Improvement of Workflow and Productivity through Application of Maynard Operation Sequence Technique (MOST)

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Abstract

To sustain in business under the current global situation of fierce competition a company needs to reduce or eliminate the idle and/or down time of operations in addition to improvement of the current working methods. In this case study, the problems and challenges of an auto company engaged in assembling car rear window assembly are attributable to non-optimal operations with inefficient capacity planning. The whole assembly line suffers due to the absence of established standard time for activities carried out by operators, the non-value added activities involved and the inefficient methods such as manual screwing, unplanned aisle and walking distance, material wastages and imbalance in the material flow. This study is conducted through application of Maynard Operation Sequence Technique (MOST) in the rear window assembly section to capture the workflow activities using systematic and descriptive workflow data block for the value adding, value engineering and methods engineering analysis. Subsequently, new methods and work standards are developed in advance for capacity planning, workplace layout design and manning analysis. Thus through the process redesign and process flow analysis, material handling and workflow are improved. Consequently, it has been possible to reduce the production cycle time to cater the higher level of demand with shorter takt time maintaining the current level of manpower.

Keywords
Maynard Operation Sequence Technique (MOST), Line Balancing, Bottlenecks, Process redesign, material handling

1. Introduction

In today's world of advanced technology, business has become more diversified and too competitive in securing its own market share. Moreover, with the introduction of alternative product by competitors, it has become even much more challenging to keep track with consumers' behavior as they make choices in a fragile manner. As a result, all business oriented people are trying to find out the ways and means to exploit consumer needs with an extreme pressure of satisfying the customer demand. But failure in satisfying the customer demand is not very uncommon in the manufacturing industries, which may happen due to the diversified reasons including the resource allocation and utilization problems. In the context of the resource allocation and assessment of the manpower requirement can be made from two perspectives - the manpower employed to carry out a particular task is often surplus than the requirements, sometimes there is a shortage of manpower in meeting the target production quantity. Another concern is the resource utilization level which largely depends on the way work is done and the tool is used. In both cases, the resource allocation and utilization directly or indirectly affect the profitability of a business as more wages for extra labor or high penalty for late deliveries need to be paid by the manufacturer. Thus measure has to be taken in order to sustain the competitiveness of a business in the market and at the same time try to achieve higher yield in profitability based on enhancement of productivity.

In this competitive manufacturing arena, inside most of the mass production industries, the lean manufacturing philosophy is widely accepted as it helps to satisfy the customer demand on time by allocating the limited resources and maximizing their utilization. But establishing a lean manufacturing environment is not an easy task as the companies need to identify and eliminate all the possible wastes from their production lines. In a typical manufacturing industry, the waste can be identified in the form of defects, rework, setup, inventory, waiting and transport, etc. As any kind of waste brings losses to the company, hence the lean manufacturing philosophy that identifies, and eliminates the wastes inside a production system by prescribing the way of utilizing the resources can bring the competitive advantages to the companies by improving their productivity.

As a part of the way of implementing lean manufacturing philosophy, the work and time measurement techniques help the manufacturer to increase the productivity by defining the proper working method and standard time, the way of maximizing the resource utilizations and helping to distribute the work load among the workstations etc. One of the most common methods used inside the industries for determining the standard activity time is the Methods Time Measurement (MTM), developed in 1948 for dividing the operations into basic motions (Genaidy et al., 1989). The detailed nature of MTM leads to a number of drawbacks such us the tediousness of the work, the handling of a huge amount of detailed data during their application, and etc. Though a number of methods other than MTM also proposed in the literature, most of them suffer from the same problems as stated (Genaidy et al. 1989, Genaidy et al. 1990, Ma et al. 2010). To overcome these drawbacks Maynard in 1960 proposed the concept of Maynard Operation Sequence Technique (MOST) in literature. The MOST can be defined as a way of analyzing the operations or sub-operations performing through several methods, steps and sequences, etc. in terms of time. In other words, it is a predetermined motion time method that aims to define the standard time of performing the work.

MOST presents an alleviation of the tediousness of analysis and reduces the work load of handling a large amount of data while other MTM techniques still suffer from the same problems (Ma et al. 2010, Yadav 2013). Since its introduction in time study analysis, the implementation of MOST in different industries proved its significant contribution to enhance the productivity. Belokar et al (2012) implemented MOST to increase the efficiency and the cost effectiveness of the work and reduce worker's fatigue through identification and minimization of the Non-Value Added (NVA) activities. As a result of their study, the authors managed to save 18% of the working time and define a new set of reduced standard time. Similarly, Gupta and Chandrawat (2012) applied the basic MOST in a small Indian industry. Their work also shows a possible and significant improvement in the productivity. MOST can also be used in combination with some other techniques for a particular purpose. Jiao and Tseng (1999) used MOST together with Cost-related Design Features (CDFs) approach to determine the product cost in electronics manufacturing company. To standardize the process of manufacturing inside two companies, Jamil et al. (2013) integrated MOST with the Ergonomics study, this integration helps to simultaneously optimize the standard times of the process activities and reduce the fatigue of the workers. As a result, the workforces gained a better condition while performing their activities and the rate of productivity also increased. Because of its universality, relatively and ease of use, nowadays, as stated by Gupta and Chandrawat (2012), MOST is used in almost every domain wherein a defined working method exists. In addition, the capability of proceeding with MOST becomes easier, faster and more reliable through computerization of data collection and the analysis procedure. For instance, the work conducted by Cohen et al. (1998) in which the authors developed an automatic speech recognition system, to be implemented with MOST procedures. Through a case study, the authors have shown the usefulness of this system named TalkMOST and how it can present as a great tool that reduce the analysis time and ease the establishment of time standards.

In this paper, an assembly line of an automotive company is taken under consideration with the aim of identifying and minimizing the bottlenecks, and improving the productivity by standardizing the work method and time, maximizing the utilization of resources as well as changing the conventional tools. To do so, the MOST technique is implemented for increasing the productivity by identifying the bottlenecks, standard times and NVA activities of the production line. However, due to the suggestion of replacing the conventional resources with the advanced ones, the economic viability of the proposed investment cost also assessed in terms of monthly profit. The following paper is arranged as follows; in section-2 a brief discussion on MOST is presented, in section- 3 the overview of the undertaken case study has been narrated , in section-4 the adopted research methodology is described and in section-5 the results are discussed.

2. Basic MOST

MOST is a work measurement technique, introduces to compile the standard work time and maximizes the resource utilization by improving the working method. Though the concept of MOST was firstly introduced by Maynard in 1960, its industrial application had started from 1967 in the form of Basic MOST. For performing the administrative and the clerical work in the production and service industries, in 1970 the Basic MOST was modified and named as Clerical MOST. Whereas, in 1972 and 1974, the basic MOST was lunched for first time inside Sweden and United

States respectively. A part of the Basic MOST, two other widely used version of MOST namely Mini MOST and Maxi MOST were also introduced in literature in 1980 (Jamil et al. 2013). Thus three general versions of the MOST are found in literature i.e. Basic MOST, Mini MOST, and Maxi MOST. To perform a manual work, the Basic most defines a sequence of three actions namely General Move, Control Move and Tool Use which are described below. .

2.1 General Move

The free movement of a studied object in air are explained and categorized under the General Move Sequence Model. In brief, the General Move model follows the Sequence of GET, PUT, and RETURN i.e. |A B G|, |A B P|, and |A|. An explanation of the parameters A, B, G, and P are given in Table 1. Each of these parameters A, B, G, and P has its own index value which is determined from the MOST Data Card.

Table 1: Parameters used in General Move

Notations	A	B	G	P
Description	Action Distance	Body Motion	Gain Control	Placement

2.2 Control Move

The movement of a studied element while it is in contact with surface or attached with other objects are explained and categorized under the Control Move Sequence Model. The control move model has sequence of GET, MOVE or ACTUATE, and RETURN phases i.e. |A B G|, |M X I|, and |A|. An explanation of the parameters A, B, G, M, X and I are given in Table 2. Each of these parameters A, B, G, M, X and I has its own index value which are determined from the MOST Data Card.

Table 2: Parameters used in Control Move

Notations	A	B	G	M	X	I
Description	Action Distance	Body Motion	Gain Control	Move Controlled	Process Time	Alignment

2.3 The Tool Use

During the assembly or production, the operations of hand tools are explained and categorized under the Tool Use Sequence. The Tool Use model consists of a Sequence of GET TOOL, PLACE TOOL, TOOL ACTION, PLACE TOOL, and RETURN phases i.e. |A B G|, |A B P|, |U|, |A B P|, and |A|. An explanation of the parameters A, B, G, P and U are given in Table 3. For the GET TOOL phase, and the PUT TOOL phase, the index values are assigned in the same manner as the GET phase in General Move sequence model. TOOL ACTION PHASE is considered when the operators perform the necessary tool actions. This phase includes F - Fasten, L- Loosen, C - Cut, S - Surface Treat, M - Measure, R- Record, and T - Think.

Table 3: Parameters used in tool use.

Notations	A	B	G	P	U
Description	Action Distance	Body Motion	Gain Control	Placement	Tool Action

2.4 Time Unit used in MOST

The time measurement unit (TMU) is used as a time unit for MOST analysis, which is converted to the minute by using the following Table 4.

Table 4: Unit conversion table.

1 TMU	=	0.00001 hour	1 hour	=	100,000 TMU
1 TMU	=	0.0006 minute	1 minute	=	1667 TMU
1 TMU	=	0.036 second,	1 second	=	27.8 TMU

3. Case Study

In this case study, assembly activities performed in four consecutive workstations to build the rear window of a typical car. The rear windows that are intended to assemble are supplied by a well reputed local car manufacturer. In the whole assembly line five major operations are performed in four successive work stations. As shown in Figure 1, the operator, at work station 1, fixes the U-Rubber to the mainframe which can been broken down into nine distinct work elements as recorded in Table 5. Whereas, as shown in Figure 2, the second operator at the Work station-2, fixes the glass to the mainframe through seven elemental tasks as recorded in Table 5. Inside the third workstation, the assembly operation performs six elemental works (recorded in the Table) to assemble screw to mainframe and to apply silicon to close the screwing area before sending the frame for Leak Test as shown in Figure 3.

Figure 1: Photograph of fixing the channel rubber.

Figure 2: Fixing glass to frame.

Figure 3: Applying silicon to corner.

Figure 4: Preparation of frame for testing.

In the work station 4, the leak test and final assembly operations are performed together. The assembly operation requires the combination of both machine and human labor. However, from the detailed MOST analysis, the required time for each of the elemental activities of four different assembly operations are summarized in Table 5. To show the data extraction process in line with the MOST analysis, a brief explanation is given below by taking the example of an elemental activity (Loosening Mainframe Screws) performed in assembly operation 1 for making the rear window:

SN.	Method description	Index Value	Move
1.	Turning the frame from store	A3 B0 G1 A1 B0 P0 A0	General Move
2.	Pick up the knife	A3 B0 G1 A1 B0 P0 A0	General Move
3.	Peel tape from frame	A1 B0 G1+1 (A3 B0 P1 C3) A0 B0 P0 A0	Tool use
4.	Place back the knife	A0 B0 G0 A3 B0 P1 A0	General Move
5.	Pick the screw driver	A3 B0 G1 A1 B0 P0 A0	General Move
6.	Loosening the screws	(A1 B0 G1) (A1 B3 P3 L32) A3 B0 P1+1 A0	Tool use
7.	Place back the screw driver	A0 B0 G0 A3 B0 P1+1 A0	General Move

Sample Calculation for total time in TMU:
Work elements 1, 2, 4, 5, 7: (24 TMU) x 10 = 240 TMUs
Work element 3: ((3 TMU + (7 TMU x 4 repeat frequency)) x 10 = 310 TMUs
Work element 6: ((2 TMU x 2) + (39 TMU X 4 repeat frequency + 5 TMU)) x 10 = 1650 TMUs

Thus the total time for loosening mainframe screw is found to be 2200 TMUs which is equivalent to 79 seconds. The above calculations do not include the allowances which are usually assumed as 10%. Similar procedure has been adopted in assigning the index values for estimating the elemental times involved in all other operations conducted in four work stations. The relevant data are presented in Table 5.

Table 5: Elemental activity times as estimated for the current operations in work stations 1,2,3,4

WORK STATION-1				WORK STATION-2			
SN	Elemental Activities	Activity Time (TMU)	Activity Time (min)	SN	Elemental Activities	Activity Time (TMU)	Activity Time (min)
1	Loosening Mainframe Screws	2200	1.45	1	Place Mainframe Glass to Work Station	950	0.63
2	Place mainframe to work station	2650	1.75	2	U-Rubber Preparation	27	0.02
3	Sealant Frame	430	0.28	3	Assemble U-Rubber to Glass	660	0.44
4	Channel Rubber Preparation	27	0.02	4	Assemble Mainframe to Glass	2990	1.97
5	Assemble C/Rubber to L/Frame	910	0.60	5	Assemble 2nd U-Rubber to Glass	5700	3.76
6	Assemble C/Rubber to U/Frame	1270	0.84	6	Assemble L/Frame to Glass	3900	2.57
7	Assemble L/Frame to U/Frame	1750	1.16	7	Refill Soap Water	28	0.02
8	Refill Soap Water	28	0.02	8	Refill Silicon	88	0.06
9	Refill Silicon	86	0.06				
	Total completion time	**9351**	**6.17**		**Total completion time**	**14341**	**9.46**
WORK STATION-3				WORK STATION-4			
1	Set Mainframe to manual Jig	2240	1.48	1	Unload Tested Frame from Machine	1080	0.71
2	Assemble Screw to Mainframe manual	4040	2.67	2	Load Frame to Machine for Test	11930	7.87
3	Release Frame from Jig	840	0.55	3	Assemble Weather Strip to Frame (m/c time)	0	0
4	Close Screwing Area with Silicon	1880	1.24	4	Frame Glass Polishing & Sealant (m/c time)	0	0
5	Final Touch-up to Frame before Leak test	2150	1.42	5	Frame Glass 2nd Polishing & Sealant (m/c time)	0	0
6	Refill Silicon	85.5	0.06	6	Reject Frame (m/c time)	0	0
	Total completion time	**11236**	**7.41**	7	Assemble Rope into Frame (m/c time)	0	0
				8	Rope Preparation	132	0.09
				9	Refill Soap Water	28	0.02
				10	Refill Silicon	86	0.06
					Total completion time	**13256**	**8.75**

4. Research Methodology

By analyzing the undertaken case study, several problems have been identified including the improper capacity planning. Moreover, due to the absence of pre-defined standard time, working methods and lack of practice of advanced tools i.e. unplanned walking distance, material wastages and imbalance in the material flow and manual screwing etc. the non-value added activities were increased and affected the whole assembly line. Hence, the competitive advantages in the undertaken assembly line can be brought into system by the proper use and selection of tools, balancing work flow and optimizing layout. Inclusion of hand tool can help the operator by reducing their effort to perform the tasks as well as the completion time. In addition, the modifications in the methodology and standardized the time of the works lead to create a well balanced line and eliminate the non-value added activities as well as completion time. Meanwhile, the changes in layout of the different workstations and processing areas are also expected to help improve the scenario in the context of travel distance of operators, avoidance of interruptions in the paths of operators, material or equipment handling, organization of tools and WIP storage areas as well as the smoother delivery of materials from one station to another.

However, in these contexts, the proper work measurement techniques can play a vital role by balancing and increasing the production rate of the studied line through the identification and elimination of the bottlenecks.

Hence, to increase the line efficiency as well as the production rate of the undertaken case study, the MOST technique is implemented for identifying the bottlenecks and NVA added activities of the production line as well as setting time standard.

On the basis of the MOST analysis, some of the scopes of improvement in the studied assembly line for the rear window of a typical car have been identified and possible solutions of incorporating the advanced resources are proposed accordingly. The whole research methodology is arranged in two different sections namely (1) Bottleneck identifications and (2) Defining the scope of improvements.

4.1 Bottlenecks identification

The MOST analysis is used in this study to determine the NVA activities, unnecessary movements and the bottlenecks of the whole line. To do so, by applying the MOST technique the operations were broken down into the basic elements and analyze each of the elemental activity times. The bottlenecks in this study are viewed from two different perspectives i.e. bottleneck workstations within the assembly line and the bottleneck tasks within each work stations. The bottleneck workstation in the production line can be easily identified as the station having the maximum cycle time (greater than the takt time) whereas within the workstation tasks having the maximum activity time can be identified as bottleneck tasks. The elemental times presented in Table 5 are used to identify the bottleneck task within the workstations.

- ✓ In Work station-1, Placing the mainframe to workstation has a maximum task time of 1.75 minutes among all the tasks
- ✓ In work station-2, Assembling the second U-Rubber to the glass has a maximum task time of 3.76 minute among all the tasks
- ✓ In work station-3, Fixing the screws manually to the mainframe has a maximum completion time of 2.67 minutes among all the tasks
- ✓ In work station-4, Loading the frame to machine is identified as the bottleneck elements as it has a task time of 7.87 minutes among all other elementary tasks.

Besides, to indentify the bottleneck work stations of the undertaken production line, the cycle times of each workstation found from the MOST analysis are presented in Table 6. As evident from the figures in Table 6, Work station 2 can be identified as the bottleneck workstation requiring a cycle time 9.465 minutes.

Table 6: Summary of undertaken production flow line

SN.	Work Stations	No. of Operators	Station time (TMU)	Station time (sec)	Station time (minutes)
1	Work Station 1	1	9350	370.3	6.172
2	Work Station 2	1	14340	567.9	9.465
3	Work Station 3	1	11236	444.9	7.415
4	Work Station 4	1	13256	524.9	8.748

4.2 Scope of improvement

For brining the competitive advantages, attempt is to be made first to reduce the cycle time through incorporation of positive changes within the bottleneck work station. Since work station 2 requires 9.465 minutes to complete all the elementary tasks, it is necessary to reduce this cycle time to a level of the operation having the second longest cycle time (8.748 minutes). As the bottleneck is a dynamic situation, after lowering the cycle time of work station 2 to the level of latter operation, effort can be made to address both the assembly operations for effective reduction in cycle time and so on. By applying the MOST technique, process flow, working procedure (also called standard operation procedure (SOP)) and layout of the plant, it can be easily identified that the work station cycle time can possibly be reduced by modifying the working method and replacing the manual tools as the operators are facing difficulties mostly in performing manual activities, such as fastening and loosening of screws. Hence to increase the productivity, it is necessary for the company to provide the operator with advanced hand tools. The use of these hand tools would not only make the process faster, but also it requires a reduced amount of effort from the operators. As a result, fatigue experienced by the operator would be delayed and enabling them to work for longer hours consistently in terms of quality and rate of production. As presented in Table 7, the current working conditions can be improved by adopting alternative ways of doing the tasks or by using additional tools such as screwdriver and air pressure pump etc.

Table 7: Proposed changes in the rear window assembly operations and their effects

SN	Source operation(s)	Current practice	Proposed changes and effect
1	Assembly operation 1	Manual fastening of screws (4 pcs.), Task time: 1.24 min.	Air screw driver for fastening (4 pcs), Estimated task time: 30 sec
2	Assembly operation 3	Difficult to fasten and loosen, Task time: 2.80 min.	One way clamping Estimated task time: 7.1 sec
3	Assembly operation 1, 2, 3 & Final	Too heavy and need precise alignment Task time: 27.32 sec	Air pressure silicon pump Estimated task time: 23.36 sec
4	Assembly operation 2	Channel rubber: stock in bundle, to cut according to frame, Task time: 1.4 min.	Proposed to cut 30 pieces/bundle Estimated task time: 59 sec
5	Assembly operation 1	Plaster sprayed on frame & Loosening screws manually Task time: 1.4 min.	Requested vendor spray the screwing area and screws to be in bundle.

Apart from the above proposed actions, it is also proposed that the 'Leak test' which is currently done in work station 4 can be transferred to work station 3 to readjust the work station cycle time for betterment of the process flow. However, the unloading of tested rear window is to remain within workstation 4. This modification is expected to lead to a balanced production line with four assembly operations at their respective workstations.

5. Results and Discussion

As the improvement to be brought by implementing the suggestions needs investment, it is necessary to assess and justify the proposed modifications from two different perspectives: (a) the increment of production rate (b) the amount of investment.

5.1 Asses the increment of production rate

To visualize the improvement in production rate, MOST analysis has been carried out again based on the proposed modifications in the assembly operations. Inside work station-1, based on the proposed modifications, the MOST analysis have shown a total time of 560 TMU has been reduced for the elemental activities 3, 5, 6, and 7 as shown by Table 8. A comparative scenario is evident in Figure 1 for eight activities to be performed workstation. Similarly, for work station 2, it is found from the MOST analysis, a total time of 3260 TMU is possible to be reduced for the activities 3, 4, 5, and 6. On the other hand, the MOST analysis also shows that an approximate total time of 2106 TMU for workstation 3 and 3010 TMU for workstation 4 are possible to be reduced.

Table 8: Elemental task times as estimated for the proposed W/S- 1

No	Elemental Activities	TMU (Current)	TMU (proposed)	Min (proposed)
1	Loosening Mainframe Screw (4 screws)	2200	2200	1.45
2	Place mainframe to work station	2650	2650	1.75
3	Sealant Frame	430	370	0.24
4	Channel Rubber Preparation	27	27	0.02
5	Assemble C/Rubber to L/Frame	910	690	0.46
6	Assemble C/Rubber to U/Frame	1270	1130	0.75
7	Assemble L/Frame to U/Frame	1750	1610	1.06
8	Refill Soap Water	28	28	0.02
9	Refill Silicon	86	86	0.06

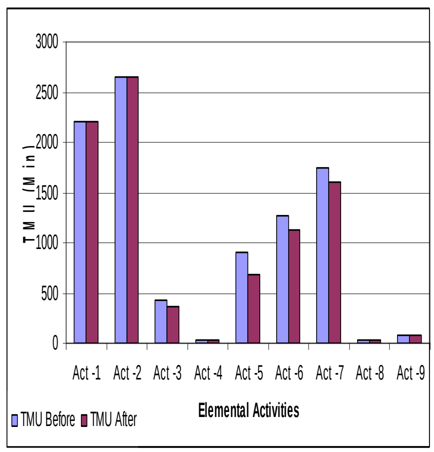

Figure 5: Comparison for W/S 1

To assess the improvement in production rate, the takt time of the considered assembly line is determined by dividing the total available time with the customer demand. The total available time for production is obtained by deducting the fixed loss from the total working time per day. The fixed loss consists of meal break, allowable downtime, briefing time and cleaning time. Necessary information for calculating the takt time is given in Table 9.

Table 9: Information available to work out the takt time

Total working time	Fixed loss	Available working time	Total activity time	Highest operation time	Daily required quantity
9.5 hours	1 hour	8.5 hours	25 minutes	7.3 minutes	66 units

$$\text{Takt time} = \frac{\text{Available working time}}{\text{Daily required quantity}} = \frac{8.5 \text{ hours}}{66 \text{ pieces}} = 0.13 \text{ hr/pc} = 7.8 \text{ min/pc}$$

However, a comparative scenario of overall improvement among the workstations that are achieved by implementing the proposed changes is illustrated in Figure 6 and Table 10. By observing both of the Figure 6 and the Table 10, the significance of the proposed changes over the current practice can be realized. The maximum work station time in the current practice is 9.465 minutes which is longer than the takt time (shown by the break line in Figure 6), whereas the maximum work station time calculated for the proposed modifications is 7.30 min. As the calculated takt time for the assembly line is as 7.8 minutes per piece, the customer demand of 66 pieces per day cannot be entertained by the current practice. However, by bringing the proposed changes in assembly lines it is possible to satisfy the demand on time as well as increase the productivity.

Table 10: Comparative scenario of W/S times

SN.	Work Stations	Station time (min) (current)	Station time (min) (proposed)
1	Work station- 1	6.172	5.81
2	Work station-2	9.465	7.32
3	Work station-3	7.415	5.33
4	Work station-4	8.748	6.78

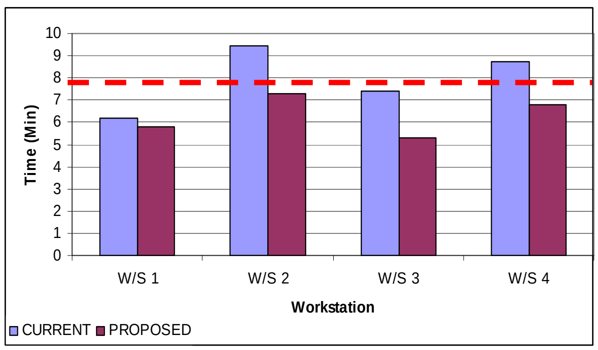

Figure 6: Comparative scenario for improvement

5.2 Economic validation of investment

By implementing the proposed ideas, it is likely to bring in more benefits to the company as it cuts the processing time leading to lower the production costs.

Table 11: Economic evaluation of proposed changes

SN	Work/Station	Current practice	Proposed changes	Action budget	Remarks
1	Assembly 1	Manual fastening of screws (4 pcs), Time: 1.24 min.	Air screw driver to fasten (4 pcs), Est. time: 30 sec	Low budget plan: RM 400	Saved 44.45S RM 125/mth
2	Assembly 3	Difficult to fasten and loosen, Task time: 2.80 min.	One way clamping Est. time: 7.1 sec	Medium plan RM 1600	Saved 2.70 min, RM 448/mth
3	Assembly 1, 2, 3 & Final	Too heavy-need precise alignment, Task time: 27.32 sec	Air pressure silicon pump, Est. time: 23.36 S	Low budget plan	4 seconds saved i.e. RM 10.9/month
4	Assembly 2	Channel rubber: stock in bundle, to cut according to frame,Task time: 1.4 min.	Proposed to cut 30 pc/bundle Estimated time: 59 sec	Low budget plan	9.5 sec saved i.e. RM 26/month
5	Assembly 1	Plaster sprayed on frame & Loosening screws manually Task time: 1.4 min.	Requested vendor spray the screwing area and screws to be in bundle	Low budget plan	1.40 min saved i.e. RM 233/month

The processing times for certain assembly operations are estimated by using MOST technique. It is found that some of the operations can be performed within reduced times by incorporating certain tools. As shown in the Table 11, though some investment is necessary to facilitate those resources, the overall production costs are deemed to be lower compared to that of the current level.

6. Concluding Remarks

It is evident that to sustain in this competitive industrial environment, a company needs to reduce or eliminate the idle and/or down time, improve the working methods, standardize the time as well as enhance the overall capacity planning and in this respect the MOST can play a vital role. In this research, a possible way of improving the productivity of undertaken by an auto company is presented. The result shows that by replacing some working tools and modifying the methods, it is possible to bring the competitive advantages in terms of satisfying the customer demand, well balancing the process flow as well as ensuring the economic benefits. Thus the incorporation of the MOST to estimate the standard times for various elemental tasks involved in different operations, inclusion of simple tools and jigs to perform a task in shorter time with minimum effort from operators and maneuvering the distribution of activities in different workstations to balance production lines can substantially improve the productivity of an industry from the current level. In future, a research study with the application of the MOST can be explored from a wider perspective through implementation in a single or mixed model assembly lines having large number of work stations.

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