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Improving Productivity by Using Extra Mechanical Automation on Different Sewing Machine

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Abstract Apparel sector is the most promising and rapid growing sector of Bangladesh. To sustain and survive in the global competition, machine automation is becoming the demand of time. Now-a-days apparel manufacturing industries are trying to improve their production efficiency to cope with the emerging challenges of this sector. The aim of this research is to improve productivity of sewing line by using extra mechanical automation on sewing machine in affordable cost. These reduce the cycle time, increase productivity in SMV wise 73.81 to 83.1 and manpower wise from 21.42 to 24.19. Which saves a remarkable cost and helps to beat the lead time successfully as well.

Keywords Apparel, Productivity, SMV, Lead time

1. Introduction

Bangladesh has already occupied the 2nd position in RMG export in the world [1]. In the financial year 2016-2017 the RMG industry generated US$28.14 billion, which was 81.23% of the total export earnings in exports and 12.36% of the GDP [2]. To retain this growth & safeguard our position in world RMG market there is no alternative to increased productivity [3]. Productivity is evaluated by achievement toward established goals based on relationships between inputs and outputs of industry [4].

In project management, productivity is the process by which resources are optimized in order to achieve the desired outcomes of the project. There are various components that are involved in the productivity of a workplace which are human resources (labor), machinery, and the working condition of the workplace [5].

Many people think of automation on a large scale; But automation can be added to machine tools in many other, more affordable ways as well [6]. A study showed increase of productivity of garment industry with their existing industry set up. It has been observed that there is scope to improve the productivity with improving the flap design. With regular flap design only one pocket flap can be manufacture, but with change in flap design, the double flap can be produced at less time. [7]

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Technological advancements like high speed sewing machine, CAD and computer- aided manufacturing (CAM) applications, new techniques in cutting, fusing and pressing, and application of robotics on the process of garment production, a substantial increase in productivity can be achieved [8].

In this research we try to increase productivity by reducing sewing time. We develop some self-made automation through air cylinder commonly known as Pneumatic cylinder.

2. Material and Methodology

2.1. Product Specification

Item: Short Pant
Buyer: Primark
Fabric construction: 100% cotton
Order quantity: 108400pcs
Color: Black, dark blue, indigo
Sewing data:
Sewing SMV: 20.32
Working hour: 10
Manpower required: 70
Daily target: 1500pcs

Figure 1. Front and back side of Short pant

Operation 1: Auto Disposer
Process: Zipper Attach to single fly
Machine: Double needle lock stitch machine
Machine parts:

- Air Cylinder
- Compressed air
- Rubber pad
- Air trigger

Figure 2. Added automation on double needle lock stitch machine

For adding zipper at fly position at first zipper needs to attach in single fly. Here requirement was used single needle machine earlier but we replace this machine with double needle lock stitch machine as 2 stitches with ¼ gap needs to give in zipper fly. Here we are adding one auto disposer also, so that operator doesn't need to dispose zipper by hand.

Operation 2: Auto thread cutter
Process: Waist belt attach
Machine: KANSAI
Machine parts:

- Air Cylinder
- Compressed air
- Scissor
- Steel Base
- Air Pipe
- Air trigger

Figure 3. Adding auto thread Cutter on a Kansai machine

After attaching waist band by kansai machine loose threads comes, though Kansai machine doesn't have auto thread cutting system that's why after joining waist band loose threads needs to cut by hand. Operator dose this by hand cutter before. We are adding here one auto thread cutting automation, so that we can reduce the thread cutting time.

Operation 3: Auto mouth cutter
Process: Waist belt mouth close
Machine: Self-made cutter
Machine parts:

- Air Cylinder
- Compressed air
- Steel Base
- Air Pipe
- Air trigger

Figure 4. Auto Mouth Cutter

For doing Waist band mouth close operation extra fabric piece needs to cut by hand cutter. We are added automation here to increase the helper capacity, also easier the process and savings the cutting time.

Operation 4: Auto hem cutter
Process: Hem cutting for Distortion effect
Machine: Overlock
Machine parts:

- Vertical Knife
- Plastic Base

Figure 5. Auto hem cutter

Buyer requirement was to bring distortion effect in bottom hem by wash, but at first hem needs to cut so that it creates a distortion effect after washing. This process is too slow, a lot of manpower needed. We are innovating a easier way to cut it by overlock machine including a vertical knife.

Operation 5: Auto Pocket hem folding
Process: Back Pocket Hem
Machine: Single Needle Chain Stitch machine
Machine parts:

- Air Cylinder
- Compressed air
- Steel Base plate
- Air Pipe
- Air trigger

Figure 6. Auto pocket turner

For attaching back pocket, at first back pocket mouth position have to fold by hand thus it consumes time. So we are adding a automation to fold the pocket automatically.

2.2. Methodology (Working Flow Chart)

Selecting machines and processes

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Studying the machine capacity without automation

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Adding automation on the selected machine

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Studying the machine capacity after adding automation

⇩

Calculating the unassigned time

⇩

Eliminating extra machine and men power

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Calculating efficiency, productivity and others

3. Data Analysis

Daily Production target 150pcs/hr needed to beat the lead time
Target in 100% efficiency=60/SMV
Capacity=3300/Actual cycle time (5mins was allowance time)

Table 1. Capacity before Adding Automation

Process	Machine	SMV	Target (pcs) in 100% efficiency	Actual Cycle time (Sec)				Capacity pcs/hr (here 1hr=55min)	Manpower required for 150pcs/hr
				1	2	3	Avg		
Zipper attach to single fly	lock stitch	0.43	139	27	26	25	26	126	1.5
Waist belt attach	Kansai	0.87	69	57	58	60	58	56	2.5
Waist belt mouth cut	Cutter	0.44	136	26	26	27	26	126	1.5
Decorative hem cutting	Over lock	2.03	30	123	122	124	123	27	6
Back pocket hem	Chain stitch	0.42	143	24	25	26	25	132	1.5

Table 2. Capacity after Adding Automation

Process	Machine	SMV	Target (pcs) in 100% efficiency	Actual Cycle time (Sec)				Capacity pcs/hr	Manpower required
				1	2	3	Avg		
Zipper attach to single fly	lock stitch	0.18	333	9	11	12	10	330	0.5
Waist belt attach	Kansai	0.75	80	43	42	44	42	78	2
Waist belt mouth cut	Cutter	0.36	166	19	21	20	21	157	1
Decorative hem cutting	Over lock	0.33	181	18	19	20	20	165	1
Back pocket hem	Chain stitch	0.3	200	17	19	18	18	183	1

Table 3. Calculation of Unassigned time, SMV and Manpower reduction

Process	Before cycle time	After cycle time	Unassigned time (sec)	SMV before adding automation	SMV after adding automation	SMV reduction	Required manpower before adding automation	Required manpower after adding automation	Manpower reduction
Zipper attach to single fly	26	10	16	0.43	0.18	0.25	1.5	0.5	1
Waist belt attach	58	42	16	0.87	0.75	0.12	2.5	2	0.5
Waist belt mouth cut	26	21	4	0.44	0.36	0.08	1.5	1	0.5
Decorative hem cutting	123	20	103	2.03	0.33	1.7	6	1	5
Back pocket hem	25	18	7	0.42	0.3	0.12	1.5	1	0.5
						∑=2.27			∑=7.5/8

4. Results and Discussions

Before adding automation	After adding automation
SMV: 20.32 Working hr: 10 Manpower: 70 Output: 1500pcs Now, Input-hour in minute=(Number of operator*total working time in min)= (70*10*60)=42000 Output-hour in minute=(Number of garment*Standard time)=(1500*20.32)=30480 So, Productivity = {(Output/Input)*100} = {(30480/42000)*100} = 72.57%	SMV: 18.05 Working hr: 10 Manpower: 62 Output: 1500pcs Now, Input-hour in minute=(Number of operator*total working time in min) = (62*10*60)=37200 Output-hour in minute=(Number of garment*Standard time)=(1500*18.05)=27075 So, Productivity = {(Output/Input)*100} = {(27075/37200)*100} = 72.78%

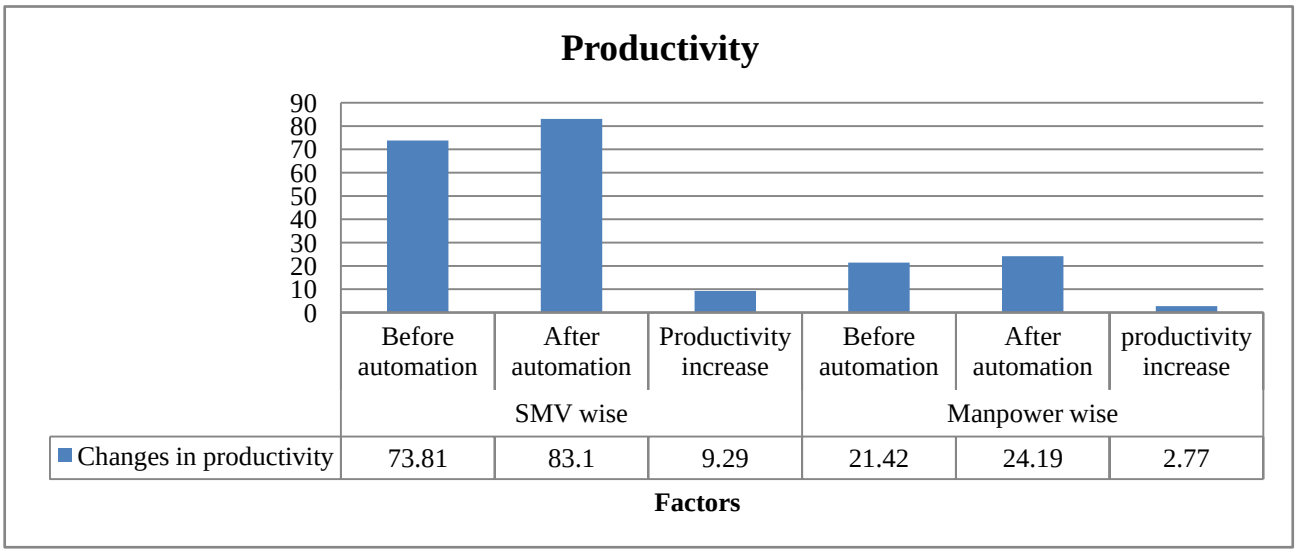

Figure 7. Productivity changes in SMV wise and manpower wise

Figure 7 shows productivity changes in SMV wise and manpower wise before and after adding automation. Productivity increase 9.29 in SMV wise and 2.77 in manpower wise.

5. Conclusions

To meet and beat the buyer's lead time, machine automation has no alternate. In our country, the order quantity is increasing day by day but the lead time and price of the product are decreasing. So, it's high time to introduce and implement lean manufacturing and machine automation as well.

In this part we want to summarize our work and also point out our findings;

We implement different automation in five operations in this work these are-i. Auto disposer to attach zipper with single ply, ii. Auto thread cutter in waist belt attachment, iii. Auto mouth cutter in waist belt mouth cut, iv. Auto hem cutter in hem cutting for distortion effect, v. auto pocket hem folding for back pocket hem joining. All these effort increase the productivity by reducing the cycle time and ultimately saves huge cost in respect of by reducing SMV and operator. Our findings are:

- Sewing SMV reduces to produce primark short pant from 20.32 to 18.05.
- The number of operators is reduced from 70 to 62 after adding automation.
- Line productivity increases from 72.57% to 72.78% after adopting automation.
- The effect of automation is also considered in terms of productivity in SMV wise and Manpower wise. The productivity in terms of SMV is increased from 73.81 to 83.1 which is about 12.6% and in respect of manpower, the productivity reaches from 21.42 to 24.19 which is also about 12.93%.

Thereby we can conclude that there is a remarkable improvement in cost and productivity by introducing very

simple existing technology and locally available equipment. Our main focus is to increasing the productivity by existing technique and parts without purchasing a full automatic machine.

6. Limitations

- We cannot provide actual costing of automation because of company privacy.
- Further research can be done in this respect.

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