

WORK STUDY IMPROVEMENT FOR CUERVO (ANALOG) PRODUCT IN AN ELECTRONIC INDUSTRY

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ABSTRACT

Many industries are applied a work study techniques in order to gives benefits for investigating human work and leading to further improving of work productivity. This paper determines the improvement of the work study technique in ensuring the reduction of the processing time for the Cuervo (analog) product. All the information related to work study practices and the improvement in the time study aspect were compiled from related journals, books and internet sources. This study was conducted in an electronic industry in Malaysia. A time study is used in order to define the steps in a production procedure and the time consumed by the worker for the increasing efficiency or productivity of workers in full time and motion study.

Keywords: Work study, Time study, Bottleneck, Work balancing, Electronic industry.

INTRODUCTION

According to the British Standard definition, BS 3138 (1979), work study is the systematic examination of the activities by use of human and other material resources. When undertaken as an ongoing process work study can provide the discipline needed to adopt the internal customer approach as an organizational way of life. Brown, S., (1994) state that work study is not, in itself, but an absolute assurance of “quality”. Rather, some of the tools and techniques offered by work study methods. In particular, method study can serve the organization in measuring progress in terms of reduced lead times, lower cost and faster responses to delivery where all of which are important factors in providing customer satisfaction and, therefore, quality.

Through work study, the improvement can be achieved in term of lean perspective which is value added and non value added activities. Value added work is the work that is actually valuable. Furthermore, value added work is utilizing resources that add value to the finished product, whether it's actually building a product or shipping it. The capacity, information and material are mostly the factor that for work to be considered value added. Non value added work, also called waste is the work that doesn't add value to or is unnecessary for the overall project. The waste can be such as overproduction, transportation handling more than once, high inventory, over processing, waiting, defective and unnecessary motion. Baines, A., (1995) stated that time study technique basically used in order to find the standard time that is a direct

observation of work with a time standard for the work being derived by converting the observed time through performance rating of the worker carrying out the work.

Problem Statement

In manufacturing plant, the assembly area usually maintain a store of components to be assembled in the finished part. The main problem of this study is the highest processing time based on the certain process to produce a Cuervo (analog) product. Some of the process required highest time activities to assemble the product's part. This situation actually will increase the bottleneck. The bottleneck is a resource that limits or constrains the capacity or maximum output of the process. The bottleneck reduces productivity in the productive system. The bottleneck is occurs because of the longest process time required at the certain process. Basically, this project focuses more on the work study in production area of XYZ Company in order to reduce the processing time. Currently, this company faces a problem in term of the processing time to surpass the workload efficiently. Furthermore, this project is also concerned on the work study to determine the current standard time and type of waste that exist at this company. Finally, the collected data will be analyzed to determine the best method that required improving this problem.

Objective

The objectives of this study are:

- To study and perform the work study techniques to solve the problems related with time.
- To reduce the processing time at the bottleneck activity.
- To standardize the processing time in order to eliminate the waste and improve productivity.
- To identify the improvement of the work study at the XYZ Company.

LITERATURE REVIEW

According to Adebayo (2007), work study is the study of work that specifies a generic term for those techniques particularly method study and work measurement, which are used in examination of human work in all its content and which lead systematically to the investigation of all the factors which affect the efficiency of the existing situation, in order to seek improvement. Figure 1 is the flow charts diagrams that show all the steps in a process. This makes them useful tools for communicating how processes work, and for clearly documenting how a particular job is done. The flow process chart is valuable in providing a graphical representation of the step by step sequence that take place. Flow process chart are used as a device for recording a process in a compact manner by focusing on the movements of the operator or the flow of materials (Barnes, 1980). Allowances are extra time added to the normal time to make the time standard practical and attainable. The allowances for such interruptions to production are classified as personal allowance, fatigue allowance and delay allowance or unavoidable. According Aft, (2000), the personal, fatigue and delay allowance are added in the time allowed to complete the tasks whether the amount of the time provided for PFD is usually constant for all the jobs although it may vary due t particular working environment.

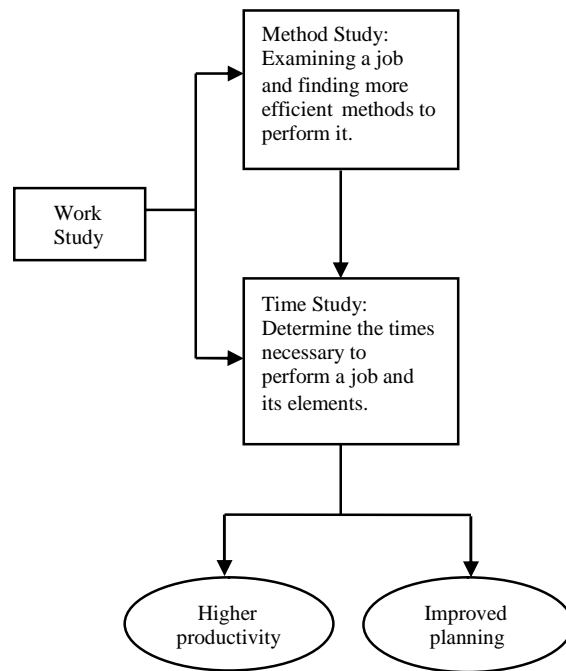


Figure 1: Component work study (Aft, 2000)

Generally, the time standard is an important piece of management information and has many uses that are critical to the operation of an organization. Moreover, Aft, (2000) defined time standard is the time required by typical worker to complete a specific task at a normal pace using a defined procedures. Although a time standard is developed for a job, it is required to provide a complete description of the parameters of the job. Stopwatch time study is the most common technique for setting time standards in the manufacturing area. The time standard is the most important piece of manufacturing information and stopwatch time study is often the only method acceptable to both management and labor. Frederick W. Taylor started using the stopwatch time study around 1880's for studying work. But, nowadays, this method is widely used of measurement work especially appropriate for short and repetitive task. From the research, the usage of work study in machine shop by using stopwatch is to find out the time of the work and make continuous time observation about what a worker did over the period of day.

Time study is the study of each of the steps in an operational or production procedure and the time consumed by the worker, for the purpose of devising methods of increasing efficiency or productivity of workers in full time and motion study. The time study is essentially the direct observation of work with the time standard for the work being derived by converting the observed time through performance rating of the worker carrying out the work (Baines, 1995).

METHODOLOGY

Area and process selection

The selection area and process that involve needs to be properly study. In this study, the production area has been selected at the XYZ Company. This process selection focus

on the times that worker conducts an activities or traveling process of the Cuervo (analog) product assembly.

Operator selection

The operator selection is important because it will affect the time produced by the processing product. The qualifier operator is select based on their skill and experience at the required field. The operator has to work under the normal time to perform the specific task or operation according to standard job required which is not too slow or fast.

Data collecting

In this study, the data that been collected is in term of time. This time will be considered as the frequency and how long of the job sequence and movement to finish up the process to produce the product. Lastly, all the related time must been compiled and calculated. Actually, the main purpose for collecting data is to identify the processing time, current standard time of the operation and sequence of each job of process. This is importance technique in order to find all the time related to the process.

Data analyzing

Analyzing is important because it determines the improvement of the process and at the same time affect the productivity. Based on the result that will be obtain from the data collection, the processing time is analyze to identify which element are value added or non-value added that contribute to the time obtain. There is some way to analyze the time. For example, time study is used to be the study of each of the steps in an operational or production procedure and the time consumed by them, for the purpose of devising methods of increasing efficiency or productivity of workers in full time and motion study.

Recommendation

Finally, the ideal solution for reducing the processing time is been recommended due to the increasing of current time and productivity. Based on the current data, the improvement of the standard time of the process to produce Cuervo product can be made according to the technique that is selected. The improvement also will gain in term to selected the another worker to conduct the task in the related process.

RESULTS AND DISCUSSION

From the data collected, the figure 2 is draw in order to make the comparison in term of the processing time of each process. The graph is draw based on the total of fifteen time of the activity. The graph has shown below identified that the box build process turn to the highest processing time of the activity which is 3199 seconds or 53.3 minutes compared to the others activity. But, the lowest time achieve is at the functional test process. Basically, box build process contains many part or task of activity that is needed to assemble all the part at that process. Furthermore, this process only conducts by one operator and as a result, this process getting the highest processing time. Based

on the result, the highest processing time is also can be identified as a bottleneck activity. So, this will affect the productivity of the product because the longest activities time basically gives the impact to the product. At the bottleneck activity of the process, the analysis can be gain in term of man, machine or workstation.

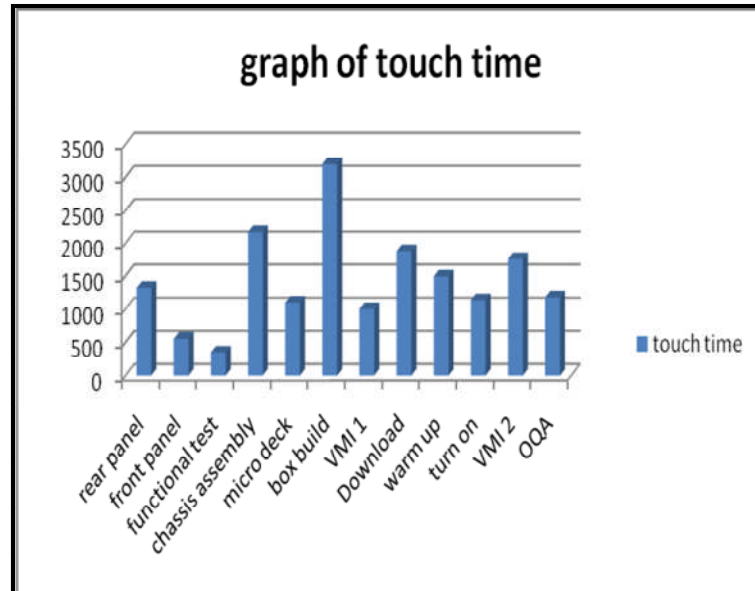


Figure 2: Graph of the processing time of the Cuervo (analog) product

After the highest processing time is identified from the graph, the process mapping of the box build process is perform to classify all the activity based on their criteria of process such as operation, transportation, inspection, delay, and storage. It is some of the techniques in order to found out the criteria that involve in the box build process. From the Figure 3, there are only two criteria required for box build process which is operation and inspection. It is summarizing that both of the criteria is required to make the assembly process successfully done. But, there are mostly required to identify and determine again that activity as important as needed.

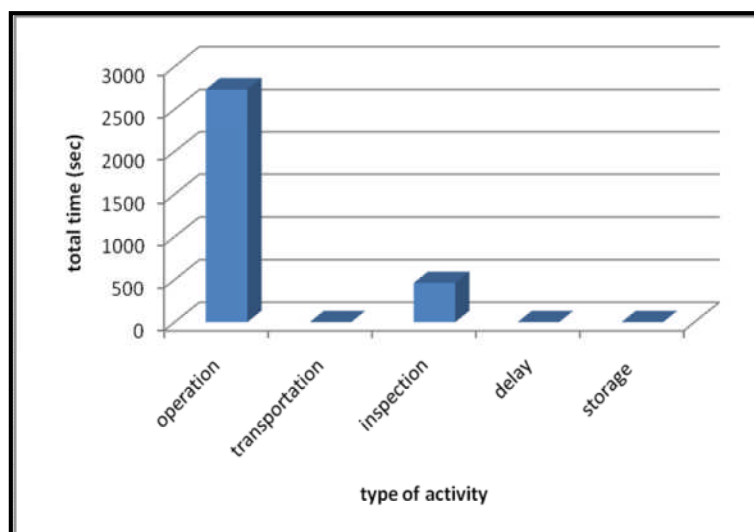


Figure 3: The graph of the classification of the activities in the process box build

According to the Figure 3, the operation of the box build is contributed to the highest time compared to the others. The inspection of the process only contribute for 463 sec and others activities is null because it is mostly unimportant activities for the box build process. Furthermore, the operation activities cannot be removed from the process box build because it is the important activities. In the process box build, the activities of transportation is not required because basically the finished assembly part only pass to the another next part at the nearest distance and do not required for using any transportation. Each activity of box build process is required to identify their category whether it is value added, non value added or necessary non value added. It is because, this categorize will determine which activity is not required in order to assembly that process. In addition, the value added (VA), non value added (NVA), and necessary non value added (NNVA) is identify in order to compare that activity based on the priority of the activity needed for that process. Hence, the time to produce that process will be reduced in order to avoid the bottleneck activities.

According to the Table 1, the non value added activities is setting and serial, check front panel, dress up cable and double check activities. The setting and serial activity is classified to non value added activities because basically this activities is only just to prepare all of the assembly part in one station in order to make it easy for the operator. But, the operator should prepare first all the part required before the process can be started in order to reduce the time to search the part for the next assemble. For the check front panel, this activity is mostly should be removed from the box build process. It is because the process of front panel has been done first before the process of box build. So, the check front panel activity should proceed at the front panel process because it is related at each other. In addition, after the process to assemble the part of front panel, every finished part must be check first in order to reduce the waste and detect defect. So, the check front panel is required at the front panel process.

Dress up cable also categorize in non value added activities because this process is basically for the finishing and required for the perusal to make the cable is successfully match with each others. Hence, it is better for assemble all the necessary cable by the consideration of an operator to make their own perusal too when assemble the part or cable. So, there are no others activity required for the finishing and the time will reduce in that activity. Furthermore, the double check activity is not required because there are checklists activities that will check all the part whether it is finished good or have some defect.

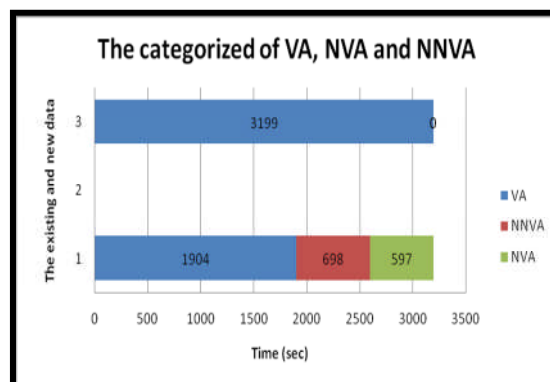


Figure 4: The comparison of VA, NVA and NNVA activities

According to the Figure 4, after the non value added activity is identified, the processing time for the box build process become 2501 seconds. Hence, the processing time is reduced as many as 81.34% compared to the existing time. These drastically reduction of the processing time will avoid the bottleneck activity by reducing the processing time and improve the productivity of the Cuervo (analog) product successfully. By reducing the non value added activities, the processing time will be reduce too.

Table 1: The categories of VA, NVA and NNVA

Step	Activity	Average time (sec)	Category
1	Setting & serial	138	NVA
2	Attach plug hole Attach R.F	41	VA
3	Connector	41	VA
4	Attach Micro deck	290	VA
5	Check front panel Attach sampler	68	NVA
6	module	68	VA
7	Attach Frac & module	68	VA
8	Attach reference module	68	VA
9	Attach Output module	66	VA
10	Attach serial Attach Yig driver	86	VA
11	board	45	VA
12	Attach ALC Board Attach mode gen	12	VA
13	board	9	VA
14	Attach cpu board	16	VA
15	Attach attenuator	265	VA
16	Insert ribbon cable Attach crystal	137	VA
17	oscillator Attach cable & 20	193	VA
18	doubler	276	VA
19	Dress up cable connect R.F. out	356	NVA
20	semi rigid cable	223	VA
21	Double check	35	NVA
22	checklist	138	NNVA
23	Scan	560	NNVA

Table 2: The work balancing of the process box builds

Operator	Activity	Average time (sec)	Total time (sec)		
A	Setting & serial	138	510		
	Attach plug hole	41			
	Attach R.F Connector	41			
	Attach Micro deck	290			
	Check front panel	68			
	Attach sampler module	68			
	Attach Frac & module	68			
	Attach reference module	68			
	Attach Output module	66			
	Attach serial	86			
	Attach Yig driver board	45			
	Attach ALC Board	12			
	Attach mode gen board	9			
B	Attach cpu board	16	2129		
	Attach attenuator	265			
	Insert ribbon cable	137			
	Attach crystal oscillator	193			
	Attach cable & 20 doubler	276			
	Dress up cable connect R.F. out semi rigid cable	356			
	Double check	223			
	checklist	35			
	C	Scan		138	560
				560	

The work balancing is determine in order to make the process is balance with each other in term of time to avoid the highest processing time. From the time study data collection, the activities in the box build process will be arranged in order to balance each process. It means that, this process is divided into two stations that will conduct by the same operator from the other process. It is because hired others operator required cost to conduct the process. From the Table 2 above, the process of box build is separated into three workstations which are conducted by the same operator. It means that the setting and serial, attach plug hole, attach R.F connector and attach micro deck can be combined together into one process which is the micro deck process that is conducted by operator A. So, the total processing time for the micro deck process is become 1612 seconds. But, the scan activity can be combined with the VM1 process that is conducted by operator C. Basically, VM1 process only focuses for the check activity that required 1002 second. So, the scan activity in the box build process can handle together the check activity in the VM1 process because both of these two activities are related to each others in order to make it balance. The new total processing time for the process VM1 become 1562 seconds. After the work balancing is made, the total processing time for the box build activity is about 2129 seconds.

Table 3: The comparison of the work balancing

Process	Processing Time (sec)	
	Before apply work balancing	After apply work balancing
Rear panel	1331	1331
Font panel	556	556
Functional test	350	350
Chassis assembly	2171	2171
Micro deck	1102	1612
Box build	3199	2129
VMI 1	1002	1562
Download	1878	1878
Warm up	1490	1490
Turn on	1137	1137
VMI 2	1757	1757
OQA	1177	1177

Based on the Table 3 above, the process of micro deck, box build and VMI 1 can be combined by each other to make the process balance and at the same time the processing time for the box build activity that facing on bottleneck activity will be reduced. Figure 4 indicates the results of processing time before work balancing is used, all the process is shown unbalanced graph. The mostly seen is at the box build process which is highest time achieved and the lowest time is at the functional test. It is because the box build process has many activities in order to assemble their part. But, some of those activities are not necessary or unimportant for box build process. Furthermore, at this process have the repeated activities that need to assemble at the others process.

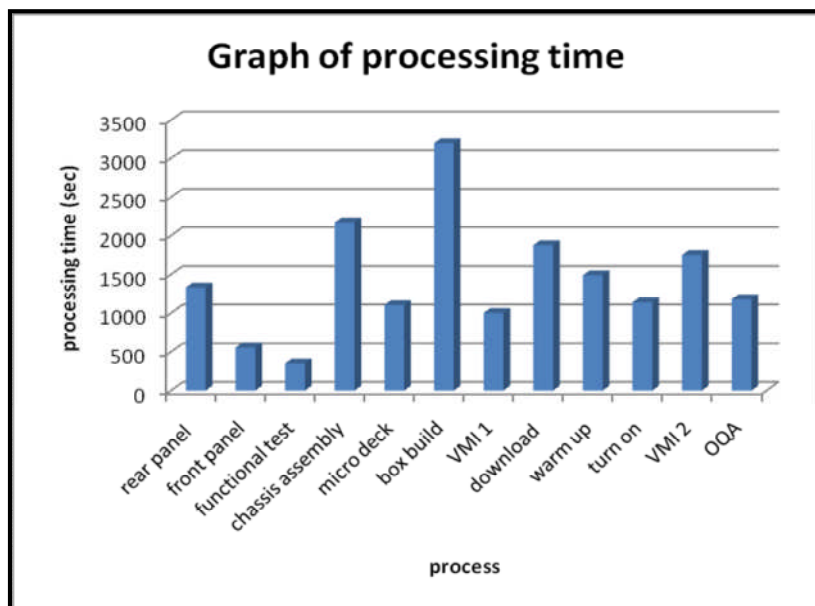


Figure 4: The graph of processing time before applying work balancing

Figure 5 indicates the results of processing time after work balancing is used; the graph is showed a balance pattern. It is because, the highest time at the box build process has been analyzed in order to reduce the time or bottleneck activity. After all the activities in box build process been balanced with other process, the processing time is reduced and there are no bottleneck activities again. Furthermore, the work balance for box build process is not interrupt for the others process in term of time because some of these activities can be combined together with the other process that have the lowest processing time. When line balancing is apply and according to Table 4, there are seven station produced when consider the balance obtain using the technique assuming a cycle time of 3199 seconds compared with the calculation. It is slightly different because there are just assuming for the cycle time and take the highest time that contribute at these process. Process real panel, front panel and functional test are assigned to the station real panel. That leaves a slack of 962 seconds or 16 minutes at this station.

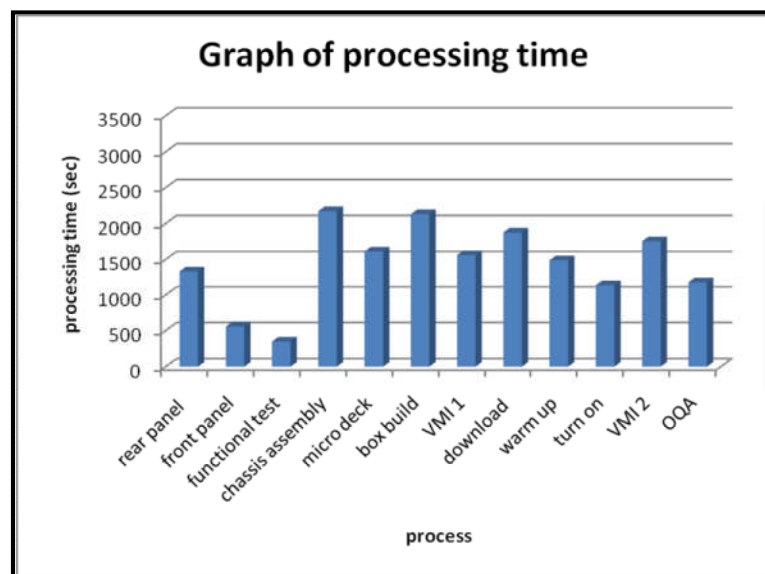


Figure 5: The graph of processing time after applying work balancing

Chassis assembly must be assigned to the next station because the total time of this process is not exceeding the assuming cycle time which is 3199 second or 53 minutes. The other stations are computed similarly. Although the minimum possible number of stations for this problem is seven, the ranked positional weight technique results in a seven-station is balance. But, it is possible that there is a solution with the others number of stations.

Table 4: The station balance for the Cuervo (analog) product

Station	1	2	3	4	5	6	7
Process	real panel, front panel, functional test	chassis assembly	Micro deck	Box build	VMI 1, Download	Warm up, Turn on	VMI 2, OQA
Idle time (sec)	962	1028	2097	0	319	572	265

Table 5: The new station balance for the Cuervo (analog) product

Station	1	2	3	4	5	6
Process	Real panel, Front panel, Functional test	Chassis assembly, Micro deck	Box build	VMI 1, Download	Warm up, Turn on	VMI 2, OQA
Idle time (sec)	1063	27	101	420	673	366

In this case, the optimal balance requires six stations when cycle times are 3300 seconds. But, if the cycle time is increase from 3199 seconds to the 3300 seconds, the balance station is obtained as the Table 5. This is clearly a much more efficient balance. The total idle time has been cut from 5243 seconds per unit to only 2650 seconds per unit. The number of stations decreases by about 14 % while the cycle time increases by 3 %. Hence, by assembly line balancing, the total idle time at all workstation will reduce. It is because, the idle time is become one of the factor that contributes to the highest processing time. So, the processing time will be decrease whereas the number of workstation of the process is reduced. It is because the reduction of the workstation occurred when certain process is combined together to make the assembly parts run successfully without involving the additional processing time.

CONCLUSION

Based on the study that has been done, the entire objectives are successfully achieved. The standard time is successfully done utilizing the work study method which is time study and work measurement. So, this standard time will determine the processing time require in order to ensure that each process is in that range of standard time. Besides, all the process to produce Cuervo (analog) product considers a very important process because it will affect the result in term of processing time whether it will face on the bottleneck or not . The other important thing that required to concern is about the

allowance and the performance rating of the worker. Basically, both of these factors should be suitable because it will determine encouragement of the worker to conduct the process and finally give the affect of processing time. Moreover, this study is focused on the work study improvement in term of reducing the processing time. Specifically, the collected data is analyzed for the highest processing time that gives the effect to the bottleneck activity. Based on the analysis on statistical of the results, there are several new findings obtained about the effect of the bottleneck activity. Before the improvement, there are bottleneck activities at the box build process.

Furthermore, the factor of specific task activity had been identifying in order trying to reduce the processing time of the box build process. By reducing the cycle time by eliminate non value added activities and make the work balancing of the process, in the same time can increase the output of the Cuervo (analog) product. This is been focus on the operation of the box build process activity which result the highest processing time compare to other. Besides that, the manpower is recommended in order to reduce the processing time and improve the productivity of the company. The purpose for the manpower is to get a number of manpower availability for the box build process. By adding another one operator from one to two, the process time will reduce and still can meet a daily demand.

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