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# A PROPOSED FRAMEWORK TO APPLY OPERATIONAL EXCELLENCE (OPEX) AS A BUSINESS STRATEGY

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***Abstract*** *This study is initiated from a perspective that OPEX is not one of the mainstream issues in the area of productivity improvement. However, the potency of OPEX applied to assist the management to improve the productivity is solid. From the literature review, it is found that this circumstance is probably caused by the confusions of the researcher and management about OPEX. In this paper, OPEX is then considered as a business strategy in order to narrow the discussion and reduce the confusion. As a business strategy, it is important to develop a framework to apply it in every level of organisation. Because, framework of OPEX has not yet found, a framework is proposed in this research based on the structure of OPEX. The framework is then applied in two case studies at two different company. The result shows that the framework is capable to assist the management to achieve the goal of OPEX.*

***Keywords****: operational excellence, productivity, framework, asset management, line balancing*

## 1. Introduction

In many ways, Operational Excellence (OPEX) is fuzzy. The main cause of this circumstance is because there are variety of meanings and methodologies in this area [1]. However, it is argued that OPEX is not a methodology either as in [2]. According to[2], OPEX is a mindset of an organization to relentless pursuit of finding better way to improve profitability and performance of the organization. Another definition of OPEX is declared by [3] who define "OPEX constitutes the continuous pursuit of improvement of a production plant in all dimensions. Improvement is measured by balanced performance metrics comprising efficiency and effectiveness, thus providing a mutual basis for an improvement evaluation". According to [4], OPEX is categorized as a business strategies, besides product leadership and customer intimacy. The purpose the implementation of OPEX as a business strategy is to achieve competitive advantages through cost leadership. Briefly, management have three option if they choose to apply OPEX. It can be applied as a methodology, a mindset, or a business strategy. From those three, it is argued that implementing OPEX as a business strategy is more reasonable and applicable in a managerial level.

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Based on this hypothesis, in this paper OPEX is considered as one of corporate business strategies. In this paper, there are two words proposed to describe OPEX: simplify and standardize.

As a business strategy, it is important to determine a framework to apply the strategy in an organization. However, there is lack of research to propose a framework to apply OPEX as a business strategy. This paper presents a proposed framework of OPEX, so the implementation of OPEX as a business strategy is more feasible, easier and understandable by people in every level of management. The process of developing the framework is initiated at presenting the current structure of OPEX in [5]. Then, a framework will be developed based on the structure. The framework is then tested into a case study and the result is analyzed.

## 2. Research in OPEX

Research in OPEX is not a mainstream issue in the area on management or industrial engineering. The research in the area of OPEX is limited compared to the researches on its "twin": lean manufacturing or lean management. From the few, some interesting articles on OPEX are identified such as [6], [7], [8] and [9]. In [9], the authors present how OPEX is associated with information technology. The effects of the use of IT to the implementation of OPEX is discussed in the

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paper. The result of the study emphasis that the full potential of information technology is only able to attain when it is used to support the routine of organization's activities after OPEX are implemented.

To assess the performance of an organization regarding to the implementation of OPEX, a tool or framework to assess it is necessary. It is the main reason to develop a OPEX assessment framework as presented by [7]. Another interesting study also reported by [8] who propose a conceptual model of OPEX. It is argued that in the study the authors tend to consider OPEX as a program which is closer to opinion that OPEX is one of business strategies as mentioned in [4]. A more thorough description about the history, development and application of OPEX is found in [6]. The authors mentioned that recently, operational excellence has been evolved into operations excellence. Additionally, an assessment framework for OPEX is also proposed in the paper. Both [6] and [7] propose an assessment framework for operational excellence. However, framework in [7] is more applicable since the result of the assessment is presented into a operational excellence maturity level.

From the limited number of references about OPEX, there is lack of research that highlight OPEX in two point of view: (1) as a business strategy, and (2) framework to apply OPEX. Since most of the paper on OPEX framework is discuss about the assessment framework instead of framework to apply OPEX in an organization, especially as a business strategy. A research opportunity arises from this review of literature is a research to design a framework to apply OPEX as a business strategy in an organization regardless the level of management (from top management downward).

## 3. Proposed Framework

According to [10], the definition of framework is "a basic conceptional structure (as of ideas)". In this research, framework of OPEX is defined as a basic conceptual structure to apply operational excellence strategy. As aforementioned that the framework in this paper is developed based on the structure of OPEX in [5] as shown in Figure 1. The difference of the Figure 1 from its origin is the content of the tools pillar. In the origin version, seven waste was presented in the tools pillar. However at this moment, nine waste has been introduced as shown in [11]. So, in this paper the tools pillar has been modified from by changing the seven waste to nine waste. The structure of OPEX is presented as form of a house or building. It consists of three main parts: the foundation, the pillars, and the roof (or the top of the building).

In Figure 1, the goal of OPEX is represented as the roof of the structure. Based on the structure, the goals are: improved profitability, reduced waste & process variation, improved quality & delivery, reduced inventory, marketing flexibility, and customer satisfaction. To achieve the goals, it is important to set a firm foundation and pillars to support the process of achieving the goals. The foundation required are: quality management system, and KPI which support three pillars of the OPEX: method & philosophy, culture, and tools. The details of the method & philosophy, culture, and tools of the OPEX are shown in Figure 1.


**Fig. 1** The Structure of Operational Excellence adopted from [5]

It is reasoned that the structure of operation is a good basis to develop a framework to apply OPEX as business strategy. An organization applying OPEX as business strategy can adopt the structure of OPEX, but a framework is required to assist people in every level of organization in implementing OPEX. At this stage, a framework to apply OPEX based on the structure of OPEX has not been found yet. The result of this study is a framework for the OPEX to fill the gap of knowledge as aforementioned and the proposed framework is shown in Figure 2.

The framework consists of eight steps however for some organisation with more mature practice of OPEX may have a smaller number of steps should be accomplished. The steps are explained as follow:

Step 1: This step is to determine whether the problem is relevant to OPEX. Most of repetitive process includes in the production process is relevant to OPEX because repetitive process usually requires more attention to simplify the process in order to reduce the cycle time.

Step 2: In this step, the relevant KPI to the process related to OPEX in assessed. If the KPI has been set, then it can be proceeded to step 4 otherwise the KPI should be set up in step 3.

Step 3: This step is to accommodate the process or activities without KPI. The KPI should be set up by considering the KPI of the organisation. In the structure of OPEX presented in Figure 1, this process is to provide the foundation of the structure which is the KPI. After the KPI has been set up, the process continues to step 4.

Step 4: In step 4, the pillars of the structure of OPEX should be considered. There are three pillars: tools, culture, and methods. There are several alternatives that can be chosen in each pillar. In order to achieve the KPI set previously, at least one item should be selected in each pillar. In other words, it is recommended to choose at least one item from the tools pillars, at least one item from the culture pillars, and at least one item from the methods pillar to be implemented in the organisation to achieve the KPI.

Step 5: In a circumstance when there are no appropriate tools and/or culture and/or methods, a new tool or method should be created and added into the structure and a new culture should be designed and added also.

Step 6: After the appropriate tool, culture and method are selected, then those are implemented in the organisation and to be evaluated to see whether the KPI can successfully achieve with the selected combination of tool, culture, and method.

Step 7: This step is to check whether the OPEX problem is solved. If the problem is solved, then proceed to step 8 otherwise the process returns to step 1.

Step 8: This is the last step in the framework. After the problem is solved, it is recommended to write a report to management as a part of knowledge management system.

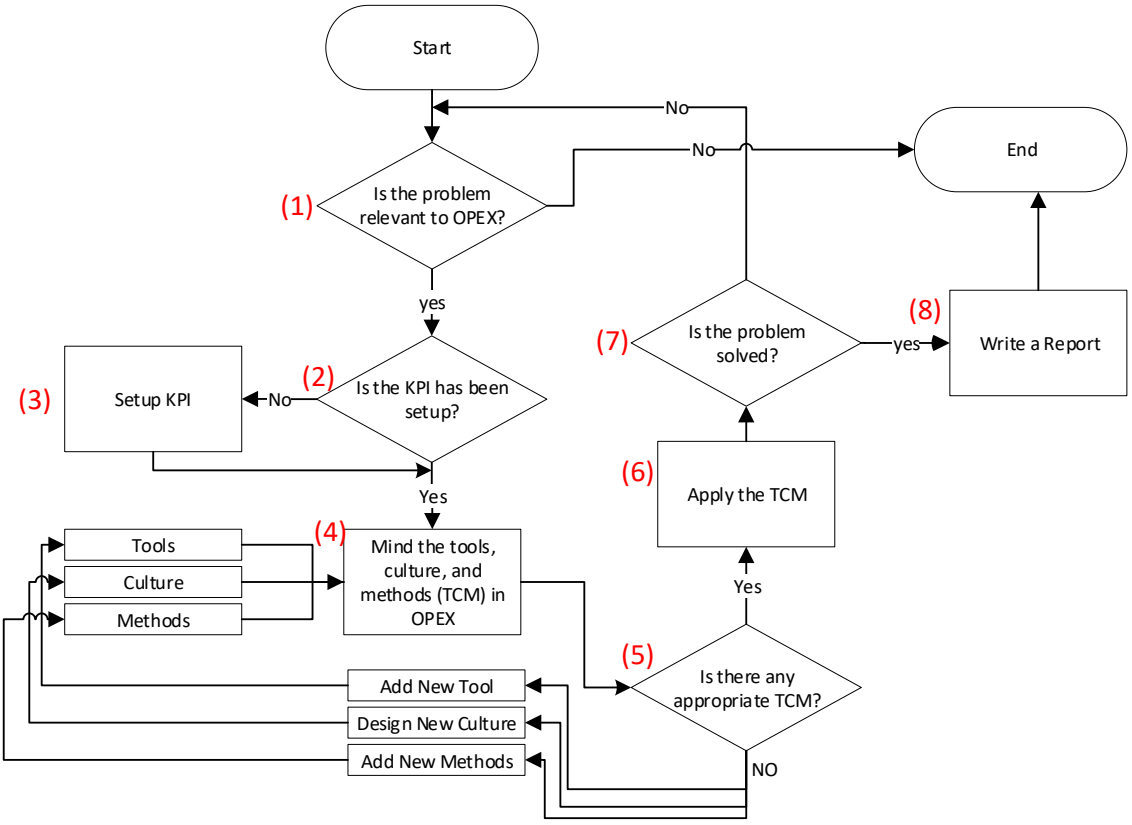


**Fig. 2 The** proposed framework for OPEX implementation as business strategy

## 4. Case Study and Discussion

In this paper, two case study will be discussed. The purpose of the case studies is to verify the proposed framework. The First case study in the paper is adopted from a research in a sugarcane mill manufacture in Yogyakarta. The second case study is from an electronic manufacturing company in Indonesia. In the first case study, the main issue is to determine the most effective maintenance strategy using RRCM (Reliability and Risk Centered Maintenance). The case study is presented in [12] with the approach of RRCM and OPEX but the paper has not yet includes the framework which is discussed in this paper. Based on the framework, the step is initiated with setting the KPI (step 2). After the required data and information were collected, there is no formal KPI set by the organization (the process continues to step 3). To set the KPI, the critical machine or components should be determined first. So, at this stage, the main purpose is to determine the KPI. To do so, an RRCM methodology is conducted with the framework shown in [13].

Based on the framework in [13], interval preventive maintenance as one of the KPI can be determined and calculated using the tools in the structure of OPEX: Pareto and Histogram as shown in Figure 3. The figure shows that the most downtime contributed by the Milling Station (more than 90%). With this respect, milling station is considered as the critical process and one of the components will be considered as the critical component for the further process.

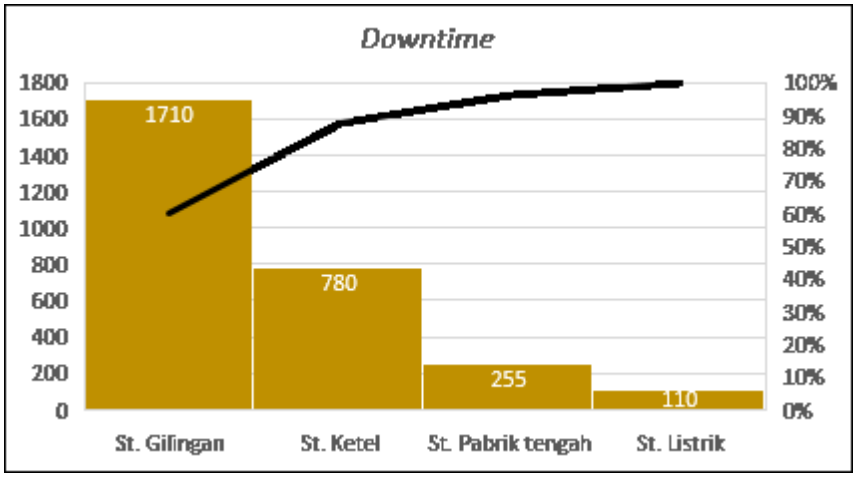


**Fig. 3** Pareto Chart for Downtime

The selected critical component in milling station is scrapper. The main reason is because it has highest number of failures compared to other components as shown in Table 1. From the result of calculation process using the RRCM framework, it is resolved that the proposed interval of preventive maintenance is approximately 495.49 hours. This result is set as the basis of the KPI for MTBF (mean time between failure). It is proposed that the KPI for MTBF is 480 hours. The new KPI is then inputted into a reliability model to find out the impact of this policy. The result of the model is shown in Figure 4. At this stage, the step 3 in the framework is accomplished.

In Figure 4, Rm(t) represents the probability of the system reliability with preventive maintenance. While, R(t) represents the probability of the system reliability without preventive maintenance. From the figure, it shows that the line for Rm(t) is approximately merged with the line of R(t). It indicates that there is no difference on the probability of system reliability with or without preventive maintenance.

Then, the process continues to select the tools, culture, and method & philosophy to be applied in to the maintenance management system. At least one item in each pillar will be proposed. For the tools pillar, nine waste and histogram & pareto charting are selected. Those two tools are necessary to make decision based on data which is the proposed culture from the culture pillar.

**Table 1. Critical components**

| Machine | component | Freq |
|---|---|---|
| Milling | Scrapper | 63 |
| Milling | Bolt for upper block | 50 |
| Cane carrier 2 | Cutter Motor | 18 |
| Cane carrier 2 | Cutter | 13 |
| Cane carrier 3 | *Stang hammer* | 16 |

For the pillar of method and philosophy, method for waste reduction and variation is selected. The main concern is the result inputting the KPI into the reliability model that show that there is no difference in the reliability between corrective maintenance strategy or preventive maintenance strategy within 480 hours of component life. It means that doing preventive maintenance within 480 hours of the component life is wasted activities and should be reduced or eliminated. The reduction or elimination of the wasted activities normally leads to cost reduction and profit improvement. To design the optimum maintenance strategy, proposed approach in [14] can be applied.

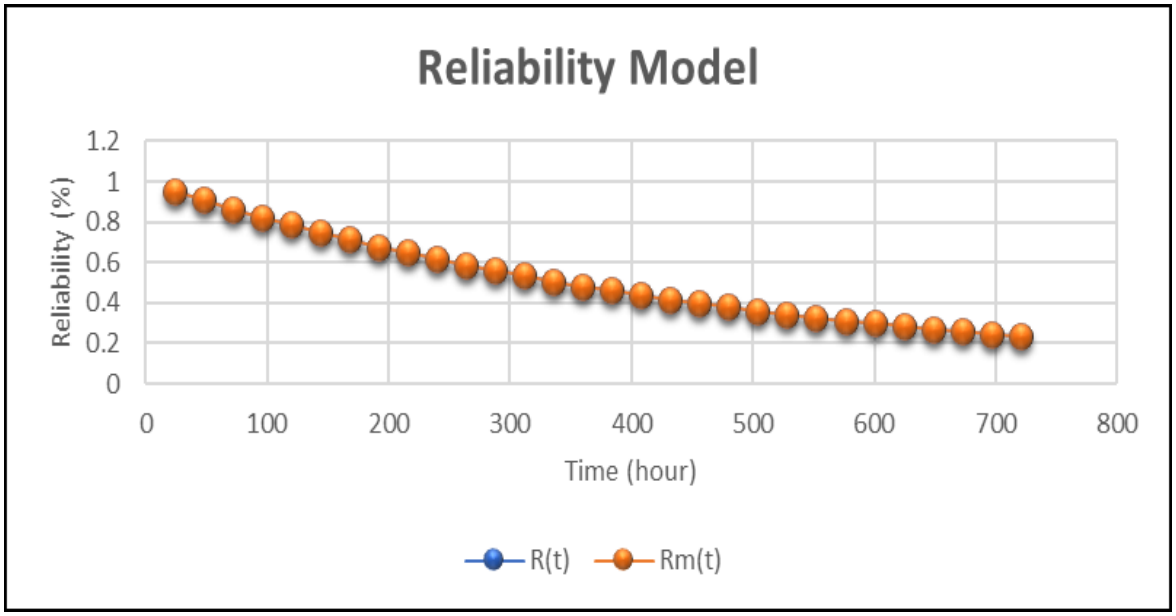


**Fig. 4.** Component Reliability Based on 480 hours PM interval.

To resume the process of solving the case study number 1, a resumed process of the case is presented in a step by step explanation:

Step 1: The problem discussed in this case study meets the attribute of problem relevant to OPEX. The maintenance activities in this case study is a repetitive process and can be simplified.

Step 2: At this stage, the company did not have any KPI. The KPI should be determined.

Step 3: From the analysis using the RCM approach, the KPI for the scrapper is determined. The KPI is 480 hours mean time between failure.

Step 4: At this step, nine waste, histogram & pareto are selected as tools for this problem. The selected culture is decision based on data is selected from the culture pillar. The decision based on data use the tools selected in the tools pillar. Finally, for the method and philosophy, waste reduction &variation is selected.

Step 5: This step is skipped because each pillar already had its selected item.

Step 6: All the selected tools, culture, and method & philosophy have been suggested to the organisation.

Step 7: At this stage, the result of the application of OPEX approach has not been observed directly but according to the result of the discussion with the department of maintenance of the company, the suggested approach may contribute in the process of improving the maintenance process.

Step 8: A report contained the whole process of the improving the maintenance performance has been written.

The second case study is more complex. In the case study, an ink cartridge production line improvement is discussed. The company sets a target for the production line is 8600 pieces per day. When a thorough observation was being done at this line, the line has not met the desired level of the target. To find the root of the problem, a more thorough observation was done. The result shows that the main cause of this problem is that the production line is not balance. Implementation of the OPEX framework to solve the problem is suggested. In this case study, the procedure of the OPEX framework will be discussed step by step.

Step 1: The problem in this case study is about unbalanced line in the production line. It is a repetitive process within the production process, and it requires an improvement in term of reducing the cycle time. With this sense, the problem is considered as relevant to OPEX.

Step 2: This step is to check whether the KPI has been set up. Based on the information from production supervisor, the target for the line is to produce 8600 piece per day. However, at this moment this number has not been achieved yet.

Step 3: Based on the information in step 2, the KPI of the line is to produce 8600 pieces per day. However, the company cannot achieve the target yet.

Step 4: In this step, one item of each pillar will be selected. For this problem, the selected method is value stream mapping, the selected culture is "continues improvement", and the suggested tool is not listed in the structure of OPEX. The suggested tool in this problem is five why's. The purpose of using five why's to find the root cause of a problem in a cause effect analysis [15, 16], which is similar to the purpose of FMEA.

Step 5: Because the proposed tool is not listed, the tool will be added to the structure.

Step 6: Using the tool, method and culture selected in step 5, the process continues to apply those pillars. From the method pillar. The value stream mapped has developed and presented in appendix 1 as in [17]. The value stream map in appendix 1 is the current value stream map. From the analysis of the value stream map, its is found that the problem causing the line to achieve the target is because of there is a bottleneck at the station of manual part combination.

Then, for the five why's as the tool pillar, five why's questions were asked to the production department to find the cause of the problem. The questions and the answers are shown in Table 2. In this problem, the five why's is used to find the main cause of the bottle neck found in value stream map. The result of the five why's is the root cause of the bottleneck issue is because the operator prefers to place the part to the easily reachable place instead of the place set by the company. Because the operator thinks that the place set by the company is not comfortable.

**Table 2.** Whys for Root Cause Analysis

| | |
|---|---|
| **Why 1** | **Why is the production output cannot reach the targeted?**<br>The targeted cycle time cannot be achieved because there are some inefficient activities in the workstation of manual part |
| **Why 2** | **Why do the inefficient activities occur?**<br>The occurrence of the inefficient activities is because the poor layout of the work station. |
| **Why 3** | **Why is the layout of thee work station is poor and ineffective?**<br>The layout is poor and ineffective because the predetermined places for parts are different with the sequence of the assembly. It makes the repetitive movement. |
| **Why 4** | **Why is the placement of the parts different with order of the assembly sequence?**<br>It is because the operator prefers to place the part in an easy and reachable place. |
| **Why 5** | **Why does the operator prefer to place the parts at easily reachable position?**<br>It is preferred by the operator because of the convenience and the comfort of conducting the repetitive activities. |

From the result of the five why's, the main cause of the problem is the ineffective layout of the works station. The conclusion is not attained only from the last why but all the answer from the five whys should be analysed

instead. This valuable information is attained from the second why, then tis issue is dug further to seek more detail information. From the answer of the third why, it is found that the poor layout causes ineffective result. From the fourth why, the main reason of the poor layout is because of the operator prefer to put the part in easy and reachable area because the operator feel more convenient. This analysis provides a valuable information that the cause of inability in reaching the target is a poor layout as result from repetitive movement. It offers clue about what should be done to solve the problem.

Once the cause of the line balancing problem is determined, a solution this issue should be suggested. In this case study, the last pillar (culture pillar) can be used to find the solution. In the culture pillar, there is continues improvement culture that can be selected. Currently, the company has applied this culture in their organisation. So, what to do next is to find the solution of the layout issue by finding the better layout to reach more efficient result.

Step 7: From the recommendation provided in step 7, a new design of layout has been proposed to the company, and the new layout improved the result by more than 11%.

Step 8: A report has been prepared for this issue.

## 5. Conclusion and Recommendation

The lack of reference in the implementation of OPEX as a business strategy urges to find a standard procedure to do so. This paper is to propose a framework for based on the structure of OPEX to fill this niche. In this paper, a proposed framework has ben developed and then verified at two different case study at two different company. In both case studies, one of the goals of the OPEX, which is improved profitability can be attained by applying the recommended result of the framework. In the first case study, one of main source of improving the profit is from the reduction of wasted activities of preventive maintenance within the 480 hours of the component life. The result also show that the proposed framework is capable to be a reference for management to apply OPEX as a business strategy. In the second case study, the implementation of the OPEX based on the proposed framework is capable to improve the production output by more than 11%.

There are researches opportunities may arise from this result. One of them is associating cost in the process of selecting item in the pillars of OPEX do that the management has more comprehensive information.

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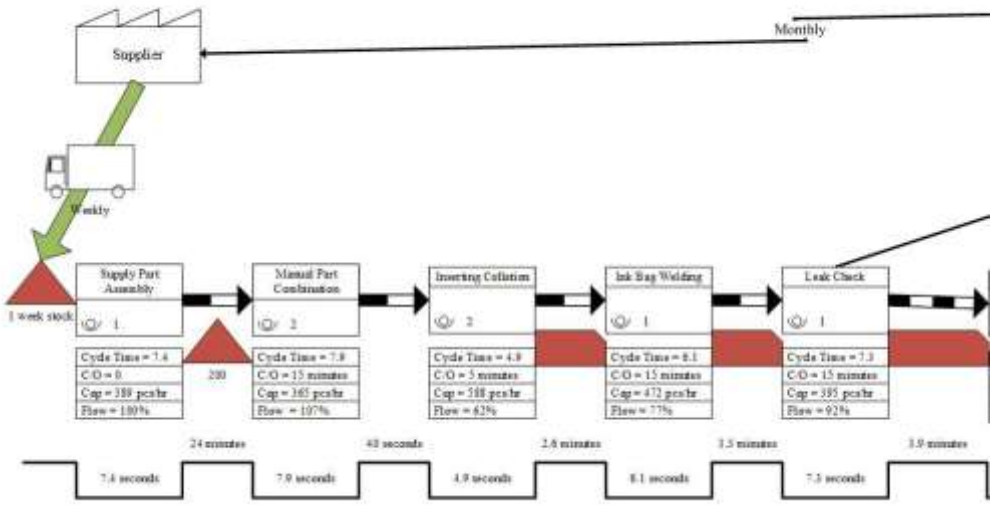
**Appendix 1.**

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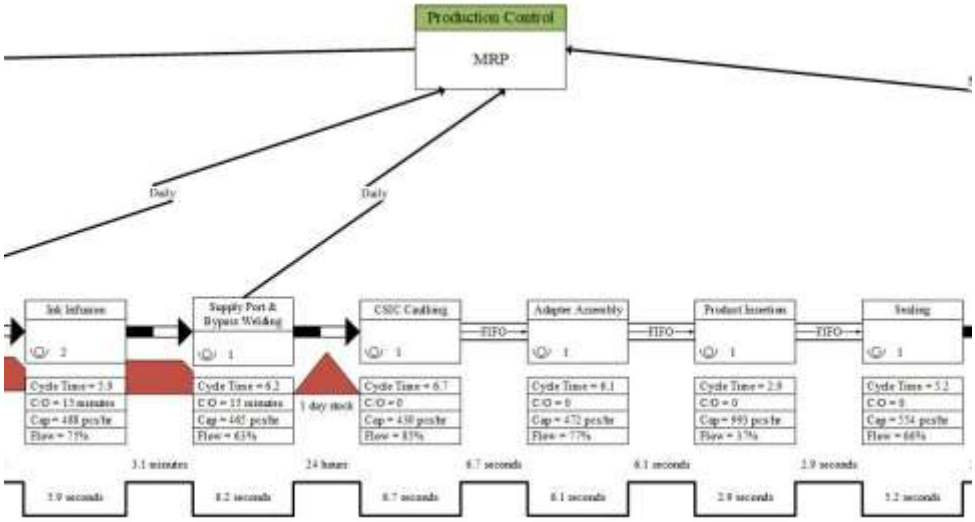


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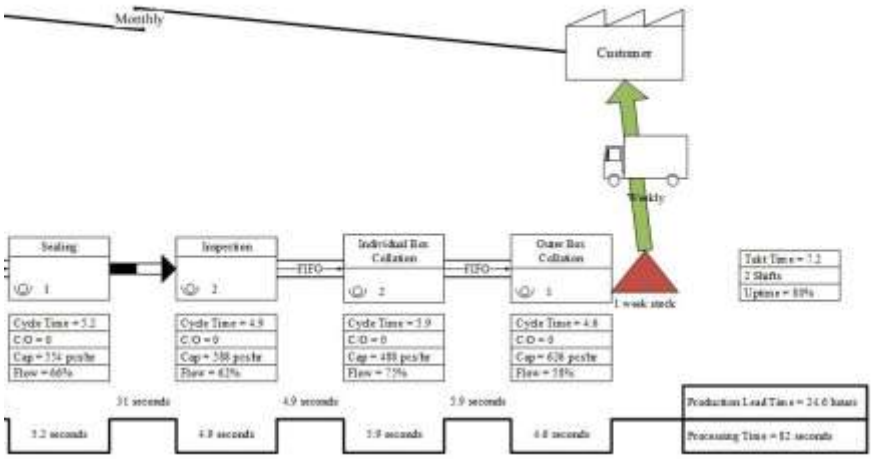


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