

# INCREASING PERFORMANCE OF FOOTWEAR STITCHING LINE BY INSTALLATION OF AUTO-TRIM STITCHING MACHINES

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## Abstract:

Industries need to innovate their processes and machines on the advent of new technology in the market especially when there is the matter of line performance, cost and process efficiency. Stitching in the footwear is considered as the bottleneck of the production because of the variability of operations in the different articles (shoes). In this regard, such operations which remains constant (i.e. thread cutting after the stitching operation is complete on the specific footwear component) are required to be automated so that the time and cost can be saved. In the case company, stitching machines don't cut the thread automatically after the completion of operation on the shoe component. On the same time, such stitching machines are available in the market which cut the thread automatically when the operation is completed. Before, purchasing those machines, it was needed to prepare the feasibility of the investment and its impact on the performance, cost effectiveness and overall line efficiency. One of the latest machines was brought for trial in the case company and the stitching operations were performed on both machines (existing and new machine) so that the difference in the performance can be calculated. Time of the performed operation was recorded by the help of stopwatch, amperes of the motors of existing machines were checked by the help of ampere meter. The data was put into MS excel and various formulae were applied in the spreadsheet to prepare the feasibility. It was concluded that after the installation of 10 post bed single needle stitching machines and 2 post bed double needle stitching machines, the production will increase by 61 pairs/day; the line efficiency will increase by 12% and Rs.8/pair will be saved.

**Keywords:** footwear; efficiency; performance; stitching.

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## 1. Introduction and Literature

Footwear producing companies gain the competitive advantage by their ability to improve the effectiveness and efficiency of resources by waste elimination from the processes (Dang & Pham, 2016). Footwear production is consisted of three sections i.e. cutting, stitching and lasting. Mostly, cutting and lasting operations are standardized except few but the stitching has been known as the bottleneck of the footwear production. This is due to the variability of the stitching operations of different articles (shoes). Generally, the sequence of workstation (consisted of machines or manpower of manual work) designed to stitch/sew the shoe is called as sewing/stitching line. The specific tasks are set in predefined sequence for the smooth running of the production of whole line. Generally, one group of tasks are assigned to one workstation according to the skill grade of workers. Line supervisors and foremen are supposed to assign the task of equal magnitude (in terms of time) to each of the workstation so that whole sewing line can be balanced (Morshed & Palash, 2014). On the same time, those tasks which are unnecessary or non-value added are eliminated

from the line. One of those tasks is manual thread cutting after the operation is complete; this operation (thread cutting) was eliminated by the installation of auto-trimer machines so that one helper and the time of skill worker could be saved (Abtew et al., 2019). The line balancing leads to greater efficiency by better synchronization of man-machine and materials (Abtew et al., 2019; Jalil et al., 2015). It was reported by Jalil et al., 2015 that after the installation of auto-thread cutter over lock machine, two helpers were saved moreover, before this innovation, there were 44 workers and they were decreased to 38. Six workers were saved but the target remained same (Jalil et al., 2015). These small and little things add the value and reduce the operation time at the various stages of sewing. Sudarshan and Rao (2015) used information technology (IT) for the improvement of line efficiency by initiating the multi-skill labor system. It was such a system, in which the skill matrix of targeted line was already initialized. Due to the varying content of the work, right operator for the right job (operator having the efficiency of >50% for the needed operation) was quite difficult to be decided but by the help of multi-skill labor system, engineers can easily select the worker and

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balance the sewing line easily (Sudarshan & Rao, 2015). Ahmed and Chowdhury (2018) conducted a research in which the low performing operators were trained about the eight wastes of lean methodology. Operational procedure standardization was taught to the low performing operators; so that their excessive movement could be reduced in order to avoid fatigue. In this way, line efficiency was boosted from 53.79% to 61.21%. Furthermore, line productivity was increased from 29% to 44% and operators' average performance was increased from 76.15% to 77.05% (Ahmed & Chowdhury, 2018). Nabi et al. (2015) conducted a research for the improvement of sewing line efficiency by the help of time study technique. The time of all the operations of an article were recorded and operations with the greater capacity were highlighted so that the workload of operators (performing low capacity operations) could be shared with those operator (performing the operations of less SMV). In this way, the sewing line was balanced and for that, operators were needed to be motivated. In result, sewing line efficiency was increased from 54.22% to 59.74% (Nabi et al., 2015). Rajput et al., (2018) used visual management and work standards techniques to improve the productivity and quality. Initially, the factors which affect the productivity and quality were identified and reduced; by the use of above mentioned tools, line efficiency was increased by 8.07% (Rajput et al., 2018). Akter and Hosain (2017) used different techniques to increase the sewing line efficiency i.e. layout of line, time study and line balancing. They designed three different layouts; in layout 1 (22 workstations), efficiency and line balancing was 83.13% and 48.49% respectively; in layout 2 (20 workstations), efficiency and line balancing was calculated to be 72.27% and 41.24% respectively; in layout 3 (18 workstations) efficiency and line balancing was calculated to be 89.00% and 53.38% respectively (Akter & Hossain, 2017). Morshed and Palash (2014) reduced non-value added operations, cycle time and workload distribution at each workstation by the use the use line balancing technique. All above mentioned techniques were applied on the single model line at the factory and line efficiency was in-creased from 43% to 53% (Morshed & Palash, 2014). Quddus and Ahsan (2014) implemented KAIZEN on the sewing floor and on investigation, it was indicated that efficiency was increased (from 50% to 62%) whereas, wastes and defects were reduced (Quddus & Ahsan, 2014). Slović et al., (2016) analysed the impact of combined implementation of gain sharing wage incentives and continuous process improvement at apparel industry of Serbia; it was indicated that there was significant increase in productivity. The research was concluded that wage incentives can be used as efficient tool for motivating employees to play their role in improvement efforts (Slović et al., 2016). Syduzzaman and Golder (2015) calculated the layout plans for three different products and due to that workers' efficiency was increased i.e. for Basic Style-BOYS POLO (from 65% to 80%); for Semi-critical Style-OC BABY BODIES (from 73% to 80%); for Critical Style-ladies long shirt (from 60% to 80%) (Syduzzaman & Golder, 2015). Uddin (2015) implemented various techniques (i.e. process integration, work sharing and multitasking) for improving overall productivity of cutting, sewing and finishing. Three different lines producing different products were targeted for the implementation of this study. The line efficiency was increased from 57.29% to 58.62% (Uddin, 2015).

In this regard, this study is focused on the feasibility analysis of auto-trim single and double needle machines; by the help above mentioned machines, sewing line efficiency and cost effectiveness have been seen to support the decision of installing the mentioned machines.

## 2. Research Contribution

Literature review was conducted on the topic of efficiency evaluation and it was found that most of researchers have conducted research on the topics like, time study, line balancing, layout design, visual management, lean methodology, work standards and KAIZEN. None of them have conducted study on the improvement of efficiency by installation of latest machines (see Table 1). This is the novel contribution of this research.

Table 1: Contribution Table.

Author	TS	LB	LD	DITS	VM	LM	WS	KAIZEN
(Sudarshan & Rao, 2015)				x				
(Ahmed & Chowdhury, 2018)	x					x	x	
(Nabi et al., 2015)	x	x						
(Rajput et al., 2018)					x		x	
(Akter & Hossain, 2017)			x					
(Morshed & Palash, 2014)		x					x	
(Quddus & Ahsan, 2014)								x
(Syduzzaman & Golder, 2015)	x	x						
(Uddin, 2015)		x						

## 3. Problem Statement

Industries need to innovate their processes and machines on the advent of new technology in the market especially when there is the matter of cost and process efficiency. Similarly, in the case company, old stitching machines with the greater consumption of electricity and less features needed to be replaced with the latest technology which is with more and productive features. In the old stitching machines, workers used to cut the thread by cutter whenever the process on the component of leather shoe was completed; which used to add the value of few second in the process and those few seconds were associated with labour cost and so the over heads. To eliminate that costly value addition in the process was tried to be eliminated by this research to save those few seconds; In this regard, such stitching machines were searched throughout the market which have the feature of auto-thread cutting. In this study, the feasibility and benefit of those machines is presented.

## 4. Research Methodology

Since, this whole work is based on the footwear stitching line; thus the data regarding the operations was collected from the targeted stitching line. Machine to be installed was brought in the line for trial and same operations were performed by the different workers on both old and new machine so that the performance of both machines can be compared as presented in the Table 2.

**Table 2:** Comparison of the time taken by manual and auto-trim stitching machine.

Article & Operation		Old Machine		New Machine		Savings	
Article	Operation	Per day target (Pairs)	Cost/pair (Rs)	Per day target (Pairs)	Target (Diff. %)	Cost/pair (Rs)	Saving/Day (Rs)
4721	Collar In Stitching	400	1.90	563	41%	1.35	309
UM8101	Collar Stitching	776	0.98	1063	37%	0.72	282
RF-9101	Chakwa Decorative Stitching	450	1.69	600	33%	1.27	254
RF-9101	Qtr. Part D.N Stitching	500	1.52	700	40%	1.09	304
<b>Average</b>					38%	1	287

The time of different operations (performed by different workers) were recorded by the help of stopwatch and their means were calculated which are presented in the Table 2. Consumption of electric current by stitching machines was checked by the ampere meter. Electric power consumption was calculated on five hours per day because along with stitching machine, workers have to adjust leather pieces for stitching, they transport then when the operation is finished. In this regard, 67% time was considered for machine operation, and rest of 33% was considered for material handling (transportation of material to the machine, handling during operation and transportation after the operation is finished). After the data collection, it was put into MS excel and the various formulae were applied for the calculation.

**4.1. Assumptions**

Following assumptions were taken into consideration during the calculations.

- Cost Escalation Factor 6%
- Benefit Escalation Factor 2%
- Income Tax Rate 31%
- Discount Rate 8%
- Internal rate of return 12%

**4.2. Notations**

- i = discount rate
- r = rate of return
- Co = Total initial investment cost
- t = Number of time periods
- T = Total number of time periods
- Ec = Electricity cost
- Cs = Cost saving
- Cf = Net cash flow
- Tc = Total cost
- Tcc = Total Capital cost
- Tcs = Total cost saving
- Dc = Depreciation cost
- Oc = Operating cost
- Ob = Operating benefits
- Cef = Cost escalation factor
- Bef = Benefits escalation factor
- Itr = Income tax rate
- Eob = Escalation of benefits

- Cfbt = Cash flow before taxes
- Cfat = Cash flow after taxes
- Tbar = Total benefits and revenue
- Nit = Net income taxes
- Eoc = Escalation of cost
- DCfat = Discounted cash flow after taxes
- IRR = Internal rate of return
- NPV = Net present value
- PI = Profitability index
- Pp = payback period
- P = Electric power
- V = voltage
- I = Electric current
- n = Number of hours
- Kwh = Kilo watt hour

Used formulae/equations are given as under:

$$Kwh = \frac{VI \cos \phi}{1000} n \tag{1}$$

$$E_{oc} = T_c(1 + C_{ef})^{t-1} \tag{2}$$

$$E_{ob} = T_{cs}(1 + B_{ef})^{t-1} \tag{3}$$

$$T_{bar} = T_{cs} + E_{ob} \tag{4}$$

$$Cf_{bt} = T_{bar} + T_c + T_{cc} \tag{5}$$

$$N_{it} = I_{tr}(D_c + O_c + O_b) \tag{6}$$

$$Cf_{at} = Cf_{bt} + N_{it} \tag{7}$$

$$DCf_{at} = \frac{Cf_{at}}{(1 + i)^t} \tag{8}$$

$$NPV = \sum_{t=1}^T \frac{Cf_{at}}{(1 + r)^t} - C_o \tag{9}$$

$$0 = NPV = \sum_{t=1}^T \frac{Cf_{at}}{(1 + IRR)^t} - C_o \tag{10}$$

$$PI = \frac{\sum_{t=1}^T DCf_{at}}{C_o} \tag{11}$$

$$S_{pb} = \frac{C_o}{Cf_{at}} \tag{12}$$

### 5. Result and Discussion

In the targeted stitching line, there were 10 post bed single needle machines and 2 post bed double needle stitching machines which can be seen in table 5. Electric current of the already installed machines was checked by the help of ampere meter as discussed in research methodology. The average electric power consumption of already installed stitching (single needle and double needle) machines was 0.95 kwh/day and the electric power consumption of to be installed machines was calculated to be 0.4 kwh/day. The electricity cost of existing machines was computed to be Rs.12.14/day for each machine whereas, for suggested machines it was Rs.5.228/day. Difference in the electricity cost/day among the old and new machines was calculated to be Rs. 7.19 (55%) as presented in the Table 3.

**Table 3:** Calculation for estimation of savings.

Machine	Electricity Cons. (Kwh/day)	Electricity Cost/ Kwh (Rs)	Cost/Day (Rs)	Diff. (Rs) and (%)	Saving/Day (Rs)
Manual Stitching Machine	0.95	13.07	12.4165		
Auto Cutting Stitching Machine	0.4	13.07	5.228	7.19 (55%)	7.19

In order to purchase machines, it was necessary to prepare the feasibility of those machines to be purchased so that the quality of decision to be made could be verified if it was worth of that much investment or not. The cost of one machine was Rs.175000 as presented in the Table 4. Total electricity cost/year was calculated to be Rs.150000, escalation of cost came out to be Rs.900 with the total cost of Rs.15900 in first year of installation. The calculated cost saving in the first year of installation of auto-trim machine was calculated to be Rs.105596; escalation of benefits was computed to be Rs.2112; total benefits and revenue were calculated to be Rs.107708; On the summing up, cash flow before taxes came out to

**Table 4:** Calculation for feasibility of auto-trim stitching machines.

	Y0	1	2	3	4	5	6	7	8	9	10	Totals
T <sub>c</sub> (Rs)	-175000	0	0	0	0	0	0	0	0	0	0	-175000
<i>Operating and Maintenance Costs</i>												
E <sub>c</sub> (Rs)		-15000	-15000	-15000	-15000	-15000	-15000	-15000	-15000	-15000	-15000	-150000
E <sub>oc</sub> (Rs)		-900	-1854	-2865	-3937	-5073	-6278	-7554	-8908	-10342	-11863	-59575
T <sub>c</sub> (Rs)	0	-15900	-16854	-17865	-18937	-20073	-21278	-22554	-23908	-25342	-26863	-209575
<i>Revenue and Operating Benefits</i>												
C <sub>s</sub> (Rs)		105596	105596	105596	105596	105596	105596	105596	105596	105596	105596	1055961
E <sub>ob</sub> (Rs)		2112	4266	6463	8705	10991	13322	15701	18127	20601	23125	123412
T <sub>bar</sub> (Rs)	0	107708	109862	112059	114301	116587	118918	121297	123723	126197	128721	1179373
Cf <sub>bt</sub> (Rs)	-175000	91808	93008	94194	95363	96513	97641	98742	99815	100855	101858	794798
<i>Income Tax Calculation</i>												
D <sub>c</sub> (Rs)		-17500	-17500	-17500	-17500	-17500	-17500	-17500	-17500	-17500	-17500	-175000
O <sub>c</sub> (Rs)		-15900	-16854	-17865	-18937	-20073	-21278	-22554	-23908	-25342	-26863	-209575
O <sub>b</sub> (Rs)		107708	109862	112059	114301	116587	118918	121297	123723	126197	128721	1179373
N <sub>it</sub> (Rs)	0	-23035	-23408	-23775	-24138	-24494	-24844	-25185	-25518	-25840	-26151	-246387
Cf <sub>at</sub> (Rs)	-175000	68773	69601	70419	71226	72019	72797	73557	74297	75015	75707	548411
DCf <sub>at</sub> (Rs)	-175000	63678	59671	55901	52353	49015	45874	42920	40141	37526	35067	307147

be Rs.91808 in the first year of installation. Depreciation (10%) per year was computed to be Rs.17500; operating cost (Rs.15900), operating benefits (107708), net income tax (Rs.23035), cash flow after tax (Rs.68773) and discounted cash flow after tax (63678) were calculated as presented in the Table 3. Results of feasibility analysis show that; net presented value of this investment was Rs.307146.61, internal rate of return was computed to be 38.8%, profitability index of 2.76 along with the payback period of 2 years and 6 months as presented in Table 5.

**Table 5:** Overall results of feasibility.

NPV	Rs. 307,146.61
IRR	38.8%
PI	2.76
P <sub>p</sub>	2 Years 6 Months

Time study list is presented in the Table 6. In the time study table, the manual post bed single needle and post bed double needle machines were replaced by the auto-trim single needle (ten machines) and double needle (ten machines) machines. So that the impact of these machines on per day target and overall efficiency of line can be calculated. In Table 6, it can be seen that on installation of new machines, production of stitching line will increase by 61pairs/day, overall line efficiency will increase by 12% and cost Rs.8/pair will be saved.

Efficiency relates to the use of all inputs in producing any given output, including personal time and energy (Abteu et al., 2019). Ahmed and Chowdhury (2018) increased sewing line efficiency from 53.79% to 61.21% by the use of operational procedure standardization. Furthermore, line productivity was increased from 29% to 44% and operators' average performance was increased from 76.15% to 77.05% (Ahmed & Chowdhury, 2018). Nabi et al. (2015) increased sewing line efficiency from 54.22% to 59.74% by using work sharing technique between the operators performing the operations of high and low capacity (Nabi et al., 2015). Ahmed and Chowdhury, (2018) increased sewing line efficiency from 53.79% to 61.21% by the use of operational procedure standardization. Furthermore, line productivity was increased from 29% to

44% and operators' average performance was increased from 76.15% to 77.05% (Ahmed & Chowdhury, 2018). Nabi et al. (2015) increased sewing line efficiency from 54.22% to 59.74% by using work sharing technique between the operators performing the operations of high and low capacity (Nabi et al., 2015). Rajput et al. (2018) increased efficiency of line (by 8.07%) by the help of visual management and work standard techniques (Rajput et al., 2018). Akter and Hosain (2017) increased sewing line efficiency (from 83.125 to 89%) by the use of efficient layout of line, time study and line balancing (Akter

& Hossain, 2017). Morshed and Palash (2014) increased an efficiency of line from 43% to 53% by reducing non-value added operations and cycle time and efficient line balancing (Morshed & Palash, 2014). Efficiency was increased from 50% to 62% by the implementation of KAIZEN on the stitching floor (Quddus & Ahsan, 2014). Slović et al. (2016) indicated wage incentives as the useful tool for motivating the employees to put their efforts in improvement efforts (Slović et al., 2016). Syduzzaman and Golder (2015) increased workers' efficiency by calculating the line layout as per the requirement of

**Table 6:** Calculation for estimated cost saving and estimated increase in efficiency on the installation of auto-trim machine.

Total	Before			After			Difference			
	2768	497	Rs 71	2464	559	Rs 63	Rs 61.31	12%	Rs 8	
Operation Name	Require Machine	Time/ Pair (Sec)	Target/ Day (Pairs)	Rate/ Pair (Rs)	Time/ Pair (sec)	Target/ Day (Pairs)	Rate/ Pair (Rs)	Target/ Day (Pairs)	%	Rate/ Pair (Rs)
Qtr.Cloth Fitting	manual	60	450	1.55	60.00	450.00	1.55	0	0%	0.00
Heel Grip Stitching	Post Bed S.N Stitching M/C	60	450	1.55	37.20	725.81	0.96	276	61%	0.59
Counter Back Seaming	Post Bed S.N Stitching M/C	27	1000	0.70	16.74	1612.90	0.43	613	61%	0.26
Counter Back Pressing+Tapping	Upper Pressing M/C	18	1500	0.45	18.00	1500.00	0.45	0	0%	0.00
Back Counter Pasting	manual	60	450	1.50	60.00	450.00	1.50	0	0%	0.00
Back Counter Fitting	manual	60	450	1.58	60.00	450.00	1.58	0	0%	0.00
Back Counter D.N Stitching	Post Bed D.N Stitching M/C	54	500	1.42	33.48	806.45	0.87	306	61%	0.55
Qtr.Side Part Pasting	manual	54	500	1.35	54.00	500.00	1.35	0	0%	0.00
Qtr.Side Part Fitting	manual	54	500	1.40	54.00	500.00	1.40	0	0%	0.00
Qtr.Side Part D.N Stitching	Post Bed D.N Stitching M/C	36	750	0.95	22.32	1209.68	0.58	460	61%	0.37
Qtr. Parts Pinching Stitching 1+2	Post Bed S.N Stitching M/C	108	250	2.79	66.96	403.23	1.74	153	61%	1.05
Qtr Part Back Pressing	Back Pressing M/C	60	450	1.55	60.00	450.00	1.55	0	0%	0.00
Qtr Part Fancy Stitching 10/3	Post Bed S.N Stitching M/C	128.5	210	3.39	79.67	338.90	2.07	129	61%	1.32
Thread Pulling Pasting	manual	77.14	350	1.92	77.14	350.00	1.92	0	0%	0.00
Vamp Pinching Stitching	Post Bed S.N Stitching M/C	41.53	650	1.09	25.75	1048.60	0.67	399	61%	0.43
Pinching Pressing+Tapping	manual	84.5	320	2.10	84.50	320.00	2.10	0	0%	0.00
Vamp Fancy Stitching	Post Bed S.N Stitching M/C	54	500	1.42	33.48	806.45	0.87	306	61%	0.55
Upper+Lining Pairwising	manual	27	1000	0.67	27.00	1000.00	0.67	0	0%	0.00
Collar Turnover Stitching	Turnover Stitching M/C	56.2	480	1.48	56.20	480.00	1.48	0	0%	0.00
Collar Turnover Folding	Folding M/C	49.1	550	1.29	49.10	550.00	1.29	0	0%	0.00
Collar Foam+Stiffner Pasting Fitting	Pasting M/C (Roller Type)	54	500	1.40	54.00	500.00	1.40	0	0%	0.00
Qtr.Lining Pasting	manual	60	450	1.50	60.00	450.00	1.50	0	0%	0.00
Qtr.Lining Fitting	manual	60	450	1.58	60.00	450.00	1.58	0	0%	0.00
Eyelet Part In Stitching	Post Bed S.N Stitching M/C	60	450	1.58	37.20	725.81	0.96	276	61%	0.62
Mudgard Cloth Fitting	manual	29.2	925	0.75	29.20	925.00	0.75	0	0%	0.00
Mudgard Cloth Pasting No-02	manual	45	600	1.12	45.00	600.00	1.12	0	0%	0.00
Mudgard Cloth Fitting No-02	manual	45	600	1.16	45.00	600.00	1.16	0	0%	0.00
Vamp Cloth Pasting	manual	45	600	1.12	45.00	600.00	1.12	0	0%	0.00
Vamp Cloth Fitting	manual	45	600	1.16	45.00	600.00	1.16	0	0%	0.00
Tongue Turnover Stitching	Post Bed S.N Stitching M/C	41.55	650	1.09	25.76	1048.10	0.67	398	61%	0.43
Tongue Turnover Folding	Folding M/C	33.75	800	0.89	33.75	800.00	0.89	0	0%	0.00
Tongue Foam Pasting, Fitting	manual	40	675	1.03	40.00	675.00	1.03	0	0%	0.00
Tongue Lining Pasting Fitting	manual	40	675	1.03	40.00	675.00	1.03	0	0%	0.00
Tongue In Stitching	Post Bed S.N Stitching M/C	41.55	650	1.09	25.76	1048.10	0.67	398	61%	0.43
Tongue Trimming By M/C	Trimming M/C	18	1500	0.47	18.00	1500.00	0.47	0	0%	0.00
Tongue Part Pasting Fitting	manual	27	1000	0.70	27.00	1000.00	0.70	0	0%	0.00
Tongue Part Stitching	Post Bed S.N Stitching M/C	27	1000	0.70	16.74	1612.90	0.43	613	61%	0.26
Eyelet Part Punching	manual	33.75	800	0.87	33.75	800.00	0.87	0	0%	0.00
Eyelet Pressing By M/C	Eyelet Press M/C	33.75	800	0.87	33.75	800.00	0.87	0	0%	0.00
Eyelet Part Trimming By M/C	Trimming M/C	38.57	700	1.00	38.57	700.00	1.00	0	0%	0.00
Qtr.Vamp Pasting	manual	60	450	1.50	60.00	450.00	1.50	0	0%	0.00
Qtr.Vamp Fitting	manual	60	450	1.58	60.00	450.00	1.58	0	0%	0.00
Lock Stitching	Flat Bed S.N Stitching M/C	120	225	3.16	74.40	362.90	1.93	138	61%	1.23
Re-Lining Pasting Fitting	manual	54	500	1.40	54.00	500.00	1.40	0	0%	0.00
Final Cleaning	manual	108	250	2.69	108.00	250.00	2.69	0	0%	0.00
Final Thread Cutting	manual	102	265	2.54	102.00	265.00	2.54	0	0%	0.00
Final Thread Burning	Thread Burning M/C	33.75	800	0.87	33.75	800.00	0.87	0	0%	0.00
Feeding+Coupon Inserting	manual	27	1000	0.70	27.00	1000.00	0.70	0	0%	0.00
Stitching Packing	manual	45	600	1.16	45.00	600.00	1.16	0	0%	0.00
Re-Punching	manual	27	1000	0.70	27.00	1000.00	0.70	0	0%	0.00
Upper+Insole Pairwising	manual	27	1000	0.67	27.00	1000.00	0.67	0	0%	0.00
Strobule Zig Zag Stitching	Zig Zag Stitching M/C	90	300	2.37	90.00	300.00	2.37	0	0%	0.00
Collar Hammering	Upper Pressing M/C	27	1000	0.67	27.00	1000.00	0.67	0.00	0%	0.00

products and then balanced line (Syduzzaman & Golder, 2015). Uddin (2015) increased efficiency (57.29% to 58.62%) by implementing the techniques i.e. process integration, work sharing and multitasking (Uddin, 2015).

## 6. Conclusion

The use of latest technology leads to the improved performance, cost effectiveness and increased efficiency. A lot of researches indicate that the efficiency can be boosted up by the organized and simplified micro motions of workers (after they are trained) but the use of latest and sophisticated machines is another aspect of work simplification and increasing efficiency. In this research, efficiency and labour cost of stitching was substantially increased and decreased. It was highlighted that apart

from workers' training and process optimization, use of latest machines can also cause an increase in the efficiency irrespective of labour's efforts.

## Conflict of Interests

There is no conflict of interest among the authors of this research paper.

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