ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

EFFECTIVE WAY TO ESTIMATE THE STANDARD MINUTE VALUE (SMV) OF A U3 SHIRT BY USING TIME STUDY TECHNIQUE

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DOI: 10.5281/zenodo.1312753

ABSTRACT
There is no doubt that sewing section in an apparel industry is the most important department that plays a vital role in the whole firm .Time study is a method of measuring work for recording the time of performing a certain specific task or its elements carried out under specified conditions. To improve the existing situation of this section and increasing productivity, time study is a very effective technique. This study is based on calculations of standard minute value (SMV) of a U3 long sleeve shirt. For conducting time study, a traditional stop watch was used for measuring time of each operation. The U3 shirt (Uniform number 3) manufacturing has 43 operations, for each one 10 measurements were taken for each task and operator working on the line. Then the average of each task is calculated and the final SMV as well.

KEYWORDS: Standard Minute Value, Time Study Technique, SMV estimation, U3 shirt

I. INTRODUCTION
Work measurement applies different types of techniques to determine the required time to complete one operation and the total work that can be performed by one operator in a specific time. It provides a fair way of estimating the time to do a skillful operation with plentiful work supply & proper equipment. Different work measurement techniques used by sewing floor managers are stopwatch study or time study, historical time study, predetermined data, standard data, judgment, operator reporting & work sampling. Among them stopwatch study or time study is the most popular (1).

Time study is a method of measuring work for recording the times of performing a certain specific task or its elements carried out under specified conditions. An operator does same task throughout the day. It helps to define how much time is necessary for an operator to carry out the task at a defined rate of performance (2).

Measuring the Standard Minute Value (SMV) correctly in garment manufacturing process is very important because SMV plays a vital role in apparel business from order placement to shipment. (3). To estimate SMV, the garment must be analyzed carefully and the different factors that affect the SMV has to be checked also. SMV of a product varies according to the work content or simply according to the number of operations, fabric types, stitching accuracy needed and sewing technology to be used etc.(4).

Delivering of high quality garments at low cost in shorter lead times are the major challenges faced by the apparel manufacturer's .SMV and such like other tools can be effectively applied to apparel industries for better production efficiency (5). The standard time setting may be used for the following purpose:
1. To improve the accuracy of planning.
2. To determine Efficiency of Production Line.
3. To understand the effect of teaching skills (6).

One problem of time study is the Hawthorne Effect where it is found that employees change their behavior when they know that they are being measured.

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The important criteria in garment production is whether assembly work will be finished on time for delivery, how machines and employees are being utilized, whether any station in the assembly line is lagging behind the schedule and how the assembly line is doing overall (7) .

II. MATERIALS AND METHODS

In this study U3 long sleeve shirt which made by Sur Military clothing factory was selected as the case study. The fabric of the U3 is 65% polyester and 35% cotton coming from SUR Textile Mills. The first step was to understand the shirt sewing processes components and the chronological sequence of assembly operations needed to transform raw materials into finished garment. The whole U3 shirt manufacturing cycle includes a sequence of different phases. The manufacturing process of U3 shirt consists of 43 operations. Some operations have more than operator and others have only one. Figure (1) below shows the operation flow chart of U3 shirt with a code number assigned to each operation (task).

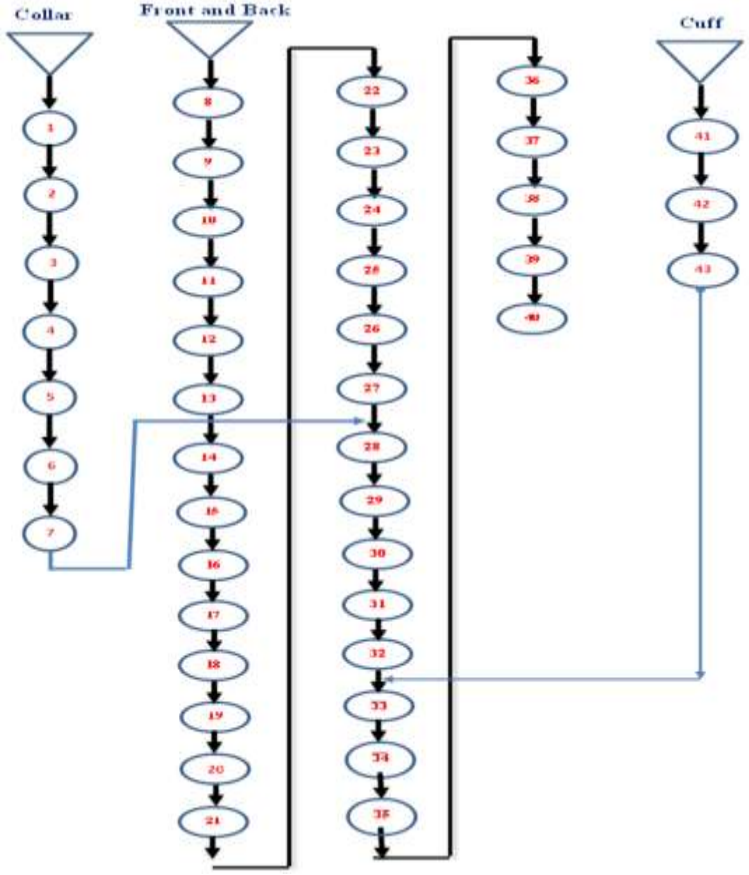

Fig.1: operations flow chart of U3 shirt

Where each operation has a code number as follows:

Task No	Task Name	Task NO	Task Name
1	Topstitch collar (stand collar)	**23**	Topstitch Chest pocket Flap
2	Runstitch collar	**24**	Attach back yoke
3	Trim and turn collar	**25**	Attach Event
4	Press collar	**26**	Bar tack Event
5	Topstitch collar	**27**	Cut Event
6	Attach bottom collar to stand collar	**28**	Attaching and Topstitch Collar Size Label
7	Topstitch Centre collar	**29**	Joint Shoulder
8	Hem pocket	**30**	Attach Epau
9	Runstitsh Flap	**31**	Attach Sleeve
10	Runstitsh Epau	**32**	Close Side Seam
11	Invert Flap	**33**	Attach Cuff
12	Invert Epau	**34**	Topstitch Cuff

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13	Topstitch Flap	**35**	Bottom Hemming
14	Topstitch Epau	**36**	Button Hole Collar x3 / Cuff
15	Over lock Flap	**37**	Marking Button Position (x12)
16	Button Hole Flap	**38**	Attach Button (x12)
17	Button Hole Epau	**39**	Thread Cleaning and Fasten Button
18	Topstitch Right Front Edge	**40**	Pressing
19	Topstitch Left Front Edge	**41**	Hem Cuff
20	Button Hole Front	**42**	Closed Cuff
21	Attach Chest pocket +Flap	**43**	Invert Cuff
22	Topstitch Pen Pocket		

Time study:
Duration of tasks depends on several factors, such as the task nature (simple or complex), operator fatigue or stress, the properties of fabric and sub materials, the working environment etc…(8). In order to calculate the approximate real process time of a task, 10 measurements were taken for each task and operator working on preparation and assembly lines of U3 shirt. Time study was conducted using a stop watch. Each operation was measured in seconds and recorded**.**

Formula of SMV and targeted production calculations for U3 shirt manufacturing:
Average cycle time was counted after measuring time for ten repetitive operations by using the stop watch. The time readings are done for every worker during different periods of the day. Then, the cycle time or the observed time is converted to normal or basic time by multiplying it with the operator performance rating. A worker cannot work all the day continuously. He will require time for rest, going for toilet, drinking water etc. Unavoidable delays may occur because of tool breakage and other unexpected incidence. So some extra time was added to the normal time. The extra time is known as the allowance. Finally standard time for each element in seconds is found by summing up all elemental time and then seconds is converted into minutes**.** The following are the equations for doing that:

$$Average\ Observed\ Time = \frac{sum\ of\ the\ recorded\ time\ to\ perform\ each\ elemnt}{number\ of\ cycles\ observed} \quad \text{(i)}$$

$$Normal\ time\ = observed\ time\ *\ Rating \quad \text{(ii)}$$

$$Standard\ Minute\ Value\ (SMV)\ =\ Basic\ Time\ (1 +\ Allowance\ \%) \quad \text{(iii)}$$

Let, Performance rating = 100% and Allowance = 15%

III. RESULTS AND DISCUSSION

The following table denotes the estimated SMV of operations to the respect of average cycle time by considering 15% job allowances.

Table 1: Calculated SMV for U3 shirt

Op No	Operation	Observed time avg (s)	SMV (s)
1	Hem pocketx2	12.15	13.97
2	Topstitch collar (stand collar)	6.71	7.72
3	Runstitch collar	15.22	17.5
4	Trim and turn collar	4.95	5.69
5	Press collar	15.82	18.19
6	Topstitch collar	9.55	10.98
7	Attaching bottom collar to S. collar (cut to shape collar)	19.8	22.77

ISSN: 2277-9655
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8	Topstitch Centre collar	11.12	12.79
9	Runstitch Flaps x2	16.6	19.09
10	Runstitch Epau x2	15.03	17.28
11	Invert Pocket Flap	12.92	14.86
12	Invert Epau	17.63	20.24
13	Topstitch Flaps x2	18.47	21.24
14	Topstitch Epau x2	14.16	16.3
15	Overlock Flap	3.04	3.5
16	Button Hole Flap	4.56	5.24
17	Button Hole Epau	3.14	3.61
18	Hem Cuff	5.46	6.28
19	Closed Cuff	8.65	9.95
20	Invert Cuff	13.9	15.99
21	Topstitch Right Front Edge	20.62	23.71
22	Topstitch Left Front Edge	14.53	16.71
23	Button Hole Front	18.98	21.83
24	Attach chest pocket+ Flap	29.27	33.66
25	Topstitch Chest pocket Flap	7.06	8.12
26	Topstitch Pen Pocket	5.95	6..84
27	Attach Back Yoke	30.26	34.8
28	Attach Event x2	12.95	14.89
29	Bartack Event x2	10.39	11.95
30	Cut Event	12.93	14.87
31	Attaching and Topstitch collar size label	58.5	67.3
32	Joint Shoulder	33.56	38.59
33	Attach Epaulets	12.15	13.97
34	Attach Cuff	33.56	38.59
35	Topstitch Cuff	13.24	15.23
36	Attach Sleeve	36.19	41.62
37	Closed Side Seam	42.52	48.9
38	Bottom Hemming	29.26	33.65
39	Button Hole Collar x3/cuff	12.49	14.36

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40	Attach Button x12	43.69	50.24
41	Marking Button Position x12	42.72	49.13
42	Thread Cleaning and Fasten Button	104.33	119.98
43	pressing	46.65	53.65
Total SMV (minutes)			**17.15**

The following graph shows the Average Cycle Time (sec) for performing the operations to make a U3-shirt, while figure (3) shows the SMV graph for all operations.

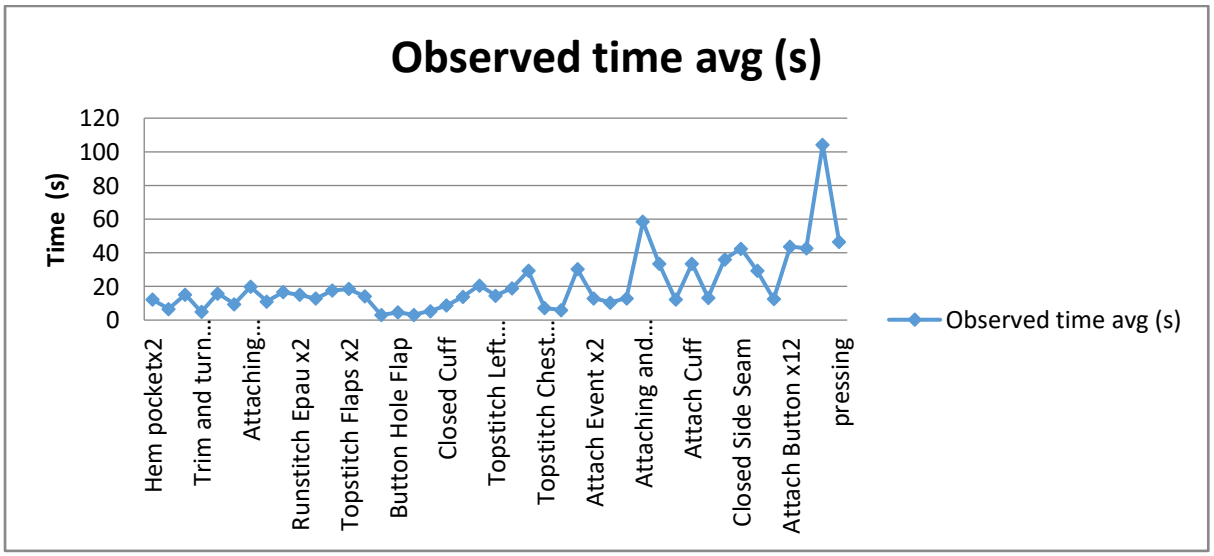

Fig 2: average cycle time (s) graph for performing the operation to make a U3 – shirt

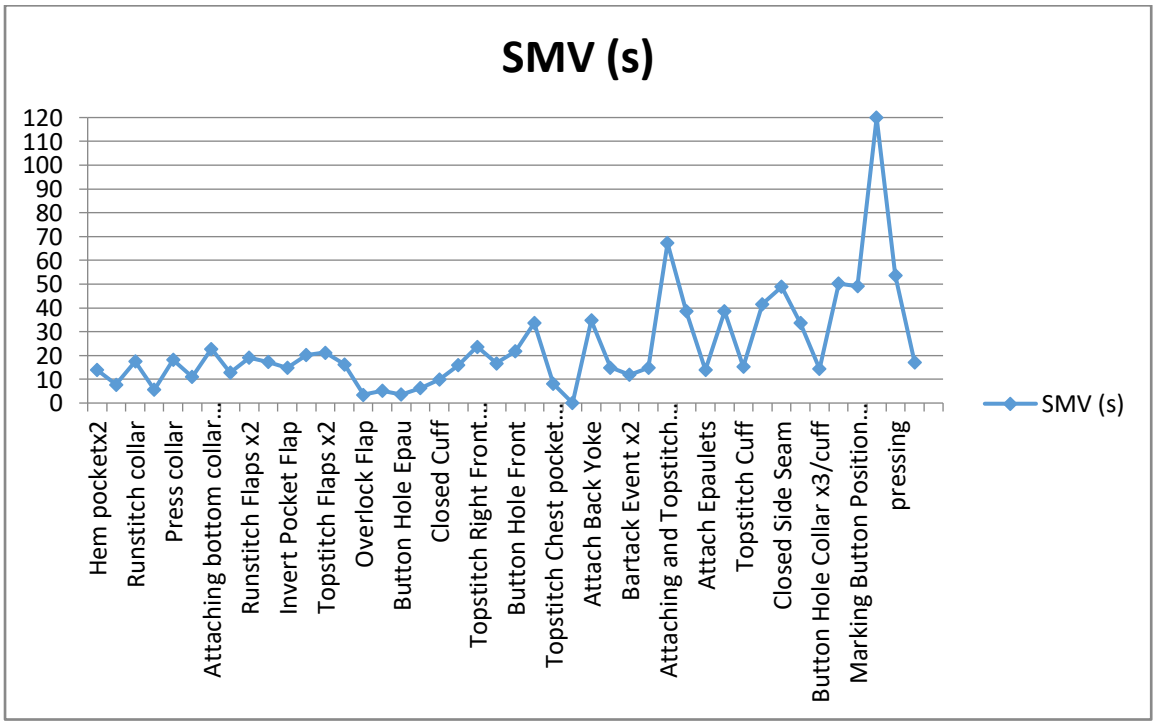

Fig 3: Estimated SMV for performing the operations to make a T-shirt

ISSN: 2277-9655
Impact Factor: 5.164
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IV. CONCLUSION

Delivering high quality garments at low cost in shorter lead times are the major challenges faced by the apparel manufacturers. The study measured the SMV of U3 long sleeve shirt. This SMV data will help the management to improve line sewing efficiency through line balancing. Based on the practical experiment conducted, it can be seen that SMV and such like others tools can be effectively applied to apparel industries for better production efficiency. Different time is needed to sew the different parts of a garment. As a result time variation is a must. Since garments are made with the help of different operator, time limitation must be given to achieve the target production.

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CITE AN ARTICLE

Hanan, O. A., & Seedahmed, A. I. (2018). EFFECTIVE WAY TO ESTIMATE THE STANDARD MINUTE VALUE (SMV) OF A U3 SHIRT BY USING TIME STUDY TECHNIQUE. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY, 7*(7), 179-184.