

Significance of the use of sewing work aids in garments production.

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ABSTRACT: In garment production, the most critical manufacturing process is sewing because it generally involves a great number of operation. The production process includes a set of workstations, at each of which a specific task is carried out in a sequence, with hundreds of employees. Sewing work aids means additional working parts that are attached with the sewing machine to increase production to reduce faults and to increase quality and also help to decrease manufacturing cost. In this study, the manufacturing sequence of jacket and pants, types of machines used for each process, the number of workers used in a sewing line, SMV and daily production of those related garments were enlisted. Data were collected while the garments were manufactured by using work aid and also when those same garments were manufactured in the sewing line without using sewing work aids. This project demonstrated that If work aids are used effectively operation cycle time can be reduced than existing cycle time and effect on SMV, production and product quality and also help to decrease manufacturing cost. At the end of the project it shows that sewing work aids can increase up to 11% efficiency of sewing line for the selected product.

Keywords: work aid, SMV, work study, product quality, and efficiency.

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I. INTRODUCTION

The apparel sector is the highest industrial employment generator and the highest foreign exchange earner to the country's economy. The total export income of the sector for the year 2011 was US\$ 4.2 Billion which is equivalent to 39.6%. The export growth in 2011 is 24 percent (BOI, 2014). Readymade garments (RMG) of Bangladesh is powered by young, urbanizing workers where most of them are women. [1]

The industry emerged at the time when Bangladesh began its struggle for achieving economic emancipation and leading the country to prosperity with its limited resources. That time jute industry was the major export product, which contributed to the herculean task of rebuilding the war-ravaged country. But the 'Golden Fiber' lost its golden days. The readymade garment (RMG) sector emerged after that, which within a short span of time appeared to be crucial to our economy as a source of export earnings and employment generation. Now the RMG sector is a 22-billion-dollar industry that accounts for 79 percent of the country's export earnings and contributes 10 percent to the national economy. Around 4.4 million people are employed in the sector, and 80 percent of them are woman. [2]

In the early eighties, Bangladesh entered into the garments industry. The RMG sector has experienced an exponential growth since 1980. In year 1984-85 the number of garments factory were 384 with 0.12 million workers which reached at a total number of garments factory 4306 with 4.20 million workers in year 2014-15 [3] Though, there are various types of garments are manufactured in Bangladesh, but all the readymade garments are classified into two broad categories, where one is woven products and another one is knitted products. Woven products include Shirts, Pants, Shorts etc. On the other hand, knitted product includes T-Shirts, Polo Shirts, Undergarments, Socks, and Stockings etc. [4]

The apparel industry is one of the oldest and largest among the most global industries being primarily concerned with the design and production of clothing and their supply.[5] Bangladesh is self-sufficient for knit fabric as more than 90 percent of knitwear fabric is manufactured in Bangladesh. The capacity of our woven fabric manufacturing and processing is also growing rapidly that has reached 2 billion meters per annum. Besides, currently we have around 9 million spindles installed that can produce up to 1.7 billion kg of yarn per

year. We are also almost self-sufficient for trims and accessories. So, with the expansion of the RMG industry the backward linkage industries developed and have been playing an important role in reducing lead time and offering competitive price in the international market [2]

Today's business climate for clothing manufacturers requires low inventory and quick response systems that turn out a wide variety of products to meet customers demand. It is especially in the apparel industry that managers are trying to develop their current systems or looking for new production techniques in order to keep pace with the rapid changes in the fashion industry. The joining together of components, known as the sewing process which is the most labor intensive part of garment manufacturing, makes the structure complex as some works has a priority before being assembled. [6]

In the apparel industry, the assembly process involves a set of workstations in which a specific task is processed in a pre- defined sequence. Before production, in order to achieve a balanced line, the sewing line supervisors assign one or more sewing operatives to each task based on the standard time required to complete the task. [7]

The work aids that are used during sewing operations can be categorized in a number of different ways and they vary in the aspect of their overall purpose that they emphasize some otter greatly increased the speed of working in a situation where quality is already satisfactory. Others give a very little improvement in productivity but the great accuracy of sewing [8]

II. METHODOLOGY



Steps of the sewing process and the line orientation is observed. For making a shirt first making the front, back and sleeve. After that all this are joined and ready for finishing. Same as for making a pant front part, back part and west belt are made and then attach them for the required product. As well as it is observed that in which machine is used the sewing work aid. Line setup, manpower and operation time also observed.

In this project work following sewing work aids has been chosen.

- Folder
- 1/4Guide
- 1/16 Guide
- Hanger Guide
- Zipper Guide



Fig 3.1: Hanger Guide



Fig 3.2: 1/16 Guide



Fig 3.3: 1/4 Guide



Fig 3.4: Folder



Fig 3.5: Zipper Guide

Data Collection with and Without Sewing Work Aids. Here cycle time is collected for each step needed for completing Pant and Jacket in the sewing line. And this process was doing two times for each product. First when using sewing work aids and second without sewing work aids. For data collection, a stop watch was used. We collect three times of cycle time and average them. Take one stop watch. Stand by side of the operator. Capture cycle time for that operation. Cycle time means total time taken to do all works needed to complete one operation.

III. INDENTATIONS AND EQUATIONS

After data collection with that data SMV was calculated by following steps-

- Convert this cycle time into basic time by multiplying cycle time with operator performance rating.

Basic Time = Cycle Time X Performance Rating

The operator at what performance level he was doing the job seeing his movement and work speed is called performance rating.

- SMV= (Basic minute + Bundle allowances + machine and personal allowances).
- Add bundle allowances (10%) and machine and personal allowances (20%) to basic time finally, the ultimate SMV variation and other factors was calculated.

IV. FIGURES AND TABLES

SMV of a Jacket:

Table 4.1: Data Table for SMV of Jacket (Vicky-8) With Using Sewing Work Aids

Sl.	Operation Name	Machine Name	Work Aid	GARMENT						
				Cycle Time (sec)				Basic Time (sec)	With Allowance	SMV (min)
				1st	2nd	3rd	AVG			
1	Sleeve Overlock	4 thread overlock		17.55	20.17	19.99	19.24	15.39	20.01	0.33
2	Sleeve Rolling	SNLS	1/4 Plain Guide	19.87	20.96	21.25	20.69	16.55	21.52	0.36
3	Sleeve Top Snitch	SNLS	1/4 Plain Guide	21.29	18.49	20.42	20.07	16.05	20.87	0.35
4	Inside Sleeve Rolling	DNLS	1/16 Plain Guide	17.77	16.96	16.94	17.22	13.78	17.91	0.30
5	Back Panel & Yoke Joint	4 thread feed of the arm	1/4 Guide	13.55	13.76	14.00	13.77	11.02	14.32	0.24
6	Sleeve Overlock	4 thread overlock		22.97	22.95	21.06	22.34	17.87	23.23	0.39
7	Waist Band Make	SNLS	Plain Guide	17.33	17.95	18.03	17.78	14.22	18.49	0.31
8	Cuff & Belt Tuck Collar	SNLS	Plain Guide	18.51	19.30	20.20	19.34	15.47	20.11	0.34
9	Ironing	helper		19.27	18.03	18.75	18.69	14.95	19.44	0.32
10	Waist Band & Cuff Ironing	helper		16.00	15.18	16.10	15.76	12.61	16.39	0.27
14	Front Pocket Safety	SNLS	1/16 Guide	6.99	7.08	7.25	7.11	5.69	7.39	0.12
15	Flap Make	SNLS	Plain Guide	18.03	18.39	17.60	18.01	14.41	18.73	0.31
16	Front Pocket 1/16 Stitch	SNLS	1/16 Guide	15.61	15.94	14.79	15.45	12.36	16.06	0.27
17	Front Pocketing Joint	SNLS	Plain Guide	31.53	31.28	33.87	32.33	25.86	33.62	0.56
18	Front Pocket 1/4 Stitch	SNLS	Hanger Guide	8.56	9.67	9.90	9.38	7.50	9.75	0.16
19	Pocket Flap Ironing	Helper		24.00	23.67	25.55	24.41	19.53	25.38	0.42
20	Front Pocket Overlock	4 thread overlock		5.36	6.00	4.90	5.42	4.34	5.64	0.09
21	Front Panel Tuck	SNLS	Plain Guide	13.58	13.77	14.08	13.91	11.13	14.47	0.24
22	Front Panel Joint	SNLS	1/16 Guide	16.46	17.22	18.76	17.48	13.98	18.18	0.30

10	Waist Band & Cuff Ironing	helper		16.00	15.18	16.10	15.76	12.61	16.39	0.27
11	Collar Make	SNLS	Plain Guide	35.66	36.00	35.00	35.55	28.44	36.98	0.62
12	Loop Make	SNLS	Plain Guide	11.56	12.00	10.65	11.40	9.12	11.86	0.20
13	Flap Top Stuch	SNLS	Plain Guide	43.00	44.00	44.56	43.85	35.05	45.61	0.76
24	Front Pocket Overlock	4 thread overlock		19.65	23.63	24.00	22.43	17.94	23.32	0.39
25	Back Panel Joining	feed of the arm	Plain Guide	21.35	22.00	21.00	21.45	17.16	22.31	0.37
26	Front Panel Tuck	SNLS	Plain Guide	26.76	27.41	27.03	27.07	21.65	28.15	0.47
27	Front Pocket Panel Joining	DNLS	Plain Guide	21.66	20.23	20.12	20.67	16.54	21.50	0.36
28	Front Pocket 1/16 Stuch	SNLS	Plain Guide	20.34	22.22	20.15	20.90	16.72	21.74	0.36
29	Flacket Ironing	helper		10.66	17.00	10.00	18.55	14.84	10.30	0.32

SL	Operation Name	Machine Name	Work Aid	GARMENT						SMV (min)	
				Cycle Time (sec)				Basic Time (sec)	With Allowance		
				1st	2nd	3rd	AVG				
30	Front Panel 1/4 Stuch	SNLS	Plain Guide	26.77	25.77	29.25	27.26	21.81	28.35	0.47	
31	Front Pocket Bar rack	SNLS	Plain Guide	13.24	13.09	12.83	13.07	10.46	13.59	0.23	
32	Front Pocket Show Stuch	SNLS	Plain Guide	23.32	23.98	24.13	23.81	19.05	24.76	0.41	
33	Flap 1/4 Top Stuch	SNLS	Plain Guide	16.00	15.98	16.66	16.21	12.97	16.86	0.28	
34	Button Placket Joint	SNLS	Plain Guide	45.24	48.04	47.90	47.06	37.65	48.94	0.82	
35	Box Placket Joint	SNLS	Plain Guide	61.88	50.51	63.00	58.46	46.77	60.80	1.01	
36	Front Panel 1/16	SNLS	Plain Guide	31.19	31.29	31.99	31.49	25.19	32.75	0.55	
37	Front Panel 1/16	SNLS	Plain Guide	30.00	30.00	28.00	29.33	23.47	30.51	0.51	
38	Box Placket 1/16	SNLS	Plain Guide	13.98	14.38	15.36	14.57	11.66	15.16	0.25	
39	Label Joint	SNLS	Plain Guide	18.00	22.12	20.21	20.11	16.09	20.91	0.35	
40	Thread Cut	helper		12.00	14.00	15.00	14.33	11.44	14.88	0.25	
41	Shoulder Joint	4 thread feed of the arm	Plain Guide	24.57	26.57	25.59	25.58	20.46	26.60	0.44	
42	Sleeve Mark	helper		10.87	8.87	13.99	11.24	8.99	11.69	0.19	
43	Sleeve Joint	5 thread overlock		24.89	25.00	26.12	25.34	20.27	26.35	0.44	
44	Cuff Make	SNLS	Plain Guide	20.11	14.00	19.23	17.78	14.22	18.49	0.31	
45	Side Seam Overlock	4 thread overlock		18.79	19.04	16.58	18.14	14.51	18.56	0.31	
46	Arm Hole Top Seam	DNCS	Plain Guide	32.32	31.99	32.47	32.26	25.81	33.55	0.56	
47	Collar Marking	helper		11.90	12.00	11.89	11.93	9.54	12.41	0.21	

SL	Operation Name	Machine Name	Work Aid	GARMENT						SMV (min)	
				Cycle Time (sec)				Basic Time (sec)	With Allowance		
				1st	2nd	3rd	AVG				
48	Collar Joint	SNLS	Plain Guide	26.56	25.30	22.90	24.92	19.94	25.92	0.43	
49	Collar Top Seam	SNLS	Plain Guide	28.89	29.14	28.00	28.68	22.94	31.54	0.53	
50	Collar 1/16 Stuch	SNLS	Plain Guide	20.14	22.45	20.51	21.03	16.83	23.14	0.39	
51	Collar 1/4 Top Seam	SNLS	Plain Guide	25.55	24.55	27.29	25.80	20.64	28.38	0.47	
52	Thread Remove	helper		12.00	11.30	11.55	11.62	9.29	12.08	0.20	
53	Side Joint	4 thread overlock		25.52	30.48	28.41	28.14	22.51	29.26	0.49	
54	Cuff Joint	SNLS	Plain Guide	60.00	57.39	58.19	58.53	46.82	60.87	1.01	
55	Cuff 1/16 Top Stuch	SNLS	Plain Guide	30.78	31.00	30.81	30.60	24.48	31.82	0.53	
56	Quality Check	helper		19.00	22.57	23.45	21.67	17.34	22.54	0.38	
57	Thread Check	helper		14.00	13.00	16.11	14.37	11.60	14.04	0.24	
58	Waist Band Attach	KANSAI	Plain Guide	70.45	77.22	80.23	75.97	60.77	79.01	1.32	
59	Mouth Close	SNLS	Plain Guide	24.00	22.46	24.47	23.64	18.91	24.59	0.41	
60	Loop Joint	SNLS	Plain Guide	59.12	58.12	57.00	58.08	46.46	60.40	1.01	
61	Waist Band Loop Decoration	SNLS (VELCRO M/C)		17.70	16.78	16.20	16.89	13.51	17.57	0.29	
62	Final Quality Check	helper		25.78	23.76	26.00	25.18	20.14	26.19	0.44	
Total = 27.43											

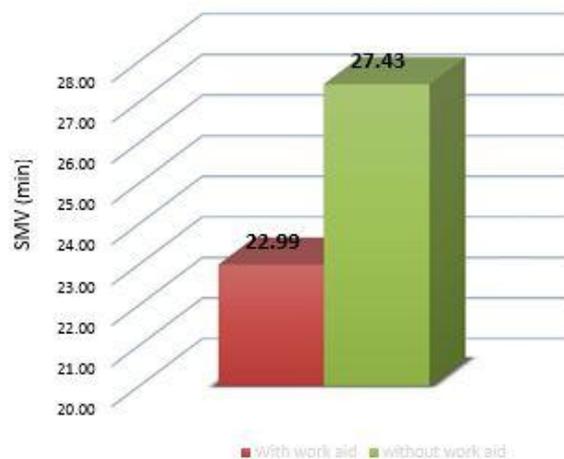


Figure: Changes in SMV of jacket due to using sewing work aid

From this graph, it is apparent that SMV of garment produced with using work aid is lower than SMV of garment produced without using sewing work aid. Decreasing of SMV is directly related to cycle time which decrease due to reduce material handling by using sewing work aids. On the other hand, without using sewing work aids SMV increase by affixing handling and to maintain actual quality. SMV reduction after using sewing work aids is 16 %.

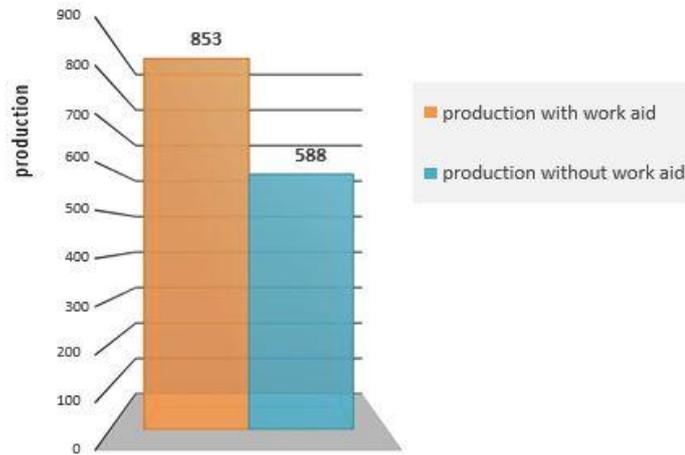


Figure: production variation of jacket due to using sewing work aid.

From this graph, it is concluded that production of the garment produced with using sewing work aid is higher than garment production without using sewing work aid. The difference between daily (per shift) production with and without using sewing work aid is 265 which is huge. Sewing work aid ensure better garment quality and increase the productivity.

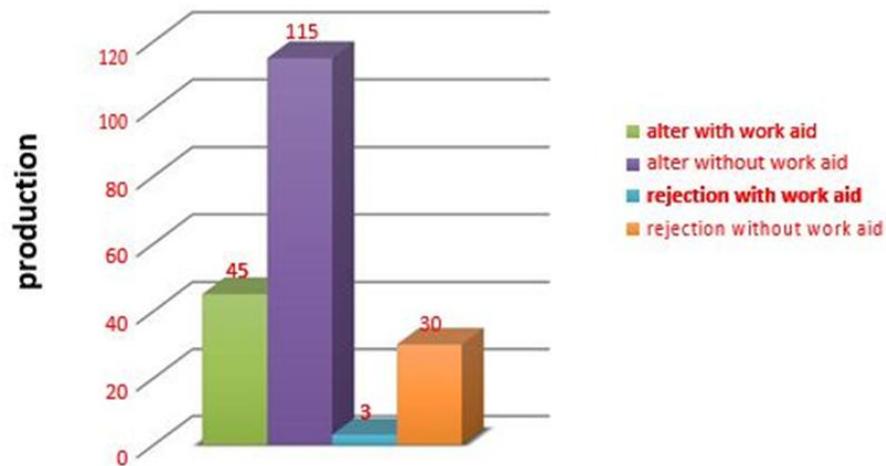


Figure: Changes in rejection& alteration of jacket due to using work aid.

During total production process per shift alteration and rejection cause vital factor. Alteration and rejection gradually increase when total machines are running without sewing aid as well as quality parameters decreasing downwards from buyer requirement. In the above figure we can identify that with using sewing work aids in sewing line alteration and rejection quantity is 40 and 2 on average. On the other hand without using sewing work aid it is increasing to 100 and 25.

COST OF MANUFACTURING		
	With Work Aid	Without Work Aid
Making of Garment	\$28.00	\$32.00
Entertainment	\$0.17	\$0.17
Overhead Cost	\$1.00	\$1.00
Maintenance Cost	\$0.15	\$0.15
Test Charge	\$0.20	\$0.20
C & F	\$0.50	\$0.50
Bank Interest	\$0.20	\$0.20
Buying House Commission	\$0.70	\$0.70
Fixed Cost	\$0.40	\$0.40
Profit Margin	\$0.30	\$0.30
Environmental Cost	\$0.10	\$0.10
Social Welfare Cost	\$0.15	\$0.15
Total	\$31.87	\$35.87

CM (Cost of manufacturing) variation of jacket (Vicky-8) before and after using work aid

From the table, it is shown that during costing CM cost is identified on the basis of total SMV, machine output, garments production, types of style. If the production output range of this garment produced with using work aid is in between 800-900 then CM cost of that garment is defined \$18.87 per dozen. On the other hand, without using work aid it increases up to \$19.87 as production output decreases in between 500-600.

SMV of a Pant:

Table: Data Table for SMV of Pant (Chino-5) With Using Sewing Work Aids

SL	Operation Name	MACHINE NAME	Work Aid	GARMENT							SMV (min)
				Cycle Time (sec)				Basic Time (sec)	With Allowance	SMV (min)	
				1st	2nd	3rd	AVG				
1	Back Pocket Seam Top Stitch	SNLS	1/16 CR Guide	14.18	16.73	15.45	15.45	12.36		16.07	0.27
2	Bone Tuck	SNLS	1/16 CR Guide	34.40	32.33	30.21	32.31	25.85		33.61	0.56
3	Back Rise Overlock	4 thread overlock		6.21	9.33	7.49	7.68	6.14		7.98	0.13
4	Bone Tuck	SNLS	1/16 CR Guide	32.56	35.89	29.31	32.32	25.86		33.61	0.56
5	Bone Facing Top Stitch	SNLS	1/16 CR Guide	18.40	11.25	11.84	18.99	8.72		11.33	0.19
6	Bone Show Top Seam	SNLS	Plain Guide	13.53	15.68	14.80	14.40	11.52		14.98	0.25
7	Back Pocket Top Seam	SNLS	1/16 CR Guide	33.40	34.40	32.33	33.38	26.70		34.71	0.58
8	Pocket Closing	SNLS	1/16 CR Guide	48.28	33.38	37.80	36.89	29.51		38.36	0.64
9	Back Pocket Raise Cutting	HELPER		11.39	9.67	11.89	10.66	8.53		11.08	0.18
10	Loop/ Inside Supporting Ironing	HELPER		5.12	5.56	6.33	5.67	4.54		5.90	0.10
11	Bone Ironing	HELPER		6.89	7.29	4.00	6.06	4.85		6.30	0.10
12	Back Pocket Closing	SNLS	Plain Guide	9.54	8.64	8.02	8.73	6.99		9.08	0.15
13	Double Ply Net	SNLS	Plain Guide	9.48	9.54	10.02	9.68	7.74		10.07	0.16
14	Front Pocket Joint	SNLS	Plain Guide	19.91	18.75	20.84	19.57	15.65		20.35	0.34
15	Front Pocket Safety Stitch	SNLS	1/16 CR Guide	13.53	14.18	14.80	13.90	11.12		14.46	0.24
16	Waist Belt Ironing	HELPER		18.27	17.11	17.84	16.81	13.45		17.48	0.29
17	Front Pocket Opening Tuck	SNLS	Plain Guide	8.27	10.72	9.43	9.47	7.58		9.85	0.16
18	Front Pocket 1/4 Top Stitch	SNLS	1/4 CR Guide	40.11	35.91	31.76	36.26	29.01		37.71	0.63
19	Front Pocket Inside Top Stitch	SNLS	1/4 CR Guide	9.54	9.67	8.99	9.40	7.52		9.78	0.16
20	Front Pocket Overlock	4thread overlock		26.49	28.45	37.88	34.67	27.74		36.06	0.60
21	Front Rise Overlock	4 thread overlock		13.66	14.55	12.95	13.42	10.74		13.96	0.23
22	Pocket Facing Ironing	HELPER		2.00	2.66	3.96	2.87	2.30		2.99	0.05
23	J-Stitch	SNLS	Plain Guide	16.89	14.05	14.99	15.84	12.03		15.65	0.26
24	Front Pocket 1/4 Top Stitch	SNLS	1/4 Guide	40.10	36.86	38.43	38.20	30.56		39.72	0.66
25	Front & Back Part in Seam	4 thread overlock		13.67	14.00	13.90	13.89	11.11		14.44	0.24
26	Front & Back Part in Seam	4 thread overlock		13.67	14.00	13.99	13.89	11.11		14.44	0.24
27	Zipper Joint	SNLS	Zipper Guide	18.92	17.71	18.80	18.21	14.57		18.94	0.32
28	Zipper Top Seam	SNLS	1/16 CR Guide	16.81	14.17	13.60	15.84	12.67		16.48	0.27

SL	Operation Name	MACHINE NAME	Work Aid	GARMENT							SMV (min)
				Cycle Time (sec)				Basic Time (sec)	With Allowance	SMV (min)	
				1st	2nd	3rd	AVG				
28	In Seam, Top Stitch	Feed of the arm	Folder	13.91	15.08	15.84	14.94	11.95		15.54	
29	Double Ply Joint	SNLS	Plain Guide	16.80	15.39	15.80	15.46	12.37		16.08	
30	Waist Belt Ironing	KANSAI	Folder	13.42	14.40	13.70	13.36	26.40		34.40	0.58

SL	Operation Name	Machine Name	Work Aid	GARMENT						
				Cycle Time (sec)				Basic Time (sec)	With Allowance	SMV (min)
				1st	2nd	3rd	AVG			
29	Back Rise Top Seam	SNLS	1/4 Cr Guide	14.38	14.72	12.89	13.96	11.17	14.52	0.24
30	Quality Control	helper		9.08	13.00	12.22	11.43	9.15	11.89	0.20
31	Front & Back Part Inside Seam	4 thread overlock		13.67	14.63	15.09	14.46	11.57	15.04	0.25
32	Side Overlock	4 thread overlock		34.08	39.10	36.69	36.62	29.30	38.09	0.63
33	Back Part Attach	4 thread overlock		21.82	15.27	17.89	18.33	14.66	19.06	0.32
34	Side Seam Top Stitch	SNLS	1/16 Guide	18.07	16.60	17.20	17.62	14.10	18.33	0.31
35	Waist Belt Mark	helper		10.00	8.00	8.90	8.97	7.17	9.33	0.16
36	Waist Belt Ironing	helper		32.47	34.40	33.39	33.42	26.74	34.76	0.58
37	Side Seam Overlocks	4 thread overlock		34.08	39.10	37.50	36.89	29.51	38.37	0.64
38	Label Joint	SNLS	Plain Guide	15.60	13.32	16.42	15.11	12.09	15.72	0.26
39	Side Seam Safety Stitch	SNLS	Plain Guide	23.63	22.31	24.07	23.34	18.67	24.27	0.40
40	Mouth Tuck	SNLS	Plain Guide	17.11	18.24	17.89	17.75	14.20	18.46	0.31
41	Loop Joint	SNLS	Plain Guide	12.42	15.51	13.97	13.93	11.18	14.49	0.24
42	Waist Belt Tuck	SNLS	Plain Guide	29.73	35.65	32.78	32.72	26.18	34.03	0.57
43	Quality Control	helper		12.00	10.00	15.00	12.33	9.87	12.83	0.21
44	Hook Button Mark	helper		11.32	9.99	6.43	9.25	7.40	9.62	0.16
45	Waist Belt Top Stitch	SNLS	1/4 Guide	37.63	40.59	33.00	37.07	29.66	38.56	0.64
46	Hook Attaching	eyelet m/c		11.94	11.68	12.01	11.88	9.50	12.35	0.21
47	Lower Loop Tuck	SNLS	Plain Guide	19.40	13.66	16.55	16.54	13.23	17.20	0.29
48	Button Attaching	SNLS	Plain Guide	5.30	6.40	7.03	6.24	4.99	6.49	0.11
49	Thread Cut	helper		11.00	7.98	6.49	8.49	6.79	8.83	0.15
50	Waist Band Tuck	SNLS	Plain Guide	29.73	26.00	25.78	27.17	21.74	28.26	0.47
51	Waist Belt Top Stitch	SNLS	1/4 Guide	23.30	27.04	29.00	26.45	21.16	27.50	0.46
52	Upper Loop Tuck	SNLS	Plain Guide	19.40	13.66	13.99	15.68	12.55	16.31	0.27
53	Bottom Hem Stitching	SNLS	1/16 Cl Guide	19.00	18.03	35.55	24.19	19.35	26.16	0.42
54	Loop Bar Tack	SNLS	Plain Guide	43.75	44.24	45.09	44.36	35.49	46.13	0.77
55	Waist Belt Show Stitch	SNLS	Hanger Guide	30.45	27.79	34.50	30.91	24.73	32.15	0.54
56	Waist Belt Make	KANSAI	Folder	28.92	27.00	32.88	29.60	23.68	30.78	0.51
57	Loop Make	SNLS	Plain Guide	59.88	58.22	61.01	56.37	45.10	58.62	0.98
58	Loop Belt Tuck	SNLS	Plain Guide	20.80	22.06	17.76	19.92	15.94	20.72	0.35
59	Final Inspection	helper		20.65	18.48	21.39	20.17	16.14	20.98	0.35
Total = 21.38										

Table: Data Table for SMV of Pant (Chino-5) Without Using Sewing Work Aids

SL	Operation Name	Machine Name	Work Aid	GARMENT						
				Cycle Time (sec)				Basic Time (sec)	With Allowance	SMV (min)
				1st	2nd	3rd	AVG			
1	Back Pocket Seam Top Stitch	SNLS	Plain Guide	31.31	30.31	33.00	31.54	25.23	32.80	0.55
2	Bone Tuck	SNLS	Plain Guide	30.45	29.45	31.45	30.45	24.36	33.67	1.39
3	Back Rise Overlock	4 thread overlock		6.21	9.33	7.49	7.68	6.14	7.98	0.13
4	Bone Tuck	SNLS	Plain Guide	79.46	77.46	78.00	78.31	62.65	81.44	1.36
5	Bone Facing Top Stitch	SNLS	Plain Guide	19.87	19.80	18.89	19.52	15.62	20.30	0.34
6	Bone Show Top Seam	SNLS	Plain Guide	13.53	15.65	14.00	14.40	11.52	14.95	0.25
7	Back Pocket Top Seam	SNLS	Plain Guide	120.80	122.80	120.80	121.67	96.53	125.49	2.09
8	Pocket Closing	SNLS	Plain Guide	59.47	59.00	55.13	57.87	46.29	60.18	1.00
9	Back Pocket Raise Cutting	helper		11.30	9.67	11.00	10.66	8.53	11.08	0.18
10	Loop/Inside Supporting Ironing	helper		5.12	5.56	6.33	5.67	4.54	5.90	0.10
11	Bone Ironing	helper		6.89	7.29	4.00	6.06	4.85	6.30	0.11
12	Back Pocket Closing	SNLS	Plain Guide	9.54	8.64	8.02	8.73	6.99	9.08	0.15
13	Double Ply Net	SNLS	Plain Guide	9.48	9.54	10.02	9.68	7.74	10.07	0.17
14	Front Pocket Joint	SNLS	Plain Guide	19.91	18.75	20.04	19.57	15.65	20.35	0.34
15	Front Pocket Safety Stitch	SNLS	Plain Guide	27.10	28.00	30.04	28.38	22.70	29.52	0.49
16	Waist Belt Ironing	helper		16.27	17.11	17.04	16.81	13.45	17.48	0.29
17	Front Pocket Opening Tuck	SNLS	Plain Guide	8.27	10.72	9.43	9.47	7.58	9.85	0.16
18	Front Pocket 1/4 Top Stitch	SNLS	Plain Guide	79.00	81.01	82.16	80.72	64.58	83.95	1.40
19	Front Pocket Inside Top Stitch	SNLS	Plain Guide	21.00	21.66	23.00	21.89	17.51	22.76	0.38
20	Front Pocket Overlock	4 thread overlock		36.40	30.45	37.08	34.67	27.74	36.06	0.60
21	Front Rise Overlock	4 thread overlock		13.66	14.55	12.05	13.42	10.74	13.96	0.23
22	Pocket Facing Ironing	helper		2.00	2.66	3.96	2.87	2.30	2.99	0.05
23	J-Stitch	SNLS	Plain Guide	16.08	14.05	14.99	15.04	12.03	15.65	0.26
24	Front Pocket 1/4 Top Stitch	SNLS	Plain Guide	75.80	74.80	75.00	75.20	60.16	78.21	1.30
25	Front & Back Part in Seam	4 thread overlock		13.67	14.00	13.99	13.89	11.11	14.44	0.24
26	Zipper Joint	SNLS	Plain Guide	31.20	30.20	27.00	29.47	23.57	30.65	0.51
27	Zipper Top Seam	SNLS	Plain Guide	42.09	44.00	43.05	43.05	34.44	44.77	0.75
28	In Seam, Top Stitch	Feed of the arm	Plain Guide	42.45	44.65	41.00	42.70	34.16	44.41	0.74
29	Double Ply Joint	SNLS	Plain Guide	16.00	15.30	15.00	15.43	12.37	16.08	0.27

SL	Operation Name	Machine Name	Work Aid	GARMENT						
				Cycle Time (sec)				Basic Time (sec)	With Allowance	SMV (min)
				1st	2nd	3rd	AVG			
38	Back Rise Top Seam	SNLS	Plain Guide	29.00	22.00	23.02	21.67	17.34	22.54	0.38
31	Quality Control	helper		9.08	13.00	12.22	11.43	9.18	11.89	0.20
32	Front & Back Part Inside Seam	4 thread overlock		13.67	14.63	15.09	14.46	11.57	15.04	0.25
33	Side Overlock	4 thread overlock		34.08	39.10	36.69	36.62	29.30	38.09	0.63
34	Back Part Attach	4 thread overlock		21.82	15.27	17.89	18.33	14.66	19.06	0.32
35	Side Seam Top Stitch	SNLS	Plain Guide	41.80	40.00	40.39	40.46	32.37	42.08	0.70
36	Waist Belt Mark	helper		10.00	8.00	8.90	8.97	7.17	9.33	0.16
37	Waist Belt Ironing	helper		32.47	34.40	33.39	33.42	26.74	34.76	0.58
38	Side Seam Overlock	4 thread overlock		34.08	39.10	37.50	36.89	29.51	38.37	0.64
39	Label Joint	SNLS	Plain Guide	15.60	13.32	16.42	15.11	12.09	15.72	0.26
40	Side Seam Safety Stitch	SNLS	Plain Guide	23.63	22.31	24.07	23.34	18.67	24.27	0.40
41	Mouth Tuck	SNLS	Plain Guide	17.11	18.24	17.89	17.75	14.20	18.46	0.31
42	Loop Joint	SNLS	Plain Guide	12.42	15.51	13.87	13.93	11.15	14.49	0.24
43	Waist Belt Tuck	SNLS	Plain Guide	29.73	35.65	32.78	31.72	26.18	34.03	0.57
44	Waist Belt Joining	KANSAI	Plain Guide	57.11	51.11	57.07	55.30	44.24	57.51	0.96
45	Quality Control	helper		12.00	10.00	15.00	12.33	9.87	12.83	0.21
46	Hook Button Mark	helper		11.32	9.99	6.43	9.25	7.40	9.62	0.16
47	Waist Belt Top Stitch	SNLS	Plain Guide	45.14	45.80	39.00	43.31	34.65	45.05	0.75
48	Hook Attaching	Eyelet m/c		11.94	11.68	12.01	11.88	9.50	12.35	0.21
49	Lower Loop Tuck	SNLS	Plain Guide	19.40	13.66	16.55	16.54	13.23	17.20	0.29
50	Button Attaching	SNLS	Plain Guide	5.30	6.40	7.03	6.24	4.99	6.45	0.11
51	Thread Cut	helper		11.00	7.95	6.49	8.49	6.79	8.83	0.15
52	Waist Band Tuck	SNLS	Plain Guide	29.73	26.00	25.78	27.17	21.74	28.24	0.47
53	Waist Belt Top Stitch	SNLS	Plain Guide	26.11	31.10	32.13	29.78	23.82	30.97	0.52
54	Upper Loop Tuck	SNLS	Plain Guide	19.40	13.66	13.99	15.68	12.55	16.31	0.27
55	Bottom Hem Stitching	SNLS	Plain Guide	60.00	62.00	59.07	60.36	48.29	62.77	1.05
56	Loop Bar tack	SNLS	Plain Guide	43.75	44.24	45.09	44.36	35.49	46.13	0.77
57	Waist Belt Show Stitch	SNLS	Plain Guide	55.41	57.91	53.00	53.77	43.00	55.97	0.93
58	Waist Belt Make	KANSAI	Plain Guide	120.22	118.22	115.00	117.81	94.25	122.53	2.04
59	Loop Make	SNLS	Plain Guide	59.88	58.22	51.01	56.37	45.10	58.02	0.98
60	Loop Belt Tuck	SNLS	Plain Guide	20.00	22.00	17.76	19.92	16.94	20.72	0.35
61	Final Inspection	helper		20.65	18.48	21.39	20.17	16.14	20.98	0.35
Total = 26.58										

SMV Variation of pant (chino-5) against after and before using work aid:

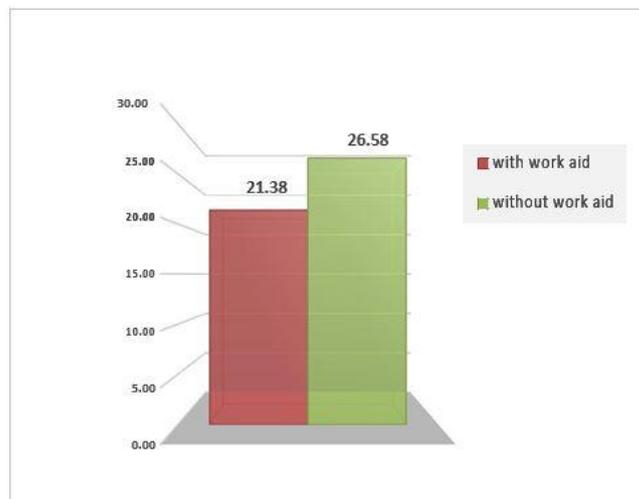


Figure: Changes in SMV due to using sewing work aid.

From this graph, it is shown that SMV of garment produced with using work aid is lower than SMV of garment produced without using sewing work aid. Decreasing of SMV is directly related to cycle time which decrease due to reduce material handling by using sewing work aids. On the other hand, without using sewing work aids SMV increase by affixing handling and to maintain actual quality. SMV reduction after using sewing work aids 19.56%

Production variation of pant (chino-5) against after and before using work aid:

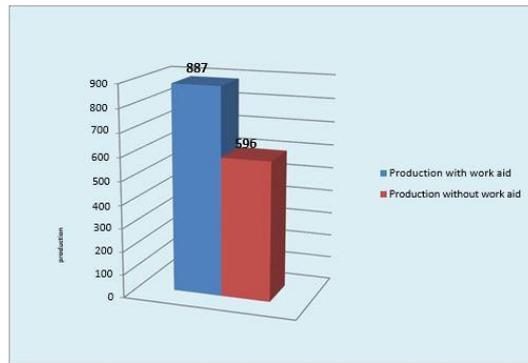


Figure: Changes in production variation due to using sewing work aid.

Production of the garment with using work aid is higher than garment production without using sewing work aid. The difference between daily (per shift) production with and without using work aid is 291 which is huge. So, work aid ensures better garment handling and increase the productivity.

Rejection and Alter percentage in total production process for pant:

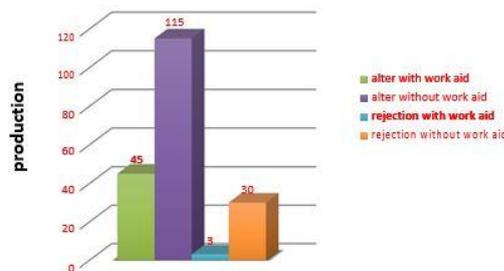


Figure: Changes in rejection & alteration quantity by using sewing work aids.

From the figure, it is shown that alteration and rejection gradually increase when total machines are running without sewing aid. Rejection and altering has an effect on production quality so it also decreased when sewing work aid was not used. . In the above figure we can evaluate that with using sewing work aids in sewing line alteration and rejection quantity per shift is 45 and 3 on average. On the other hand without using sewing work aid it is increasing to 115 and 30.

CM (Cost of manufacturing) variation of pant (chino-5) before using sewing work aids:

COST OF MANUFACTURING		
	With Work Aid	Without Work Aid
Making of garment	\$20.00	\$23.00
Entertainment	\$0.17	\$0.17
Overhead Cost	\$1.00	\$1.00
Maintenance Cost	\$0.15	\$0.15
Test Charge	\$0.20	\$0.20
C &F	\$0.50	\$0.50
Bank Interest	\$0.20	\$0.20
Buying House Commission	\$0.70	\$0.70
Fixed Cost	\$0.40	\$0.40
Profit Margin	\$0.30	\$0.30
Environmental Cost	\$0.10	\$0.10
Social Welfare Cost	\$0.15	\$0.15
Total	\$23.87	\$26.87

This table represents that during costing CM cost is identified on the basis of total SMV, machine output, garments production, types of style. If the production output range of this garment produced with using work aid is in between 800-900 then CM cost of that garment is defined \$23.87 per dozen. On the other hand, without using work aid it increases up to \$26.87 as production output decreases in between 500-600. This style is almost basic as well.

Efficiency of sewing line with using sewing work aids and without using sewing work aids:

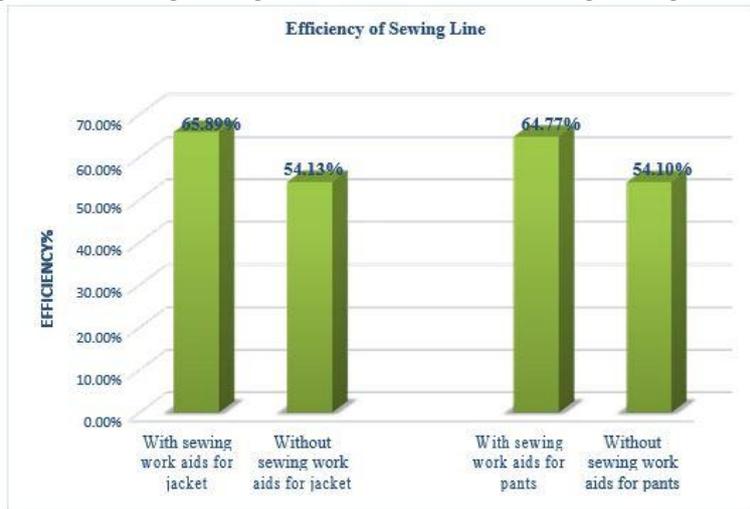
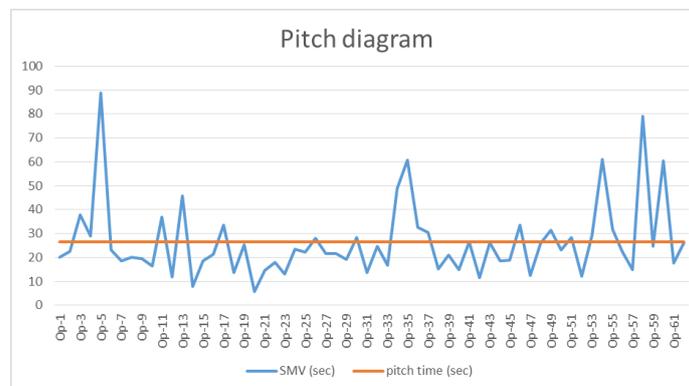


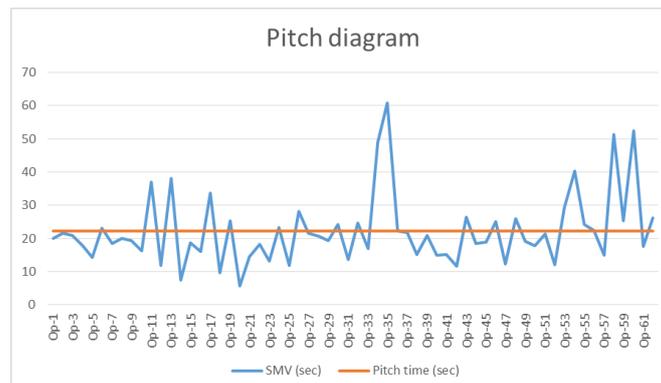
Figure: Graphical representation of sewing line efficiency with using sewing work aids and without using sewing work aids.

Comments

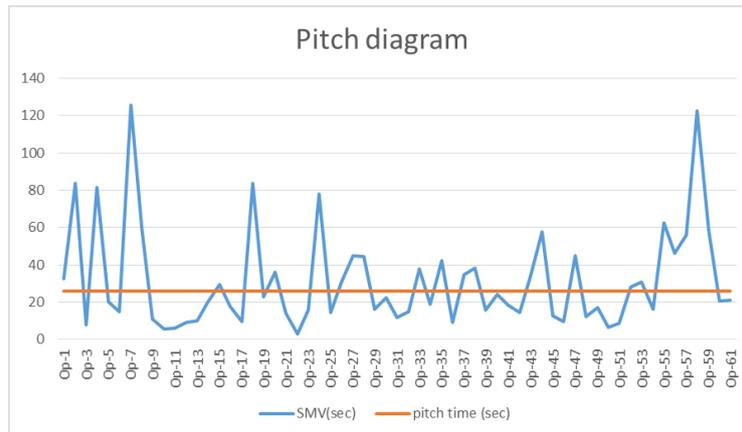
- After using sewing work aids efficiency of the sewing line was 65.89% for jacket and 64.77% for pants.
- Efficiency of the sewing line without sewing work aids was 54.13% for jacket and 54.10% for pants.
-



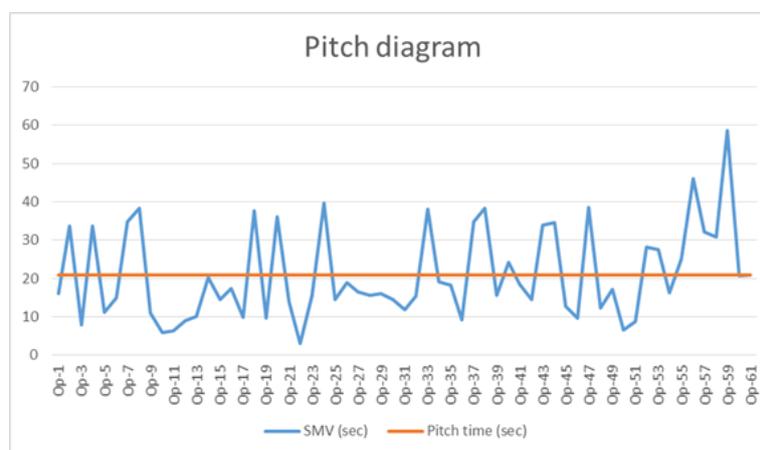
Pitch diagram of jacket without using work aids



Pitch diagram of jacket using work aid



Pitch diagram of pant without using work aids



Pitch diagram of pant using work aids

From the pitch diagram, it is clear that time required for making jacket without using work aids is more showing more number of bottleneck condition than that of jacket which is made using work aids. Similar cases has been observed for making pant with or without using work aids.

V. CONCLUSION

Key Findings

1. After using sewing work aids SMV was reduced 16% for jackets and 19.56 % for pants so that lead time is decreased. As a result, Production was increased 265 pieces for jacket and 291 for pants after using work aids. Rejection and altering process was reduced consequently with the help of sewing work aids.
2. During the evaluation of manufacturing cost as production percentage per shift is increasing significantly as a result manufacturing cost was decrease \$2 for jacket and \$3 per dozen for pants after using sewing work aids.
3. After using sewing work aids efficiency increased to 65.89% for jacket and 64.77% for pants whereas without sewing work aids efficiency was 54.13% for jacket and 54.10% for pants.

In Apparel manufacturing process sewing is one of the most important operation. Industrial sewing is done by industrial sewing machines. Work aids of sewing machine is an additional part used to increase production, reduce faults and increase quality. Work aids are one of the most effective sewing tools. The suggestive tools developed in this article cover a comprehensive series of aspects in minimizing cost and time in the sewing section of apparel industries by ensuring quality production. In the sewing process, it is seen that a sewing machine works with 20% time and rest of the time remain stopped. In this 80% time fabric handling means folding, placing of fabric under the needle, bundle shifting and so on is done. To reduce this wastage of time in production of garments work aid can plays a vital role. This paper also will aid industry in the development of apparel production quality and production rate by minimizing non-productive activities. By this project, it is shown that about 20% time can be saved by using sewing work aids. Beside this it's also increased productivity and make an order more profitable.

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