for change over is 60 min. Then the printing of job takes place the time required completely depends on the running meter required by the customer. After printing the job is taken for slitting where they make rolls according to requirements of the customer. It usually takes them 60 min for doing slitting.

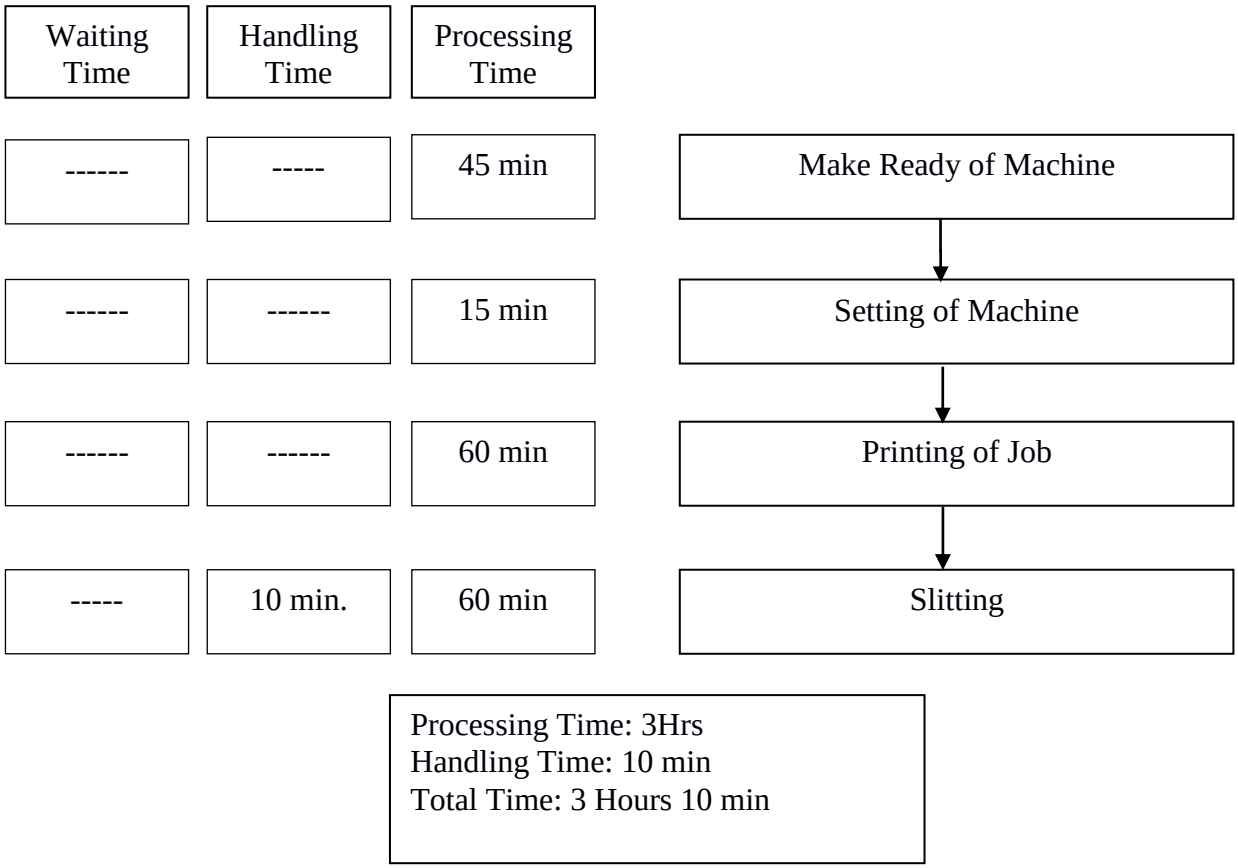


Fig 6.1.1.d Current State Map of Printing and Slitting Department

e. QC Department

Here labels are checked by sampling inspection. A sampling plan has been provided so that they can see the acceptance limit of labels out of the total batch. They check the quality of labels which include its dimension, shade, text, defects etc. and takes 30 min. for each job of 2000rm.

According to it the time required for production varies.

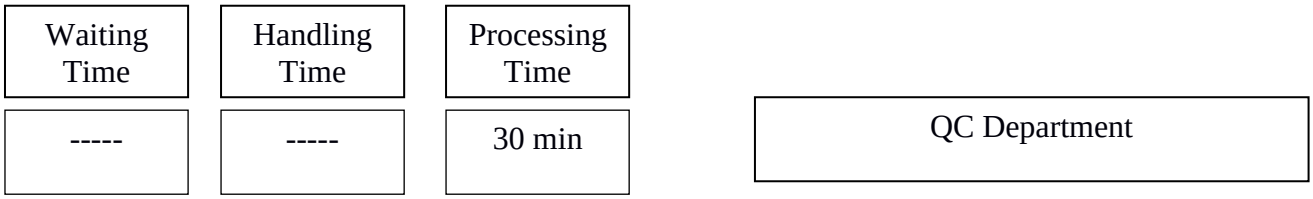


Fig 6.1.1.e Current State Map of QC Department

f. Packing and Dispatch Department

After the job has passed QC inspection the job is transferred to packing department where they wrap plastic over the bundle of job and pack in box and paste the dispatch slip on the box. The process takes 5 min for one box. The sales department sends the data to the dispatch department when which job is to be dispatched along with GST invoice and challan and then the job is transferred to the vehicle and dispatched.

Waiting Time	Handling Time	Processing Time	
------	-----	15 min	Plan from Planning Dept.
-----	-----	15 min	Sales order from sales team
-----	-----	30 min	Verify the dispatch either from stock or fresh production
-----	5 min	-----	Labels received from packing Dept. along with job card
-----	-----	30 min	Make delivery note and challan
-----	-----	10 min	GST invoice
-----	-----	10 min	Packing Slip
-----	25 min	-----	Segregate the consignment as per logistic and arranging logistic as per requirement

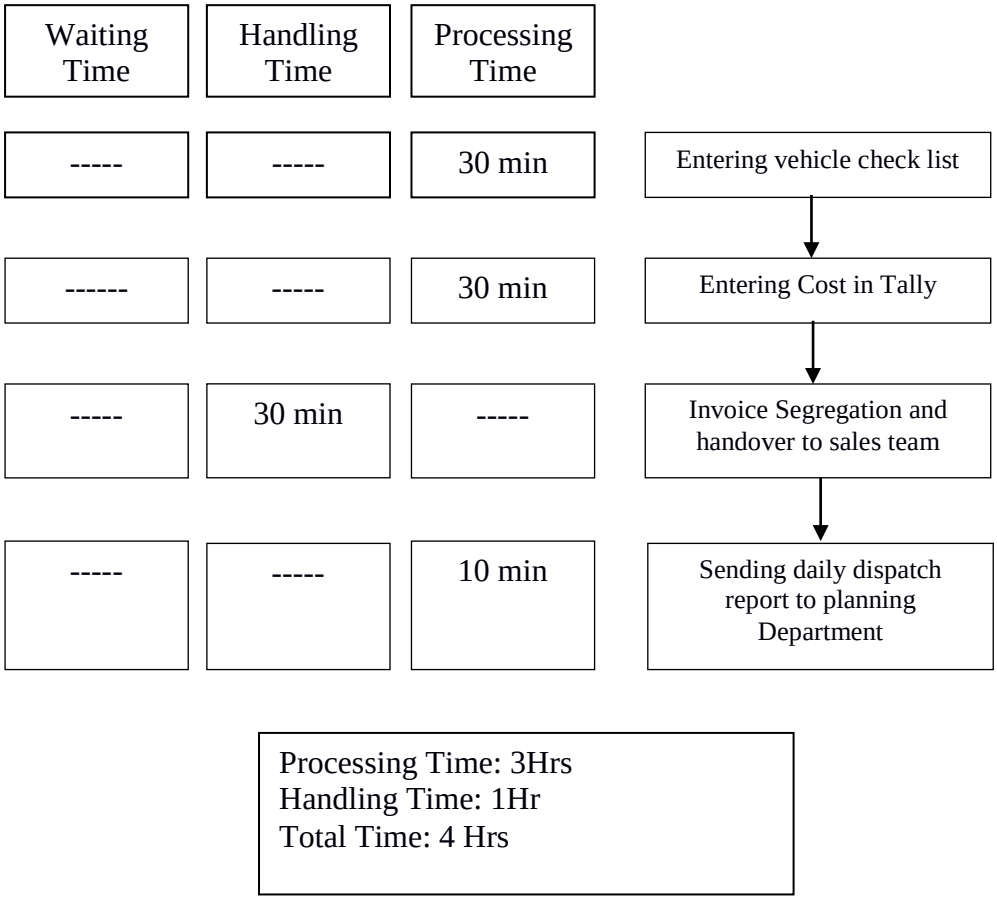


Fig 6.1.1.f Current State Map of Packing and Dispatch Department

6.1.2 Future State Map of Labels Business

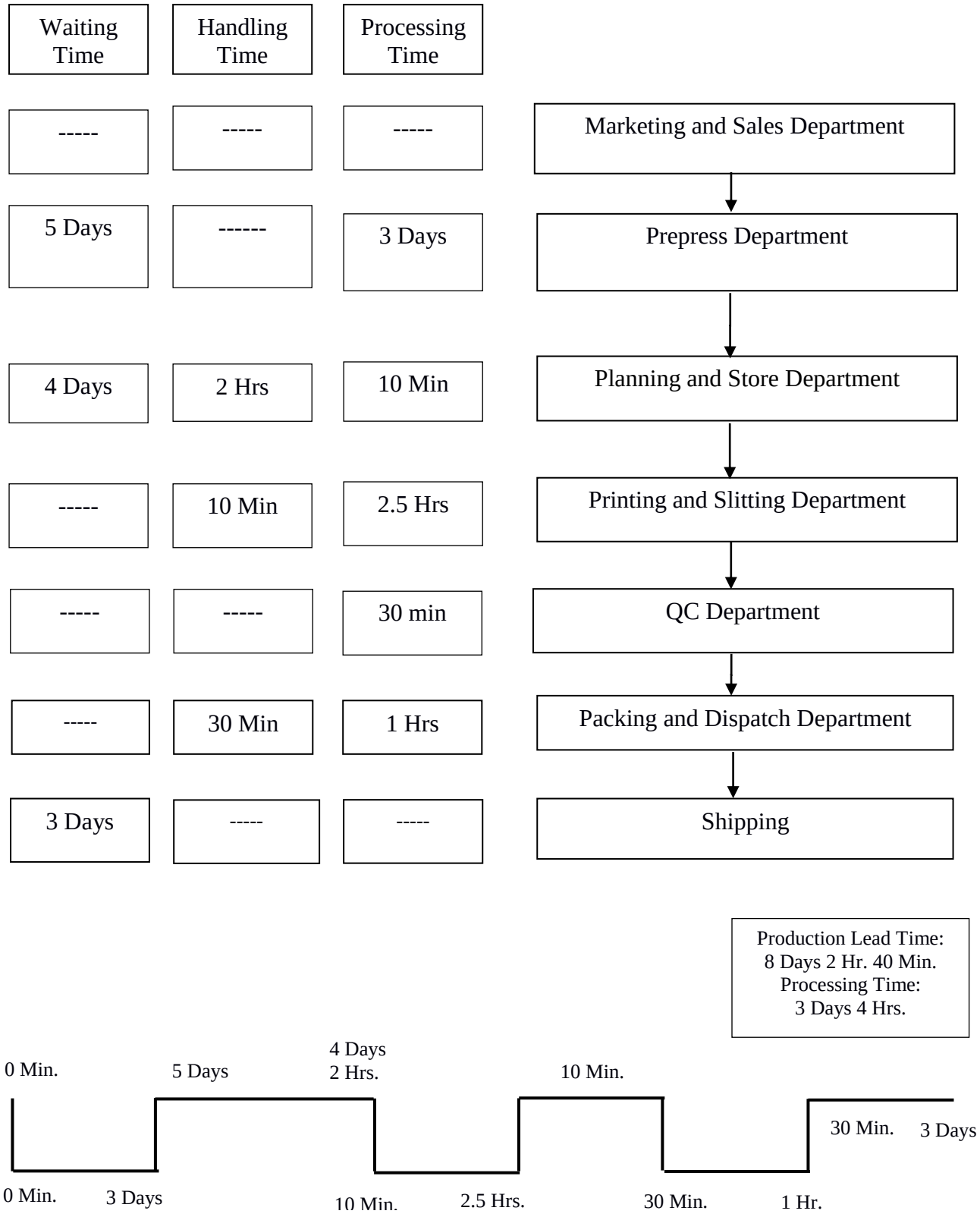


Fig 6.1.2 Future State Map of Labels Business

6.1.2 Future State Map of Labels Business

a. Marketing and Sales Department

As the time required for taking orders completely depends on customer and hence it is kept as it is.

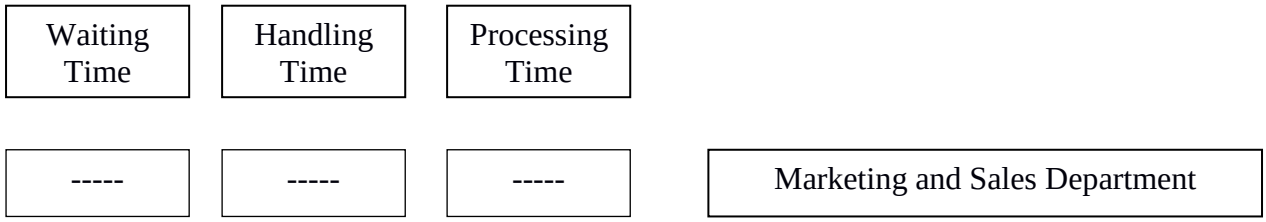


Fig 6.1.2.a Future State Map of Marketing and Sales Department

b. Prepress Department

Here the major issue is with the lead time as the TPD are ordered from foreign countries and hence it takes more time and therefore finding a supplier in India with same quality can actually save time of 2 days.

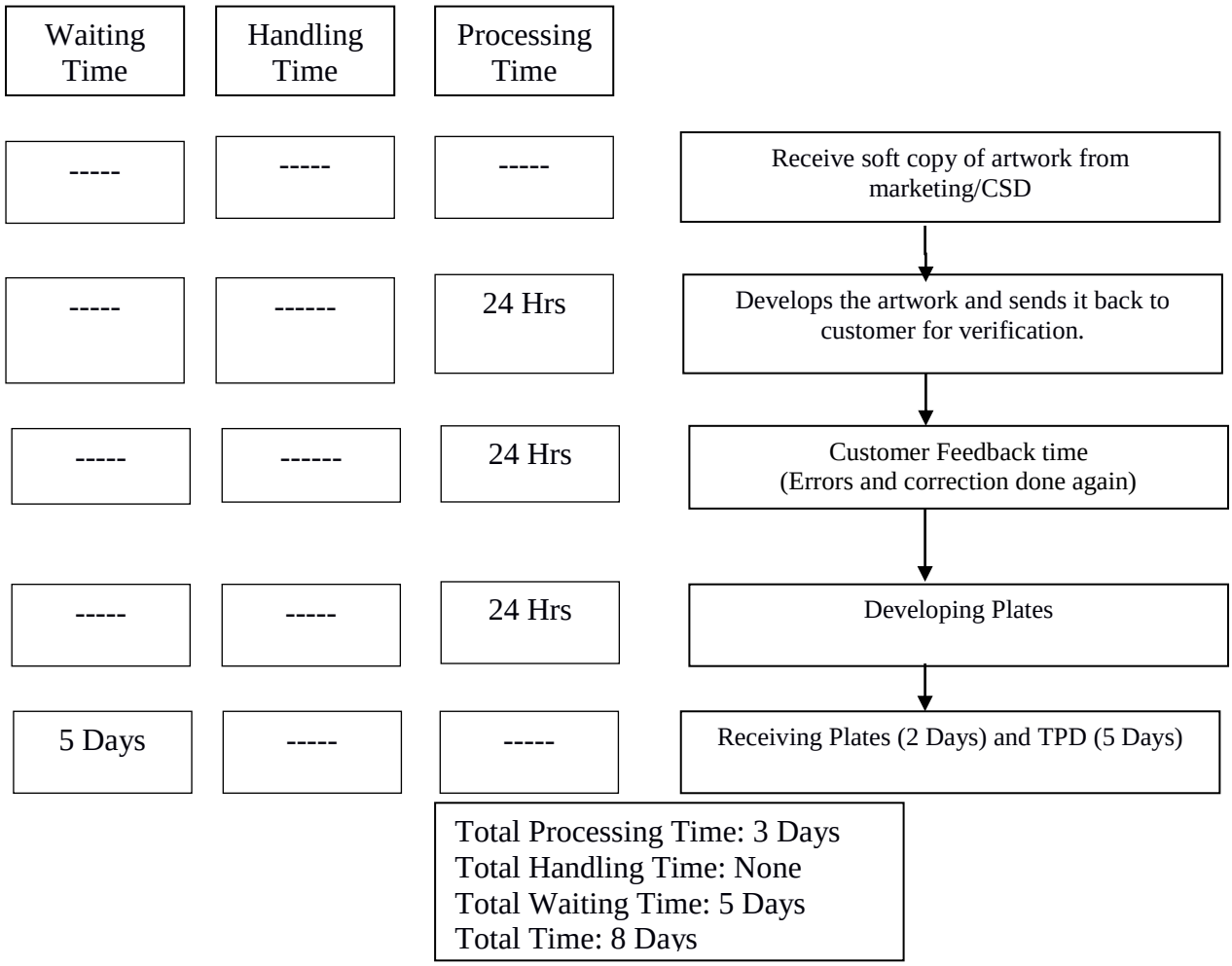


Fig 6.1.2.b Future State Map of Prepress Department

c. Planning Department and Store Department

Implementation of SAP system in industry will reduce the time for placing purchase order, as all the orders will be placed by the marketing team as they are the one who get all the necessary details of the job first. Planning about the job will also be based on the basis of first in first out. Thereby it will help reducing the planning time as well.

In store department if we get the segregated products as well the time gets reduce here too.

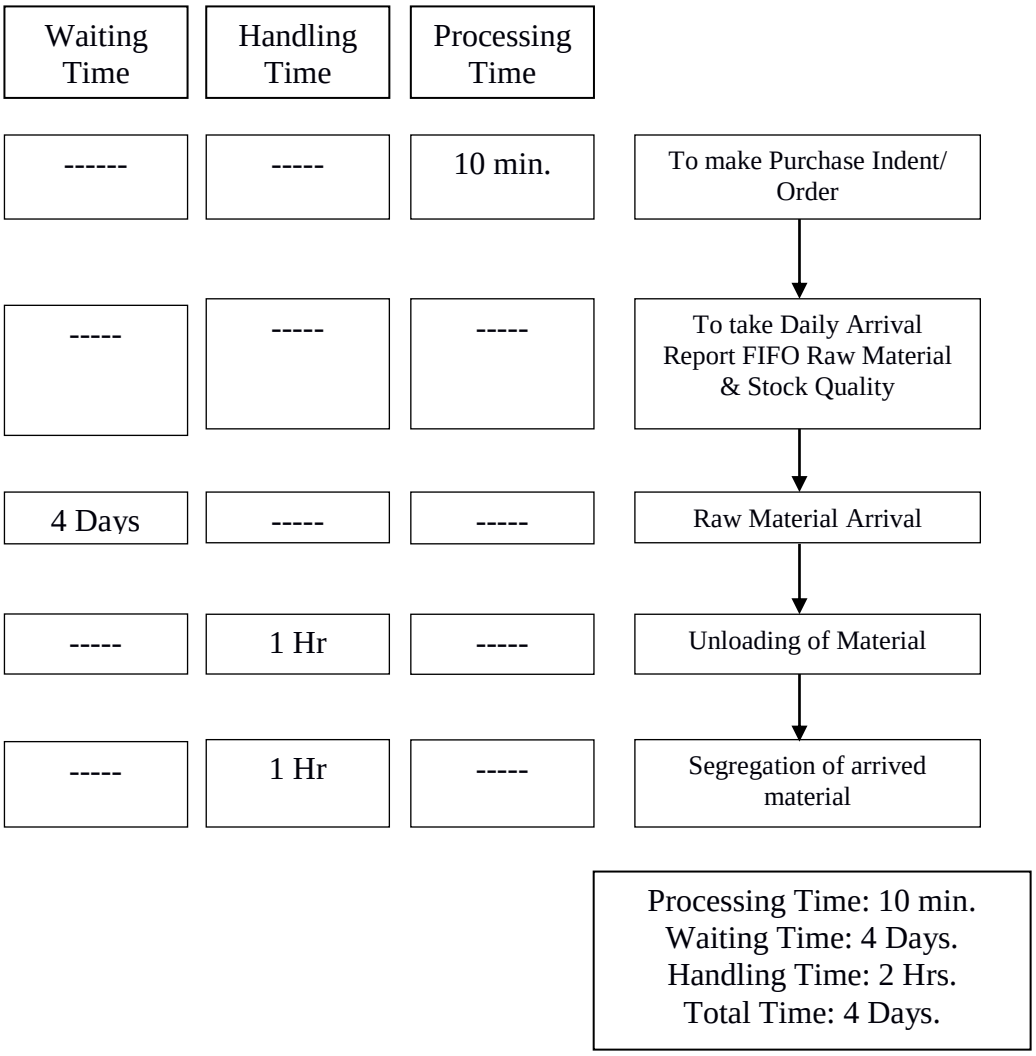


Fig 6.1.2.c Future State Map of Planning and Store Department

d. Printing Department and Slitting Department

The average time required for make ready of machines is 60 min in which major time is wasted to clean the ink trays and anilox cylinder so keeping a person in order to make ink and replace it with old job ink trays can save up to 15 min. for each job. And other setting time can be saved by implementing auto pressure and auto register settings.

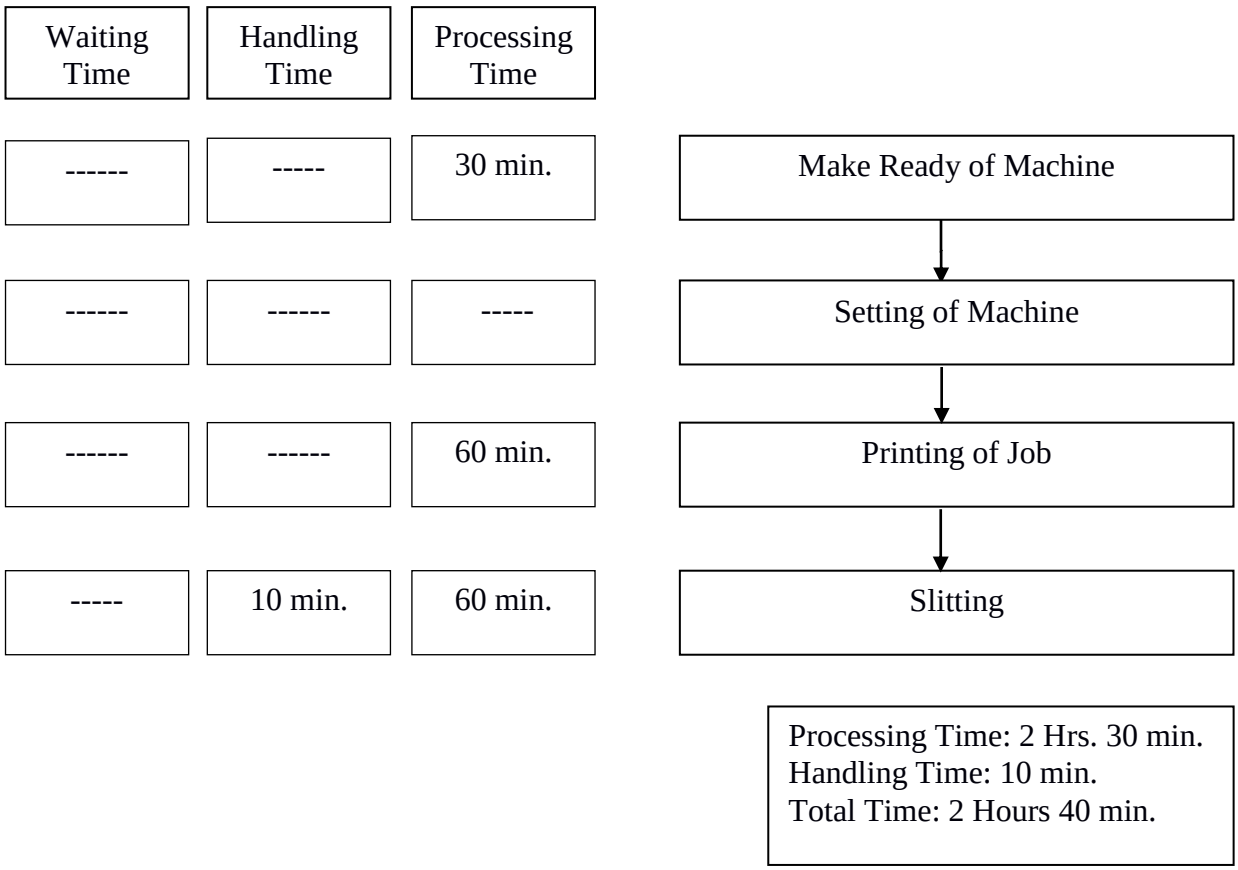


Fig 6.1.2.d Future State Map of Printing Department.

e. QC Department

Quality is the major requirement of the customer and hence one cannot risk it, hence it's not been touched.

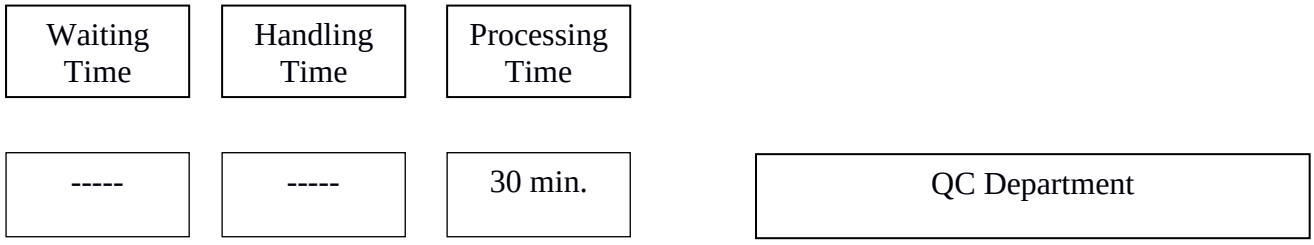


Fig 6.1.2.e Future State Map of QC Department.

f. Packing and Dispatch Department

Here we did time and motion study for this department and found out that the initial packing procedure consumes much lead time as it takes 5 min for each box which can be reduce to 3 minutes for each box by adding a single table which will even reduce the efforts taken by them to pick up and place it on packing machine where it can be done by sliding the box.

Adding SAP system will even reduce the work load here as the other time is wasted during

Waiting Time	Handling Time	Processing Time	
------	-----	10 min	Plan from Planning Dept
-----	-----	-----	Sales order from sales team
-----	-----	-----	Verify the dispatch either from stock or fresh production
-----	5 min	-----	Labels received from packing Dept. along with job card
-----	-----	-----	Make delivery note and challan
-----	-----	10 min	GST invoice
-----	-----	-----	Packing Slip
-----	20 min	-----	Segregate the consignment as per logistic and arranging logistic as per requirement

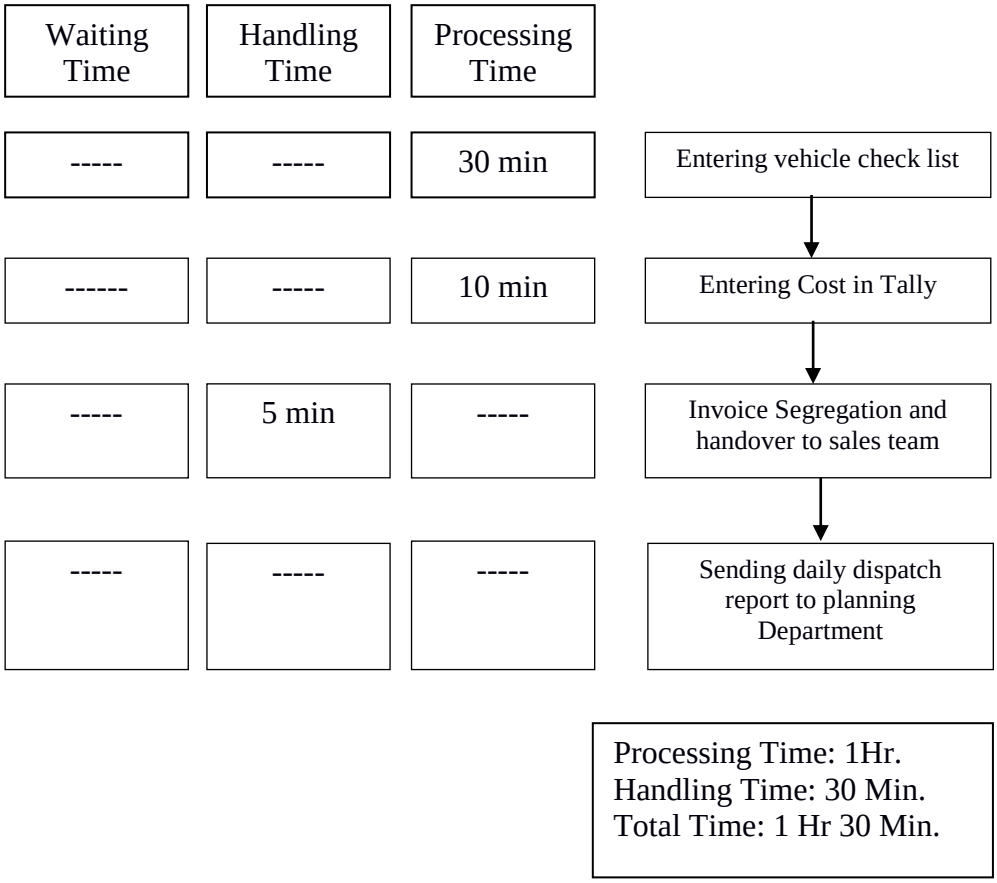


Fig 6.1.2.f Future State Map of Packing and Dispatch Department

Changes in layout of packing department are as follows:

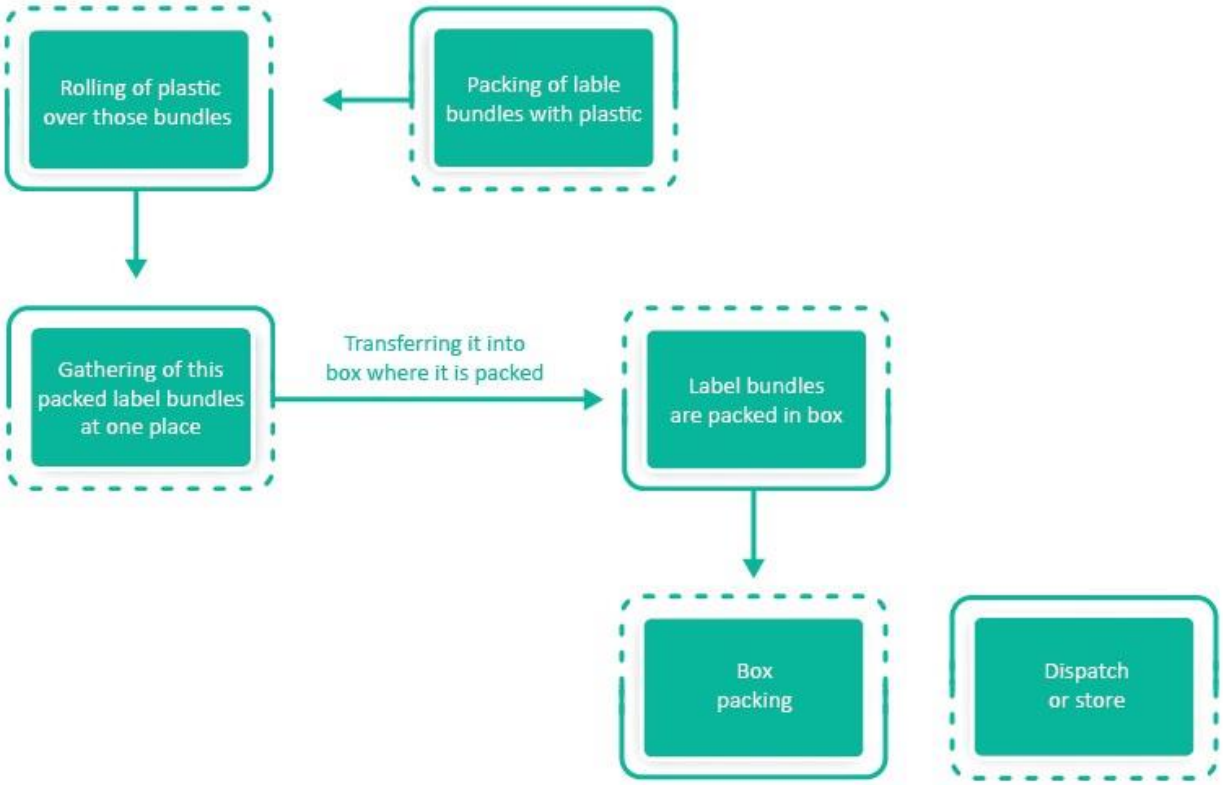


Fig 6.1.2.f.i Current Layout of Packing Department

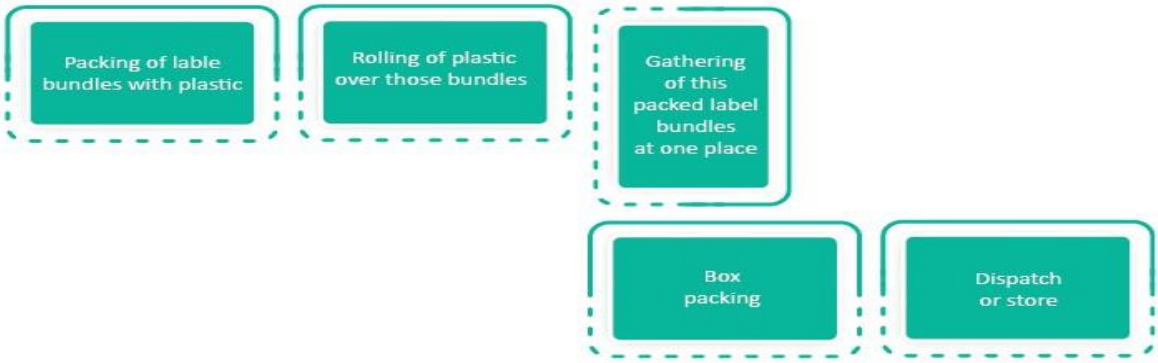


Fig 6.1.2.f.ii Future Layout of Packing Department

6.2Machine Business Unit

6.2.1 Current State Map of Machine Business Unit

a. Marketing and Sales Department

The marketing department's role is to promote the business and mission of an organization. Sales department work is to negotiate with prices, distribution of machines and give proper customer service. They receive the order from the consumer. The time require to complete the process completely depends on the customer. Customer places the order according to their requirement i.e. dimensions of the machine, type of labelling (front & back, wrap round, top, bottom), speed, etc. are also specified by the customers. Sales department give the estimate to the customer. Sales department orders the material requires in the manufacturing of the machine as per the purchase order.

b. Design Department

The work of design department is to analyse and make a design as per the requirement received from the customer. They make the purchase order as per the design and then it is handed over to the sales department.

c. Production Department

Production department gets the 2D design from the design department. The estimated time is decided as per the size, requirements of machine. They assemble various parts to the machine and then they run it on dry mode to check the components are working properly. Then testing is done on it to check whether label is properly applied on the product provided by customer and after the successful testing it is handed over to quality department.

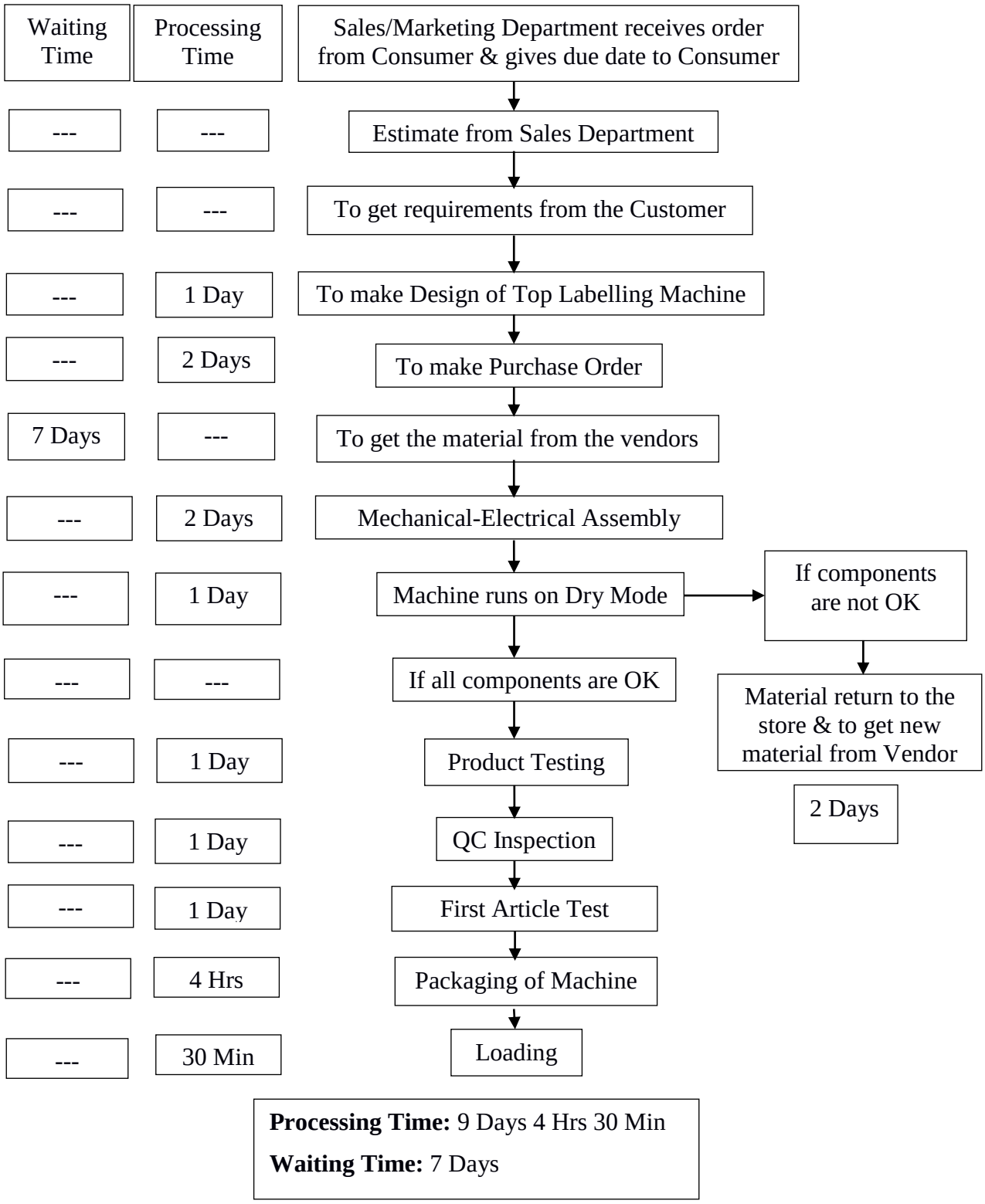
d. Quality Department

Quality department work is to provide quality product to the customer. They inspect the quality of machine and if they find any problem with respect to quality then they ask to overcome that problem. After the quality inspection machine gets ready for dispatch.

e. Dispatch Department

Dispatch department disassemble the machine and pack it. Then it is loaded in the truck with the help of pallet jack.

a. Top Labelling Machine



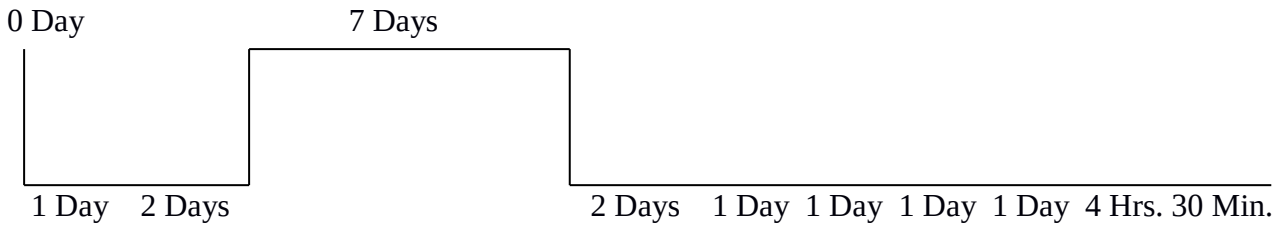


Fig 6.2.1 a. Current State Map of Top Labelling

b. Front-Back Labelling Machine

Waiting Time	Processing Time	
		Sales/Marketing Department receives order from Consumer & gives due date to Consumer
---	---	Estimate from Sales Department
---	---	To get requirements from the Customer
---	2 Days	To make Design of Front Back Machine
---	2 Days	To make Purchase Order
7 Days	---	To get the material from the vendors
---	3 Days	Mechanical-Electrical Assembly
---	1 Day	Machine runs on Dry Mode
---	---	If all components are OK
---	1 Day	Product Testing
---	1 Day	QC Inspection
---	1 Day	First Article Test
---	5 Hrs	Packaging of Machine
---	1 Hr	Loading

If components are not OK

Material return to the store & to get new material from Vendor

2 Days

Processing Time: 11 Days 6 Hrs

Waiting Time: 7 Days

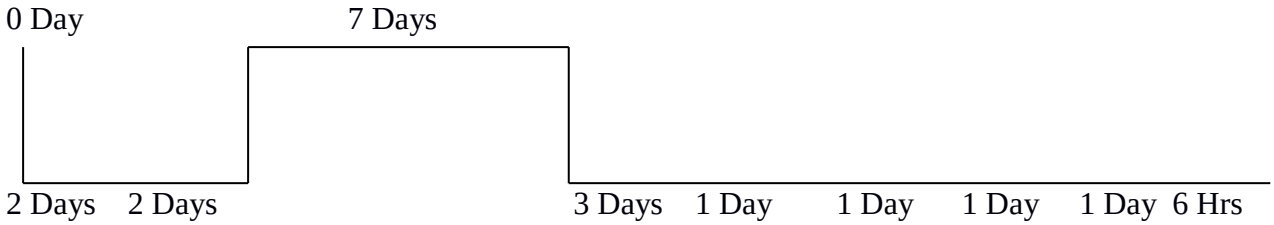


Fig 6.2.1 b. Current State Map of Front-Back Labelling

c. Wrap Round Labelling Machine

Waiting Time	Processing Time	
		Sales/Marketing Department receives order from Consumer & gives due date to Consumer
---	---	Estimate from Sales Department
---	---	To get requirements from the Customer
---	2 Days	To make Design of Wrap Round Labelling
---	2 Days	To make Purchase Order
7 Days	---	To get the material from the vendors
---	3 Days	Mechanical-Electrical Assembly
---	1 Day	Machine runs on Dry Mode
---	---	If all components are OK
---	2 Days	Product Testing
---	1 Day	QC Inspection
---	1 Day	First Article Test
---	5Hrs	Packaging of Machine
---	1 Hr	Loading

If components are not OK

Material return to the store & to get new material from Vendor

2 Days

Processing Time: 12 Days 6 Hrs

Waiting Time: 7 Days

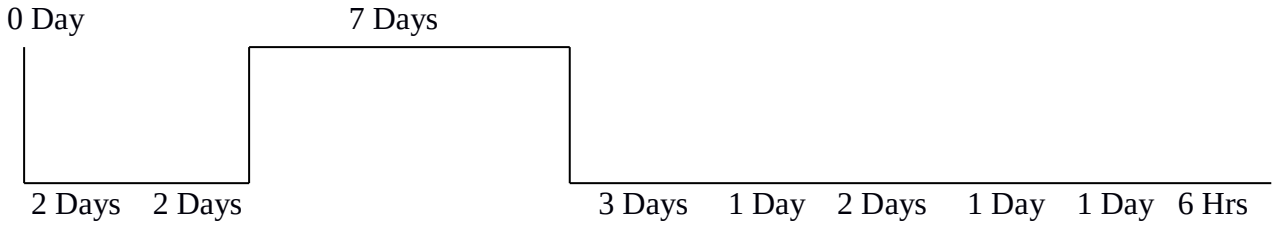


Fig 6.2.1 c. Current State Map of Wrap Round Labelling

d. Customize Labelling Machine

Waiting Time	Processing Time	
		Sales/Marketing Department receives order from Consumer & gives due date to Consumer
---	---	Estimate from Sales Department
---	---	To get requirements from the Customer
---	7 Days	To make Design of Customize Machine
---	2 Days	To make Purchase Order
9 Days	---	To get the material from the vendors
---	4 Days	Mechanical-Electrical Assembly
---	1 Day	Machine runs on Dry Mode
---	---	If all components are OK
---	4 Days	Product Testing
---	2 Days	QC Inspection
---	1 Day	First Article Test
---	8 Hrs	Packaging of Machine
---	1 Hr	Loading

If components are not OK

Material return to the store & to get new material from Vendor

2 Days

Processing Time: 21 Days 9 Hrs

Waiting Time: 9 Days

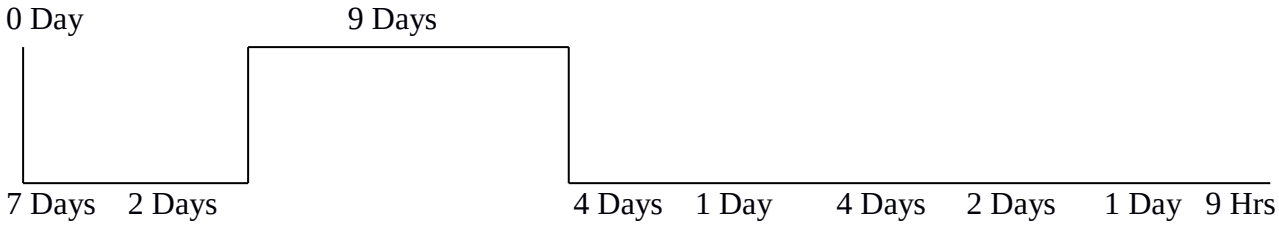


Fig 6.2.1 d. Current State Map of Customize Labelling

e. Special Purpose Labelling Machine

Waiting Time	Processing Time	
		Sales/Marketing Department receives order from Consumer & gives due date to Consumer
---	---	Estimate from Sales Department
---	---	To get requirements from the Customer
---	15 Days	To make Design of Special Purpose Machine
---	2 Days	To make Purchase Order
7 Days	---	To get the material from the vendors
---	4 Days	Mechanical-Electrical Assembly
---	1 Days	Machine runs on Dry Mode
---	---	If all components are OK
---	6 Days	Product Testing
---	2 Days	QC Inspection
---	1 Day	First Article Test
---	8 Hrs	Packaging of Machine
---	1 Hr	Loading

If components are not OK

Material return to the store & to get new material from Vendor

2 Days

Processing Time: 31 Days 9 Hr

Waiting Time: 7 Days

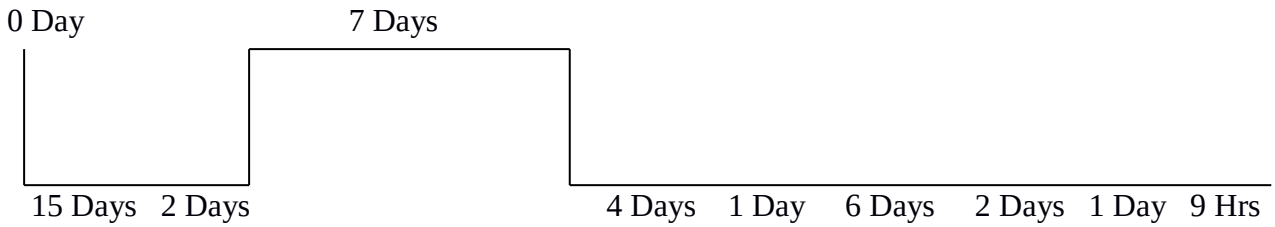


Fig 6.2.1 e. Current State Map of Special Purpose Labelling

6.2.2 Future State Map of Machine Business Unit

a. SAP System

SAP system is software which increases interaction between vendor and industry. By installing this system, the materials which are required can be directly added to it and order will be placed automatically. Hence, 1 day can be saved which was earlier 2 days to make purchase order.

b. Components

Components that are used frequently for all sort of Labelling machines (e.g. Labeler, motors, etc.) that can be pre ordered thus saving our lead time.

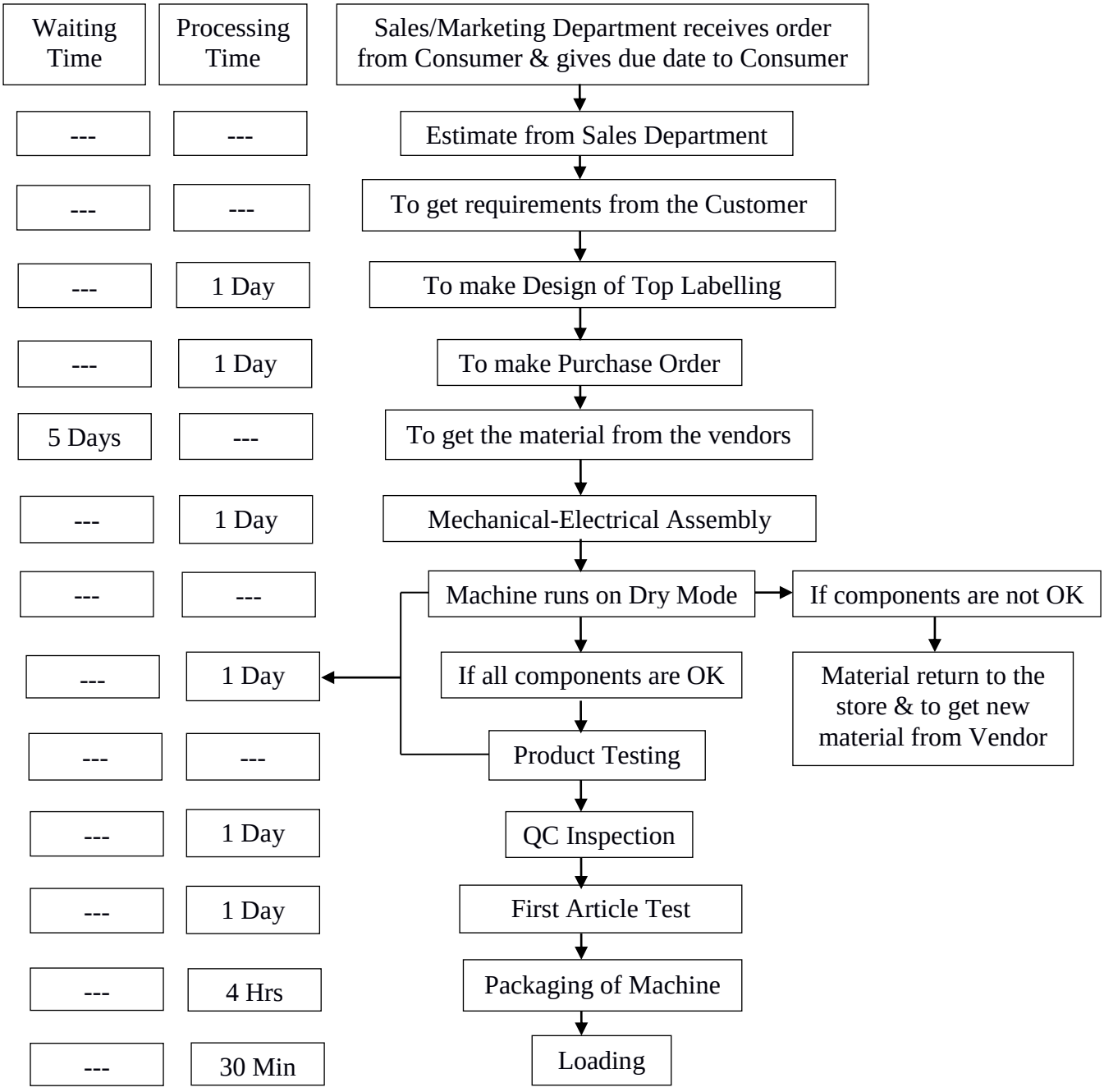
c. Assembly Time

Mechanical-Electrical Assembly can be completed in one day by gathering man power and making them work on a single machine, and electric assembly just takes about 2-3 hours.

d. Clubbing two sections

The total man power available for product testing is of four people so we can divide them in two shifts and club it with product testing which takes one day (shift of 8 hours) and making them work in evening shift so that both things can be done in single day.

a. Top Labelling Machine



Processing Time: 6 Days 4 Hrs. 30 Min

Waiting Time: 5 Days

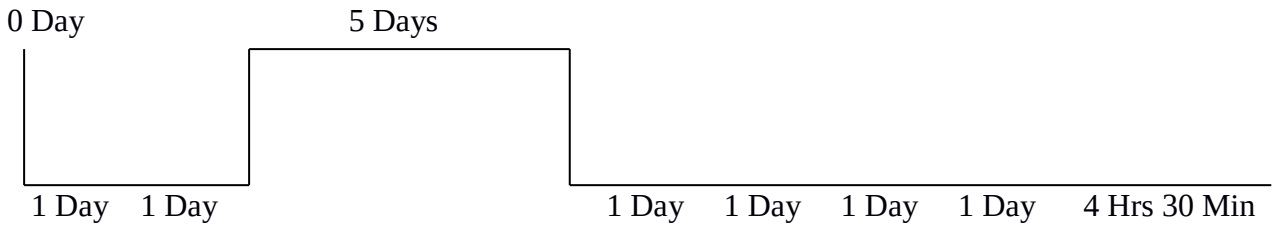
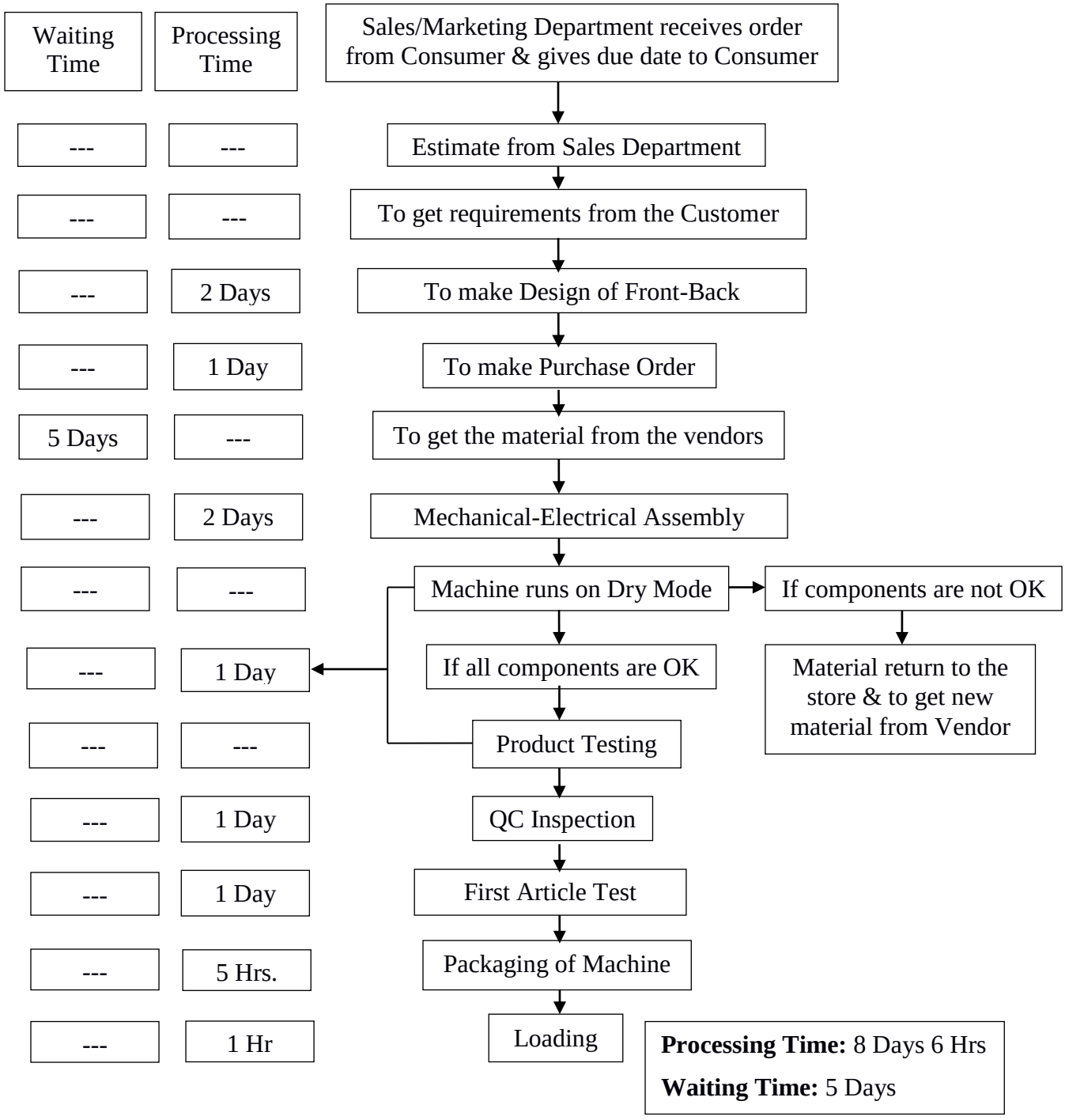


Fig 6.2.2 a. Future State Map of Top Labelling

b. Front-Back Labelling Machine



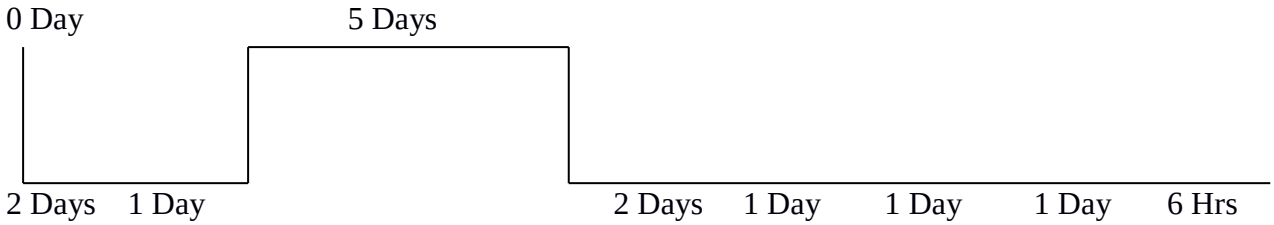
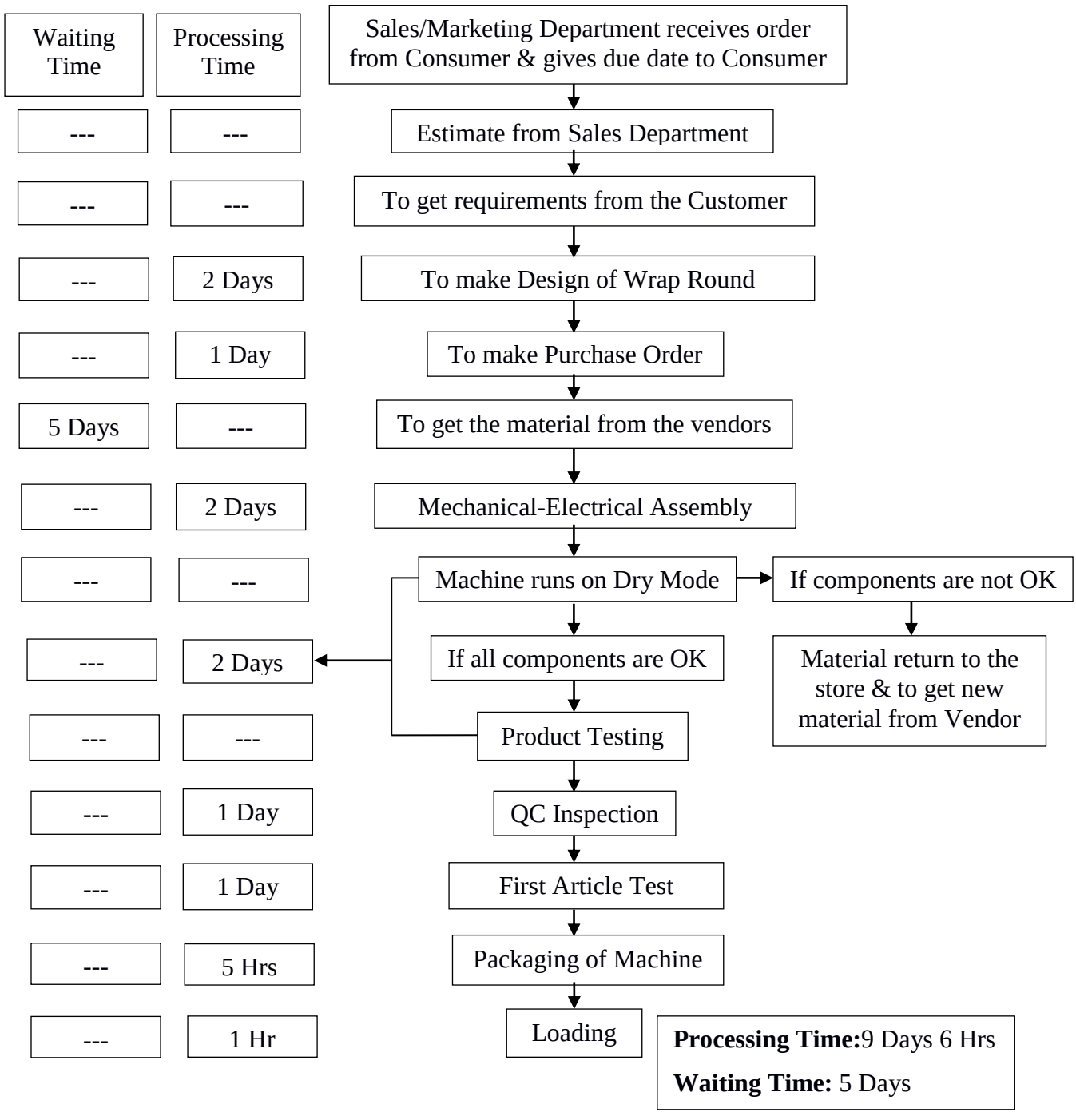


Fig 6.2.2 b. Future State Map of Front-Back Labelling

c. Wrap Round Labelling Machine



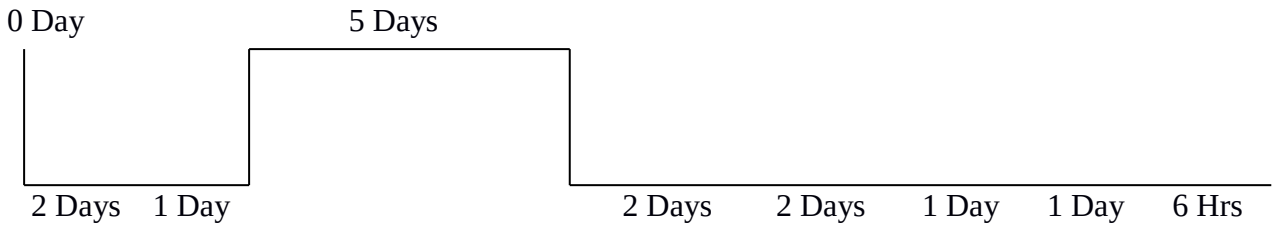
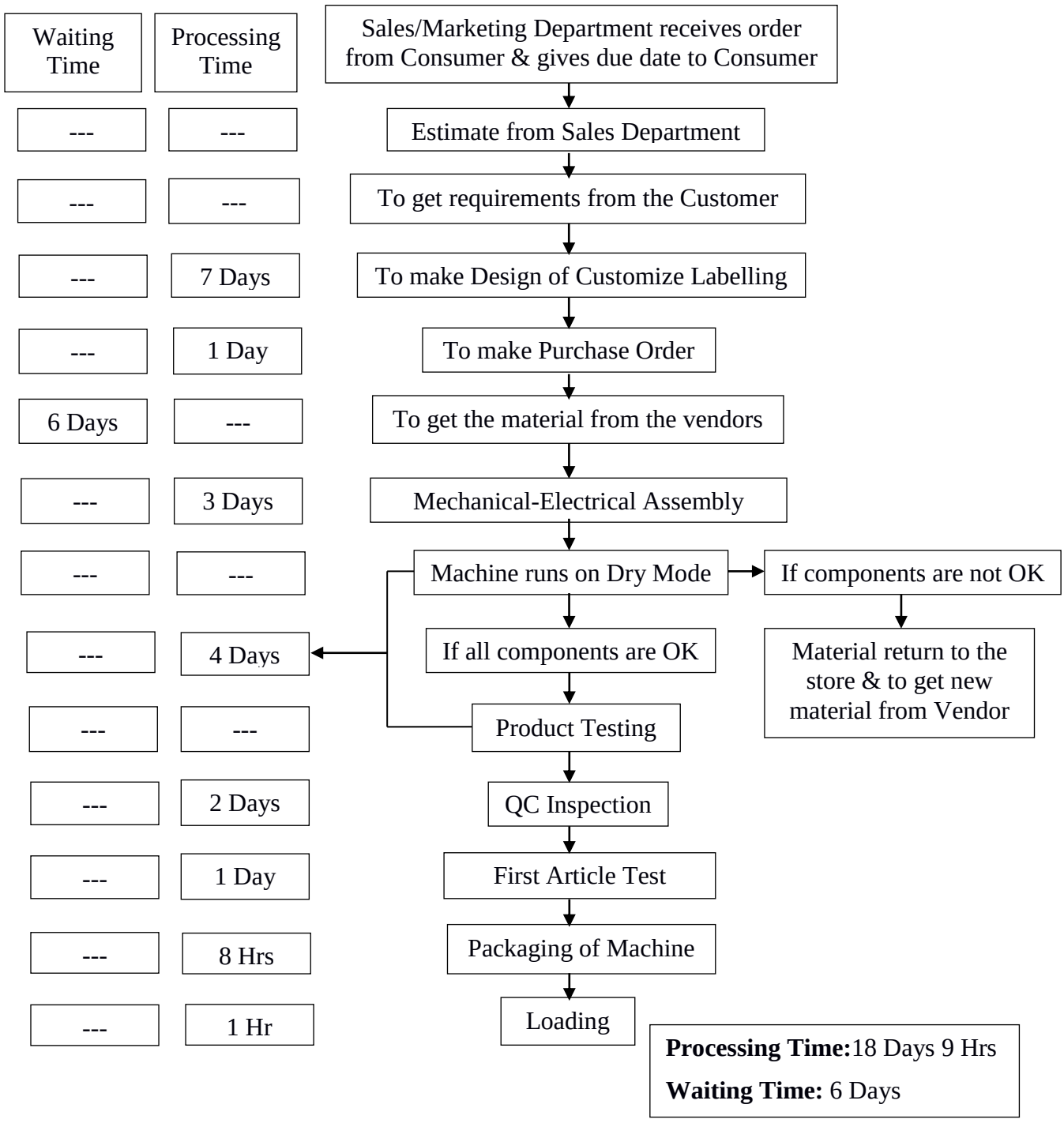


Fig 6.2.2 c. Future State Map of Wrap Round Labelling

d. Customize Labelling Machine



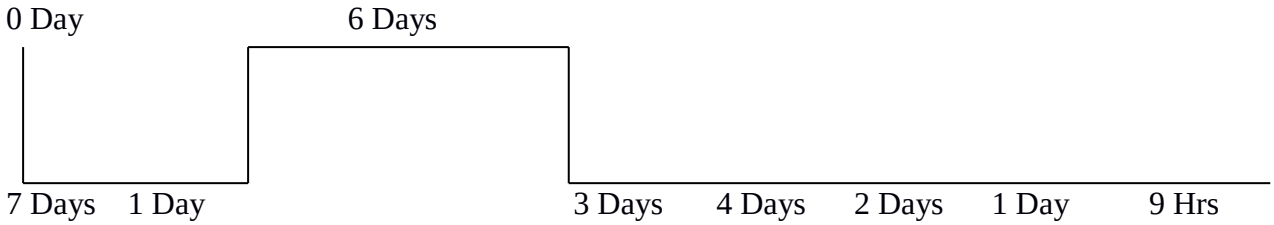
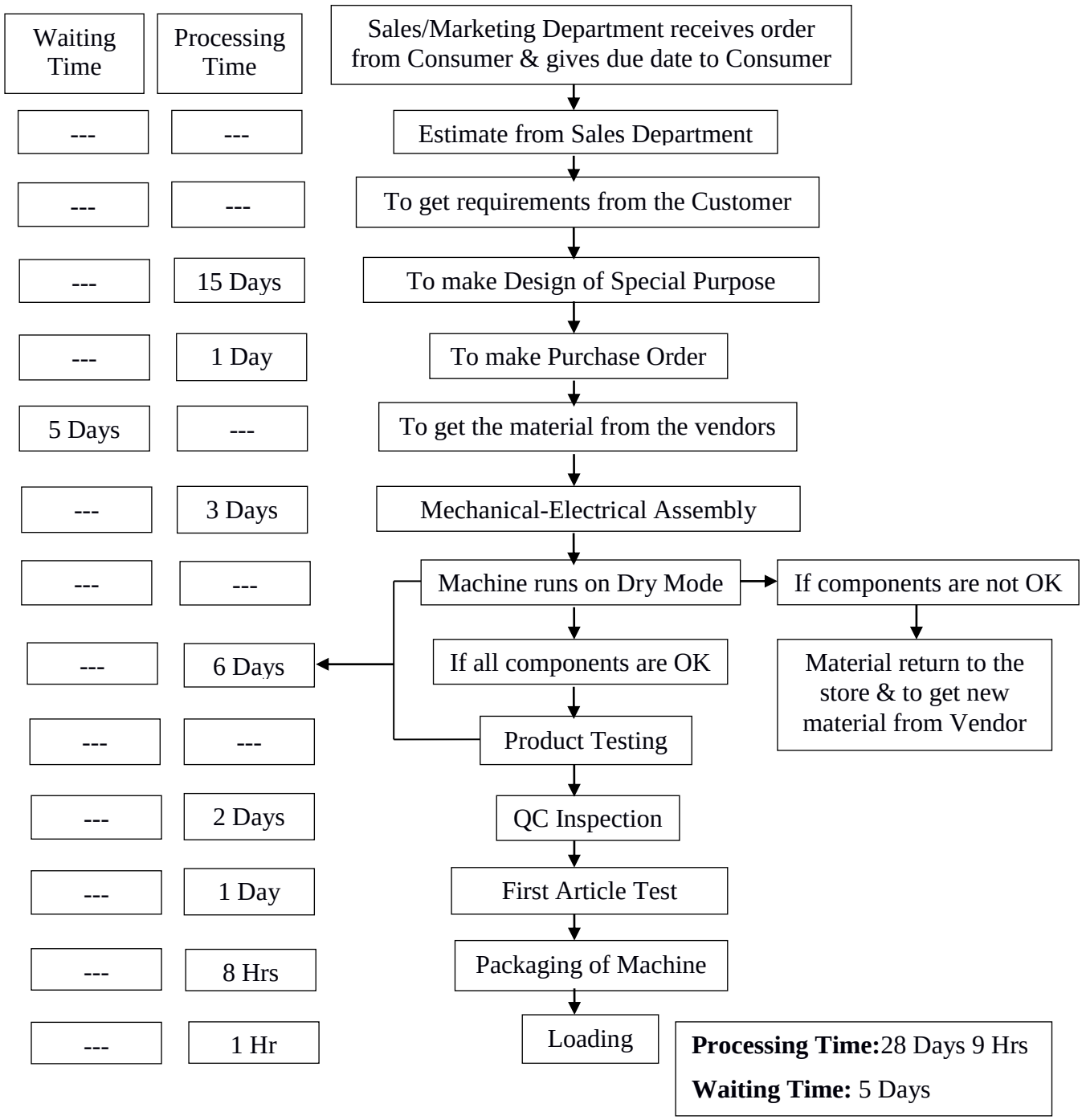


Fig 6.2.2 d. Future State Map of Customize Labelling

e. Special Purpose Labelling Machine



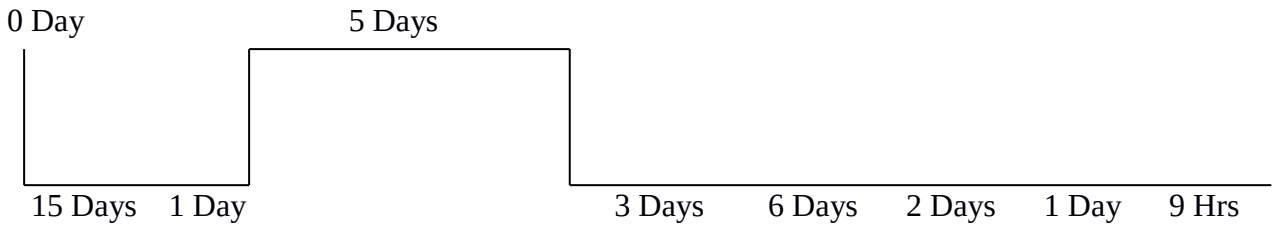


Fig 6.2.2 e. Future State Map of Special Purpose Labelling

CHAPTER 7

WASTAGE ANALYSIS AND REDUCING ACTION

7.1 Wastage in Labels Business

1. **Machine Stoppage:** Because of stopping machine the wastage of material happens as the paper is flowing is of the equal length to that so machine so instead of stopping the corrective action must be taken while the machine is running.
   The machine is stopped for two reasons:

   I. **Change of shift:** During the shift change the machine is stopped and other operator comes and takeover the job, which causes the wastage of material.
   Corrective Action: Arranging shifts in such so that no machine has to be stopped while running and one can easily explain the process going on at the time of handover this can be done by calling the next shift members prior by 10 mins.

   II. **Error in printing:** At the time of printing if any error occurs the machine is stopped which again causes wastage of material.
   Corrective Action: By implementing changes in machine i.e. auto register and auto pressure setting by linking it with AVT. This will automatically take corrective actions while the machine is running hence avoiding stoppage.

Fig 7.1.1 Flexographic Printing Machine

2. **Machine Breakdown:** The machine breakdown is one of the issues which cause the stoppage of machine even though preventive maintenance was done and this even increases the downtime.
   Corrective Action: The preventive maintenance period was increased for all machines from 1 day to 3 days, implementing this will not cause the machine breakdown.

3. **Impression Cylinder Issues:** The major wastage occurs because of the bad condition of cylinders.
   Corrective Action: The cylinder cost is too much and get replacing them will not be a good idea, so to avoid the wastage of material because of cylinder issues at the time of printing. So, segregating them will be beneficial according to their condition i.e. applying green code to the good ones and red to the bad ones. By doing this the operator or assistant can give maximum attention to this cylinders with red code.

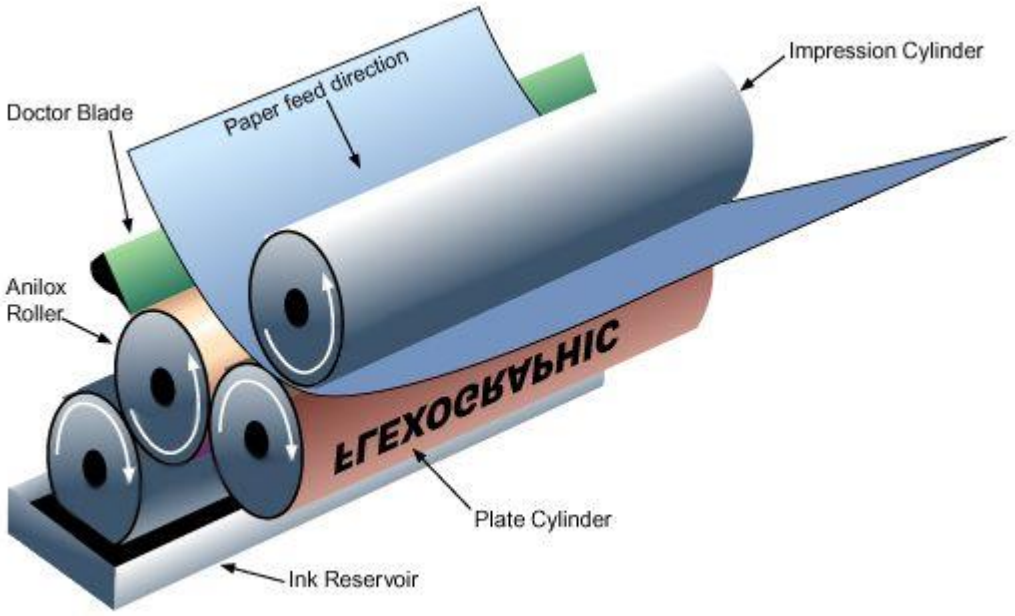


Fig 7.1.3 Use of Impression Cylinder for Printing

4. **Shade Variation:** During some long jobs the ink gets over so when the new ink is made there is variation in the shade of the one printed earlier and being print now.
   Corrective Action: To avoid such kind of problems ink formula sheet is being attached along with job card which will help obtaining the same shade as it was earlier causing no variation in shade.

7.2 Wastage in Machine Business Unit

1. **Formation of Wrinkles:** During label testing process, labels do not stick properly due to foam belt and uneven surface of bottles which cause wrinkles which may lead to wastages. **Corrective Action:** To avoid wrinkles, the belt with minimum amount of foam can be used which gives less pressure on the labels because of which the labels can stick properly.

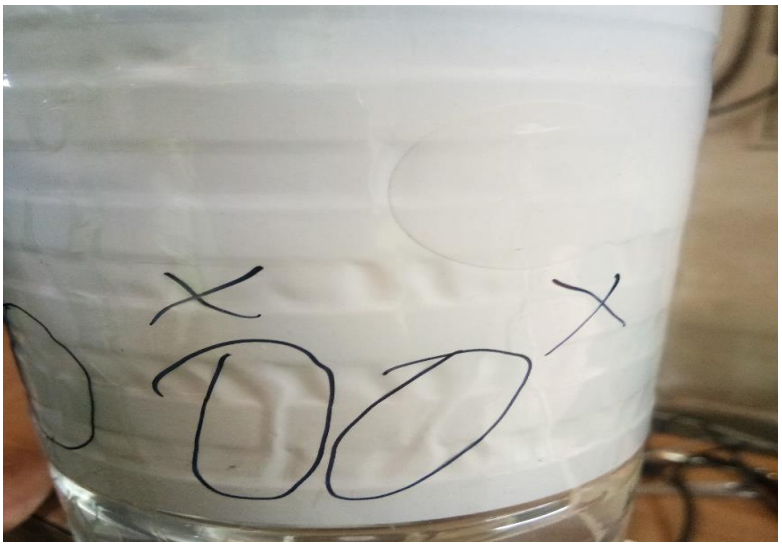


Fig 7.2.1 Formation of Wrinkles

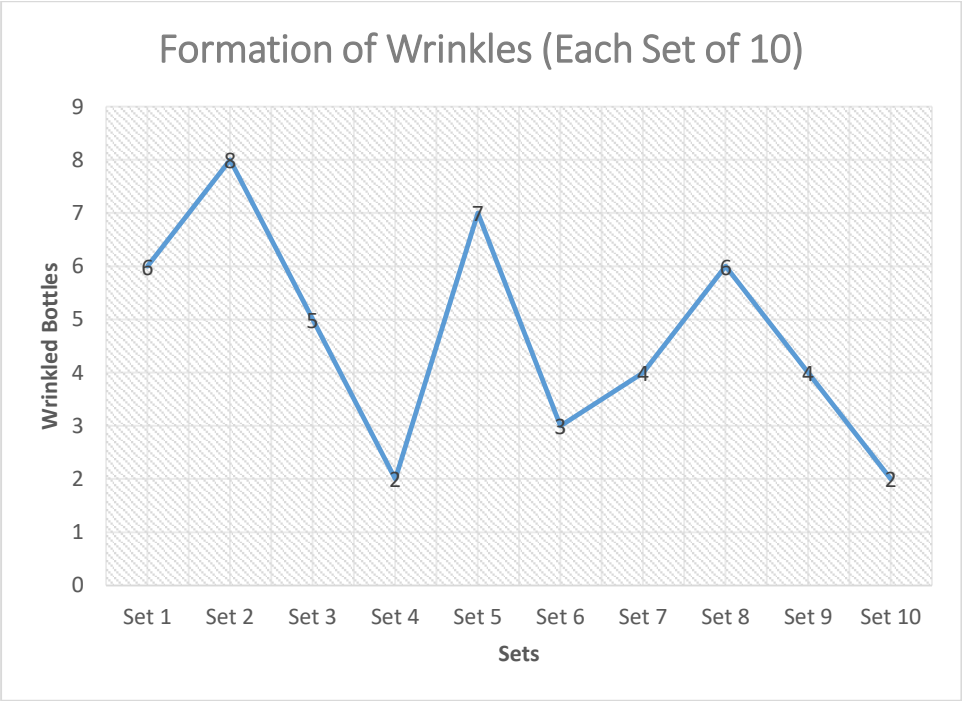


Fig 7.2.2 Graphical Representation of Formation of Wrinkles

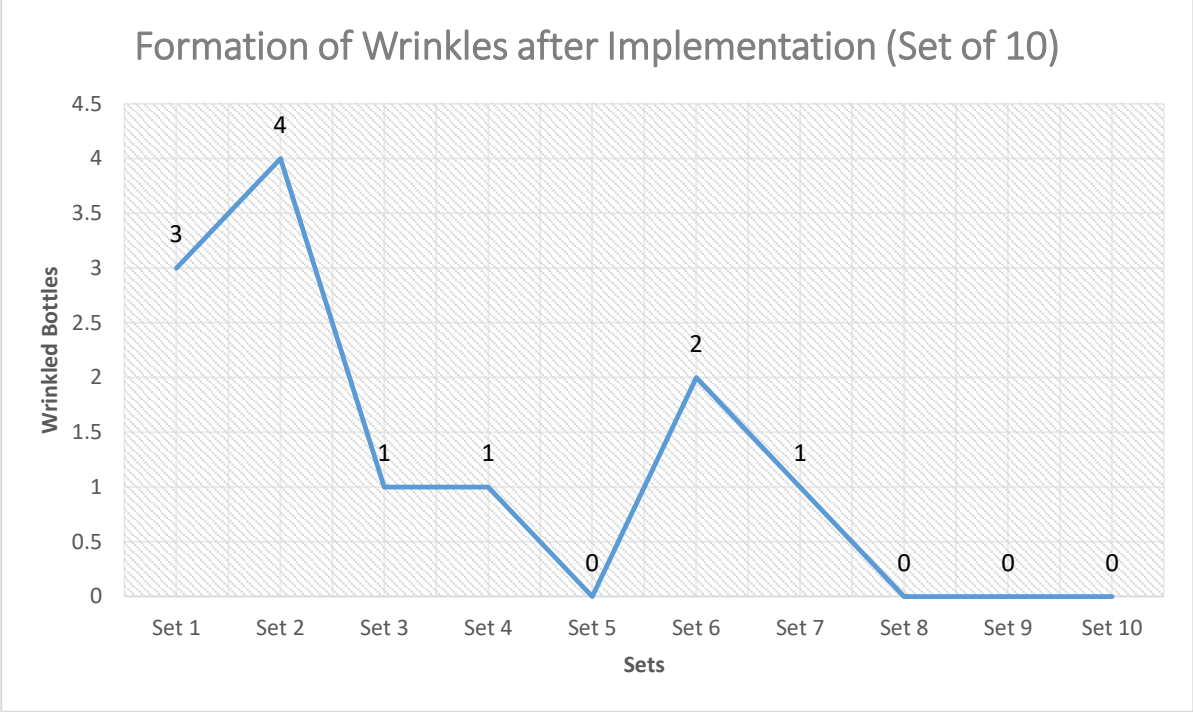


Fig 7.2.3 Graphical Representation of Formation of Wrinkles after Implementation of Less Foam Belt

2. **Formation of Air Bubbles:** During labels testing process, due to entrapment of foreign particles like dust leads in formation of air bubbles.
   Corrective Action: The brush can be provided to remove dust from the bottles and steel plate to stick the labels properly on the bottles with maximum pressure.

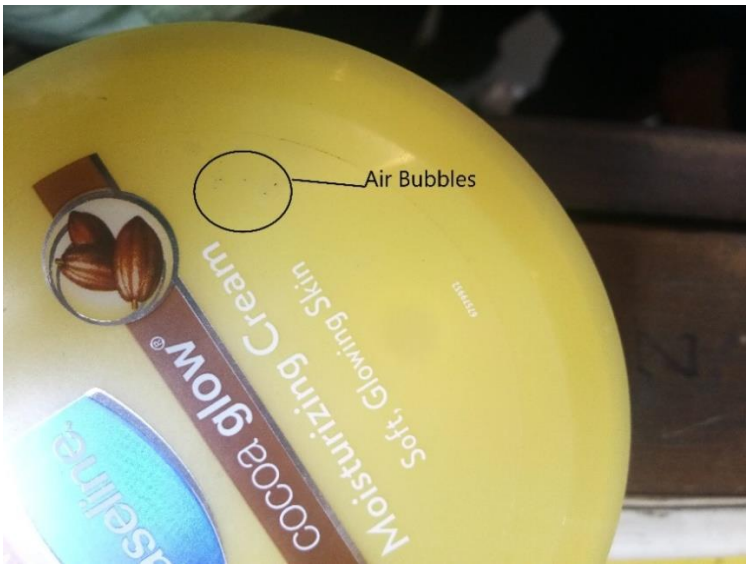


Fig 7.2.4 Formation of Air Bubbles

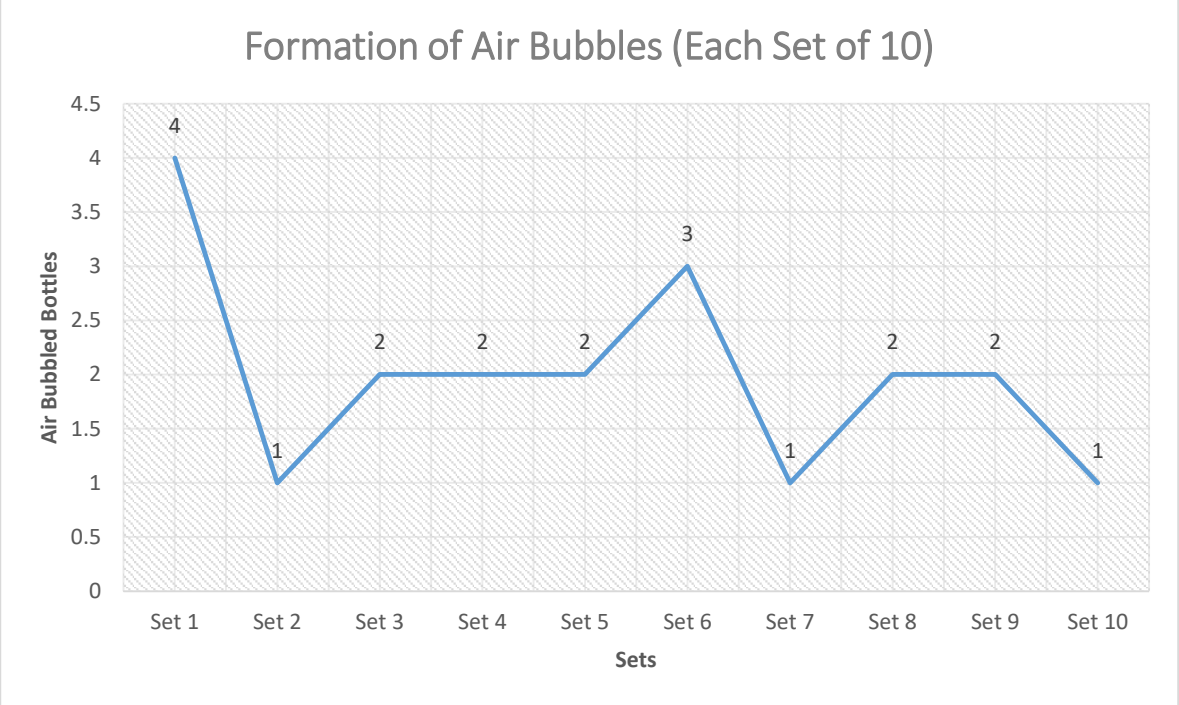


Fig 7.2.5 Graphical Representation of Formation of Air Bubbles

3. **Falling of Bottles on Conveyer:** There is loss of money behind the sensors that are used to warn the operator about the bottles that fall. Even the machine is stopped because of this issue.
   Corrective Action: This can be avoided by giving guides as shown in figure below because of which the bottle which falls down can easily pass through other conveyor and even the machine doesn't need to stop.

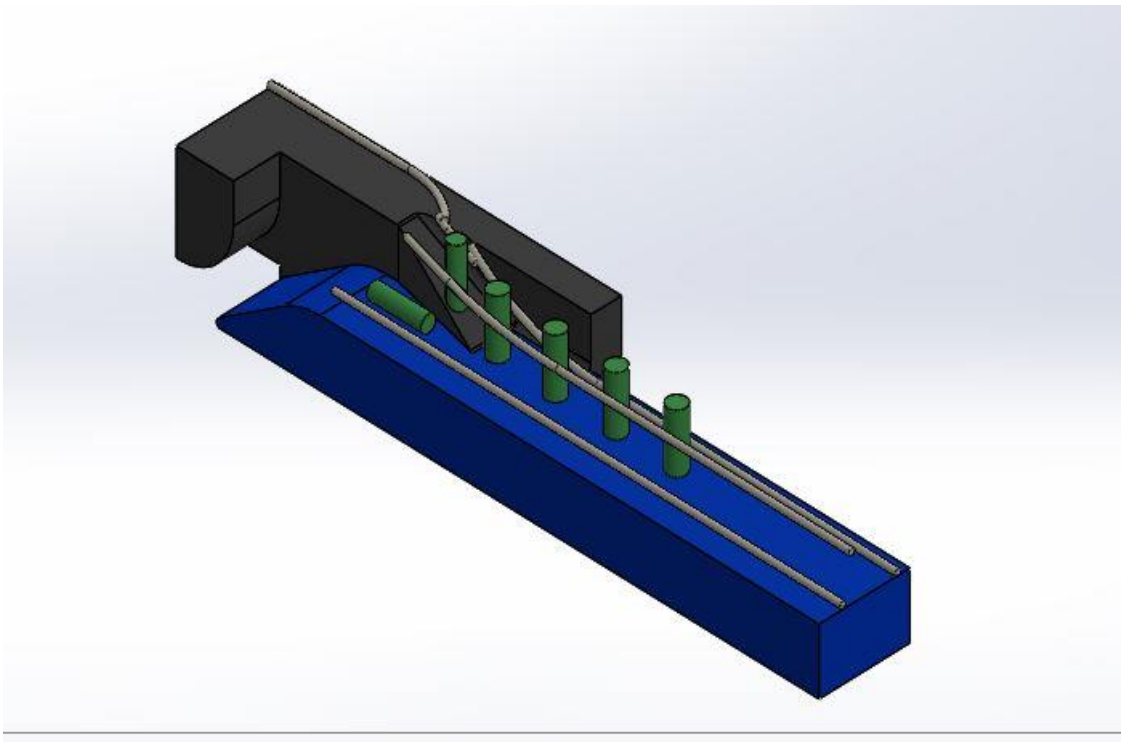


Fig 7.2.6 Falling of Bottles on Conveyer

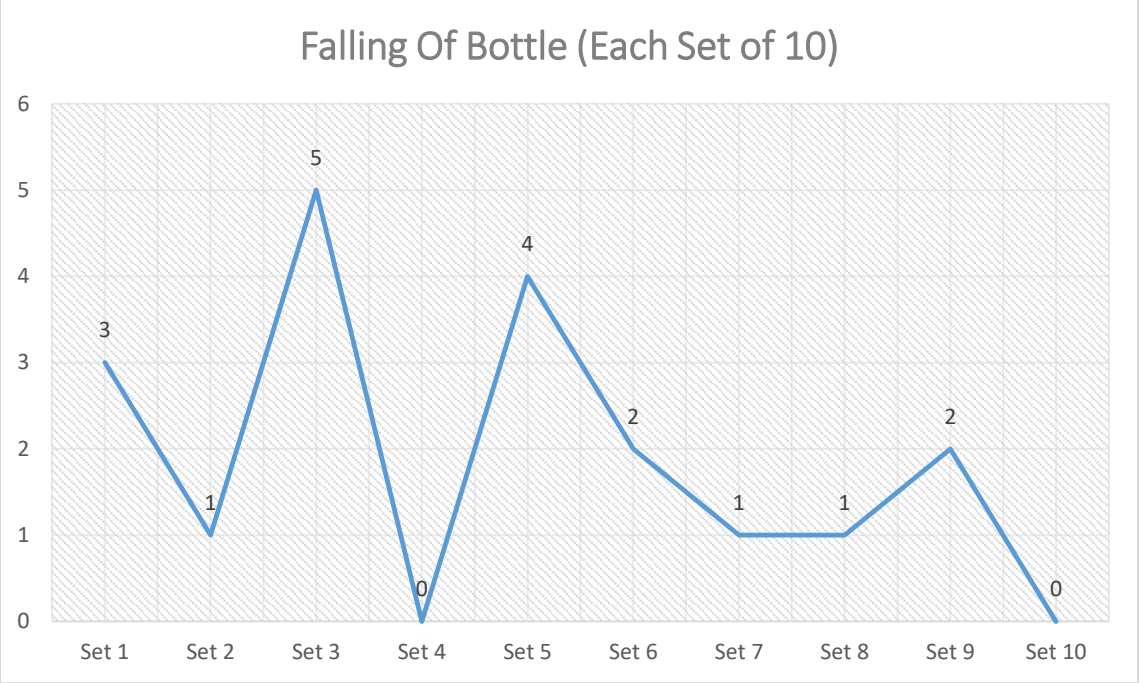


Fig 7.2.7 Graphical Representation of Falling of Bottles on Conveyer

CHAPTER 8

RESULTS

Results

Current State Time Required in Labels Business = 15 Days 13 hours 40 min

Future State Time Required in Labels Business = 11 Days 6 hours 50 min

Current State Time Required in Machine Business Unit

i. Total time required for Top Labelling Machine = 16 Days 4 hours 30 min
ii. Total time required for Front-Back Labelling Machine = 18 Days 6 hours
iii. Total time required for Wrap Round Labelling Machine = 19 Days 6 hours
iv. Total time required for Customized Labelling Machine = 30 Days 9 hours
v. Total time required for Special Purpose Labelling Machine = 38 Days 10 hours

Future State Time Required in Machine Business Unit

i. Total time required for Top Labelling Machine =11 Days 4 hours 30 min
ii. Total time required for Front-Back Labelling Machine =13 Days 6 hours
iii. Total time required for Wrap Round Labelling Machine = 14 Days 6 hours
iv. Total time required for Customized Labelling Machine = 24 Days 9 hours
v. Total time required for Special Purpose Labelling Machine =33 Days 9 hours

Earlier Wastage in Labels Business = 23%

Current Wastage in Labels Business = 20%

Earlier Wastage in Machine Business Unit = 29%

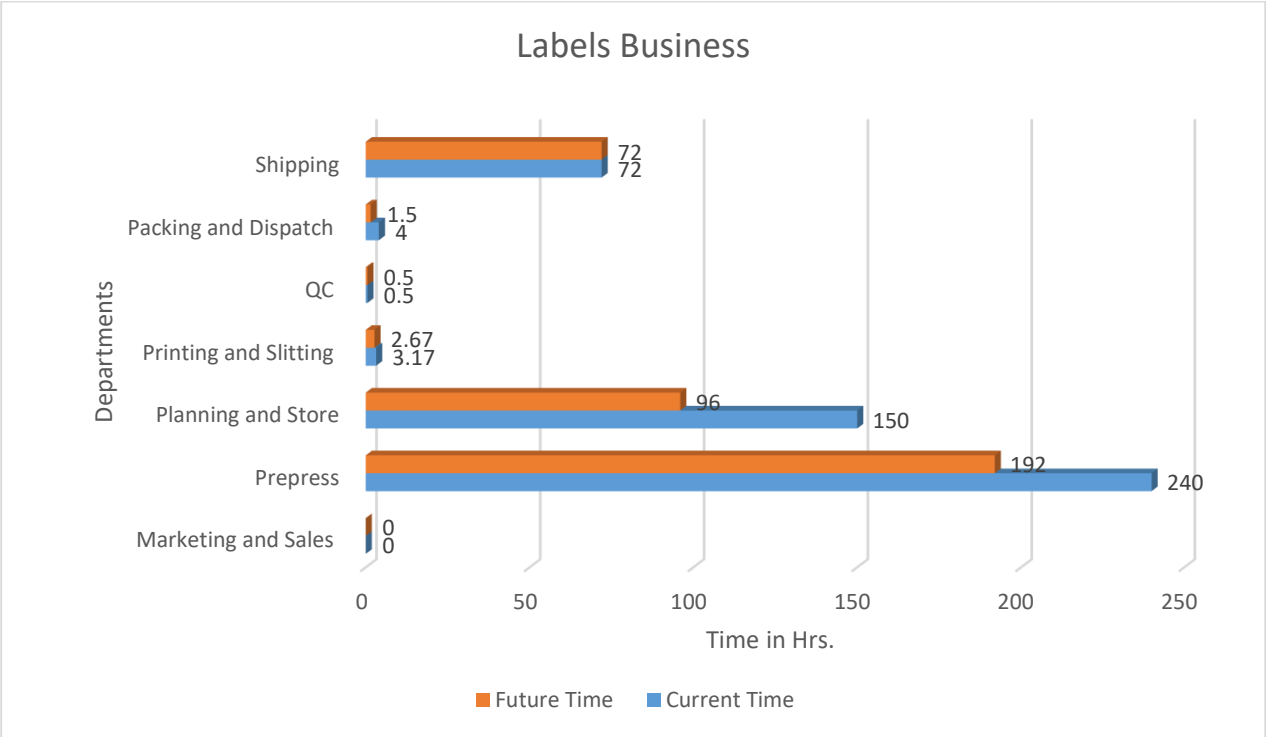


Fig 8.1Graphical Representation Current and Future State Time of Labels Business

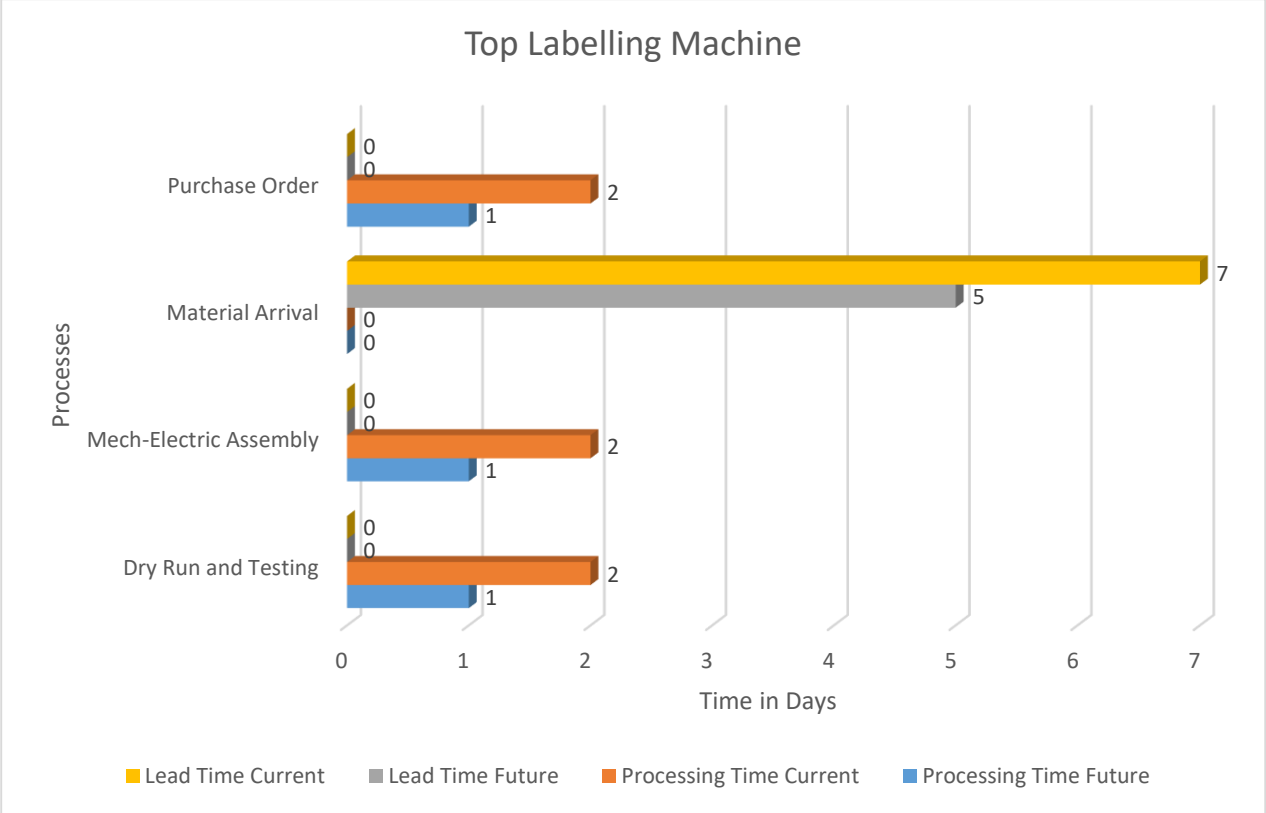


Fig 8.2 Graphical Representation Current and Future State Time of Top Labelling Machine

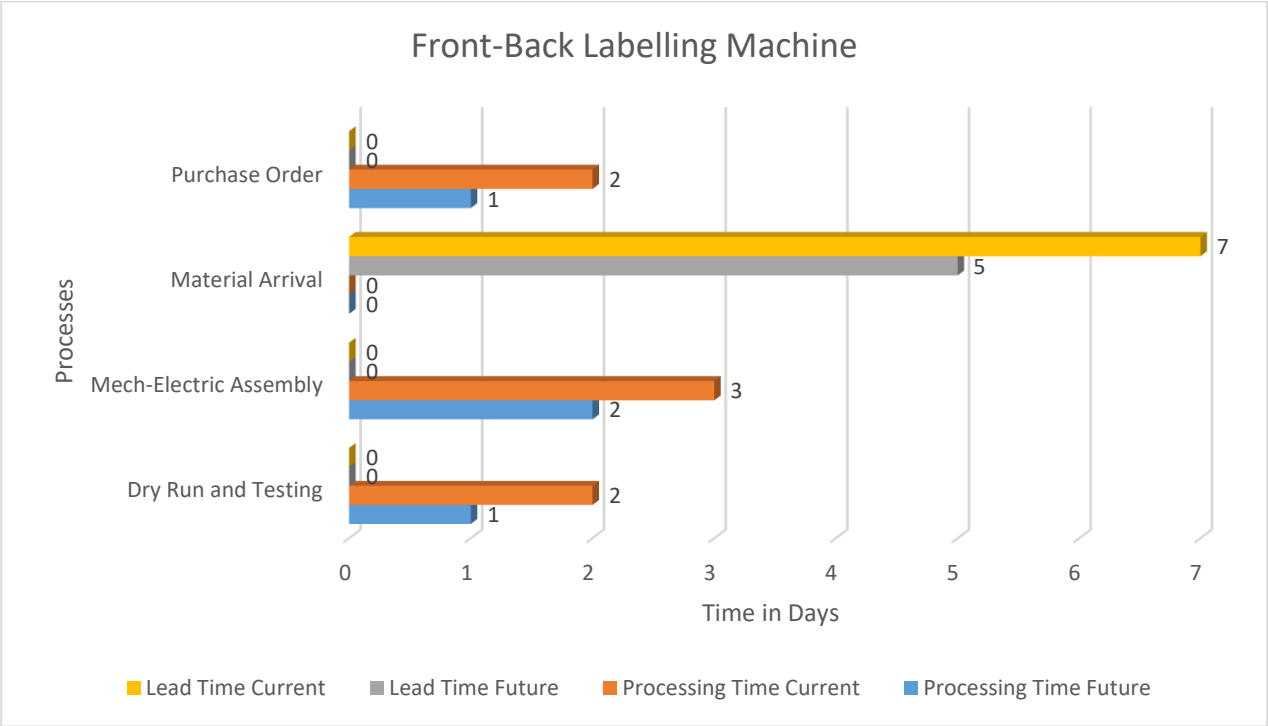


Fig 8.3 Graphical Representation Current and Future State Front-Back Labelling Machine

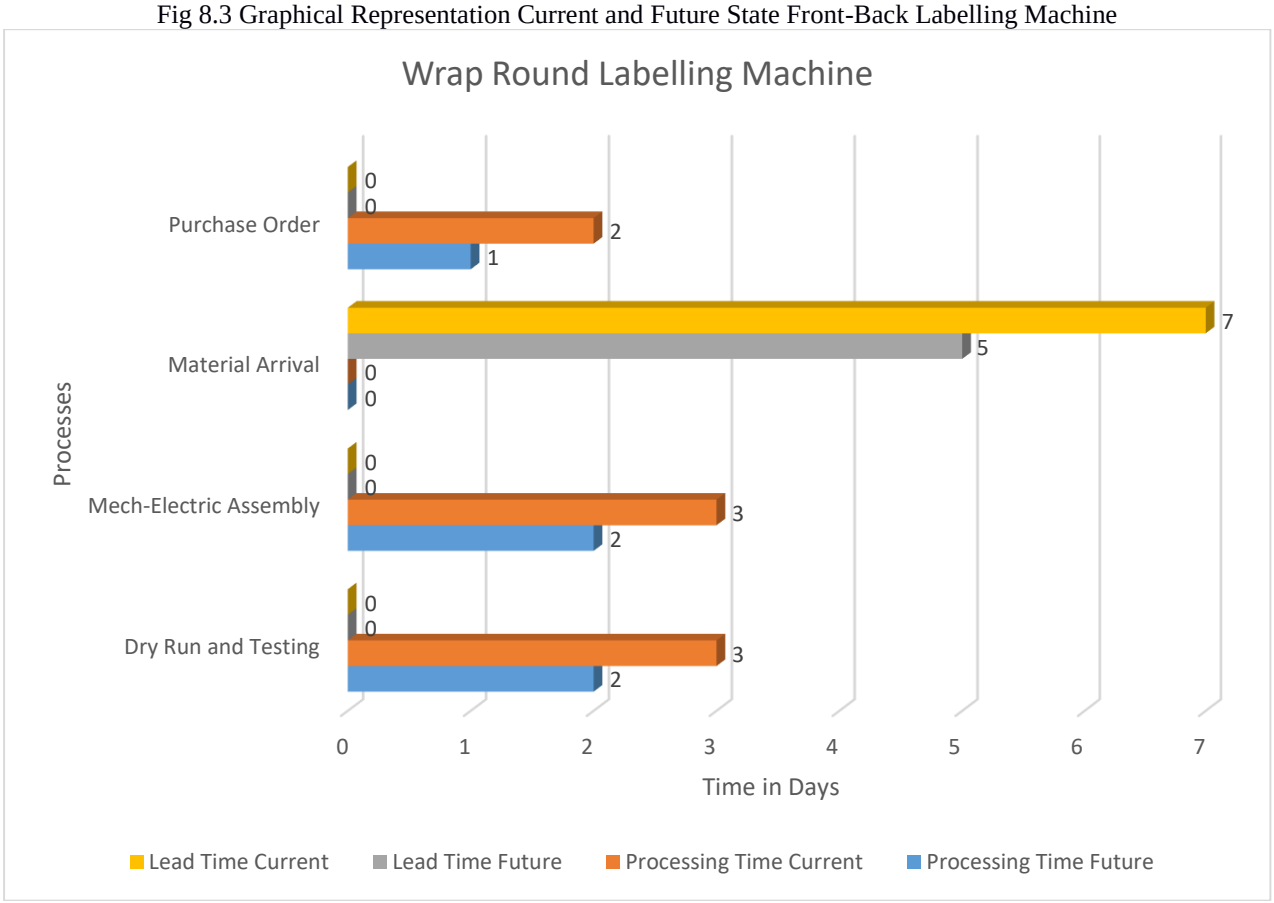


Fig 8.4 Graphical Representation Current and Future State Time of Wrap Round Labelling Machine

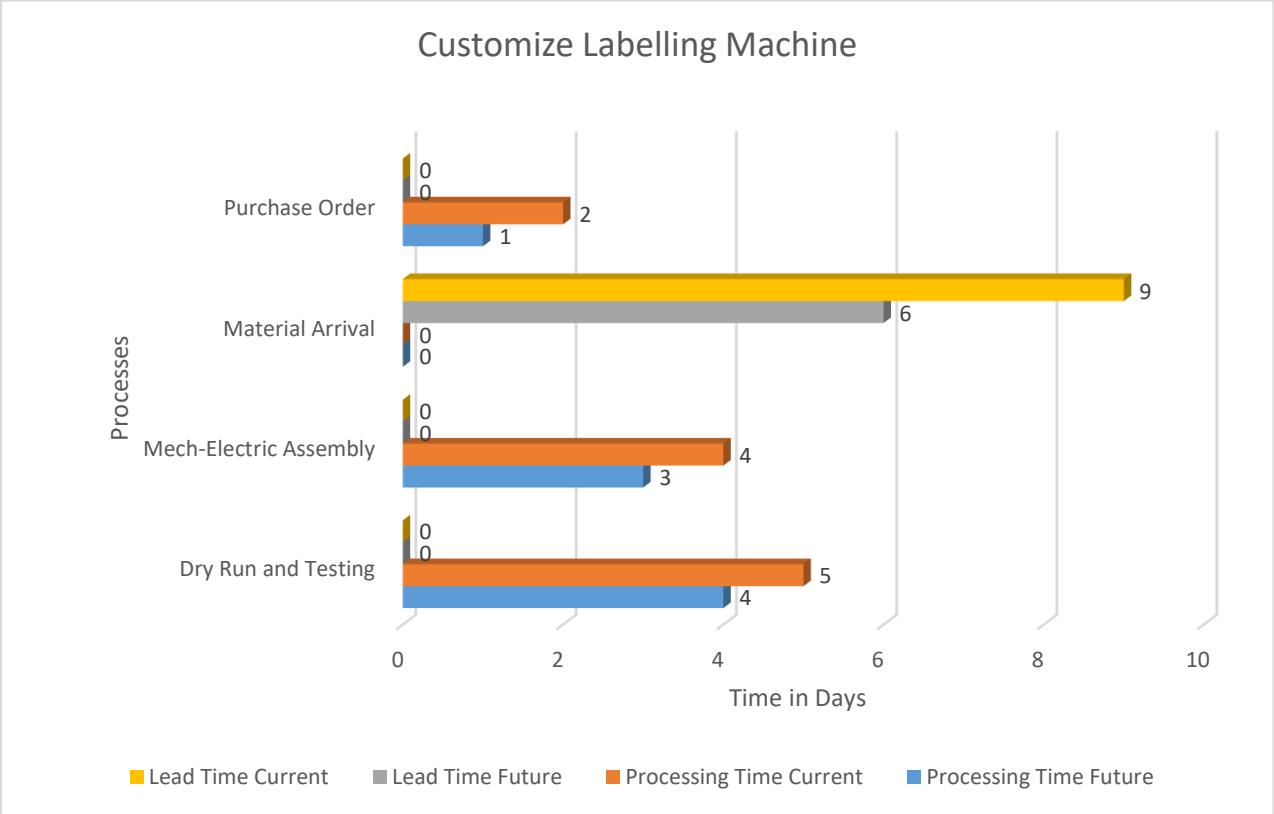


Fig 8.5 Graphical Representation of Current and Future State Time of Customize Labelling Machine

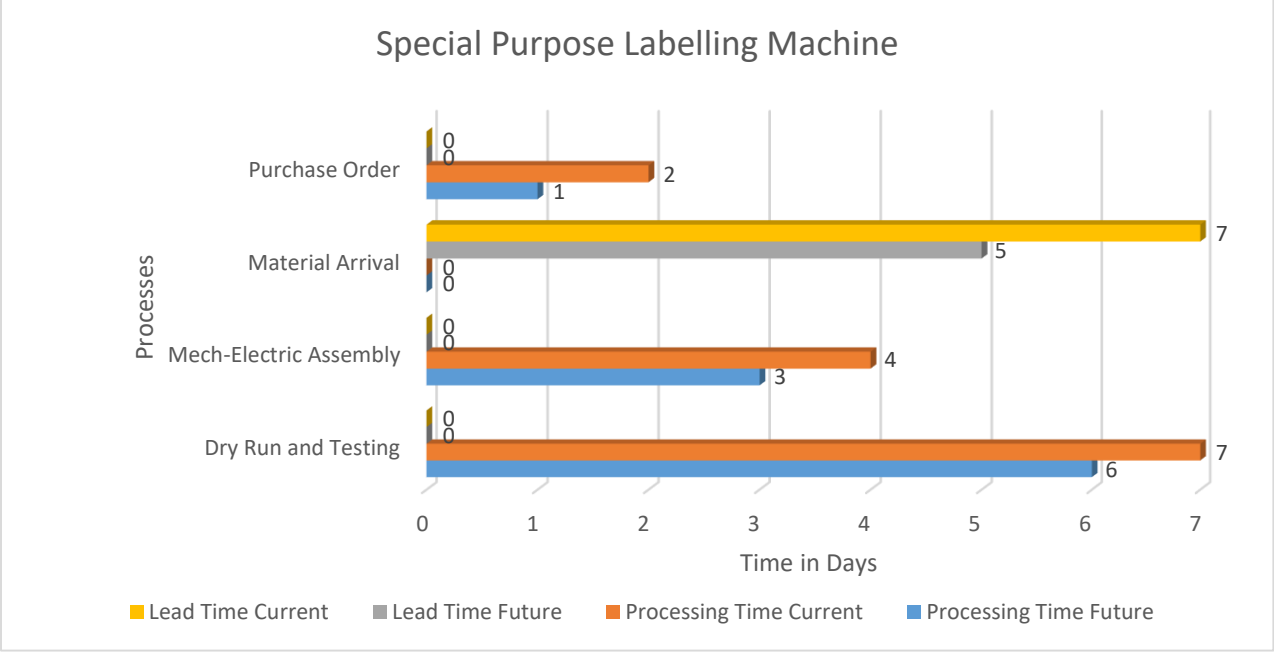


Fig 8.2 Graphical Representation Current and Future State Time of Special Purpose Labelling Machine

Feedback Given by Industry Guide:

3/4/2020 Label Printing Unit

Label Printing Unit

Name: Sujesh Pandalayat

Designation: General Manager - Operation.

SAP System

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [ ] Can be Implemented in near Future
- [x] Will be implemented soon

Double Side Printing

- [ ] Accepted
- [ ] Rejected
- [ ] Implemented
- [x] Can be Implemented in near Future
- [ ] Will be implemented soon

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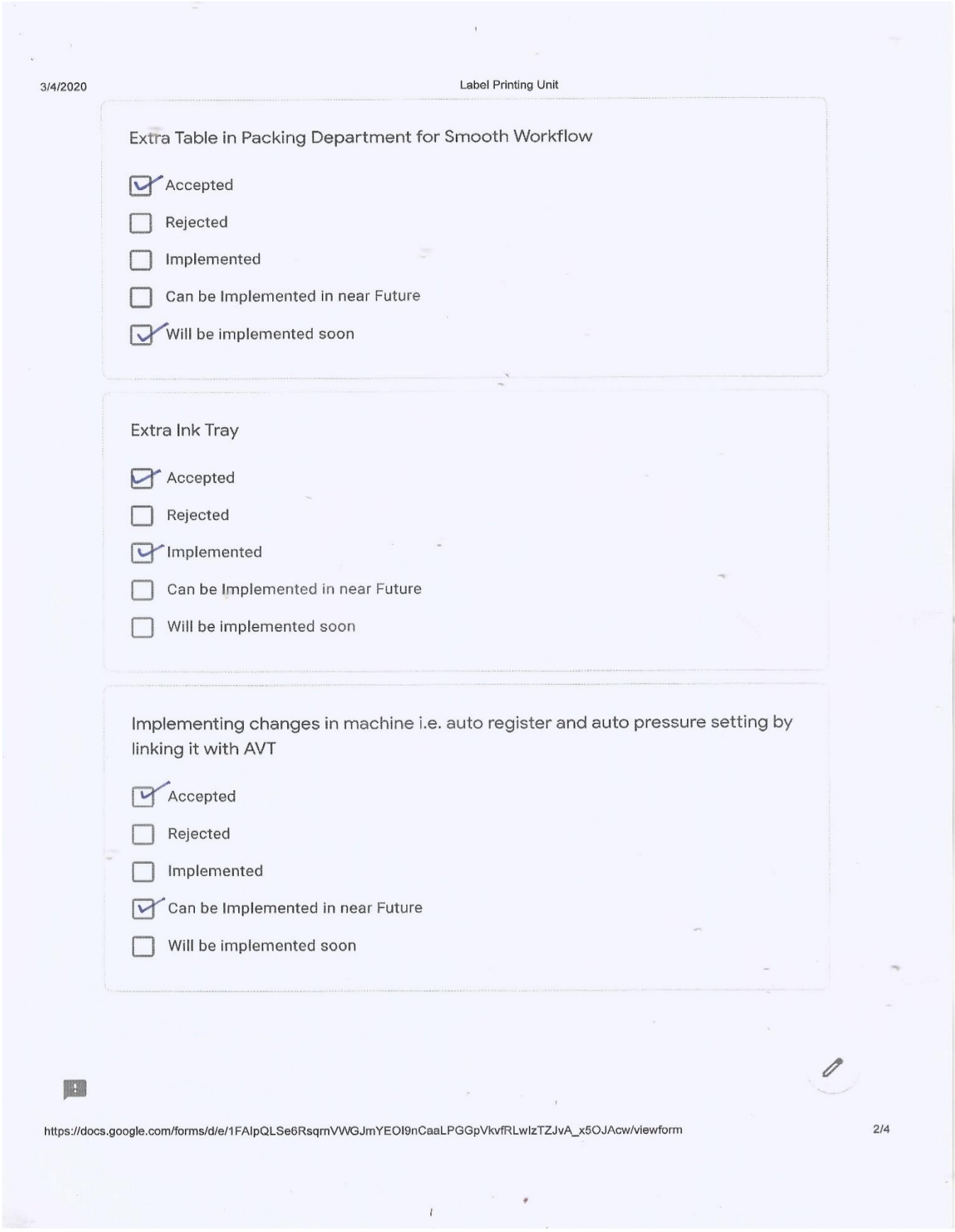

3/4/2020 Label Printing Unit

Extra Table in Packing Department for Smooth Workflow

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [ ] Can be Implemented in near Future
- [x] Will be implemented soon

Extra Ink Tray

- [x] Accepted
- [ ] Rejected
- [x] Implemented
- [ ] Can be Implemented in near Future
- [ ] Will be implemented soon

Implementing changes in machine i.e. auto register and auto pressure setting by linking it with AVT

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [x] Can be Implemented in near Future
- [ ] Will be implemented soon

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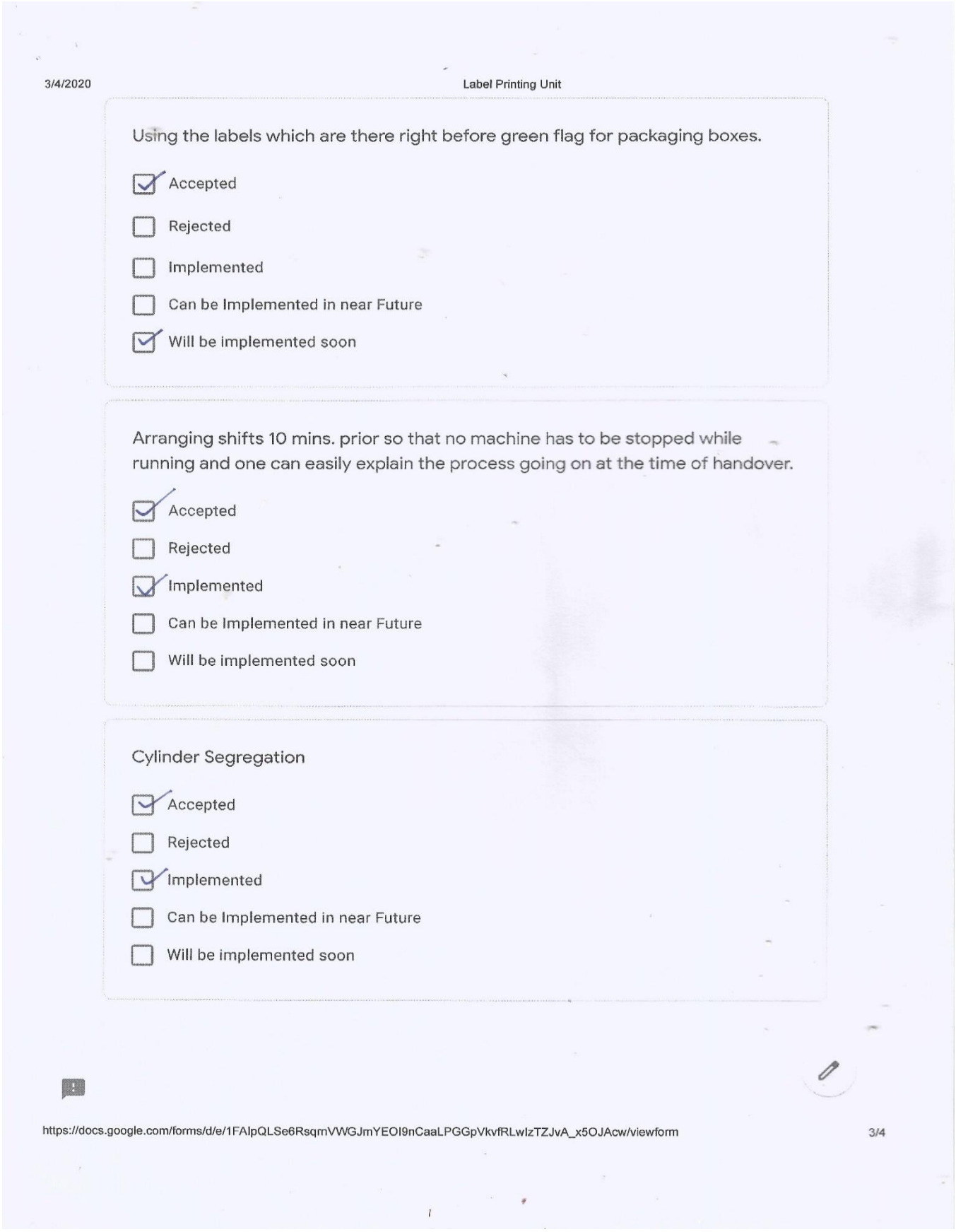

3/4/2020 Label Printing Unit

Using the labels which are there right before green flag for packaging boxes.

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [ ] Can be Implemented in near Future
- [x] Will be implemented soon

Arranging shifts 10 mins. prior so that no machine has to be stopped while running and one can easily explain the process going on at the time of handover.

- [x] Accepted
- [ ] Rejected
- [x] Implemented
- [ ] Can be Implemented in near Future
- [ ] Will be implemented soon

Cylinder Segregation

- [x] Accepted
- [ ] Rejected
- [x] Implemented
- [ ] Can be Implemented in near Future
- [ ] Will be implemented soon

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3/4/2020 Label Printing Unit

Making Ink from 7 base colours (CMYKOGV)

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [ ] Can be Implemented in near Future
- [x] Will be implemented soon

Cleaning of Machines to avoid dust Issues

- [x] Accepted
- [ ] Rejected
- [x] Implemented
- [ ] Can be Implemented in near Future
- [ ] Will be implemented soon

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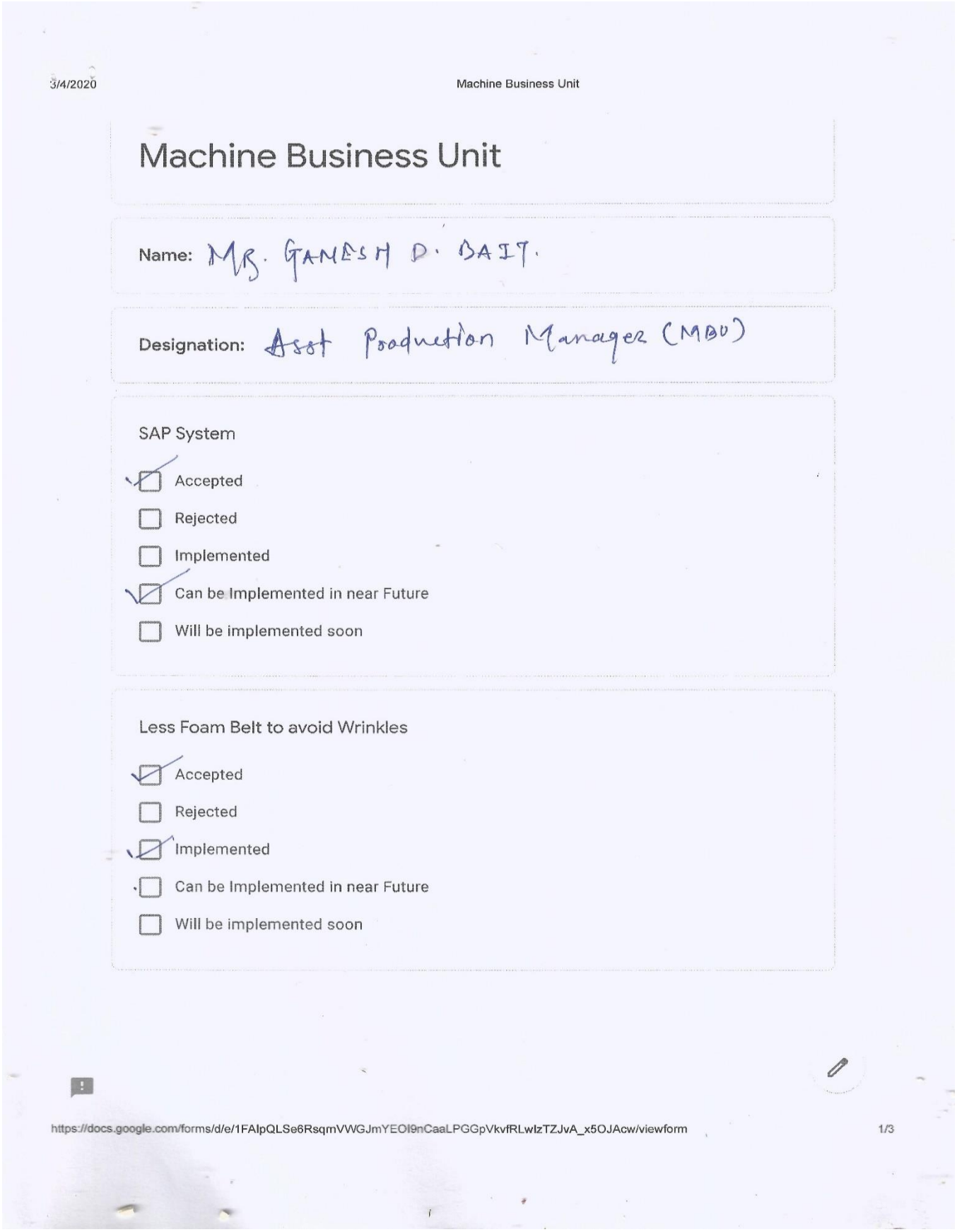

3/4/2020 Machine Business Unit

Machine Business Unit

Name: MR. GANESH D. BAIT.

Designation: Asst Production Manager (MBU)

SAP System

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [x] Can be Implemented in near Future
- [ ] Will be implemented soon

Less Foam Belt to avoid Wrinkles

- [x] Accepted
- [ ] Rejected
- [x] Implemented
- [ ] Can be Implemented in near Future
- [ ] Will be implemented soon

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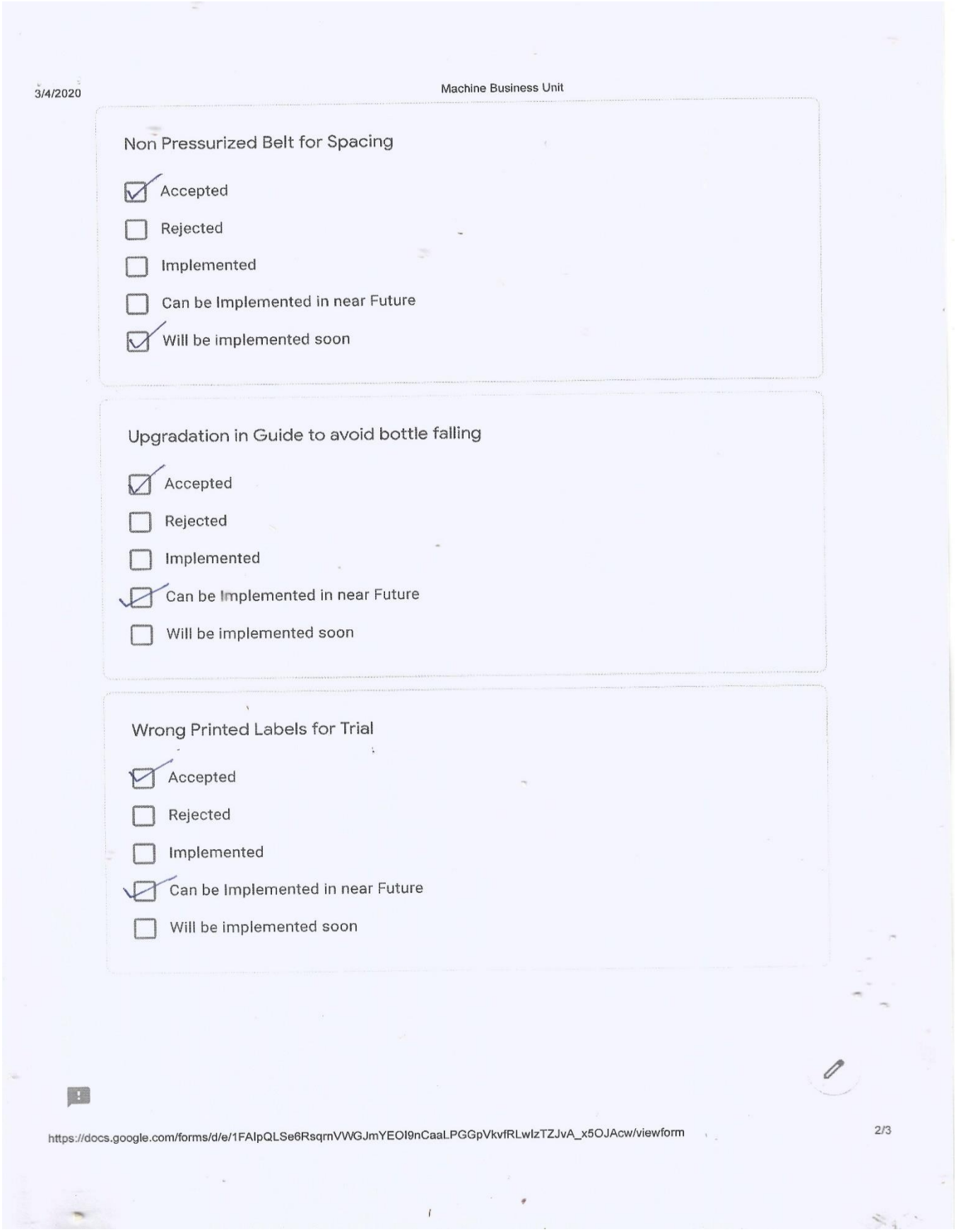

3/4/2020 Machine Business Unit

Non Pressurized Belt for Spacing

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [ ] Can be Implemented in near Future
- [x] Will be implemented soon

Upgradation in Guide to avoid bottle falling

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [x] Can be Implemented in near Future
- [ ] Will be implemented soon

Wrong Printed Labels for Trial

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [x] Can be Implemented in near Future
- [ ] Will be implemented soon

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3/4/2020 Machine Business Unit

Allow for Inventory (particular parts)

- [x] Accepted
- [ ] Rejected
- [ ] Implemented
- [ ] Can be Implemented in near Future
- [x] Will be implemented soon

Clubbing of Manpower (As per Requirement)

- [x] Accepted
- [ ] Rejected
- [x] Implemented
- [ ] Can be Implemented in near Future
- [ ] Will be implemented soon

Sign:

SKANEMA INDIA PVT. LTD. 03/2020

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CHAPTER 9

CONCLUSION

Conclusion

After implementation of all the ideas the major aim was to reduce time and wastage in industry. After reducing the lead time, the industry will be able to take more jobs and complete in the same time. These ideas will help in increasing the industry time efficiency along with its production rate and thereby increasing its profits. It has been said by kaizen "Making small change for the greater good" is always true and hence there should be continuous changes in the system and evolution according to the market demands to make industry highly efficient in every possible way.

CHAPTER 10

FUTURE SCOPE

Future Scope

- By Applying it from door to door we can develop a facility level map
- By integrating it in Departmental/ Interdepartmental practice we can develop a Process Map.
- By integrating it with Multiple plants, Customers / Suppliers we can develop Extended Level Map

CHAPTER 11

REFERENCE

REFERENCE

[1] Abhay Kakirde and Santosh B Dighe, "Lean manufacturing implementation using value stream mapping: A case study of pumps manufacturing company," International journal of science and research, Volume 3, June 2014.

[2] Abu Md. Saifuddoha, Md. Ahasan Habib, Sohana Yasmin Sumi, Md. Jennurine, Md. Saiful Islam, "Minimization of waste by applying value stream mapping in the supply chain of cement industry," *IOSR Journal of Business and Management (IOSR-JBM) e-ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 9, Issue 3 (Mar. - Apr. 2013)*

[3] A. K. Choudhury and M. K. Tiwari, R. K. Singh and S. Kumar, "Lean tool selection in a die casting unit: a fuzzy-based decision support heuristic, International Journal of Production Research," International Journal of production research, June 2015.

[4] Amandeep Singh and Harwinder Singh, "Application of lean manufacturing using value stream mapping in an auto-parts manufacturing unit,

[5] Ashwini Kumar Dhingra, Bhim Singh and Sunil Kumar, "Process improvement through lean-kaizen using value stream map," January 2018.

[6] Bangkit Wiguna, Marimin, Muhammad Arif Darmawan, Machfud and Muhammad Panji Islam Fajar Putra, "Value chain analysis for green productivity improvement in the natural rubber supply chain: a case study, Journal of cleaner production, February 2014.

[7] Carlos Ochoa Laburu, Ibon Serrano Lasa, Rodolfo de Castro Vila, "An evaluation of value stream mapping tool," Business Process Management Journal · February 2008.

[8] Christian Kohler, "Value stream optimization and digitalization-adaption of values and value streams to industry 4.0," Industrial engineering and management research institute, March 2019.

[9] Clifford S. Barber and Brian C. Tietje, "A research agenda for value stream mapping: The sales process," Journal of Personal Selling and Sales Management · April 2008.

[10] David Bennett, Deepak Goel, Dinesh Seth, Nithin Seth, LyesBenyoucef, Nitin Seth and Vipul Jain, "Application of value stream mapping (VSM) for minimization of waste in the processing side of supply chain of cottonseed oil industry," Journal of manufacturing technology management,2008.

[11] Girdhar B Kamath, Nithin Rajappa, Shrinivasa Rao Potti and Shiva Prasad H.C, "Feasibility of powder coating process inside Indian paint's company trough value stream mapping approach," International Journal of recent technology and engineering, March 2019.

[12] Gun Nanda Tian Purnama, Gunanto, Humiras Hardi Purba and Siti Aishyah, "Analysis of increasing the productivity of using tinting machines based on the value stream mapping method in the paint industry," International Journal of research in engineering, science and management, December 2018.

[13] H. Lichtenberg, "Applying lean principle in process industries," Industrial maintenance and planet operation, volume.69, number 6, pp. 24-25, 2008.

[14] Hung-da Wan, F. Frank Chen, "Leanness Score of Value Stream Maps, "January 2007.

[15] Holger Pfaff, Marina Novak and Ute Karbach, "Does value stream mapping affect the structure, process and outcome quality in care facilities?" August 2017.

[16] Jafri MohdRohania, Seyed Mojib Zahraee, "Production line analysis via value stream mapping: a lean manufacturing process of color industry," 2nd International Materials, Industrial, and Manufacturing Engineering Conference, MIMEC2015.4-6 February 2015, Bali Indonesia.

[17] K. Venkataraman, B. Vijaya Ramnath, V. Muthu Kumar, C. Elanchezhian, "Application of value stream mapping for reduction of cycle time in machining process," 3rd international conference on material processing and characterization (ICMPC 2014).

[18] Korakot Yuvamitra, Jim LeeKanjicai and Dong Korakot Yuvamitra, "Value stream mapping of rope manufacturing," International Journal of manufacturing engineering, February 2017.

[19] Nick Rich and Peter Hines, "The seven value stream mapping tools," International Journal of operation and production management, Volume 17 Iss 1 pp. 46-64, 1997.

[20] N. Sharma and V. N. Bartaria, "Implementation of lean technology using cellular manufacturing in the textile industry," *International Journal of Advance Engineering and Research Development*, vol. 2, no.5, 40–49, 2015. Pradip Gunaki, S.N. Teli, Fauzia Siddiqui, "A Review Paper on Productivity Improvement by Value Stream Mapping," April 2015, Volume 2, Issue 4.

[21] Patxi Ruiz-de-Arbulo-Lopez, Jordi Fortuny-Santos, Lluís Cuatrecasas Arbós, "Lean manufacturing: Costing the value stream, "Industrial Management & Data Systems, Vol. 113 Iss: 5, pp.647 – 668 (2013).

[22] Praveen Saraswat, Deepak Kumar and Manoj Kumar Sain, "Reduction of work in process inventory and production lead time in a bearing industry using value stream mapping tool," International Journal of Managing Value and Supply Chains (IJMVSC) Vol. 6, No. 2, June 2015.

[23] RE Aishvariya, N Akalya, T Saravana Kumar, PR Soumya and V. Minu Manjari, "Implementation of lean manufacturing tools in garment industry, International Journal of latest technology in engineering, management and applied science, Volume 6, march 2017.

[24] Sergio Rosenbaum; Mauricio Toledo, and Vicente González, "Improving Environmental and Production Performance in Construction Projects Using Value-Stream Mapping: Case Study, "Journal of Construction Engineering and Management · February 2014.

[25] T. Melton, "The benefits of lean manufacturing, what lean thinking has to offer the process industries," Trans IChemE, part A, June 2005.

IEEE PAPER

Lean Manufacturing Implementation in Machining and Labelling Industry using VSM

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ABSTRACT

Value-stream mapping is a lean-management method for analyzing each and every series of events of current state and designing an ideal state which can be useful for other lean strategies within an organization. Value Stream Mapping begins right from the start where the order of a product or service is received till it is delivered to the customer through all the manufacturing process steps, this all steps are mapped down physically in a chart. Its main objective is to identify and eliminate all non-value added activities (waste). Mapping down all the steps followed in production and doing time and motion study, helps us to know the exact state and find out the places where we are going wrong and helps to improve them by either reducing the wastage or by eliminating it. In this paper we have done a case study of a machining and label printing industry and recorded information for the same and identified non-value added activities like waiting time, wastage of labels, etc. and suggested ways in order to overcome it. By implementing these ideas, it will increase the lead time of industry, reduce and reuse of waste labels, thereby increasing company efficiency.

INDUSTRY PROFILE

ABC Private Limited is leading producer of self-adhesive labels. Organization's aim is to be preferred supplier of cost efficient and logistically smart Labelling solutions to large national and multinational customers by providing products and customer relations of high quality. Industry faces a problem dealing with the wastage of resources so in order to overcome that wastage we have studied and gathered the information regarding the ongoing processes in industry and developed various ideas to reduce wastages.

INTRODUCTION

Looking at the current market and manufacturing industries all are competing with each other value by value, so in order to overcome this and increase their profit they continuously need to review and improve their manufacturing system [7]. This can be done by using lean manufacturing tool known as Value Stream Mapping (VSM). Value Stream Mapping can be defined as visualization of all the processes going on in an industry in the form of map. A value stream map gives us a complete idea of all the processes right from the start till the order or service is being delivered, by mapping/measuring all the processes it becomes easy to find out the faults or drawbacks, i.e. where organization is lacking and one can focus on those areas and improve [11]. It is similar to that of lean Kaizen methodology that states continuous improvements, eliminates waste and boost efficiency [2]. During the implementation of VSM the managing staff needs to completely identify the processes and wastages going during the production which can be anything that does not add value to our product, VSM involves both value-added activity as well as non- value added activities [10]. Value-added activities are those in which the customer is willing to pay for it and it focuses on process variation resulting in waste whereas non- value added services are those which does not add value to our product i.e. waiting time, wasting of resources etc. a failed implementation of VSM can lead to loss of time as well as money [2].

In today's world in every manufacturing industry waste exists in some or other form, so reducing it is very crucial process in lean manufacturing, and just focusing on a single process isn't going to help in order to reduce it, hence there should be a complete study of all the processes and reducing waste from each and every place should be the main motive.

VSM is ideally used in order to represent the actual and ideal state of the processes going in industry. In order to implement a proper VSM we need to follow following stages:

Stage-I: Collecting and measuring the data require for mapping the ongoing process in industry and drawing an

actual map.

Stage-II: Identifying drawbacks and wastages.

Stage-III: Developing ideas which will overcome drawbacks and reduce wastage in order to improve processes.

Stage-IV: Making of ideal state map.

Stage-V: Implementation of ideas.

Stage-VI: Calculating the expected outcome [11].

The paper further discusses case study which shows a path in order to tackle waste.

LITERATURE REVIEW

Value stream map practices

Value stream mapping is a lean manufacturing tool which is used to plan production process involving lean methodology through systematic data capture and analysis [6]. It shows a current state map to make a picture of the production flow and understand the company's current cycle times, process communications, and machine specifications [6].

Value stream mapping (VSM) uses a lean methodology to restructure manufacturing systems and its objective is to develop a value stream map to perform lean methodology for the respective industry [5]. It focuses on increase in elimination of waste and production rate with best quality and reliability [9]. VSM involves process steps which include value added and non-value added operations to analyse and uses VSM as a visual tool to help us to see hidden waste and waste sources. Future state map developed to design a stream of lean processes through eliminating the root causes of waste and through process improvements [15]. Improved areas and current state of the manufacturing unit is being made with the help of VSM symbols [8].Value stream mapping overcomes low productivity, longer production lead time, rework and rejection. It has proved that it is a useful technique to reduce cycle time up to optimum level [10]. This methodology is subjected to principles of continuous improvement in order to improve the productivity of the process and quality of the product [13].VSM in health care organization aims to increase patients value and quality of care by visualization and quantification of care process [2].Green Value Stream (GVS) map is a tool to map waste generators that exist in value added systems [14].

Lean-Kaizen practices

Lean manufacturing refers to a manufacturing improvement process, to minimize or eliminate waste while maximizing production flow [6].It is a proved that this process is used for planning and improvements that will allow companies to develop lean practices [6]. Lean implementation must be determined from a well-defined process map in order to estimate the improvement after implementation [5].Main objective of lean methodology is to reduce waste such as human effort, inventory, time to market as well as manufacturing space which makes more responsible for the customers demand of quality product [15].The lean system solves the problem of organization by eliminating wastes that are in the way of excess production, unnecessary movement of materials, waiting and delays, over processing, workers movement, rework and rejections [8]. From the customer's point of view value added activities refers as: the customer is willing to pay for any product or service [10]. By reducing waste by lean methodology it improves the quality and reduction in cost of product [10]. Lean-Kaizen is composed of two words lean and Kaizen in which lean means elimination of non-value added activities and Kaizen means continuous small improvements [1]. Sunil Kumar, Ashwini Kumar Dhingra and Bhim Singh has implemented Lean-Kaizen concept in a small- and medium-scale enterprise (SME) at a non-capital region in India [1].In the Kaizen event, two techniques were proposed: the poka-yoke technique and brainstorming technique were applied [1]. Lean manufacturing does the task of elimination of wastes in the manufacturing system by focusing on product value and reducing non-value adding activities through continuous improvement efforts [13].

CASE STUDY

The case study which is mentioned is of multi-national industry that manufactures Labelling machines and prints labels for different leading industry. The methodology of Value Stream Mapping (VSM) starts with selection of particular job or product. In order to complete this case study, we have selected, studied and observed a product and machine which includes all the procedures that are followed in the industry and based on that we have created current state map.

1. Current State Map: The current map consists of all the processes right from the start from the time order gets placed till it gets delivered to the customer. The data which are involved in all these operations are time, material flow, information flow, inventory was recorded and map was made from it as shown in figure 1, figure 5.
2. Future State Map: After studying each and every process from current state map few modifications will be made to all process that we ideally reduce the wastage of time as well as resources as shown in figure 3, figure7.

1.1 Current State Map of Machining Department

Activities and processes of all concerned department are noted and discussed as below:

a. Marketing and Sales Department

The marketing department's role is to promote the business and mission of an organization. Sales department work is to negotiate with prices, distribution of machines and give proper customer service. They receive the order from the consumer. The time require to complete the process completely depends on the customer. Customer places the order according to their requirement i.e. dimensions of the machine, type of Labelling (front & back, wrap round, top, bottom),

speed, etc. are also specified by the customers. Sales department give the estimate to the customer. Sales department orders the material requires in the manufacturing of the machine as per the purchase order.

b. Design Department

The work of design department is to analyse and make a design as per the requirement received from the customer. They make the purchase order as per the design and then it is handed over to the sales department the time requires to complete the process is 1 day.

c. Production Department

Production department gets the 2D design from the design department. The estimated time is decided as per the size, requirements of machine. They assemble various parts to the machine and then they run it on dry mode to check the components are working properly. Then testing is done on it to check whether label is properly applied on the product provided by customer and after the successful testing it is handed over to quality department.

d. Quality Department

Quality department work is to provide quality product to the customer. They inspect the quality of machine and if they find any problem with respect to quality then they ask to overcome that problem. After the quality inspection machine gets ready for dispatch.

e. Dispatch Department

Dispatch department disassemble the machine and pack it. Then it is loaded in the truck with the help of pallet jack.

For current time related activities of above department refer figure 1.

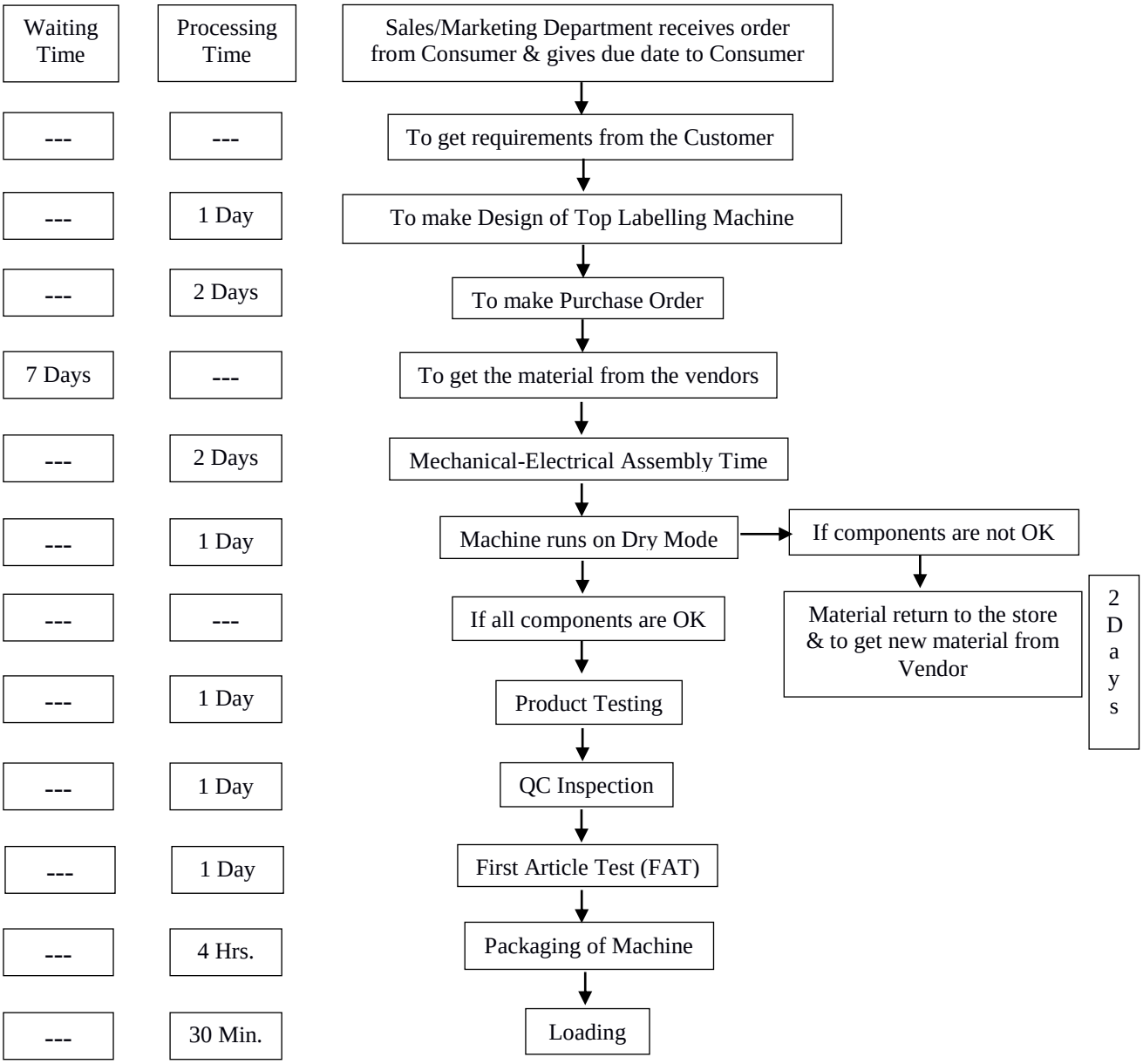

Figure 1: Current state map of machining department

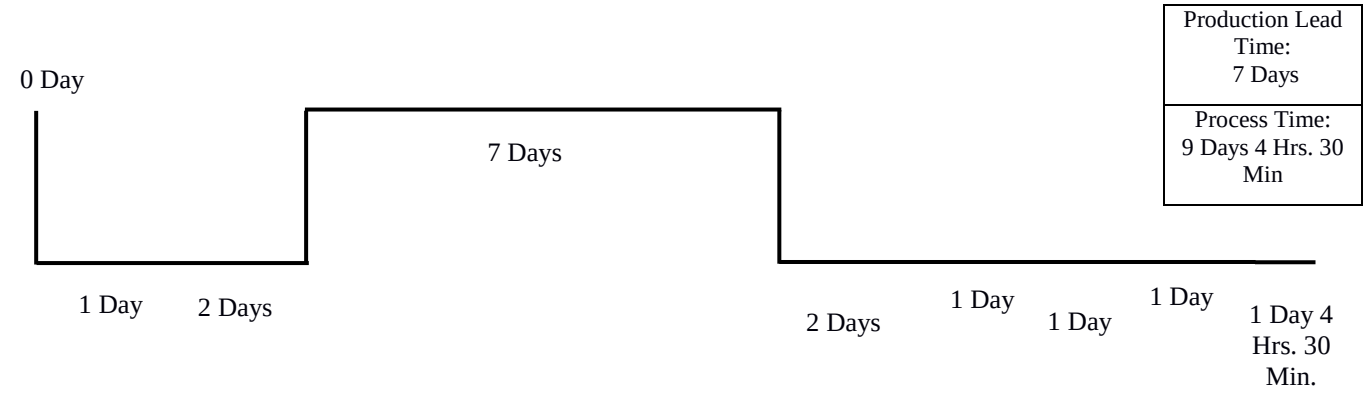

Figure 2: Value stream map of current state of machining department

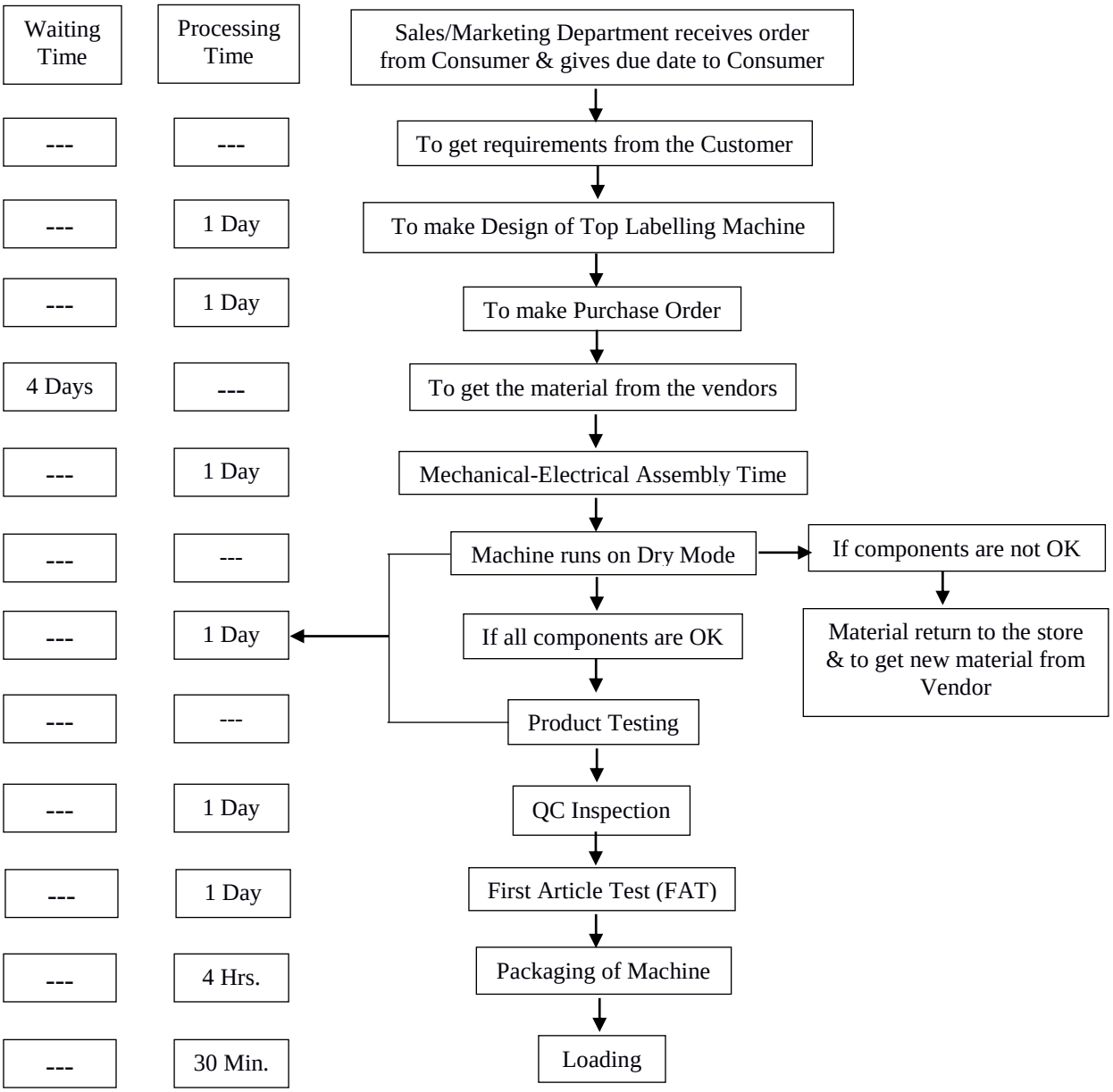

Figure 3: Future state map of machining department

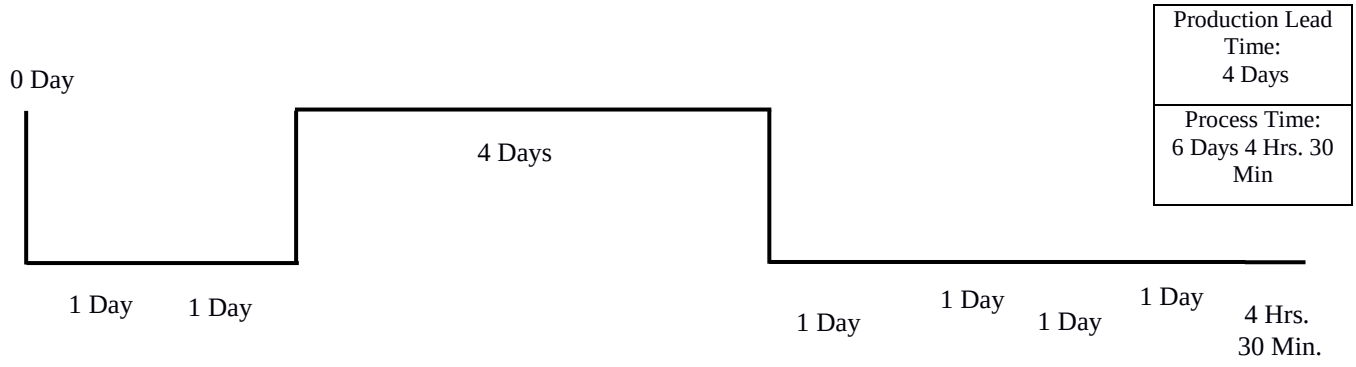

Figure 4: Value stream map of future state of Machining Department

2.1 Future state map of machining department

The description of modifications is listed below:

a. SAP System: SAP system is software which increases interaction between vendor and industry. By installing this system, the materials which are required can be directly added to it and order will be placed automatically. Hence, 1 day can be saved which was earlier 2 days to make purchase order.
b. Similar Components: Components that are used frequently for all sort of Labelling machines (e.g. Labeler, motors, etc.) that can be pre ordered thus saving our lead time.
c. Assembly Time: Mechanical-Electrical Assembly can be completed in one day by gathering man power and making them work on a single machine, and electric assembly just takes about 2-3 hours.
d. Clubbing two sections: The total man power available for product testing is of four people so we can divide them in two shifts and club it with product testing which takes one day (shift of 8 hours) and making them work in evening shift so that both things can be done in single day.

1.2 Current State Map of Labelling Department

g. Marketing and Sales Department

The work of marketing and sales department is to work for the promotion of the company and get orders. Each and every person coordinate with the respective customer for the orders, the orders is usually received via emails along with their artwork and material requirements. Then the artwork is then sent to prepress department.

h. Prepress Department

After receiving the order from the sales department the prepress department starts working on the artwork and develops it with shade and other requirements of the label and then send it to the customer for verification, after confirmation from the customer they start processing the plates of printing cylinder and thin die plate which does the work of blanking and is mounted on magnetic cylinder.

i. Planning Department

After the finalization of artwork and ordering of plates, the planning department orders the required raw materials from the vendors and keep track on the delivery of those materials which are usually delivered after 4 days from order, once the raw materials are received the store department updates them about the arrived material and segregate it accordingly, planning department then schedules when the job has to be taken for printing they plan for daily basis according to the customer requirement and hence the process takes 8 hours.

j. Printing Department

Once the job is being scheduled the raw materials are transferred to the shop floor from store then the changeover of the previous job takes place, the average time required for change over is 60 min. Then the printing of job takes place the time required completely depends on the running meter required by the customer. After printing the job is taken for slitting where they make rolls according to requirements of the customer. It usually takes them 60 min for doing slitting.

k. QC Department

Here labels are checked by sampling inspection. They check the quality of labels which include its dimension, shade, text, defects etc. and takes 30 min. for each job.

l. Packing and Dispatch Department

After the job has passed QC inspection the job is transferred to packing department where they wrap plastic over the bundle of job and pack in box and paste the dispatch slip on the box. The process takes 5 min for one box. The sales department sends the data to the dispatch department when which job is to be dispatched along with GST invoice and challan and then the job is transferred to the vehicle and dispatched.

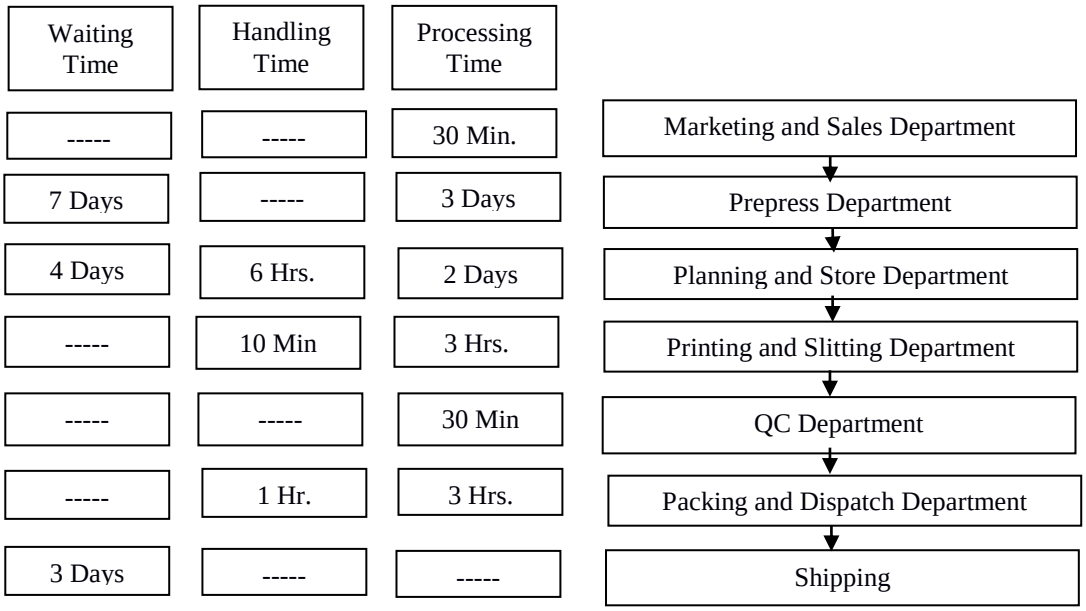

Figure 5: Current state map of labelling department

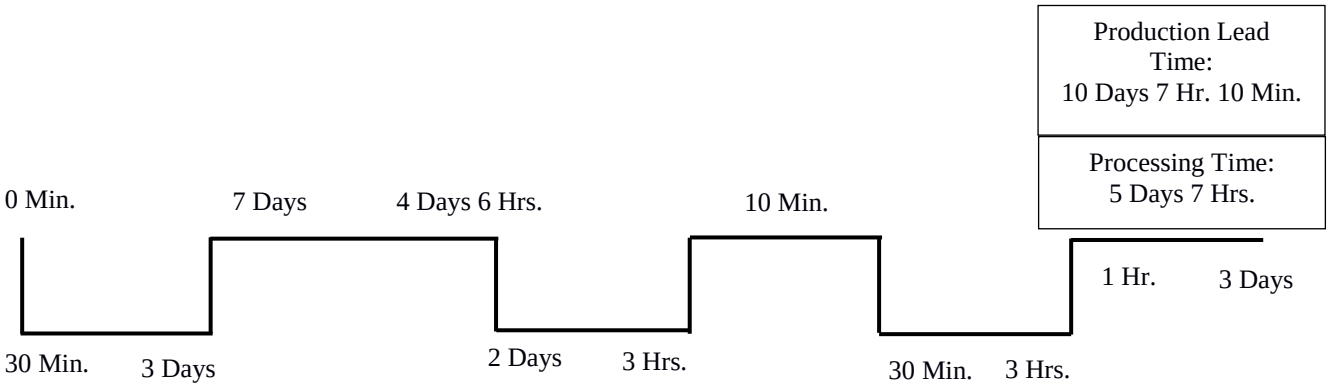

Figure 6: Value stream map of current state of Labelling

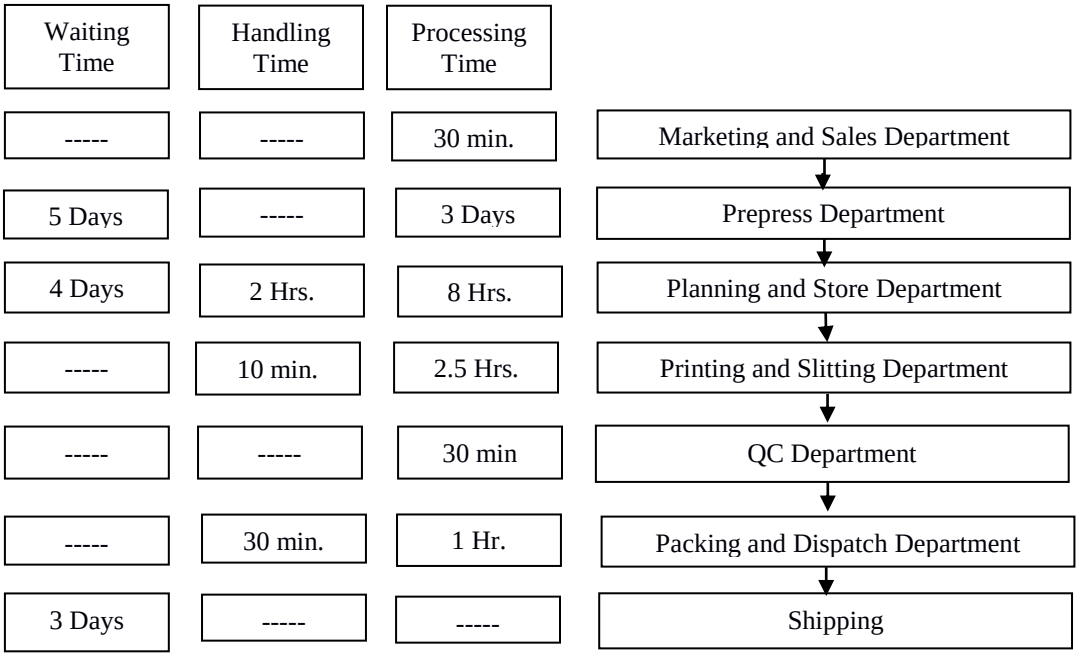

Figure 7: Future state map of Labelling department

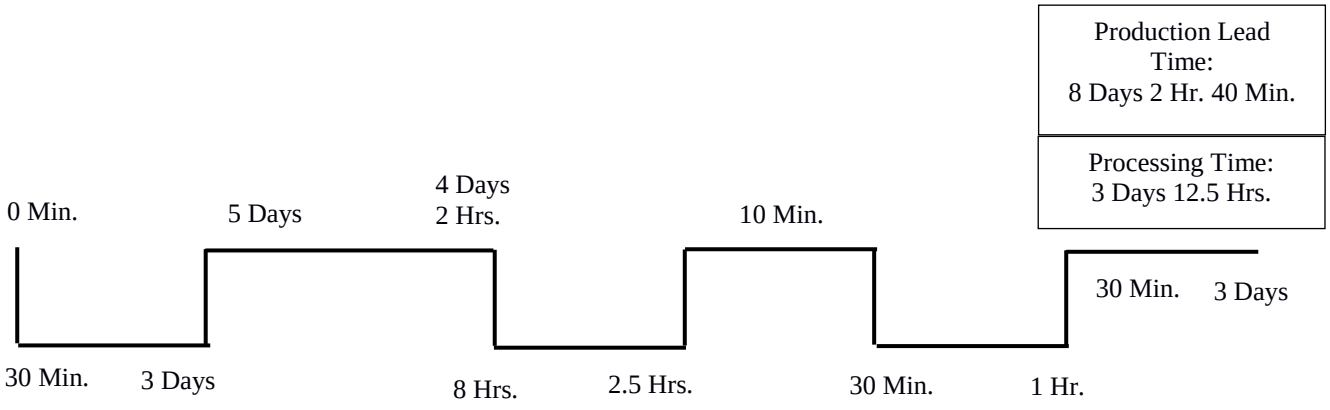

Figure 8: Value stream map of future state of Labelling department

2.2 Future State Map of Labelling Department

All the required changes are listed below:

a. Safety Stock: According to the current state map it takes about 4 days for receiving raw materials so to tackle this we can order the products of regular customer and giving them the premium tag so that we can be notified earlier regarding the changes in materials or artwork.
b. Uptime: Another main issue is less amount of uptime as there are multiple jobs because of which there is lot of change over time which is approx. 1 hour behind every job, which can be reduced by having a continuous production of one single job in every shift or daily basis.
c. Adding man and ink trays: The average time required for make ready of machines is 60 min in which major time is wasted to clean the ink trays and anilox cylinder so keeping a person in order to make ink and replace it with old job ink trays can save up to 15 min. for each job.
d. Implementing auto register and auto pressure: It takes much time for setting of pressure and register so which can be reduced by implementing auto register and auto pressure which can even reduce the wastage of labels while setting.
e. SAP System: Implementation of SAP system in industry will reduce all the extra time in which the person usually goes for checking everything, it will also reduce the time for placing purchase order, as all the orders will be placed by the marketing team as they are the one who get all the necessary details of the job first. Planning about the job will also be based on the basis of first in first out. Thereby reducing the planning time as well. And all the dispatch challan and GST invoice will be formed in dispatch department itself.
f. Initial packing procedure consumes much lead time as it takes 5 min for each box which can be reduce to three minutes for each box by adding a single table which will even reduce the efforts taken by them to pick up and place it on packing machine where it can be done by sliding the box.

CONCLUSION

After implementation of all the ideas the main aim was to reduce the overall time, the efficiency increased by 37.077 % and 25.389 % as shown in Figure 9 and Figure 10, in machining and Labelling department respectively. The graphical representation shows the area on which the value stream map has affected and hence the time has been reduced. After reducing the overall time, the industry can add few more jobs in that same time thereby increasing their production rate and profits. It has been said by kaizen "Making small changes for the greater good" is always true and hence there should be continuous changes in the system and evolution according to the market demands to make industry highly efficient in every possible way.

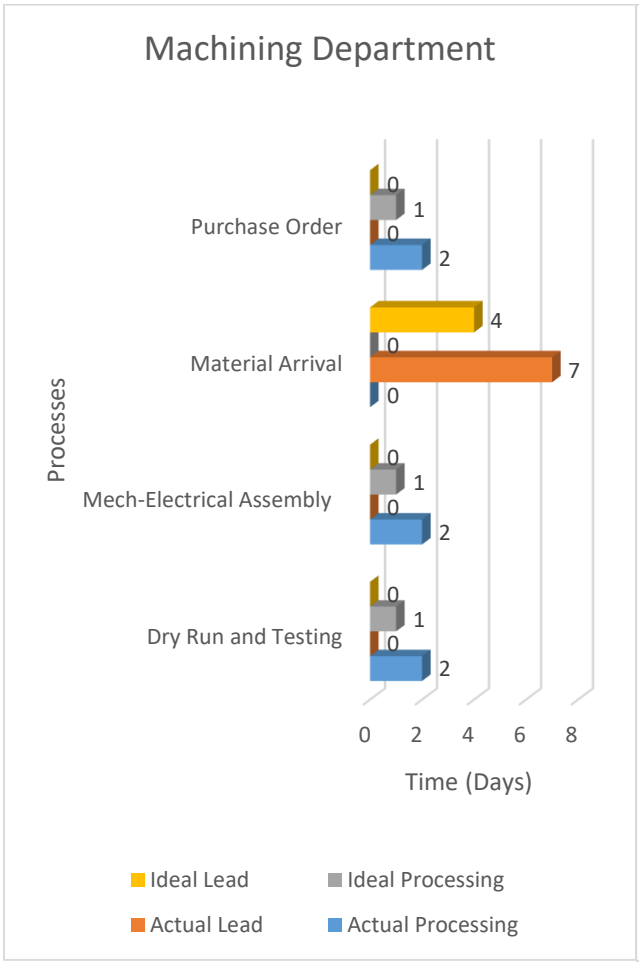

Figure 9

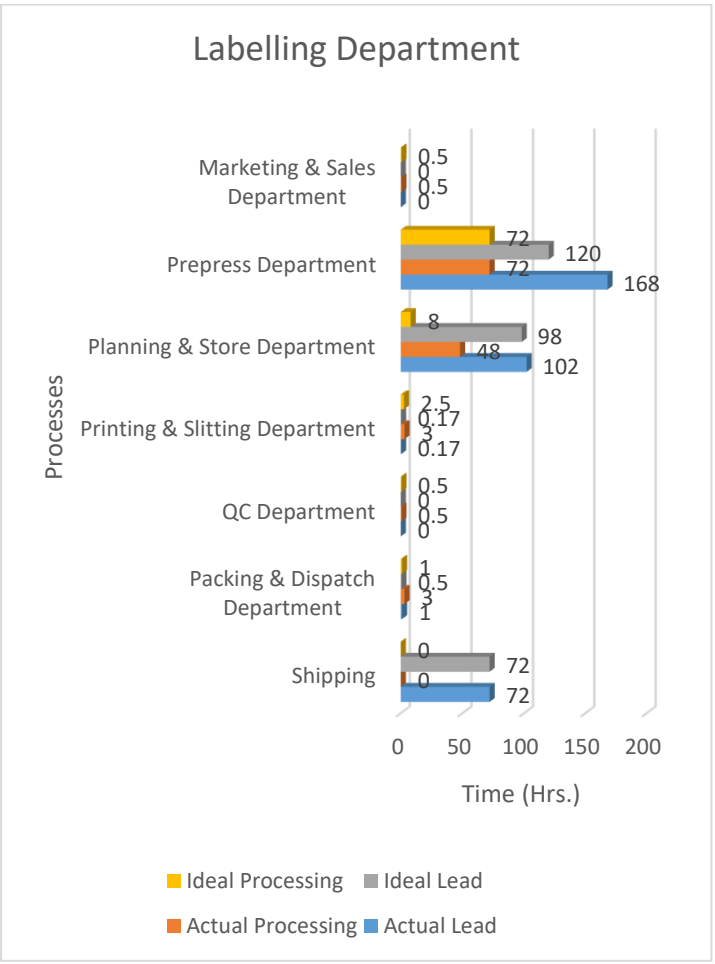

Figure 10

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REFERENCE

[26] Abhay Kakirde and Santosh B Dighe, "Lean manufacturing implementation using value stream mapping: A case study of pumps manufacturing company", International journal of science and research, Volume 3 June 2014.

[27] A. K. Choudhury and M. K. Tiwari, R. K. Singh and S. Kumar, "Lean tool selection in a die casting unit: a fuzzy-based decision support heuristic, International Journal of Production Research", International Journal of production research, June 2015.

[28] Amandeep Singh and Harwinder Singh, "Application of lean manufacturing using value stream mapping in an auto-parts manufacturing unit"

[29] Ashwini Kumar Dhingra, Bhim Singh and Sunil Kumar, "Process improvement through lean-kaizen using value stream map", January 2018.

[30] Bangkit Wiguna, Marimin, Muhammad Arif Darmawan, Machfud and Muhammad Panji Islam Fajar Putra, "Value chain analysis for green productivity improvement in the natural rubber supply chain: a case study", Journal of cleaner production, February 2014.

[31] Christian Kohler, "Value stream optimization and digitalization-adaption of values and value streams to industry 4.0", Industrial engineering and management research institute, March 2019.

[32] David Bennett, Deepak Goel, Dinesh Seth, Nithin Seth, LyesBenyoucef, Nitin Seth and Vipul Jain, "Application of value stream mapping(VSM) for minimization of waste in the processing side of supply chain of cottonseed oil industry", Journal of manufacturing technology management,2008.

[33] Girdhar B Kamath, Nithin Rajappa, Shrinivasa Rao Potti and Shiva Prasad H.C, "Feasibility of powder coating process inside Indian paint's company trough value stream mapping approach", International Journal of recent technology and engineering, March 2019.

[34] Gun Nanda Tian Purnama, Gunanto, Humiras Hardi Purba and Siti Aishyah, "Analysis of increasing the productivity of using tinting machines based on the value stream mapping method in the paint industry", International Journal of research in engineering, science and management, December 2018.

[35] Holger Pfaff, Marina Novak and Ute Karbach, "Does value stream mapping affect the structure, process and outcome quality in care facilities?", August 2017.

[36] Korakot Yuvamitra, Jim LeeKanjicai and Dong Korakot Yuvamitra, "Value stream mapping of rope manufacturing", International Journal of manufacturing engineering, February 2017.

[37] Nick Rich and Peter Hines, "The seven value stream mapping tools", International Journal of operation and production management, Volume 17 Iss 1 pp. 46-64, 1997.

[38] N. Sharma and V. N. Bartaria, "Implementation of lean technology using cellular manufacturing in the textile industry", *International Journal of Advance Engineering and Research Development*, vol. 2, no.5, 40–49, 2015.

[39] RE Aishvariya, N Akalya, T Saravana Kumar, PR Soumya and V. Minu Manjari, "Implementation of lean manufacturing tools in garment industry", International Journal of latest technology in engineering, management and applied science, Volume 6, march 2017.

[40] T. Melton, "The benefits of lean manufacturing, what lean thinking has to offer the process industries", Trans IChemE, part A, June 2005.

[41] H. Lichtenberg, "Applying lean principle in process industries," Industrial maintenance and planet operation", volume.69, number 6, pp. 24-

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