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Identifying Wastages and Calculating SMV through Work Sampling Study in Sewing Section

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Abstract:
Wastages in the sewing section are very common in garment factory. The sewing workers are engaged in sewing and its associated activities. Beside these, the sewers are provided up to 15% time for allowances due to fatigue, personal needs and machine attention. But sewing operators also spend their time in gossiping, repairing alter, waiting for work and intentionally being idle, which are wastages time. The Standard Minute Value (SMV) is vital in apparel business for target setting, line balancing, man and machine planning. To identify wastages in the sewing section and measure accurate SMV for sewing operations, this work sampling study is carried out in sewing floor. This study is done directly observing 5 sewing operators of collar section by 70 rounds. This study revealed the sewers spend 71.3% time in sewing and its related work and rest of the time in allowances and wastages. This study also calculated SMV of five sewing process. At 95.45% confidence and 5% precision level the measured SMV for c.band hem, c.run stitch, c. top stitch, c.band jnt and c.band t/s are 0.214min, 0.394 mi, 0.379min, 0.503min and 0.319min respectively. The identified wastages and calculated SMV will help the management to take the initiatives to minimize wastage in the sewing section by line balancing, SMV based target setting to the workers and improving supervision.

Keywords- SMV, Sewing, Work Sampling, Wastage, Capacity

1. Introduction

It is important to measure Standard Minute Value (SMV) correctly in garment manufacturing process because SMV plays a vital role in apparel business from order placement to shipment. SMV is used for calculating cost of manufacturing, man machine planning, line balancing, proper target setting and designing incentive plan. Any wrong calculation of SMV will hamper all plan based on SMV and create a negative impact on apparel business [1].

The SMV is measured by Time Study, Work Sampling and General Sewing Data (GSD). Though Time study is the widely used techniques for its simplicity, it has a limitation to assign performance rating to the observed operator by the observer. There is always a chance of assigning wrong performance rating to the workers because rating is subjective comparison of a given task to a benchmark and it is given to workers based on observers experience, judgment and perception[2]. In time study, SMV is calculated based on the formula, "(SMV= OT per cycle X Performance Rating factor+ allowances)". So, any wrong assessment of performance rating will result in incorrect SMV calculation. From the literature review based on Bangladesh garment study, it is found that the different researchers rate the workers differently on their own views, experience and perception In a study [3] SMV of Polo-Shirt is measured as 14min assigning performance rating 110.

A study measured SMV of T-Shirt as 6.48min assigning performance rating 80[4]. Another study [5] measured SMV for T-Shirt as 4.92min assigning performance rating 80. To eliminate need of performance rating, GSD (General sewing Data), a software based system is used to measure correct SMV of sewing process [6]. But it is costly and not affordable to all garment factories. On the other hand, Work sampling, the statistical tools can measure percentage of occurrences of job and SMV without assigning performance rating [7]. Wastages in the sewing section are very common in the garment. The garment sewers involved in stitching, trimming, bobbing threading and stitch adjustment. They are allowed to take up to 15% time for relaxation and machine attention as allowances [8] .But beyond the allowances, the sewers wasted their time in involvement with some non-value added activities such as gossiping to the other workers, reworking, waiting for work, being idle intentionally. In sewing section it is found that garment workers spent 72.7% time in productive activities and the 23.2%time in personal allowances and unavoidable delay [9]. Another study revealed that the sewing operators engaged in 40% time in main operation 33.25% time in associated operation and rest of 26.7% in allowances [10].

It is known that the wastages time of Bangladeshi garments are not measured. The work sampling studies [9] & [10] are

conducted in the sewing floor to identify delay and other allowances to but not to measure SMV of the sewing process. Work sampling study result will help the management to visualize the sewing floor and to take right initiative to minimize the wastage through proper supervision and line balancing. So, it necessary to do Work Sampling Study in Bangladesh garments to measure wastages in sewing section

2. The measurement of correct SMV for sewing operations

The Work sampling developed is basically used in ratio delay studies and analysis of non-repetitive work and occasionally used in measuring standard time for no-repetitive jobs having longer life cycle [11]. But in this research the Work sampling is used to measure SMV of sewing process which is short in cycle and repetitive in nature. A Bangladeshi garment factory is selected for this study. A successful Work Sampling Study is carried out by ten steps [12]. The steps are as follows:

Step1: Establish the purpose
Strp2: Identify the subject
Step3: Identify the measure of output
Step4: Establish a time period
Step5: Define the activities
Step6: Determine the number of observation
Step7: Schedule the observations
Steps8: Inform the personal involved
Step9: Record the data
Step10: Summarized the data

2. Methodology

The five sewing operators and their respective processes c.band hem, c.run stitch, c.top stitch, c.band jnt, c.band hem are selected for this study. Initially operator's activities are defined, classified and their activities are observed by 4 rounds in a pilot study. Based on pilot study data the minimum numbers of observations (3361times) and minimum numbers of rounds 67.2 are calculated at 95.45% confidence and 5% precision level. For ease of data collection and calculation, the mass data are collected by 70 tours in 10 hour shift in a day. The recorded data are summarized, analyzed. Based on the recorded data the wastages time in sewing section and SMVs of five sewing process are calculated.

2.1. Pilot Study

The activities of the five sewing operators are divided into six sub activities. The activities are defined, classified and explained in the table I

Table1:Garment Workers actives

Activities	Details	Symbol
Operation	Stitching ,trimming, grasping and keeping body	Op
Machine allowance	M/C failure, needle replacement, bobbing, tension adjustment	Ma
Relaxation allowance	Go to wash room, drinking , taking rest for fatigue	Ra
Idle	Workers are in rest due to unable work flow	I
Rework	Alter repair, organizing the parts due to serial mistake	Rw
Others	Gossiping, talking in mobile, intentionally being idle	Od

and calculate correct SMV. This research is conducted to measure the wastages in sewing and measure SMVs of sewing process. This study will contribute to literature of Work Sampling Study in Bangladeshi garments by fulfilling the following objectives.

1. The segregation of productive times from the wastages in the sewing section

Observing the 5 sewing operators in 4rounds, the following data are achieved .These data are presented in table II.

Table2
Pilot Study Data

Rounds	c.band hem	c.run stitch	c.top stitch	c.band jnt	c.band t/s
1	Op	Op	Op	Op	Op
2	Op	Op	Ma	Op	Op
3	I	Op	Op	Op	Od
4	Op	I	Op	Ma	I

The total observation, n= 4X5=20
Operation (Op) =14
P (Percentage of Op) =14/20=70%=0.7
The minimum no of observations are calculated using the equation (1)

$N=4*P\ (1-P)/e^2$ (1) [13, Page-101]

At 95.45% confidence and 5% precision level, the minimum no of observations, N=4*0.70(1-0.70)/ (0.05)2=336 times
The minimum no of rounds =336/no of operators=336/5=67.2 tours.

To get more accurate data and to ease of data collection and calculation 70 tours are made in the swinging floor instead of 67.2 tours. All data are recorded in data collection sheet. The data are summarized in data analysis sheet. During the study of 10 hours shift, the total outputs of each process are also counted. From the sewers percentage of spent in "Operation "and average hourly output that the sewers produced in 10 hours study time , the SMVs of each process are calculated.

3. Result

3.1. Data collection and calculation

The mass data are collected by 70 rounds. The collected data are presented in data analysis sheet in table III

Table 2: Data analysis sheet

Activities	c.band hem	c.run stitch	c.top stitch	c.band jnt	c.band t/s
OP	52	45	52	50	47
Ma	2	3	1	2	3
Ra	3	5	4	4	4
Rw	2	4	3	2	6
Od	2	2	2	2	3
Total	70	70	70	70	70

3.2. Calculation sheet

Table3: Calculation sheet

Activities	c.band hem	c.run stitch	c.top stitch	c.band jnt	c.band t/s
OP (%)	74.29	64.29	74.29	71.43	65.71
Ma (%)	2.86	4.29	1.43	2.86	4.29
Ra (%)	4.29	7.14	5.71	5.71	5.71
I (%)	12.86	15.71	11.43	11.43	10.0
Rw(%)	2.86	5.57	4.29	4.29	8.57
Od (%)	2.86	2.86	2.86	2.86	4.29
Total (%)	100	100	100	100	100

3.3. Segregation of Productive Activities and Wastage

In the table the percentage of occurrences are measured in each operation. The sewing activities and its related functions are "Operation (Op)" considered productive activities. The "Ma" and "Ra" are belongs to allowances. The rest of the activities Idle (I), Rework (Rw), and Others (Od) specially gossiping, intentionally being idle are non-value added activities or wastages. The segregated activities are presented in the table V.

Table4: Segregated Activities

Activities	c.band hem	c.run stitch	c.top stitch	c.band jnt	c.band t/s
Productive Activities :OP	74.29 %	68.57 %	74.29 %	72.86 %	67.14 %
Average :OP	71.43%				
Allowances (Ma+Ra)	7.15%	11.43 %	7.14%	8.57%	10%
Average: Allowance	8.86%				
Wastage/ non-value added (I+Ra+Od)	18.58 %	24.29 %	18.57 %	20.00 %	22.86 %
Average Wastages	20.86%				

3.4. SMV Calculation

During this study, the total outputs of each operation are counted. The counted output are summarized in production summary sheet (table VI) .From the production summary sheet (table VII) and percentages of occurrences of each process (table IV), the SMVs of sewing operations are calculated

Table5: Production summary sheet

output	c.band hem	c.run stitch	c.top stitch	c.band jnt	c.band t/s
Total output in 10hrs	2400 uit	1200unit	1350 unit	1000 unit	1450 unit
Average hourly output	240	120	135	100	145

The SMVs of all the process are measured by equations (2), (3)

SMV= BT+ A (1)

Where A=Allowances

BT=P*T

Where T= Total time of operation per unit

P =Percentages of total time utilized for the work

Now, SMV of "c.band hem" is calculated using the equations (2) and (3) and taking data from table IV and table VII.

T= 60/240 =0.25 min

P=74.29%=0.7429

BT=P*T=0.7429*0.25==0.186 min

SMV=BT+A= 0.186 +15% *of 0.186=0.214 min

Hourly Production Capacity=60/SMV=60/0.214=280 unit/hour

The calculated SMVs and capacity of five processes are summarized in table

Table 6: Calculated SMV and Capacity

Operations	c.band hem	c.run stitch	c.top stitch	c.band jnt	c.band t/s
Output/hrs	240	120	135	100	145
T/unit(min)	0.25	0.5	0.444	0.600	0.414
BT=P*T	0.186	0.343	0.330	0.437	0.278
Allowance 15% of BT	0.028	0.051	0.049	0.066	0.042
SMV	0.214	0.394	0.379	0.503	0.319
Capacity/hrs	280	152	158	119	188

4. Discussion

The objectives of this study are to identify wastage in the sewing section and measured the correct SMV of sewing process. This study properly measured the wastages of the sewing section.

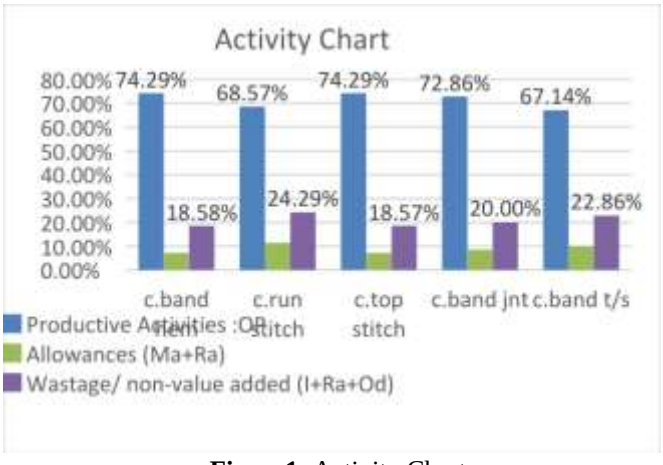

Figure1: Activity Chart

This study result showed that the sewing operators spent 71.4% time in productive activities. This result is similar to

study [7], where the sewers spent 72.7% time in productive activities. In table III, it is found that c.band hem and c.top stitch operators spent the highest 74.29 % time in productive activities and c.band t/s operators spent the lowest 67.14% time in value productive activities. In this study it is found that average allowances taken by the operators are 8.86% which is 6.14% lower than allowed allowance 15% of basic time. The reasons are that the sewers are provided new branded machines, having under bed tread trimmer and the M/Cs are regularly maintained in the factory. The big exhaust fans are installed the factory to minimize worker's fatigue

The sewing operators wasted 20.29 % time in non- value added activities. This wastage in higher than [8], where wastage in waiting for work is 9% and rework is 2.5%. But in this study it is found that sewers spent 3.15% time gossiping with the sewing helpers. This is absolutely undesirable. The workers are engaged in gossiping due to poor supervision and unnecessary sewing helpers' assignment

The average waiting time for work is found 12.86 % which is high due to imbalance line layout. The c.band top t/s operator spent 8.57% time in rework for repairing alters and c. run stitch operators spent 5.71% time in rework.

Another objective of this study is to measure correct SMV of sewing process. This study has successfully calculated the SMVs of c.band hem, c.run stitch, c.top stitch, c.band jnt and c.band top stitch

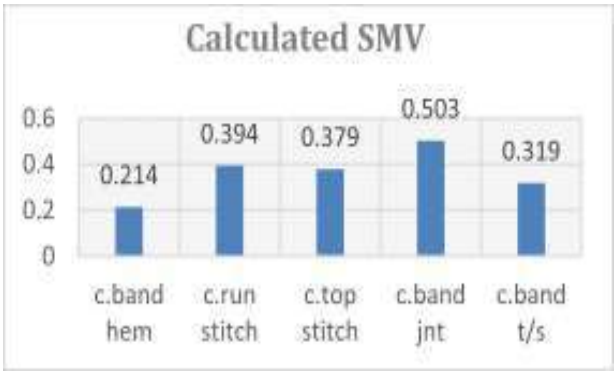

Figure2: SMV chart

At 95.45% confidence and 5% precision level, the measured SMVs of c.band hem, c.run stitch, c.top stitch, c.band jnt and c.band t/s are 0.214min, 0.394min, 0.379min, 0.503min and 0.319 min respectively

Despite identifying wastage and measuring SMV, this study has some limitations. One of the limitations is the challenge of achieving better accuracy. The present study is coducted at 95.45% confidence and 5% precision level. But to achieve 1% precession level at same confidence level, it needs to make 1680 tours in sewing floor as per Equ(1). This is time consuming and tedious work for the observer. In this study, mass data are collected by 70 round in10 hour shift in day. These insufficient observations will provide inaccurate results. The observers are advised to visit the sewing floor over period of days or weeks to improve data accuracy and minimize day to day variations affect. The observing at least10 operators in a round, 2.5% accuracy can be achieved through 135 rounds at the same confidence level

5. Conclusion

This study successfully identified the wastages in the sewing section. This study results will helps the management to visualize the sewing floor and can take initiative to minimize wastages improving supervision.

The study measured the SMV of five sewing process. This SMV data will help the management to improve line sewing efficiency through line balancing [15], [16].The Work sampling study may be applied to the other industries of Bangladesh. This study and further study will contribute to improving productivity and efficiency of garment industry of Bangladesh.

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