Implementation of Lean Services and Facility Layout to Improve Health Clinical Service Processes

U Tarigan¹, A Ishak², Y O Hutauruk³, K Siregar⁴, R M Sari⁵ and U P P Tarigan⁶

¹²³⁴ Industrial Engineering Department, Universitas Sumatera Utara, Medan, Indonesia
⁵Industrial Engineering Department, Universitas Prima Indonesia

E-mail: ukurtatarigan@gmail.com

Abstract. Clinic X is one of the health clinics that located in Medan, which provides public health and social security facilities. Based on preliminary observations and generally applicable in some health clinics in Medan, there is a high arrival of inpatients at certain times, resulting in a large number of service queues. After being observed several times, the main cause is that there are many non-value added activities in the health service process. Therefore, it is necessary to minimize waste and improve the layout of facilities to speed up the service process and reduce patient waiting time. Lean service methods are used to identify wastes that affect servants processing time and improve processes. Systematic Layout Planning methods are used to redesign the proposed layout according to the repair process. The results show that the proposed layout is better than the actual layout in terms of processing time and total transfer moments. Total transfer moment of 64.49% reduces the proposed layout 1.935 meters/week to 687 meters/week. The processing time was reduced by 22.62% from 4271.8 seconds to 3304.67 seconds.

1. Introduction
Organizing clinics in Indonesia have been regulated in Regulation of the Minister of Health No. 28 of 2011. Health clinics are health service facilities that organize and provide basic and/or specialist medical services, managed by more than one type of health worker (midwife or nurse) and led by a medical person (general practitioner or specialist) [1]. Clinic X is one of the health clinics that located in Medan, which provides public health and social security facilities. This clinic has two-shift clinic services, the morning shift is opened from 08.00 until 12.00 and the afternoon shift is opened from 14:00 until 21:00. Based on preliminary observations and generally applicable in some health clinics in Medan, there is a high arrival of inpatients at certain times, resulting in a large number of service queues. After being observed several times, the main cause is that there are many non-value added activities in the health service process. The non-value added activities are waiting activities by patients, excessive movement and activities that do not need to be carried out by administration, nurses and doctors. As a result of the poor facility layout of the clinic, the nurse had to walk for 12 meters from the examination room or medicine's preparation room to the medicine room. The movement of nurses and patients can be seen in Figure 1.

In research on the implementation of lean service in health services, a value stream mapping is carried out to identify non-value added activities starting from the patient's arrival to the patient's...
departure. Non-value added activities on lean service are categorized into 8 wastes, but in clinical health service activities, the waste category observed is waiting, transportation, and motion [2].

![Figure 1. Movement of nurses.](image)

Based on the problems that found in clinic X services and references from previous studies, it is necessary to minimize waste so that the service process flow can run smoothly using the lean service method and improve the layout of the layout using systematic layout planning so that it can be reduce the health service process time and the number of queues patient at the clinic.

Lean is a continuous effort to eliminate waste and increase the value added of goods and services in order to provide added value to customers (customer value). The goal of lean is constantly improving customer value through continuous improvement of the ratio between the value added to the waste (the value-to-waste ratio) [3]. Activities or elements on each process can be classified as [4]:

- **Value-added.** Value-added activities create more valuable products or services from the customer's perspective. For an added value, measures must meet all three of the following criteria:
  - Customers should be able to see how the activity adds value to the product or improve the services provided.
  - Actions or activities should be done right on the first try.
  - Measures must change the product or service in a certain way.

- **Non-value-added but Necessary.** This activity does not add value to the product or service from the perspective of the customer, but necessary unless there is a process that changed.
• Non-value-added. This activity does not add value to the product or service from the perspective of the patient and is not necessary for the existing process.

The term of waste in Japanese is called Muda, which is all that action is taken without producing value [5]. The layout or arrangement of existing production facilities and work areas is a problem that is often found in the industrial field. The layout of the factory (plant layout) or layout of facilities (facilities layout) can be defined as a procedure for setting facilities to support the smooth production plant [7, 8].

2. Methodology
Stages that contained in this research are [9]: Stopwatch Time Study, Calculate the normal time and standard time of each activity in the service process and Lean Service
Stages in Lean Service are [10]:

• Depiction of Value Stream Mapping
• The depiction of Cross Functional Flowchart
• Making the Value Added assessment
• Identification of 8 Waste
• Analysis methods 5W + 1H
• Preparation of Proposed Service Process
• Systematic Layout Planning

Stages in the Systematic Layout Planning are [11,12]:

• Depiction Activity Relationship Chart
• Depiction Activity Relationship Diagram
• Depiction Space Relationship Diagram
• Depiction Block Layout
• Create a proposed layout
• Evaluation of Improvements
• Calculate the total moment of movement and time of the proposed process with the future stream mapping

Normal time is the time that needs to be adjusted or normalized first to get an average cycle reasonable in completing a job. The standard time is the time that required completing a job that has been carefully (measured in the past). Calculation standard time ($T_s$) of the work to be measured by using the following formula [13]:

$$ T_s = T_n (1 + All) $$

(1)

Where All is the looseness or allowance (%) given to workers to complete the job in addition to the normal time ($T_n$).

3. Results and analyze

3.1. Lean service
Cross-functional flowchart describes the process of the movement who is responsible for the service process and the relationship between the responsible party and the executor [14]. The purpose of doing value assessment is to determine and calculate the percentage of activities including value-added category, necessary but non-value added and non-value added [15]. Value added assessment for each category can be seen in Table 1.
Table 1. Value added assessment heath clinical service process assessment.

| No. | Locations     | Implementer    | Activity                                               | Time (sec) | Type of Activities |
|-----|---------------|----------------|--------------------------------------------------------|------------|--------------------|
|     |               |                |                                                        |            | VA<sup>a</sup>     |
|     |               |                |                                                        |            | NNVA<sup>b</sup>   |
|     |               |                |                                                        |            | NVA<sup>c</sup>    |
| 1   |               |                | Asking the patient's status                            | 37.60      | V                  |
| 2   |               |                | Ask for and check the file BPJS / medical card         | 42.79      | V                  |
| 3   | Registration  | Administration| Seek medical record cards and book the patient         | 45.85      | V                  |
| 4   |               |                | Entry the patient data to the computer                 | 62.28      | V                  |
| 5   |               |                | Determining unit of clinic for patients                | 20.65      | V                  |
| 6   | Patient walk | toward the waiting room |                                                                 | 21.35      | V                  |
| 7   | Waiting room  | Patient        | Waiting to be checked                                  | 2887.37    | V                  |
| 8   |               |                | Patients walk toward the examination room             | 34.35      | V                  |
| 9   |               |                | Ask and record the patient's name                      | 40.77      | V                  |
| 10  |               |                | Asking the patient's complaint                         | 98.42      | V                  |
| 11  | Examination   | Doctor /       | Directing patients to the checkpoint                   | 11.89      | V                  |
|     | room          | Midwife        | Examination                                             | 195.29     | V                  |
| 12  |               |                | Determine further action                               | 134.21     | V                  |
| 13  |               |                | Prescribe                                              | 83.22      | V                  |
| 14  |               | Nurse          | Receive recipes                                        | 23.91      | V                  |
| 15  |               |                |                                                        |            |                    |
| 16  |               | Nurses walk to | Searching for medicine                                 | 39.83      | V                  |
|     | Medicine      | the Space      |                                                        |            |                    |
|     | room          | Medicine       |                                                        |            |                    |
| 17  |               | Nurses walk    |                                                        | 59.25      | V                  |
|     | toward        | toward medicine’s preparation room                     |            |                    |
|     | medicine’s    | preparation    |                                                        | 39.44      | V                  |
|     | preparation   | room           |                                                        |            |                    |
| 19  |               |                | Prepare the medicine                                   | 98.50      | V                  |
| 20  |               | Nurses walk    |                                                        | 8.80       | V                  |
|     | to the        | to the         |                                                        |            |                    |
|     | examination   | examination    |                                                        |            |                    |
| 21  | Examination   | Nurse          | Giving the drug to patients                            | 22.62      | V                  |
| 22  | Examination   | Doctor /       | Explanation of the drug and determine the Schedule for  | 96.23      | V                  |
|     | room          | Midwife        | the next consul                                       |            |                    |
| 23  |               |                | Patients walked to Space Registration                  | 13.49      | V                  |
| 24  | Registration  | Administration| Requesting prescription drugs from patients            | 25.28      | V                  |
| 25  |               |                | Creating invoices                                      | 57.45      | V                  |
| 26  |               |                | Payment receipts                                       | 24.96      | V                  |
| 27  |               |                | Receiving medical expenses                            | 45.3       | V                  |
| **Total** |               |                |                                                        | **4271.08**| **1068.69**         |

From Table 1, the percentage of time for each value-added, necessary but non value added, and non-value added activity can be seen, as shown in Table 2.
Table 2. Percentage of activity categories

| Activity Categories | Number of Time (sec) | Presentation (%) |
|---------------------|----------------------|------------------|
| VA                  | 1,068.69             | 25.02            |
| NNVA                | 262.36               | 6.14             |
| NVA                 | 2,940.03             | 68.84            |
| Total               | 4,271.08             | 100.00           |

At the next stage, each process along the value stream coupled with the flow of material and information flow so that it becomes a whole stream of service [16]. Value stream mapping picture can be seen in Figure 2. Value stream mapping is lean tool for identify value added and non-value added [17].

![Value Stream Mapping](image)

Figure 2. Current state value stream mapping.

Analysis of activities for the service process improvement plan is carried out by the 5W and 1H methods [18]. This is the based on direct observation and the results of discussions with the clinic leader about transportation, delay, and excessive process activities. Based on the results of the 5W and 1H analysis, for 3 non-value added activities can be eliminated by improving the system and work environment while for 8 necessary non-values added activities can reduce by improving the facility layout of the health clinic. Researcher's proposal, after the patient has been examined by a doctor and given a prescription drug, the patient prescribes the medicine to the medicine room then the nurse will...
prepare the medicine and give it to the administrative office to accumulate consultation fees and drug costs.

3.2. Systematic layout planning

Systematic layout planning (SLP) is a tool to improve distances between facilities (machines and workstations) and also improve the flow of material [19]. The ARC was a tool list the relationship to see a priority and relationship in the layout using relationship diagramming algorithm [20]. Activity Relationship Chart (ARC) is prepared based on the assessment of observation and interviews with the responsible doctor who understands the service and clinical processes in detail. Activity Relationship Chart (ARC) of Clinic X service is seen in Figure 3.

| NO | ACTIVITY          | CLOSENESS |
|----|-------------------|-----------|
| 1  | REGISTRATION ROOM |           |
| 2  | WAITING ROOM      |           |
| 3  | EXAMINATION ROOM  |           |
| 4  | ACTION ROOM       |           |
| 5  | MATERNITY ROOM    |           |
| 6  | POLY DENTAL       |           |
| 7  | MATERNITY BATHROOM|           |
| 8  | TOILET            |           |
| 9  | MEDICINE ROOM     |           |
| 10 | KITCHEN           |           |
| 11 | PARKING           |           |

Figure 3. Activity relationship chart (ARC).

Activity Relationship Diagram displayed with a line thickness that shows the relationship closeness [16]. Activity Relationship Diagram of Clinic X service shown in Figure 4.

Figure 4. Activity relationship diagram.

Space relationship diagrams or block layouts are similar to Activity relationship diagrams, but with box sizes that vary according to the area of the room [21]. Block layouts are arranged by bringing
a part or room closer to the thickness of the line. Moreover, it also takes the area needed for each room. The block diagram of the clinic room is shown in Figure 5.

![Figure 5. Block layout.](image)

The results of the proposed layout show that some location changes, the first is closing the medicine room and registration room because it has a close relationship in the service process. Parking is moved to vacant land opposite the clinic to enlarge the medicine room and registration room. Expansion of the room adds to the comfort of the activities of hospital staff. The proposed layout is the only one due to limited land and minimizes changes to the actual layout. The facility proposed by Clinic X is shown in Figure 6.

![Figure 6. Proposed of layout clinic X.](image)

### 3.3. Evaluation

After the proposed final facility layout, the total displacement distance of workers and patients is recalculated. The results of calculating the total displacement distance are converted into units of time so that the results of the time reduction can be obtained influence the changes in facility layout. Finally, described future stream mapping, explaining the changes in non-value added activities due to the influence of the final change in flexibility layout.

Total actual layout moment displacement is 1,935 meters/week and layout proposal are 687 meters/week (64.49% reduced total moment). Reduction of service time after repair process and
design layout is 3,304.67 seconds with the amount of reduction in the time was 966.41 seconds (22.64% reduced time). This is mean that redesigning the layout can reduce the waiting time of service process.

4. Conclusion

In the service process, there are activities that are non-value added, such as activity is waiting, over processing, unnecessary motion and unnecessary transportation. In designing the layout of the facilities, there have been a number of changes that have closed the medicine room and registration room, adding kitchen and maternity bathroom spaces. The results showed that the proposed layout is better than the actual layout in terms of processing time and the total moment of displacement. The total moment of transfer was reduced by 64.49% from 1,935 meters/week to 687 meters/week at the proposed layout and the processing time was reduced by 22.64% from 4271.80 seconds to 3,304.67 seconds.

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