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Implementation of Time Study on Hoodie Production and the Effect towards Productivity

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Abstract

Time study is considered the part of backbone of industrial management programs because the information that the time study generates is performed to eliminate waste. Before any improvement in quality and quantity of output, any study of operations time, any development of working method, any scheduling of work or balancing of work growth, the time study method is required. The aim of time study is to establish a time for a qualified worker to perform specified work under stated conditions and at a defined rate of working. Predetermined motion time systems is used as a technique of time and motion study in order to calculate standard minute value (SMV), measure and improve the existing amount of production, efficiency and the effect of time study on hoodie towards the productivity. Observing couple of apparel industries, it is noticed that the amount of production, efficiency of trained operators is higher than untrained operators. The amount of achieved production (pieces) per day, efficiency (%) per day, average production (pieces) per operator due to the higher amounts of production and efficiency of trained operators. Line balancing is also another cause which effects upon the production rate and efficiency percentage of operators. If factories management or administration take necessary steps to accumulate enough training facilities and do an appropriate line balance, then time study may affect positively over productivity and factories will able to achieve their target profit which increase the national remittance as well.

Keywords— Time study, hoodie, productivity, Standard Minute Value (SMV).

1. Introduction

Recent techno economic condition is marked by increasing competition in almost every sector of economy. In order to be successful, companies need to manufacture products with greater quality, lower cost and shorter production time. Thus it is necessary to develop and apply techniques that allow the best utilization of the available resources. Time is the most important thing in determining the productive efficiency and performance and develop the operation level of the company. Time study is a work measurement technique for recording the time of performing a certain/ specified conditions and for analyzing the data so as to obtain time necessary for an operator to carry out at a define rate of performance. An operator does same operation (task) throughout the day. Time study help to define how much time is necessary for an operator to carry out the task at a defined rate of performance [1-4]. It is also called work measurement. It is essential for both planning and control of operations. This is achieved by a qualified practitioner observing the work, recording what is done and then timing (using a time measuring device) and simultaneously rating (assessing) the pace of working. According to British Standard Institute time study has been defined as *"The application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance."* Time study is a tried and tested method of work measurement for setting basic times and hence standard times for carrying out specified work. Its roots are back to the period between the two World Wars. Time study is the important aspect in business to determine the production rate. Time is the most influential element in this rate. This element is taken care in any transaction in a company. In the process of manpower has no time standard stated because as we know, manpower process will be influence by many factors. When there is no time standard, any task could be finished out of planned. While a time standard is determined to know the time needed the process could be finished. Time standard is important to execute the maximum profitable production rate. Hence with the application of time and time and motion study the changes and improvement could be seen especially in cost and production matter [5-9].

2. Materials and Methods

Apparatus that have been used in this work are laptop, stopwatch android phone and calculator.

2.1. Parts of a hoodie

The parts of hoodie may vary on the basis of factories. There are various types of hoodie like basic hoodie, casual hoodie, fashionable hoodie etc. Table 1 shows the specifications of common parts of hoodie.

Table 1. Common parts of hoodie

Front and back part	Front pocket; Shoulder and Back moon
Sleeve	Armhole; Cuff; Rib and OP Round
Hood	Upper curve and Inner hood
Bottom	Hem and Bottom rib
Final assemble	Drawstring; Front neck and Back label

2.2. Description of different operations for hoodie

The hoodie whatever the factory is made with, it contains some basic parts and operations. For making a hoodie some common different operations are front and back part attachment, sleeve attachment, hood attachment, bottom attachment and final assemble (as shown in Table 2). For different operations SMV may vary. Moreover, every operation included with many sub operations.

Table 2. SMV of operations and sub operations

(1) Front and back part attachment	
Operations	SMV
Hem pocket & Trim	0.4056
Mark front pocket position	0.1944
Ironing pocket & match	0.5239
Attach pocket front	0.414
Iron back moon	0.592
Make & Label back-2 back moon	0.414

Mark back moon position	0.4056
Attach moon back	0.228
Match front back	0.372
Attach shoulder	0.363
Top stitch shoulder and trim	0.363

(2) Sleeve attachment	
Operations	SMV
Match & attach sleeve to body long	0.681
Top stitch armhole & trim	0.520
Tack care label side seam	0.865
Close side seam long	0.650
Tack bottom cuff	0.380
Invert & fold rib	0.320
Attach cuff to sleeve opening round	0.500
Top stitch cuff to sleeve opening round hard	0.500

(3) Hood attachment	
Operations	SMV
Attach hood 2 parts upper curve	0.340
Top stitch hood upper curve	0.320
Attach hood two part lower	0.340
Mark & hole hood placement	0.220
Match & attach top + inner hood	0.500
Hem hood & trim	0.500
Hood bottom close & inside tack	0.400

(4) Bottom attachment	
Operations	SMV
Tack bottom rib	0.280
Run stitch bottom rib	0.500
Mark bottom rib for attach	0.220
Attach rib to body	0.500
Top stitch bottom rib & trim	0.500

(5) Final assemble	
Operations	SMV
Match hood to body	0.250
Tack hood to body	0.350
Attach hood to neck	0.450
Attach piping to neck hoodie	0.280
Tack piping back end & trim	0.260
Top stitch back hoodie out label	0.300

3. Data collection and analysis

3.1. SMV calculation formula

For calculating SMV, following formula used,

SMV=Basic minute +Bundle allowance +Machine and personal allowances...(i)

Bundle allowances will be added 10% with basic time and machine and personal allowances will be added 20% with basic time. The determination of 'Basic minute' is the important part here. It is possible to determine by two methods i.e. using synthetic data and using time study. Here time study method is used.

3.2. SMV calculation method

3.2.1. Cycle time calculation

Cycle time means "total time needed to complete full operation. A stopwatch has been taken and cycle time for the Hoodie making operation is being measured. This process done consecutively at least for 5 cycle times. Then mean value is being calculated by adding 5 cycle times and divided those by 5. By following the process cycle time is being found.

3.2.2. Performance rating collection

At which speed a specific operator can perform his duty is being known as performance rating. It is being collected from IE department.

3.2.3. Basic time calculation

Cycle time is being converted into basic time by multiplying with 'performance rating'.

Basic time= Cycle time x Performance rating..(ii)

Here considered 65% performance rating of the operator.

Basic time= Cycle time x Performance rating..(ii)
= 0.23 x 65%
= 0.1495

3.2.4. SMV calculation

Finally adding the allowances with basic time, SMV is being calculated.

SMV=Basic minute+Bundle allowance +Machine and personal allowances

$$=0.1495 + (0.1495 \times 10\%) + (0.1495 \times 20\%)$$
$$= 0.1944$$

3.3. Efficiency calculation

Efficiency is a measure of how much work is conserved in a process. In many processes, work is lost. The efficiency is the work output, divided by the work input and expressed as a percentage. A perfect process would have an efficiency of 100%.

$$\text{Efficiency}= \frac{\text{Work output}}{\text{Work input}} \times 100\% \text{...(iii)}$$

3.4. Target calculation

Target is the amount of production, which should be produced by an operator or a line that a management desires.

$$\text{Target} = \frac{\text{No.of worker x W/hr x 60}}{\text{SMV}} \text{x Expected SMV......(iv)}$$

Total operator 20
W/hour 08 Hrs.
SMV 15.65
Efficiency 85%

So, Target = $(20 \times 8 \times 60/15.65) \times 85\%$
= 520 pcs
= 65 pcs/hr

3.5. SMV calculation by using cycle time for hoodie (front & back part)

Table-3 indicates different operations of front and back part of hoodie and the cycle time, average time, target per hour, target per day for an operator. The required information's are used to calculate SMV. By using equation (i) and (ii) and putting the respective values from the table; basic time and SMV is calculated for different operations of front & back part of hoodie.

Table 3. Time table of front & back part peration for hoodie (common practice)

Sl. no.	Operation name	Machine name	Cycle time (Sec.)					Avg. time (min)	Time with allowance	Target/ hr.	Target/day (10 hrs.)	Basic time (Sec.)	SMV
			1	2	3	4	5						
1.	Hem pocket and trim-2	SNLS	32	26	30	29	28	0.48	0.58	103	1034	0.312	0.4056
2.	Mark front pocket position	OLS	14	16	12	15	13	0.23	0.28	214	2143	0.1495	0.1944
3.	Ironing pocket and match	SNLS	39	37	36	38	37	0.62	0.75	80	802	0.403	0.5239
4.	Attach pocket front	SNLS	28	31	29	30	29	0.49	0.59	102	1020	0.3185	0.414
5.	Iron back moon	OLS	42	45	43	40	41	0.70	0.84	71	711	0.455	0.592
6.	Make and label back-2 back moon	FL	30	29	32	28	29	0.49	0.59	101	1014	0.3185	0.414
7.	Mark back moon position	OLS	28	30	28	29	28	0.48	0.57	105	1049	0.312	0.4056
8.	Attach moon back	SNLS	17	10	15	18	15	0.27	0.32	185	1852	0.1755	0.228
9.	Match front back	SNLS	25	25	28	25	28	0.44	0.53	114	1136	0.286	0.372
10.	Attach shoulder	FL	26	24	27	23	28	0.43	0.51	117	1172	0.2795	0.363
11.	Top stich shoulder and trim	SNLS	28	25	27	24	24	0.43	0.52	115	1154	0.2795	0.363

4. Results and discussion

For hoodie operation, data is collected from three different factories and make comparison among them on the basis of SMV and efficiency% of hoodie production. It is found that the data represents lower SMV is the better one and vice versa.

4.1. SMV & efficiency% of hoodie at industry A, B and C

After calculation it is found that, for the hoodie production, different industry goes through different numbers of operations. Therefore, in common practice total SMV and efficiency is found different. However, table 4 shows number operations, total SMV and efficiency for hoodie production for industry A, B and C.

Table 4. Industry data on total SMV and efficiency for hoodie production

Industries	No. of operations	Total SMV	Efficiency
Industry-A	40	16.12	70%
Industry-B	49	23.5	65%
Industry-C	49	22.23	63%

Among the three industries it is found that, Industry-A has the lower SMV and Industry-B has the higher SMV. It means that Industry-B requires maximum time and industry-A requires least time. Higher SMV means it requires more time to complete the operations of hoodie.

Again, the percentage of efficiency (%) for hoodie making. Here Industry A, B and C has the efficiency of 70%, 65% and 63% respectively. Therefore, Industry A is more efficient for hoodie making than other two industries. Though the efficiency of these three industries are very close to each other, however, for line balancing and number of operations make the difference of efficiency. Also few issues are dependent on operators of both types- trained and non-trained.

4.2. Comparative study on production and efficiency of trained and non-trained operators

Table 5 indicates the operators' evaluation that means whether the operators are trained or non trained about time and the average production and average efficiency for shift A and shift B of operators (trained and non- trained) for a given style of hoodie.

Table 5. Comparison of production and efficiency.

Operator number	Operator evaluation	A-Shift		B-shift	
		Avg. production	Avg. efficiency	Avg. production	Avg. efficiency
Operator 1, 2	Trained about time and given only one style	275	55%	280	56%
Operator 3, 4	Trained about time and given only one style	285	47%	280	46%
Operator 5, 6	Trained about time and given only one style	640	63%	620	61%
Operator 7, 8	Trained about time and given only one style	283	56%	290	57%
Operator 9, 10	Trained about time and given only one style	256	80%	260	81%
Operator 11, 12	Non-trained about time and given only one style	97	25%	110	25%
Operator 13, 14	Non-trained about time and given only one style	91	19%	99	22%
Operator 15, 16	Non-trained about time and given only one style	305	32%	250	33%
Operator 17, 18	Non-trained about time and given only one style	110	27%	102	29%
Operator 19, 20	Non-trained about time and given only one style	87	33%	88	30%

4.3. Average production of trained and non-trained operators for shift-A and shift-B

Figure 1 indicates that the operators working in shift A, who are properly trained about time study, their average production curve is at upper position and for non-trained operators the curve is at lower position. That means trained operators' production is more than non trained operators'. Similarly, figure 2 indicates that the operators working in shift B, who are properly trained about time study, their average production curve is at upper position and for non-trained operators the curve is at lower position. It also means trained operators production is more than non trained operators for shift B as well.

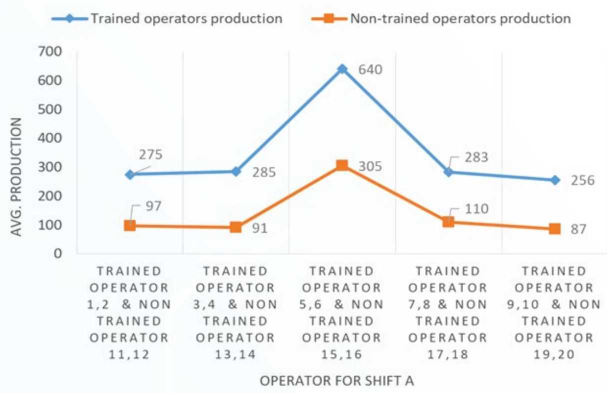

Figure 1: Average production of trained & non trained operators for Shift-A

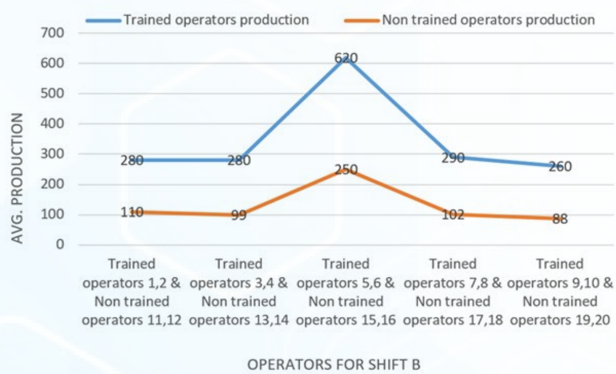

Figure 2: Average production of trained & non trained operators for Shift-B

4.4. Average efficiency of trained and non-trained operators for shift-A and shift-B

Figure 3 indicates that operators trained about time have higher average efficiency than non-trained operators on the basis of operator's production rate for Shift-A. Similarly, figure 4 indicates that operators trained about time have higher average efficiency than non-trained operators on *the basis of operator's production rate for Shift-B.*

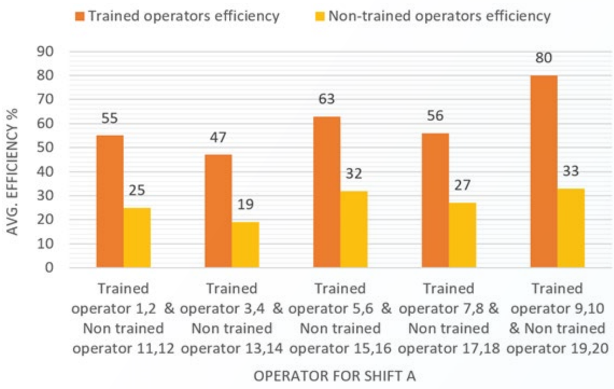

Figure 3: Average efficiency of trained & non trained operators for Shift-A

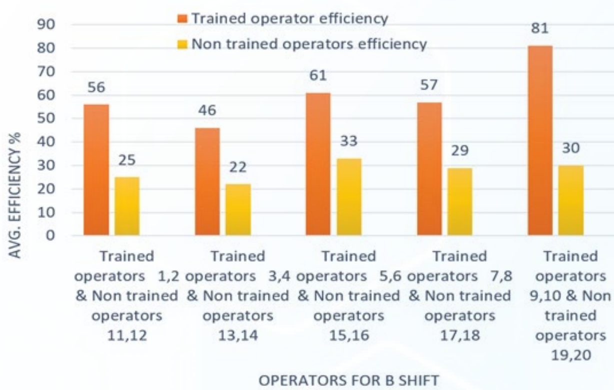

Figure 4: Average efficiency of trained & non trained operators for Shift-B

4.5. Effect of time study on achieved production of hoodie before and after training for five operators

Five operators were selected at random and they were involving in different machine and operations for making hoodie such as Operator-1 (SNLS machine for pocket join 1/4 top stich), Operator-2 (SNLS machine for side tack for side seam), Operator-3 (OL4 machine for pocket inner side over lock), Operator-4 (SNLS machine for pocket attach both side) and Operator-5 (OL4 machine for front rise join). Figure 5 shows the result on training to the operators about time study and the effects on the achieved production of hoodie. Here, for each operator production per day increases after taking training.

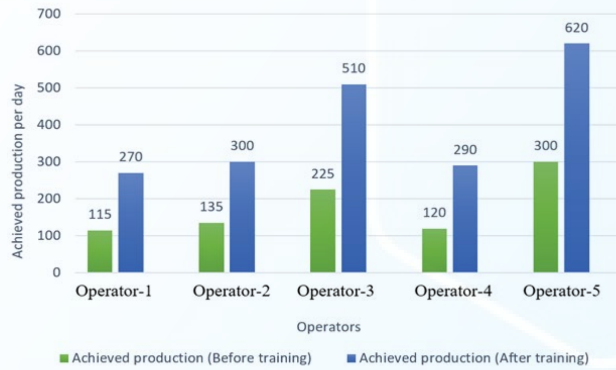

Figure 5: Average efficiency of trained & non trained operators for Shift-B

5. Conclusion

Now-a-days the concept of industrial engineering is playing a vital role for improving the work nature in apparel industry. The apparel industry is known as a buyer driven or customer driven industry, which makes it more intensified by global competition. To sustain in such a competitive world, the industry has to work more efficiently. In case of hoodie making, for achieving more productivity and efficiency time management may be one of the reasons for that purpose. By the implementation of time study through line balancing, trained up operators about time management, operators can be more efficient, production rate per day will be increased, most probable appropriate line of hoodie may consume less time of total operation and thus the number of hoodie (per day) will be increased.

This research focused on time study with the hoodie production. Here, important emphasis given on hoodie making operators whether they are trained about time management or not. Also tried to show how time study emphasis on operators' efficiency and productivity and also do compare the scenery before and after training facilities about time. It is seen that non trained operators are very poorly efficient where trained operators are very efficient and their production rate is also high. For research purpose relevant data were taken from three different factories hoodie SOP and then tried to evaluate the better one. Moreover, concerned about their line balancing which are related to the time study.

It's a hopeful matter that many compliance factories are already started to practice time study and also implement on their operation. If most of the factories of the country implement time study on their production they will able to achieve their target, get more profit, increase productivity and efficiency. In this way Bangladeshi apparel garments may be survive and sustain at the competitive world market.

5.1. Limitations

-Due to strict rules and regulations of the factories, sometimes unable to apply time study over production properly.

-Due to budget limitations, unable to go through any expensive effective procedures.

5.2. Recommendation

The research is done basically based on the emphasis of time study on operator's efficiency, productivity during hoodie making. Here the implementation of any new time management system is not shown. So there is a scope to do so. Many garments items are available in the apparel industry. So there is also scope to do research on another item and another method with time and motion study.

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