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## Creating value stream mapping to identify areas of improvements and improve USC mailing process

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### ABSTRACT

*Undergrad housing of USC receive personal mails, official mails, perishable packages, etc., on a regular basis and it is hence a very important task of the housing department to deliver the mails to the right person without any damage. Mails and packages that are received are numbered and are fed into the system by scanning the tracking number and by assigning the receiver's name to the tracking number. The process seems to be a fairly simple and effective process that makes sure that no package is lost and no package stays in the mailroom for a long time. But when the process of receiving and sorting is analyzed, we can see that there is a lot of scope for improvement & inventory management. By creating a value stream mapping to identify the areas of improvement, there were many non-value adding steps and a lot of waiting time that lead to an increased cycle time. This paper discusses the improvements that can be implemented in the process steps to make it better and hence increase the efficiency in the service delivered by analyzing the inputs, outputs, and inventory and value proposition involved.*

**Keywords:** *Lean management, Process optimization, Value stream mapping, Process flow chart.*

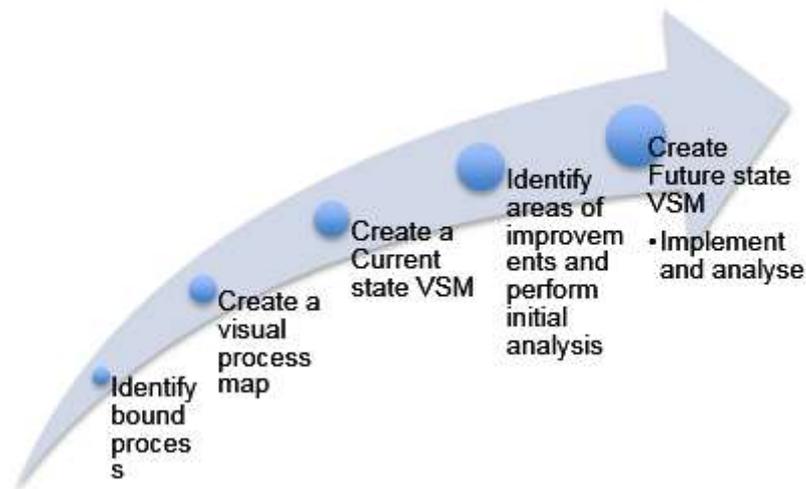
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### 1. INTRODUCTION

Lean is a way of life and implementation of lean in day-to-day processes will increase the value with less work. Lean focuses on creating more customer value with fewer resources. It concentrates on eliminating wastes from the process continuously (Kaizens method) and provide the best possible outcome from the available resources. Lean acts as a way of thinking for the entire organization and it is a misconception that it applies only to manufacturing. By implementing lean we define what process needs to be optimized, who are the people involved and the purpose of the process. Defining all these factors help us identify the wastes involved and gives us an opportunity to fix the problems and make the process at hand better.

Lean helps the organization make a good profit economically, managing the resources efficiently and become more flexible with respect to implementing changes continuously. It is also convenient for the workers when there is a standard process throughout the organization. By implementing the 5S strategy, the process becomes easier and overall efficiency is increased. Also, by using Value Stream mapping technique, we can identify the areas of improvement from the beginning to the point where it is delivered to the customer. Hence implementing Lean as a way of thinking is a recommended method in any business or Manufacturing organization.

I wanted to implement lean in the mail delivery service to reduce the cycle-time by slashing out buffer time and wait times in between the steps. This paper also concentrates on removing unwanted inventory between the process steps and effectively managing the human resource to get better results. The process that is under study is explained below. Inputs, outputs, customers, suppliers and value proposition of the project are explained below. The process was explained with respect to minimum time taken and expected time is taken for each step using a process map. The current state was plotted using Value Stream Mapping and also an initial analysis was done in the project to show the areas of improvements, inventory involved in the process, resources used for each process and the information flow. The improvements are implemented in the Future Value Stream Mapping and the reduced lead-time and resource management are pointed out in the map to show the transition from the current state to future state.



## 2. PROCESS INTRODUCTION

The **bound process** that is to be analyzed can be defined using the flowchart below:



The process, as shown above, starts with receiving mails and packages. There are three different times at which the packages arrive and all of them are logged in as and when they are delivered. There are 3 places where the packages are placed according to the size:

- 1) Bins (Smaller packages like magazine, books, etc.,)
- 2) Shelf (Packages considerably heavy and are fragile)
- 3) Mail boxes (Greeting cards and envelopes).

3 people work on logging in the packages; one scans the package, second person prints out a number and puts it on the bin or shelf according to the size. A few mails that are of small size goes into the mailbox directly and are not scanned into the system, which is done by a third person. As the residents receive emails, they come in to collect the packages. One person logs out the package and hands over the package by identifying the number by which it was logged in. Two people do the inventory check at the end of the day.

**The inputs** for the process would be the packages and mails received from the different mail delivery services at different times for the residents. It may be envelopes, perishable packages, magazines subscriptions, etc. **The outputs** of the process would be satisfied customers, Sorted mails, and packages in an organized way, a complete record of packages logged in and logged out, easy tracking of mails and packages received and an inventory maintained in an orderly manner.

**Suppliers** are FedEx, USPS, and UPS. Occasionally there are other services that come in with packages too. If we get a little deeper, senders of mails/packages can also be considered as suppliers, but as we do not directly interact with the senders in the process and senders do not affect the process in any fashion. **Customers** are the residents of the under grad housing who receive the mails and packages that they receive. They are of the at most importance to the process as the objective of the process is to satisfy the customers.

The **value proposition** associated with the process are high satisfaction of customer and gaining the trust of customers as it is the objective as mentioned before; proper utilization of time and man power, in other words, effective resource management; proper delivery of packages & mails received to satisfy the customers and maintenance of the inventory in an organized manner, hence making the process important to analyze.

Lean was applied in this process by first collecting the data of time taken from the first step to the last step for over a month, a number of people assigned for each task and the average input and customers over a month. Then a Value stream was mapped and all the areas of improvements were identified. This paper deals with finding all the areas of improvements and then mapping a future value stream to see how the value of the process was enhanced.

Data for the time taken during each step in the process and the number of inputs & customers were collected for over a month (5 weeks) and they are shown as below. The time displayed per week is the average maximum and minimum time of 5 weekdays over the week.

Sl.No	Task Name	Maximum Time Taken(minutes)					Average
		Week number					
		1	2	3	4	5	
1)	Receiving mails and packages	10	9.5	10	9.5	9	~10
2)	Logging packages and recipients being notified	14	16	15	17	14	~15
3)	Numbering the packages and mails	16.5	15	18	13.5	14.5	~15
4)	Place them according to mail size						20
	* Bins	7	7.5	7.5	8	8	~8
	* Shelves	5	4	6.5	4	5.5	5
	* Mailboxes	7.5	8	8	6.5	7	~7
5)	Residents receiving the packages						10
	* Verifying ID	1.5	1.3	1.5	1.8	1.6	~2
	* Checking for damage	6.5	5.5	5	6	5.2	~6
	* logging of parcel from the system	1.8	1.6	1.8	1.3	1.6	~2
6)	Inventory Check	29.4	28.3	28	33	28.5	30
CYCLE TIME(per day)						240( for all the 3 services included)	

Sl.No	Task Name	Minimum Time Taken(minutes)					Average
		Week number					
		1	2	3	4	5	
1)	Receiving mails and packages	8	8.5	8	7.5	7.5	~8
2)	Logging packages and recipients being notified	11.8	13	12.3	13.4	12	~12
3)	Numbering the packages and mails	12	12.4	12.1	11.9	12.4	~12
4)	Place them according to mail size						~16
	* Bins	6	7.5	6.1	5.4	5.8	~6
	* Shelves	4.8	5	5.5	4	5.2	~5
	* Mailboxes	7.5	6.3	7.2	6.2	6.9	~7
5)	Residents receiving the packages						~6
	* Verifying ID	1.5	0.9	1.2	0.8	1	~1
	* Checking for damage	5	5.3	4	4.1	3.8	~4
	* logging of parcel from the system	1.2	1.4	0.7	1.1	1.1	~1
6)	Inventory Check	24	26.2	23	25.3	24.9	25
CYCLE TIME(per day)						189(for 3 services)	

Sl.no	Task Name	Average number per week					Total Average over 5 weeks
		1	2	3	4	5	
1)	Number of customers	50	37	46	42	48	~45
	Not satisfied customers	3	4	3	3	4	~3
	Satisfied customers	42	41	42	42	41	~42
2)	Number of packages/mails from all the 3 services together	98	79	95	88	92	~90

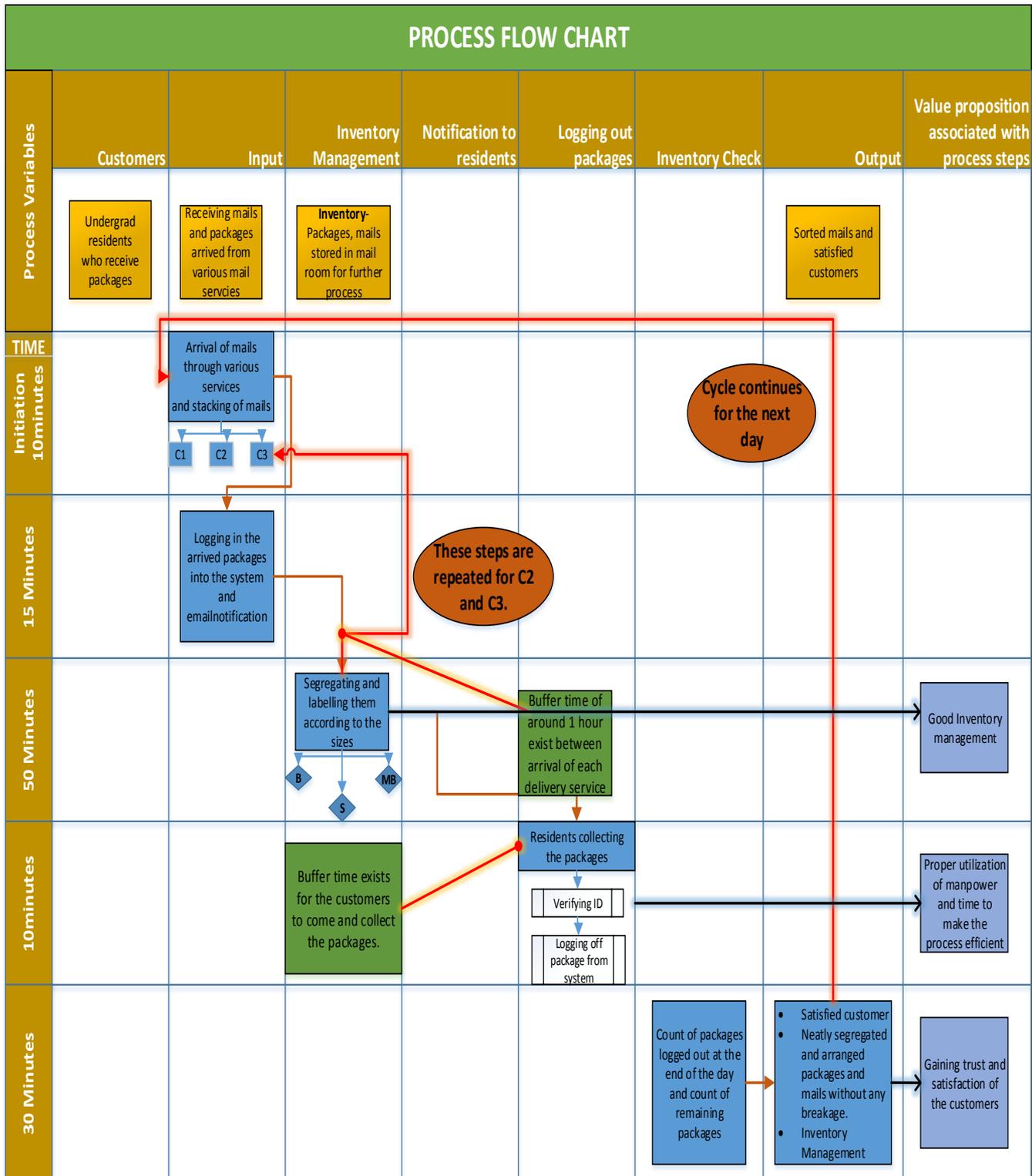
## 2.1 PROCESS MAP

An analysis of the map is provided to show the flow of the steps.

Abbreviations used	Full form of the abbreviations used
C1	Delivery service #1
C2	Delivery service #2
C3	Delivery service #3
B	Bin (Used for mails like books, magazines, etc.)
S	Shelf (Used for storing heavy packages)
MB	Mailboxes (Used for cards and letters)

The process flow chart depicted shows the flow of the receiving and sorting of mails in USC Undergrad Housing. The Process variables such as input (Mails and Packages), output (Satisfied customers and neatly arranged packages), customers (Undergrad housing residents) and value proposition (Good Inventory management, gaining the trust of customers and efficient use of manpower and time) are identified in the chart. The time associated with each step is provided in the left vertical column and the process steps are described in the top horizontal column. The Inventory is the packages and a mail received through delivery services and is identified in the flow chart.

The stacking of mails is done as soon as the suppliers/ delivery services arrive, which is the initiation step and takes around 10minutes. As soon as they are stacked the packages are logged in to the system and the residents are notified automatically. Then comes the longest step of the process sorting of mails. The step takes 50 minutes to complete as the resources are not effectively managed and hence has an unnecessary wait time of 15minutes in between labeling and segregating the packages. Later on, the packages are handed out to the residents, which takes around 10 minutes as one person does it. At the end of the day, the inventory is checked by taking a count of the number of packages logged in and a number of packages logged out for the day. The inventory count and the scrap rate are calculated after the current value stream mapping is done.



The minimum time required for each step can be tabulated as below:

Step carried out	Minimum time required
Stacking of mails	8 minutes
Logging in packages and email notification	12 minutes
Sorting of mails	28 minutes
Handing over packages to residents	6 minutes
Inventory check	25 minutes

The information flow happens between the customer and the process control manager by sharing feedback of the service provided at the end of each semester and also the supplier and process control manager by reporting issues faced by suppliers if any in front desk. The supplier also shares information regarding the number of packages with employees and gets it signed to form the one receiving the mails at the front desk every day when packages arrive. Employees also share the log of packages information and a report of the steps carried out in the process to the process control manager in his room at the end of the day. Information exchange also takes place between the employees by reporting the progress of each step to keep everyone informed, so that the next step can be carried out easily.

Employee shares the detail of a mail to the customer by verifying the ID and handing out the package/mail from the mailroom when requested for logging out of packages. As most of the process takes place in the mailroom, process manager’s room and front desk, which are located in the extreme vicinity the reporting and information flow takes place easily. Not much electronic information is carried, except for feedback messages from the customer to the manager, suppliers to the manager and vice versa.

### 3. CURRENT STATE VALUE STREAM MAPPING

The process steps are as shown in the diagram. Suppliers in this process are the delivery services and the customers are the residents collecting the packages. The working hours of the system are 8 hours and the average number of customers per day is found to be 45. A total number of staff is 5. The value and Non-value added steps are color-coded and are shown in the diagram as well. Value-added steps are Logging the packages into the system and email notification, Labeling and placing of mails according to size, Handing out packages to residents and logging off packages from the system and Inventory check at the end of the day. These are all necessary steps as they are very important and necessary to carry out the process.

Nonvalue added steps are stacking of mails, checking packages for damage, the inventory between logging in packages and sorting them according to the sizes. Checking of packages is a non-value added process, as this step need not be carried out if the employee is careful while placing the packages and notes down immediately if any damage found while placing the package. The inventory showed between segregating and sorting process is non-value added process as it can be eliminated if there is one more person employed in doing the process. The necessary steps are again, logging in, labeling and sorting, logging of packages from the system by handing out packages to residents and an inventory check, as these are the key and important steps in the process. Unnecessary steps are stacking of mails after each service delivers its packages into the mailroom and checking of mails for damage, as they do not contribute any value to the process.

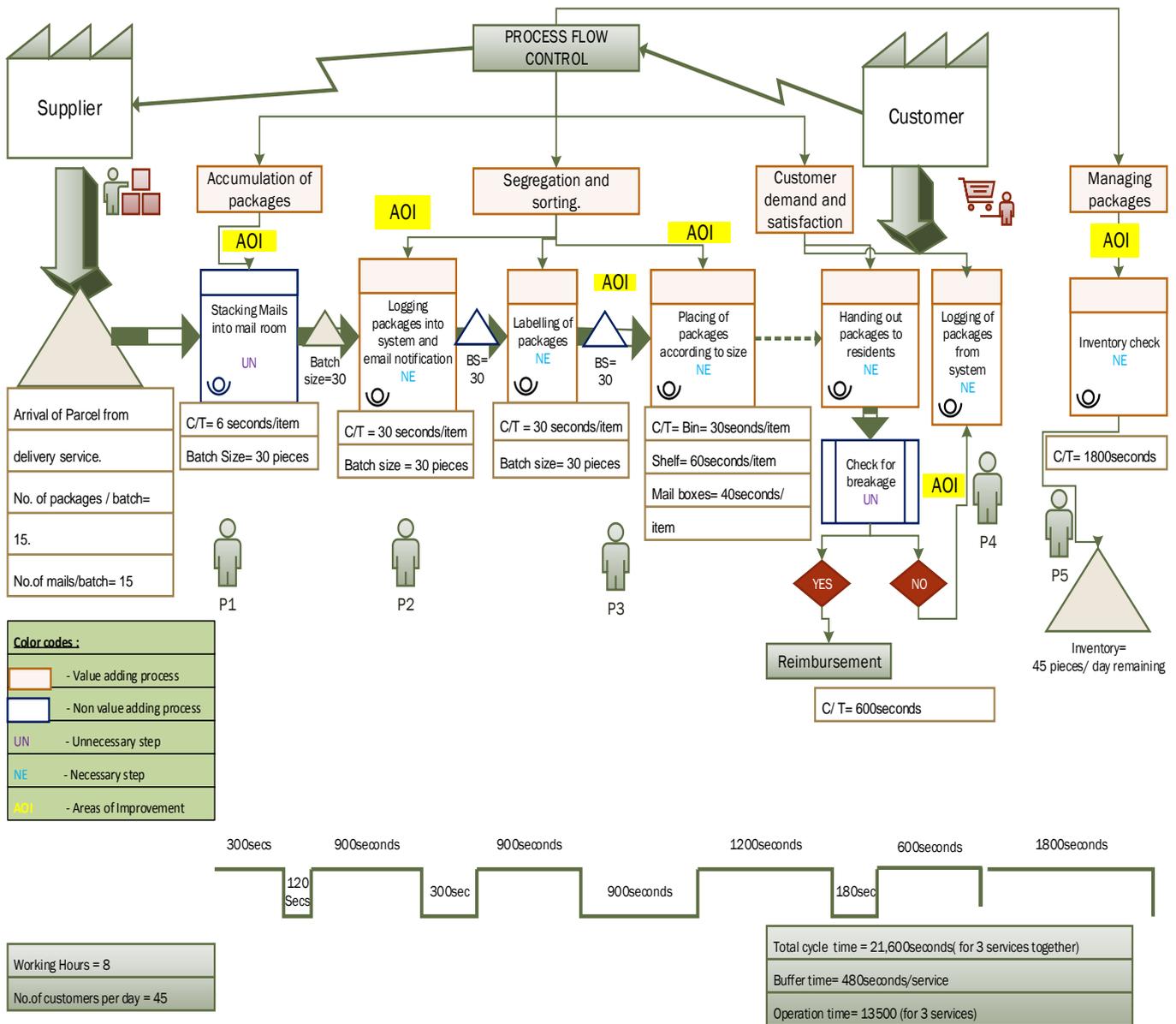
#### 3.1 CALCULATION OF INVENTORY, SCRAP RATE AND TAKT TIME

**Inventory** is present at many places throughout the process, as soon as the mails arrive, between logging in and sorting packages, which usually has a batch size of 30 and hence inventory for that part of the day would be 30mails/ batch. The inventory check usually shows 45 pieces remaining per day. This was calculated as follows: No. Of Packages/service = 30, and hence 90 mails (30\*3) approximately a day. No. Of Customers are 45/day, hence if each customer has one package on an average, then the remaining number of mails is 45, which would be the inventory at the end of the day.

The **scrap rate** in terms of breakage of the package is around 2-3% and rarely takes place. But the process mainly concerns about customer satisfaction and the scrap rate of customer satisfaction can be calculated as No.of customers on an average per day = 45; No.of satisfied customer customers= 42 and No. of unsatisfied customers= 3. Therefore the scrap rate for the process in terms of customer satisfaction would be =  $3/45 * 100 = 6.66\%$ .

To calculate **Takt time**:

Takt time= Available time / customer demand Available time = 5 \* 60 (As there is a waiting time of 1.5 hrs between each service, 3 hours is not taken into account); Number of customers = 45; Takt time =  $5 * 60 / 45 = 6.66\text{minutes}$



#### 4. INITIAL ANALYSIS AND FLOW OF WORK

The flow of work is as described in the VSM chart. All the steps above takes place in the mail room except for logging off packages which take place at the reception desk after the ID has been verified. The mails are delivered to the mailroom and further tasks are carried out in the mailroom. The packages are logged into the system that is present in the mailroom. The packages are put into shelves, Bins and mailboxes arranged separately in the mailroom and the inventory check is also done in the mailroom. Logging off packages from the system is done at the front reception desk after verifying ID and the packages are handed out at the front reception desk by bringing in their respective mail from the mailroom.

##### 4.1 IDENTIFYING THE FUNDAMENTAL WASTES IN THE PROCESS:

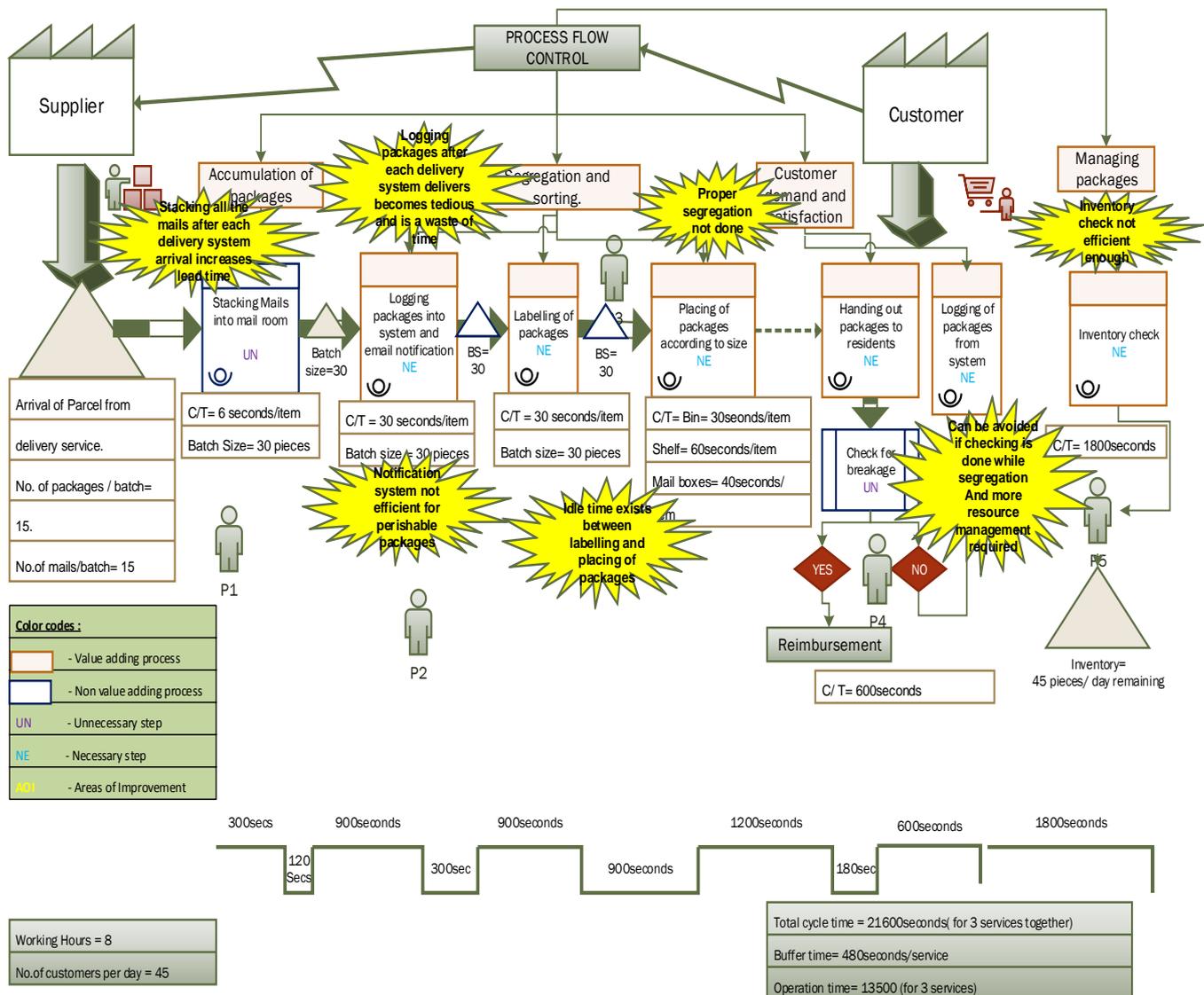
- Waiting:** There is a waiting period between a few steps, which is outlined in the process flow chart. It can be either waiting for the inputs or waiting for one person to finish the preceding step. Reorganizing the mails before labeling can also be added to this criterion of waste. This increases the time of the cycle and contributes as one of the fundamental wastes involved.
- Conveyance:** There is an unnecessary movement of goods during the initial steps of the process, which can be avoided to reduce the efforts and time in the process.
- Correction:** If the packages or mails are broken, fixing of the mails/packages are needed to be done by reimbursing the resident with the amount for the package. This is a monetary loss and also increases the time, as the procedure for reimbursement takes up extra time and there is an unnecessary time consumption when the packages are checked for damage every time before delivery.

- d) **Inventory:** Inventory management is a very important aspect in this process as improper management of inventory leads to increased storage space, the chaotic arrangement of packages hence leading to increased time in finding the right package. Also, improper inventory management will lead to loss of packages and mails making it highly risky to have an improper inventory management.
- e) **Knowledge disconnection:** Not having a proper communication between the staff at work will lead to repeating the steps and confusion in proceeding the process. Also, not keeping the team informed about the changes in the process will lead to the ineffective implementation of the improvements made. Hence, implementation of changes would be a waste if there is a knowledge disconnection between members of the team.

The Waiting, Conveyance, Correction, and Inventory are addressed in the process improvement steps in the Value stream mapping discussed in the paper. But knowledge disconnection needs to be addressed separately and having exclusive training programs and making the staff feel comfortable while following the steps can do it.

#### 4.2 QUANTIFICATION OF THE PROBLEMS:

- Stacking the mails/packages and logging in packages into the system after delivery from each delivery system increases the lead-time at least by 500seconds.
- Perishable packages are not notified to customers immediately resulting in damage and increase in scrap rate by 1-2%.
- The idle time of 1200 seconds and unwanted inventory of batch size 30 exists between labeling and segregating packages.
- Segregation is done only according to sizes, which is not very easy for tracking resulting in ineffective inventory management.
- The check for damaged packages increases the lead-time by 60-300 seconds.
- Verifying the ID and handing out packages to the customer by one person increases lead- time by 120 seconds.
- Ineffective Inventory Management at the end of the day is done only by checking the number of packages logged.



## 5. THE AREAS OF IMPROVEMENT

They are identified as given below in the table and are highlighted using Kaizen burst in the initial analysis diagram. A lot of areas can be considered for improvement and below is the list of areas of improvements that can be acceptable and implemented.

Area of Improvement	Reason for problem	The improvement that can be implemented
Stacking mails into the mailroom	This is an unnecessary step and it adds on 300seconds to the process, hence increasing the lead time and is repetitive.	All the mails can be just put in the mail room instead of stacking them neatly because the next step focuses on sorting and arranging them according to the sizes. This would save at least 200 seconds on the whole in the lead time.
Logging Packages into the system	<ul style="list-style-type: none"> <li>Logging in packages after each service has delivered mails makes the process tedious and repetitive.</li> <li>The perishable packages notification system is inefficient leading to increase in scrap rate.</li> </ul>	<ul style="list-style-type: none"> <li>If all the mails are logged in together from all the delivery services, this would lead to a reduction in lead time at least by 300seconds.</li> <li>If the perishable packages are notified through phone calls the scrap rate can be reduced to almost nil.</li> </ul>
Labeling and placing the packages	<ul style="list-style-type: none"> <li>One person does labeling and placing the packages, increasing the lead time and also leads to unwanted inventory between the processes.</li> <li>The packages from different services are placed together and are segregated only by their sizes resulting in weak Inventory Management.</li> </ul>	<ul style="list-style-type: none"> <li>If one more person is employed in doing the process, the lead time would decrease by 1200 seconds and eliminate unwanted inventory.</li> <li>If the packages are also segregated according to the delivery service, it would lead to a better inventory management.</li> </ul>
Handing out packages	This is also done by one person leading to an increase in lead time by 120 seconds.	If one more person is employed in the process, then the buffer time can be reduced by 120 seconds by saving the time for the same person to verify ID and then bringing the correct package.
Checking for damage	This is an unnecessary step in the process as this increases the lead time of the process by 60-300 seconds and incurring reimbursement cost if damaged.	Avoiding this would reduce the lead time of the process by 60-300 seconds and can be done if the packages are checked and placed properly while segregating them also reducing the reimbursement cost.
Inventory check	Just a count of packages logged out is taken, resulting in less accuracy and poor Inventory Management.	If the difference in count of packages logged in and logged out is taken into account, and the packages logged in and are still there in the inventory is checked, it would lead to a better Inventory Management.

The possible areas of improvement that can be rejected and the reasons for their rejection can be briefed as below:

Areas of Improvement	Reason for rejection
Having an inventory check after delivery of mails/packages from each delivery service.	This would lead to an accurate inventory management but would be tedious and would increase the lead time and would not be a much value added process as the inventory is checked at the end of the day.
Sorting packages at the end of the day before inventory check.	Though the process results in neatly placed packages, this step is repeated on a daily basis and will not be of much use.
Having separate storage room for placing packages that have not been collected.	This would be a good idea but would mean extra storage place and extra inventory management which would be extra work load.

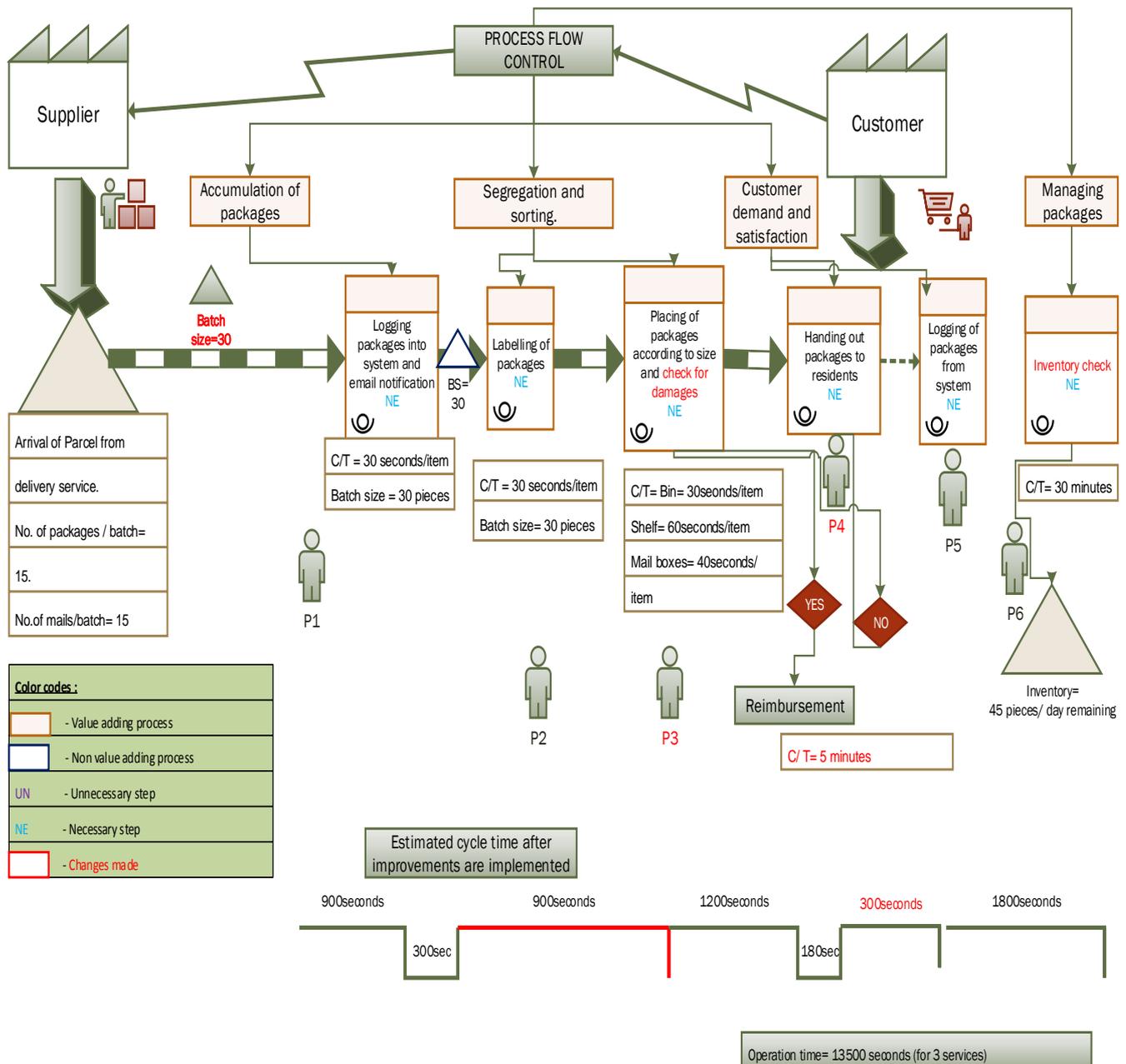
## 6. FINAL VALUE STREAM MAPPING

The final VSM shows the areas that are improved and the improvements that can be made in the cycle. It also shows the reduced lead-time and inventory in the process. This makes the process more effective and efficient. There is 2 more human resources added to reduce the lead-time and eliminate the unnecessary inventory between steps. The final time line shows an estimated cycle time or lead time for the process. The stacking of mails have been eliminated and thus reducing the cycle time by 420 seconds. The unwanted inventory has been reduced between labeling and placing of mails. The placing of mails is also done according to the courier service or the delivery service.

The inventory check is performed and the number of packages logged out and logged in is maintained by counting each package and getting the difference in a number of packages for the day. Additional people are added for placing packages and to hand over packages to residents, that there by reduces lead time and eliminates inventory maintenance between two steps.

If all the improvements proposed are incorporated and the Final Value stream mapping is implemented, the benefits achieved can be described as below:

- 1) Total cycle time will be reduced to 13,140 (3780secs \* 3 + 1800 seconds of inventory check) seconds from 21600 seconds, which is 39.16% reduction in cycle time.
- 2) Scrap rate can be reduced to 1-2%, hence delivering a very efficient service.
- 3) Effective management of resources, both storage space, and staff resource.
- 4) The high value proposition of the process is achieved.



## **7. LEAN TECHNIQUES THAT CAN BE IMPLEMENTED FOR FURTHER IMPROVEMENT IN THE PROCESS:**

### **7.1. IMPLEMENTATION OF 4P MODEL:**

- a) **Philosophy:** Delivering extremely satisfying customer service should be the main goal of Customer service department here. The goals can be based on maintaining very low scrap rate, increasing the efficiency of handling many customers at a time, reducing the time between receiving the mails and delivering the mails. Developing such long-term goals and basing the philosophy on this will help in delivering a better service on a long run.
- b) **Process:** By eliminating non- value adding steps in the process it reduces the cycle time of the process. Unwanted inventory is identified and efficient inventory management can be carried out to avoid scrap rate. All the areas of improvement identified and improvements identified will help in providing better service and identifying the goals.
- c) **People and partners:** Maintaining a good relationship with the suppliers is a very crucial step. This can be achieved by helping them in unloading the packages and putting them in the right place, following their rules and regulations for receiving the packages. A good relationship can be maintained with the employees by keeping them informed of the process and encouraging them to come up with good innovative ideas for the organizational development. Also, there is an added advantage of the process becoming efficient and less error-prone when we have the same team for a long time and having leaders who are well aware of the complete process.
- d) **Scope for continuous improvement:** Constantly taking inputs from the staff working will help in the betterment of the process. By going to the workplace, having a look at the process will give a better understanding of unnecessary steps involved and helps in understanding all the situations. These inputs and corrections can be implemented rapidly to increase the efficiency.

The improvement in the process is discussed extensively in the paper and other principles can be implemented to improve the quality of the product and serve the purpose better.

This process can be brought into the perspective of Lean Supply Chain by following the following steps:

- a) **Having no secrets:** Secrets can be avoided between the team members and a very open system can be maintained between the manager, team members, and customers. Being transparent will help in making the process better. If any mail/packages go missing or if any customer has specific demands, it can be shared with the team to ensure proper handling of the issue.
- b) **Emphasis on Value Stream:** Implementing the Future State Value Stream mapping will enhance the quality and reduce the time, making the system better and increasing the efficiency of the resources used.
- c) **Subvert objectives towards value stream:** The organization's objective should be focused on implementing the value stream so that it helps in continuing an efficient process on a long run. Here the goals to implement all the areas of improvement will help a lot to maintain and deliver good customer service that is being aimed to achieve.

### **7.2. THE 5S TECHNIQUE:**

- a) **Sort:** Sorting of items is an important step towards maintaining a good inventory and a clean work environment. In this case, the mails and packages should be sorted properly according to the delivery system and should be labeled according to the numbers and delivery service.
- b) **Straighten:** All the sorted items should be set in order to make the process easier and help the people working easier to find the required package. Hence all the labeled mails/packages according to the delivery service, according to size and according to the numbers.
- c) **Scrub:** Keeping the place clean is very important and we can clean up the storage room frequently to avoid unnecessary accumulation of garbage and occupation of storage room. This though seems like an unimportant step, aids in maintaining the inventory to a great extent.
- d) **Standardize:** All the processes should be standardized in any organization to make it effective. Hence educating all the employees on the process can standardize the processes and keeping them informed of every change that is implemented will lead to a seamless flow of information.
- e) **Sustain:** Sustaining the changes implemented in any process is very required to have the organization function efficiently. Hence by following the future Value Stream Mapping constantly for a long time will aid in delivering a better customer service and increase the customer satisfaction.

### **7.3. INVENTORY MANAGEMENT:**

As inventory is a very important part of the process, the following points can be followed to help with good management and flow of the process.

**a) Where and how can the parts be located?**

Information on where the mails and packages can be located and how are they arranged in the storage room. All the employees should be aware of this information to aid in good inventory maintenance.

**b) Estimation of Inventory levels:**

An average estimation of inventory levels during a week should be calculated to check the accommodation available for the incoming mails/packages. Check if extra storage space is available during holidays to accommodate the extra packages.

**c) How to signal delivery and when?**

It should be made sure that there are efficient ways of letting the residents know the arrival of packages/ mails and when the customers should be signaled of the mail arrival. They can be signaled through mails for regular packages and phone calls for fragile packages.

**d) Identifying waste:**

All the waste should be identified and eliminated on a continuous basis. There should be a systematic way of maintaining the inventory that is followed by all the employees. Better resource allocation should be done to ensure leveled workload and quality maintenance.

**e) Sustain:**

The process implemented should be followed throughout by all the employees. Sustaining the process for a long time is very important for successful management of improvements.

### **8. CONCLUSION**

We can see from the paper that, when we use value stream mapping we can identify that there are a lot of areas that can be improved. By making all these changes the process can be further enhanced to deliver good service and also makes it easy for the employees to fix any problem that might arise in the future. It is also the duty of the employee to make sure that the changes are followed, after all, there is no point in analyzing a process and making changes to it if it is not going to be followed. The exact cycle time can be calculated only after implementing the process. But if the process is implemented with the recommended changes, the time that can be saved is discussed in the paper. By implementing the changes, the customers will be happier about the service, management will earn a good name, all the previously mentioned value propositions associated with the process can be achieved and the employees can save time in carrying out the process and can work more efficiently than before.

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