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An Analysis of Standard Minute Value (SMV) to Increase Productivity in the Sewing Division: A Case Study on Jeans Pant Production

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Abstract

Ready-Made Garment's (RMG) achievement is noteworthy, particularly for a country plagued with poor resource endowments for industrialization. However, the RMG sectors are facing many difficulties and challenges in improving productivity on the manufacturing floor. The Standard Minute Value (SMV) is a crucial metric to complete a specific garment operation in the RMG industry. The strategic employment of SMV allows manufacturers to quickly adapt to changing market conditions, customer needs, and emerging trends. This case study aims to evaluate the effectiveness of SMV and production efficiency for jeans pant production (sewing division) in the garment industry. The implementation of the proposed technical layout demonstrated the increasing nature of the overall productivity (15.71%) by decreasing the SMV by around 2.36 minutes compared to the current layout. Importantly, this study demonstrated significant strategies to enhance overall productivity by reducing SMV.

Keywords: Standard Minute Value, Ready-Made Garment, Productivity, Manufacturers.

1. Introduction

The core of this study lies within the process of Standard Minute Value (SMV) that belongs to time study, which is one of the significant methods of productivity improvement. Time study is a well-established technique used by researchers to measure and analyze the time required to complete specific tasks. It is commonly used to determine the standard times needed to carry out target work activities. The roots of this phenomenon can be traced back to the period between World War I and II . Time study is an essential aspect to determine the production rate in business [1]. It can help to measure how much time is needed to complete a specific work for a competent worker under required conditions. Some scholars focused on motion time systems for calculating SMV, enhance production, efficiency, and the influence of time studies on productivity. Trained operators are more efficient than unskilled workers in a factory. Therefore, adequate training facilities are important to train the workers while time study can work in a right way to enhance productivity. Thus, it can help a factory to reach the profit targets which boosts national remittance [2].

On the other hand, SMV is a quantitative measure that can used researchers to quantify the time required to complete a process. It is typically measured under specific conditions, such as a standard environment with a standard worker. SMV is an essential metric in the garment industry that measures the required time for a skilled worker to finish a particular task [3]. The calculation of SMV involves the addition of various components, including the basic time, bundle allowances, machine allowance, and personal fatigue allowances. In the context of garments, the SMV is a crucial factor in estimating the time bound to complete the specific operations efficiently [4].

Some researchers examined standard full-sleeve woven shirts that are collar, cuff, flap, pocket joining, sleeve placket creasing, and button attaching. Both types of equipment were evaluated using primary and secondary data. SMV, personnel, and process cost were collected for semi-automatic and high-tech equipment. The study found that high-tech machines are reduce process, SMV, personnel, and cost for an industry [5]. Another study looked at how to increase output and quality of work using a variety of strategies, such as time study, visual management, and work standard procedures. Initially, the inquiry determined the variables which are influencing quality and productivity. After that they implemented corrective measures to reduce these variables, to improve both sewing line output and quality. This study claimed that efficiency increased by an impressive 8.07% using the

aforementioned techniques [6]. Nabi et al. calculated the SMV for every process or job in time studies, with the aim of enhancing the efficiency of the sewing section. The method described in this study involves the measurement and balancing of operator capacities in order to identify and eliminate bottlenecks in the system. The methods implemented in the sewing department to improve various areas of the factory such as SMV, manpower, bottleneck, achievable capacity, production per hour, performance rating, balance percentage, and line efficiency [7]. Rafman et al. examined and distributed T-shirt SMV through work study in order to decrease SMV and enhance coordination between humans, machines, materials, and techniques for improving efficiency [8].

Juman et al. developed a Generalized Assignment of Standard Minute Value (GASMV) model and applied it to production line of an apparel manufacturing company for identifying the optimum result. The suggested mathematical model has the best SMV with optimal assignments to each operation, which is less than the conventional means' SMV [9]. Implementing kaizen methodologies in the sewing sector, as opposed to conventional methods, yields substantial cost reductions. The decline in SMV facilitates an immediate enhancement in production, while the reduction of workforce enables an increase in profit [10]. By including the distinct attributes of items and enhancing the suggested Improved Particle Swarm Optimization - Back-Propagation Neural Network (IPSO-BP) model, standard minute value can be estimated more precisely [11]. Bizuneh & Omer developed a future state value stream map for lowering the main waste by implementing 5S and layout improvement. This resulted significant reduction of SMV of the shirt [12].

The main objectives of this research are as follows:

- To calculate the Standard Minute Value (SMV) for current layout of jeans pants production.
- To increase the productivity of the sewing division by implementing the proposed technical layout.

2. Methodology

Data Collection

We have collected our data from various divisions of S.F. Jeans Limited using “Time Study Sheet”. To calculate the SMV, we have chosen “Denim Basic 5 Pocket Jeans Pant”. It weighs around 12 oz and consists of 74% Organic cotton, 24% Cotton (Recycled), and 2% LYCRA® Elastane. Production of “Denim Basic 5 Pocket Jeans Pant” mainly consists of three steps which include back part formation, front part formation and assembly. In total 48 operations are performed in these steps to make the final product. Sequences of those operations are represented in Table 1.

Table 1. Sequence of operations involved in Jeans Pant production

Processes	Sequences of Operations
Back Part	Front and Back Knee Mark (FBNK) → Back Yoke Join (BYJ) → Back Pocket Upper Hem Stitch (BPUHS) → Back Pocket Position Mark (BPPM) → Back Pocket Iron (BPI) → Back Pocket Attach With (1 Patch) (BPAW) → Back Pocket 2nd TS (BP2TS) → Label Attach with Poly (LAWP)
Front Part	Outer Facing Lactra Tack (OFLT) → Outer Facing & Double Fly O/L (OFDF) → Outer Facing Attach to Pocket Bag (OFAPB) → Pocket Bag Close (PBC) → Pocket Bag TS With Turn (PBTST) → Front Rise Overlock (2side) With Single Fly (FROSF) → Single Fly with Front Rise Searing (SFFRS) → Single Fly Hem Stitch (SFHS) → Zipper Attach with Rope (ZAWR) → "J" Stitch Make (JSM) → Double Fly Attach with Shearing (DFAWS) → 2nd Part Attach (2PA) → 2nd Part TS & Hi Tack (2PTSH) → Front Pocket Attach (FPA) → Front Pocket Mouth TS With Piping (FPMTS) → Pocket Tack to Side & Waist (PTSW) → Shade Label Attach with Poly (SLAWP)
Assembly	Back & Front Part Match (BFPM) → Inseam Join (IJ) → Raw edge Cut (RC) → Center Seam T/S (CS) → Side Seam Join (SSJ) → Side Seam Safety (SSS) → Side Seam TS (up to Pocket) (SSTS) → Brand Label Join (BLJ) → Loop Make (LM) → Waist Belt Mark (WBM) → Waist Belt Buttonhole (WBB) → Waist Belt Matching (WBM) → Waist Belt Searing (WBS) → Waist Belt Attach (WBA) → Waist End Cut & Thread Remove (WECTR) → Mouth Close (Inn). (MCI) → Mouth Close (Top) with Mark (MCTM) → Bottom Hemming Tack (BHT) → Bottom Hemming (BH) → Loop Attach with BT (5 loop) (LABT) → Point Bartack (12 Points) (PB) → Final Thread Cut (FTC) → Eyelet Hole (EH)

SMV Calculation for Current Layout

To calculate SMV for this current layout, we have considered Rating factor as 90%, various allowances as 15% and line efficiency as 80%. Total number of manpower required in this layout is 65 including both operators and helpers. Daily working hours in this industry are 10 hours.

$$\text{Observed Time} = \frac{\text{Cycle Time}}{\text{No.of Cycle}} \quad (1)$$

$$\text{Basic Time} = \frac{\text{Observed Time} \times \text{Rating Factor}}{100} \quad (2)$$

$$\text{SMV} = \text{Basic Time} + \left(1 + \frac{\text{Allowance}}{100}\right) \quad (3)$$

$$\text{Production Target} = \frac{60 \times \text{Manpower} \times \text{Line Efficiency}}{\text{Total SMV}} \quad (4)$$

Total SMV is calculated by adding all 48 operations. By using the above equations, we have calculated various parameters which are represented in Table 2. The following table only includes the operations of the front part and assembly process.

Table 2. SMV calculation for current layout

Process	Operation	Machine Types	Observed Time (Min)	Basic Time	SMV	Hourly Target	TML	AML	Operator
Front Part	OFLT	LS1	0.29	0.26	0.30	200	0.85	1	1.00
	OFDF	OL4	0.27	0.24	0.28	217	0.78	1	1.00
	OFAPB	LS1	0.31	0.28	0.32	187	0.91	1	1.00
	PBC	OL3	0.29	0.26	0.30	200	0.85	1	1.00
	PBTST	LS1	0.32	0.29	0.33	183	0.93	1	1.00
	FROSF	OL4	0.29	0.26	0.30	198	0.86	1	1.00
	SFFRS	LS1	0.27	0.25	0.28	212	0.80	1	1.00
	SFHS	LS1	0.29	0.26	0.30	198	0.86	1	1.00
	ZAWR	LS1	0.31	0.28	0.32	187	0.91	1	1.00
	JSM	LS2	0.29	0.26	0.30	198	0.86	1	1.00
	DFAWS	LS1	0.27	0.25	0.28	212	0.80	1	1.00
	2PA	LS1	0.27	0.25	0.28	212	0.80	1	1.00
	2PTSH	LS1	0.31	0.28	0.32	187	0.91	1	1.00
	FPA	LS1	0.32	0.29	0.33	181	0.94	1	1.00
	FPMTS	LS2	0.49	0.44	0.50	119	1.43	2	2.00
	PTSW	LS1	0.39	0.35	0.40	149	1.15	2	2.00
	SLAWP	LS1	0.31	0.28	0.32	185	0.92	1	1.00
Assembly	BFPM	Helper	0.29	0.26	0.30	198	0.86	1	
	(IJ)	FOA	0.53	0.47	0.55	110	1.55	2	2.00
	RC	Helper	0.27	0.24	0.28	215	0.79	2	
	CS	FOA	0.58	0.52	0.60	100	1.70	2	2.00
	SSJ	OL5	0.58	0.52	0.60	100	1.70	2	2.00
	SSS	LS1	0.34	0.31	0.36	169	1.01	1	1.00
	SSTS	LS1	0.43	0.39	0.45	135	1.26	2	2.00
	BLJ	LS1	0.27	0.24	0.28	217	0.78	1	1.00
	LM	FL	0.16	0.14	0.17	362	0.47	0.5	0.50
	WBM	Helper	0.29	0.26	0.30	200	0.85	1	
	WMMH	BH	0.31	0.28	0.32	185	0.92	1	1.00
	WBM	Helper	0.29	0.26	0.30	200	0.85	1	
	WBS	OL5	0.31	0.28	0.32	185	0.92	1	1.00
	WBA	KANSAI	0.58	0.52	0.60	100	1.70	2	2.00
	WECTR	Helper	0.73	0.65	0.75	80	2.13	3	
	MCI	LS1	0.31	0.28	0.32	185	0.92	1	1.00
	MCTM	LS1	0.38	0.35	0.40	151	1.13	2	2.00
	BHT	LS1	0.49	0.44	0.50	119	1.43	2	2.00
	BH	CS1	0.38	0.35	0.40	151	1.13	2	2.00
	LABT	High-tech	0.38	0.35	0.40	151	1.13	1	1.00
	PB	BT	0.72	0.65	0.75	81	2.11	3	3.00
	FTC	Helper	0.33	0.30	0.34	176	0.97	1	
	EH	Eyelet	0.19	0.17	0.20	305	0.56	0.5	0.50

Implementation of the Technical Layout

The following figure depicts the proposed technical layout for the sewing division.

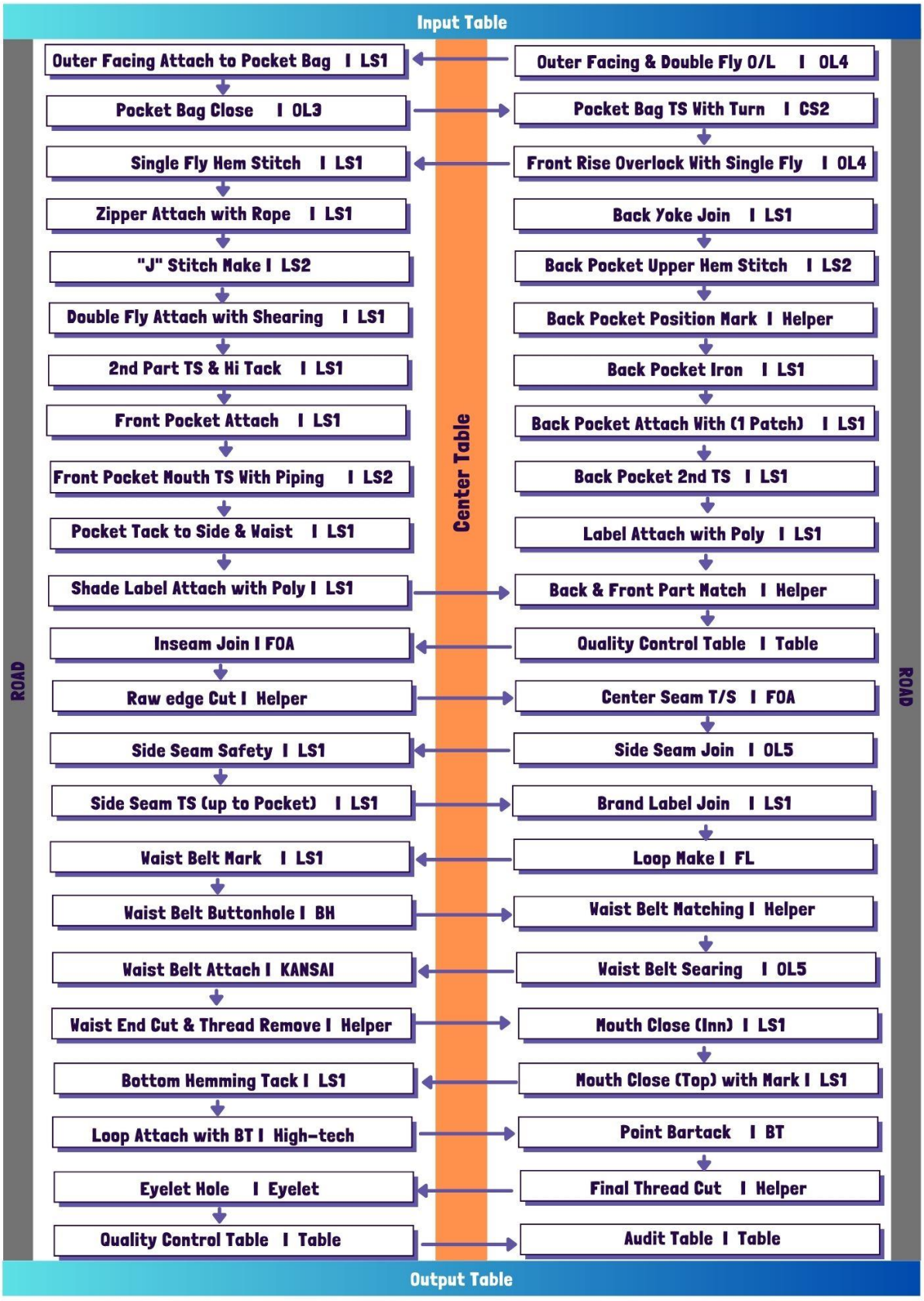


Fig. 1. Technical layout

Layouts Comparison

After implementation of the technical layout, we calculated the various criteria for the proposed layout while Table 3 represents the comparison of the two layouts and Fig. 2 illustrates the comparison between the current layout and proposed layout.

Table 3. Comparison of the layouts

Criteria	Current Layout	Proposed Layout	Improvement
SMV	18.32	15.96	2.36 min decreases
Hourly Target	170	187	17 pieces increases
Daily Target (10Hours)	1703	1870	167 pieces increases
Theorical Manpower Level	52	49	3 persons decrease
Actual Manpower Level	65	62	3 persons decrease
Productivity (pc/hr.)	2.61	3.02	0.41 (pc/hr.) increases

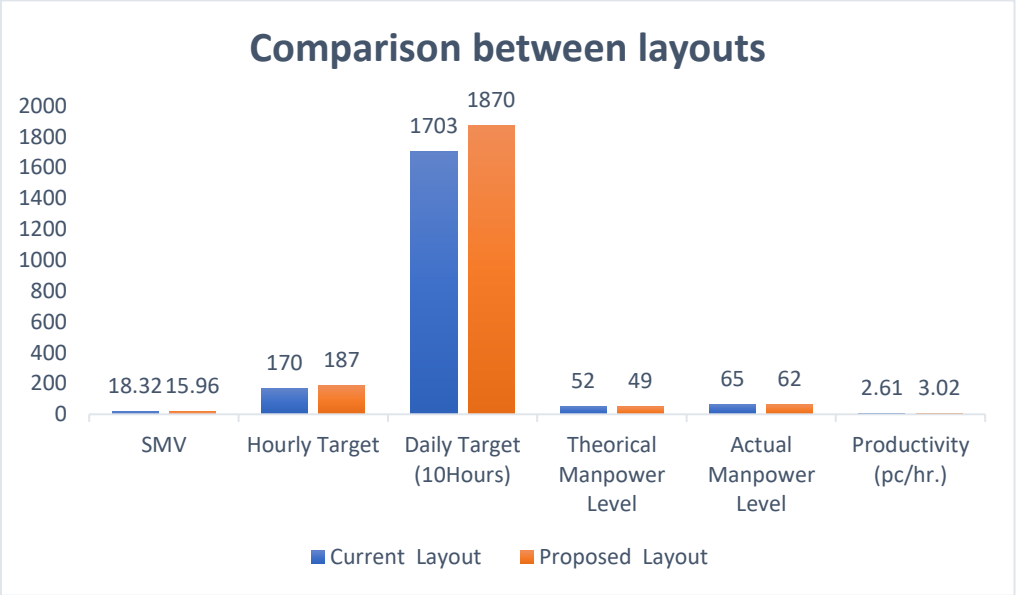


Fig. 2. Illustration of the layouts' comparison

3. Discussion

This case study aims to enhance productivity through analysis of SMV in the sewing division. At first, we have calculated various parameters like SMV, manpower, hourly target, and so on for current layout of this division. Then we have proposed a technical layout. After implementation of the proposed technical layout, we have found that it has brought significant improvement in those parameters. The summary of the results of this case study are represented in Table 4. Our proposed layout can decrease the SMV by approximately 2.36 minutes compared to the current layout. The hourly target, which was 170 pc/hr., increased about 10% after the proposed layout implementation. Manpower level reduced from 65 to 62 due to rearrangement in Waists End Cut & Thread Remove (WECTR), Bottom Hemming (BH), and Point Bar tack (12 Points) (PB) operations. As hourly target increases, and manpower decreases so there has been substantial improvement in the productivity. The proposed layout of the sewing division has resulted in a 15.71% increase in productivity. The organized strategizing, improved resource allocation, and boosted employee morale has collectively resulted in a decrease in production-related costs and enhanced the robustness and competitiveness of the industry.

Table 4. Results of the case study

Criteria	Percentages Improvement
Standard Minute Value (SMV) decreases	12.88%
Hourly Target increases	10.00%
Daily Target increases	9.81%
Theorical Manpower Level decrease	5.77%
Actual manpower Level decrease	4.62%
Productivity (pc/hr.) increases	15.71%

4. Conclusion

The implementation of technical layout and analysis of Standard Minute Value (SMV) in the sewing division of Jeans Pants production has proven to be a pivotal factor in enhancing productivity. This has made the production process more streamlined by reducing idle time and minimizing bottlenecks. The adoption of SMV has significantly enhanced the precision of production planning. By establishing time benchmarks for each task, managers can enhance their ability to precisely anticipate the duration of each work, hence facilitating improved scheduling and allocation of resources. The conformity to SMV has significantly improved the quality by minimizing errors and defects. This has had a positive influence on client satisfaction and the reputation of the company. In future, the incorporation of new smart technology in the sewing division of this industry can greatly enhance productivity through automation and digital transformation of existing operations. Motivation and training program for worker can be arranged to reduce nonproductive time.

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