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High-tech machine in RMG Industry: reducing SMV, lead time and boosting up the productivity

Abstract

Sewing is one of the most important processes in garment manufacturing where semi-automatic machines are widely used for production. This is a common scenario of the Bangladesh RMG sector where sewing can also be done using high tech machines instead of semi-automatic machines. The study intends to demonstrate numerical comparison between semi-automatic and high tech sewing machines and the result presents huge savings in terms of SMV, manpower and cost for an organization. The study was conducted the appraisal for collar, cuff & flap making, pocket joining, sleeve placket creasing and button attaching process for a basic full sleeve woven shirt. These appraisals of both types of machines were done by collecting primary and secondary data. Required SMV, manpower and cost of a process were collected of both semi-automatic and high-tech machines. The result of the study provides smaller number of process, SMV, manpower and cost by using high-tech machine which is huge industrial savings and economic. So, the apparel manufacturers will get a strong reflection of the cost and productivity impact of using high tech machines.

Keywords: sewing, high-tech, SMV, manpower, salary, production cost, lead time

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Introduction

Bangladesh is one of the leading exporters of Ready-Made Garments throughout the world standing just after China. A lion share of foreign currency has been earned from this sector an overwhelming 82% of Bangladesh's total merchandise export.[1] So, RMG sector has a direct influence on its economic development. Adding to this, around 75% of people in Bangladesh are involved with this industry directly or indirectly. So a large amount of people is interlinked with that sector and thus reflects the importance of the sector for its upcoming future. However, the scenario has changed a lot since this industry started sailing in Bangladesh with the establishment of Desh Garment, the first ever readymade garment industry in our country. Although we have emerged as one of the key exporters in this industry, the introduction of High-tech machinery in the industry is yet to be done in a broader way. Still a small amount of industries is interested to invest in using high tech machines. But the fashion industry is witnessing the advent of exciting new technology, which will change the future of the business.[2] Besides, there are several functions in the readymade garment industry but sewing section can be considered as one of the most important and valuable functions. Now a day's apparel manufacturing industries are trying to develop their current production system and situation and continuously looking for new production tools and techniques in order to keep swiftness with the rapid changes of trend in consumers of apparel products.[3] Various kinds of research and innovations are continuing for different sections of the sector. Currently in our RMG industry sewing procedure has to undergo mostly by semi-automatically which consumes a substantial amount of time like other sections in the garments.[4] Thus, it creates a significant impact over lead time. Many processes are available which are taking a lot of time but not adding value in proportion to that. So to deal with the recent problems & challenges industries have to improve production efficiency & productivity, reduce lead time, ensuring proper quality requirements.[3] On this point introduction of automatic sewing machine in sewing section can play a vital role to increase productivity and to reduce lead time. Various kinds of high tech sewing machines using for different processes can lead to reduce the time. The study focuses on the implementation of high tech machine in place of semi-automatic and demonstrates a huge industrial saving. These approaches have been influential in the field because of high tech machine increases productivity and feasibility. Moving forward to technology will not only help to face the challenges but also strengthen the existence in the competitive global market.[5] Reducing manpower can allow the employer to open more lines using the same number of manpower.

Objective of the study

The precise objectives of the study are to find out the difference between conventional and high tech sewing machine procedures to estimate SMV, manpower cost and production cost in garments. Although the study was experimental based on a full sleeve woven shirt, it is applicable to other garments as well. The study was conducted to develop the reduction techniques for time and manpower using high-tech sewing machine.

Limitations

The unattainability of high tech machinery is the main limitation of the study. On the other hand, during collecting data, there was a time limitation to conduct the process on the production floor. Availability of low-priced labor cost influence employers to depend on manpower and discouraged to use high tech machines though it is financially benefited.

Methodology

This study provides emphasis on numerical comparison of semi-automatic and high tech sewing machines in the sewing section of a garments industry. For signifying that comparison primary and secondary data were collected for both semi-automatic and high tech machine's SMV (standard minute value), manpower and wages for completing a basic full sleeve woven shirt. The comparison was completed using collar attaching, cuff & flap making, and pocket joining, sleeve placket creasing and button attaching. The comparison between two types of machine provides numerical difference which

shows a compact whole process difference of time, cost saving during a full sleeve shirt manufacturing. SMV, required manpower and wages of a full sleeve woven shirt were collected from two different factories of Bangladesh for both semi-automatic and high-tech sewing machines. The traditional process breakdown of a shirt was used for high- tech sewing machines.

Calculation of SMV and manpower using the conventional machine

The following table demonstrations the process breakdown, SMV and required manpower for making a basic full sleeve woven shirt using the conventional sewing machine (Table 1). The study shows that it takes approximately 24.75 minutes and 75 workers to complete its sewing only. It is not a small figure at all during this competitive apparel market while concerning various issues like limited lead time, higher production cost, lower productivity etc.

Table 1 Conventional machine: process breakdown, SMV, manpower

SL	Process	SMV	Manpower
Collar, Cuff & Flap			
1	Collar interlining laying and fusing	0.30	1
2	Collar make mark	0.30	1
3	Collar make	0.35	1
4	Collar trim & turn	0.30	1
5	Collar top stitch	0.30	1
6	Collar band laying & fusing	0.30	1
7	Collar band rulling	0.30	1
8	Collar & band match	0.30	1
9	Collar band join	0.40	1
10	Collar band trim & turn	0.30	1
11	Collar band top stitch	0.30	1
12	Cuff laying & fusing	0.30	1
13	Cuff make mark	0.35	1
14	Cuff rulling	0.35	1
15	Cuff make	0.45	1
16	Cuff trim & turn	0.35	1
17	Cuff top stitch	0.40	1
18	Flap laying & fusing	0.30	1
19	Flap make mark	0.35	1
20	Flap make	0.45	1
21	Flap trim & turn	0.35	1
22	Flap top stitch	0.40	1
Front			
23	Front pair tuck	0.30	1
24	Button plate by folder	0.35	1
25	Box plate	0.30	1
26	Pocket rulling	0.35	1
27	Pocket iron	0.60	1
Collar, Cuff & Flap			
28	Pocket trimming	0.25	1
29	Pocket position mark	0.40	1
30	Pocket join	0.90	2
31	Flap join mark	0.30	1
32	Flap join	0.35	1
33	Flap top stitch	0.35	1
34	Front fitting	0.35	1
Back			
35	Size label attach to main label	0.30	1
36	Main label attach to yoke	0.30	1
37	Back dart make	0.40	1
38	Back yoke join	0.40	1
39	Back yoke top stitch	0.30	1
40	Back fitting	0.30	1
Assemble			
41	Front and Back match	0.30	1
42	Front join	0.40	1
43	Shoulder top stitch	0.30	1
44	Collar match	0.30	1
45	Collar join	0.40	1
46	Collar closed	0.45	2
47	Gamble join	0.35	1
48	Gamble tuck	0.35	1
49	Half sleeve placket cut & creasing	0.45	1
50	Sleeve placket final creasing	0.30	1
51	Sleeve placket join	0.80	2
52	Armhole scissoring	0.30	1
53	Sleeve match	0.30	1
54	Sleeve join	0.50	2
55	Sleeve top stitch	0.55	2
56	Care label attach	0.30	1
57	Side scissoring	0.30	1
58	Side top stitch	0.55	2
59	Cuff match	0.35	1
60	Cuff join	0.80	2
61	Bottom hem scissoring	0.35	1
62	Bottom hem	0.40	1
63	Body hole	0.35	1
64	Button attach mark	0.30	2
65	Button attach	0.35	1
66	Thread trimming	0.35	2
Total		**24.75**	**75**

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Comparison of processes: using both conventional and high-tech machines

The making processes of a full sleeve shirt were compared using both the conventional and high-tech sewing machines. Those processes were collar cuff and flap making, pocket joining, sleeve creasing and button attaching. For comparing the data of semi-automatic and high-tech machines, they are demonstrated chronologically.

Collar, cuff and flap making

The comparison was done based on a 'six lines' sewing floor. For this comparison semi-automatic process of the collar, cuff and flap including its required SMV, worker and wages were presented separately but high-tech processes were revealed all together as all the process sequences were similar.

Semi-automatic process of collar, cuff and flap making: From the process flow chart (Table 1) for completing collar cuff and flap make per shirt in the conventional process, various processes were required. The following process consumed 6.2 minutes and 18 workers where these workers cost was $1528. The calculation was prepared for only 1 line. For six lines or per floor calculation, required 18x6=108 workers and $1528x6=$9168 (Table 2).

Table 2 Semi-automatic process of collar, cuff and flap making

SL	Process	SMV	Worker	Salary
1	Collar interlining laying and fusing	0.30	1	$85
2	Collar make mark	0.30	1	$78
3	Collar make	0.35	1	$90
4	Collar trim & turn	0.30	1	$78
5	Collar top stitch	0.30	1	$90
6	Collar band laying & fusing	0.30	1	$85
7	Collar band rulling	0.30	1	$90
8	Cuff laying & fusing	0.30	1	$85
9	Cuff make mark	0.35	1	$78
10	Cuff rulling	0.35	1	$90
11	Cuff make	0.45	1	$90
12	Cuff trim & turn	0.35	1	$78
13	Cuff top stitch	0.40	1	$90
14	Flap laying & fusing	0.30	1	$85
15	Flap make mark	0.35	1	$78
16	Flap make	0.45	1	$90
17	Flap trim & turn	0.35	1	$78
18	Flap top stitch	0.40	1	$90
Total		**6.2**	**18**	**$1,528**

Proposed process of collar, cuff and flap making: For completing this process high tech collars, cuff and flap making machine were used. Using this high tech machine point toward fewer process requirements than the semi-automatic (Table 3).

The process (Table 3) completing collar, cuff & flap making per shirt in the estimated high-tech process required four steps which less than the semi-automatic process. This process consumed 4.63 minutes and 9 workers where these workers cost was only $805. This calculation was for only 1 line. For six lines or per floor calculation this required 9x6=54 workers and $805x6=$4830.

Table 3 High-tech machine for collar, cuff and flap

SL	Process	SMV	Worker	Salary
1	Interlining laying & fusing	1.5	1	$85
2	Collar, cuff & flap make	1.2	3	$270
3	Trim & turn	0.90	2	$180
4	Topstitch	1.03	3	$270
Total		**4.63**	**9**	**$805**

Difference between semi-automatic and proposed process for collar, cuff and flap making: So, selecting high tech for collar, cuff & flap making instead of conventional can minimize a considerable figure. It saved a total of 1.57 minutes time, 54 workers and $4338USD for 1 floor containing 6 lines. Cost per collar, cuff and flap making high tech machine was $2,040. Six lines required 18 machines, 3 per line costing $2,040x18=$36720. Machine reduction cost per month was higher than other machines as more machine were required about 36720/120=$306 for 10 years. So, the net profit was calculated $4338-$306=$4032 per floor (Table 4).

Table 4 Difference for collar, cuff and flap making between semi-automatic and high-tech machine for 6 lines

Method	SMV	Worker	Salary
Semi-automatic	6.2	108	$9,168
High tech	4.63	54	$4,830
Economize	1.57	54	$4,338

Pockets joining

This comparison also was completed based on the 'six lines' sewing floor. First of all, the semi-automatic process of the pocket joining was shown. That was a basic double pocket shirt. Then finally representing the high-tech machine procedure to estimate the comparison between two processes.

Semi-automatic process of pockets joining: In the conventional process required five processes for completing pocket join per shirt. These processes required 2.5 minutes and 6 workers where these workers cost was $511. For six lines or per floor calculation required 6x6=36 workers and $511x6=$3066 (Table 5).

Proposed process of pockets joining: From the proposed process joining of the pocket was done by using pocket creasing & setter machine. This machine is more efficient and time consuming than semi-automatic (Table 6). For completing pocket join per shirt in the projected high-tech process required only two processes instead of five. These processes required 1.2 minutes and 2 workers where these workers cost was only $180.For six lines or per floor calculation required 2x6=12 workers and $180x6=$1080.

Difference between semi-automatic and proposed process for pockets joining: So, selecting high tech for pocket joining instead of conventional it saved 3 extra processes, 1.3 minutes, 24 workers costing $1986. The calculation was only for 1 floor containing 6 lines. It will be increased with the increasing number of floors. Cost per

pocket joining high tech machine was $20,430. For six lines required six machines costing $20,430x6=$122,580. Machine reduction cost per month was about 122,580/120=$1021.5 for 10 years. So, the net profit was calculated $1986-$1021.5=$964.5 per floor (Table 7).

Table 5 Semi-automatic Process of pocket Joining

SL	Process	SMV	Worker	Salary
1	Pocket rulling	0.35	1	$90
2	Pocket iron	0.60	1	$85
3	Pocket trimming	0.25	1	$78
4	Pocket position mark	0.40	1	$78
5	Pocket join	0.90	2	$180
Total		**2.5**	**6**	**$511**

Table 6 High-tech machine process of pocket joining

SL	Process	SMV	Worker	Salary
1	Pocket rulling	0.35	1	$90
2	Pocket creasing & join	0.83	1	$90
Total		**1.2**	**2**	**$180**

Table 7 Difference for pocket joining between semi-automatic and high-tech machine for 6 lines

Method	SMV	Worker	Salary
Semi-automatic	2.5	36	$3,066
High tech	1.2	12	$1,080
Save	1.3	24	$1,986

Sleeve placket creasing

This comparison was also done based on the 'six lines' sewing floor. First of all, the semi-automatic process of the sleeve placket creasing was presented. Then finally signifying the high-tech machine procedure escort the study to show the comparison.

Semi-automatic process of sleeve placket creasing

To complete sleeve placket creasing per shirt in the conventional process two procedures were required. These procedures required 0.75 minutes and 2 workers where these workers cost was only $170. This calculation was for only 1 line. For six lines or per floor calculation required 2x6=12 workers and $170x6=$1020 (Table 8).

Proposed process of sleeve placket creasing

In the proposed process sleeve placket creasing is done by using laser sleeve placket creaser machine. By using this machine one process was able to reduce (Table 9).

To complete sleeve placket creasing per shirt in the estimated high-tech process it required only one process instead of two.

This process required 0.163 minute and one-third worker where this worker cost was only $30. This calculation was for only 1 line. For six lines or per floor calculation this required 1/3x6=2 workers and $30x6=$180.

Table 8 Semi-automatic process of sleeve placket creasing

SL	Process	SMV	Worker	Salary
1	Half sleeve placket cut & creasing	0.45	1	$85
2	Sleeve placket final creasing	0.30	1	$85
Total		**0.75**	**2**	**$170**

Table 9 High-tech machine process of sleeve placket creasing

SL	Process	SMV	Worker	Salary
1	Sleeve placket creasing	0.163	1 for 3 lines	$90/3
Total		**0.163**	**3-Jan**	**$30**

Difference between semi-automatic and proposed process for sleeve placket creasing

So, selecting high tech machine for sleeve placket creasing instead of conventional can minimize 1 extra process, 0.587 minutes, and 10 workers and costing $840. So, for 6 lines, 1 floor cost per sleeve placket creasing high tech machine was $5,300. For six lines required only two machines costing $5,300x2=$10,600. Machine reduction cost per month was about 10,600/120=$88.33 for 10 years. So, the net profit was calculated $840-$88.33=$751.66 per floor (Table 10).

Table 10 Difference for sleeve placket creasing between semi-automatic and high-tech machine for 6 lines

Method	SMV	Worker	Salary
Semi-automatic	0.75	12	$1,020
High tech	0.163	2	$180
Save	**0.587**	**10**	**$840**

Button attaching

This comparison was also done based on the 'six lines' sewing floor. First of all, the semi-automatic process of button attaching is presented. Lastly indicating the high-tech machine procedure leads the result to show the comparison.

Semi-automatic process of button attaching: To complete button attaching per shirt in the conventional method three processes were required. These processes required 1 minute and 4 workers where cost was $336. This calculation was for only 1 line. For six lines or per floor calculation required 4x6=24 workers and $336x6=$2016 (Table 11).

Proposed process of button attaching: In the proposed process button attaching was done by using auto button hole and attaching machine. This machine consuming less time that the semi-automatically operated one (Table 12).

To complete button attaching per shirt in the planned high-tech process it required only two processes instead of three.

This process required 0.27 minute and two third workers where these workers cost was only $60. This calculation was for only 1 line. For six lines or per floor calculation this required 2/3x6=4 workers and $60x6=$360.

Difference between semi-automatic and proposed process for button attaching: So, selecting high tech for button attaching

instead of conventional can reduce 1 extra process, 0.73 minutes, 20 workers costing $1656. Cost per button attaching high tech machine was $23,200. For six lines required four machines costing $23,200x4=$92,800. Machine reduction cost per month was about 92,800/120=$773.33 for 10 years. So, the net profit was calculated $1656-$773.33=$882.67 per floor (Table 13).

Table 11 Semi-automatic process of button attaching

SL	Process	SMV	Worker	Salary
1	Body hole	0.35	1	$90
2	Button attach mark	0.30	2	$156
3	Button attach	0.35	1	$90
Total		**1**	**4**	**$336**

Table 12 High-tech machine process of button attaching

SL	Process	SMV	Worker	Salary
1	Body hole	0.15	1 for 3 lines	$90/3
2	Button attach	0.12	1 for 3 lines	$90/3
Total		**0.27**	**2/3**	**$60**

Table 13 Difference of button attaching between semi-automatic and high-tech machine for 6 lines

Method	SMV	Worker	Salary
Semi-automatic	1	24	$2,016
High tech	0.27	4	$360
Save	**0.73**	**20**	**$1,656**

Result and discussion

This is an important finding in the understanding of the financial benefits of high-tech machines implementation. Finally, it can be stated that from the collar, cuff and flap comparison, total industrial saving is 1.57 minutes from the processes, $4338 by removing 54 extra workers. It also helps to increase productivity by optimum utilization of resources. Chronologically from pocket joining, total savings for SMV, worker and salary is 1.3 minutes, 24 workers and $1986. From sleeve, creasing difference is 0.587 minutes, 10 workers, $840. Lastly, from button attaching 0.73 minutes, 20 workers and $1656 can be reduced. So, this is considerable savings collectively for all categories and is estimated for one floor of six lines and one month. Together, the present findings confirm that that industry will be benefited financially with shortened lead time by substituting high tech machines instead of semi-automatic (Table 14).

Planned comparisons revealed that savings of SMV, manpower and salary from four comparisons. The comparison was for four important processes during collar cuff and flap making, pocket joining, placket creasing and button attaching. Firstly, from the data of conventional collar cuff and flap making, it indicates that it takes 6.2 minutes and 18 workers where these workers cost is $1528. For a floor of six lines that need to 108 workers and $9168. Again for high tech machine for completing same task it takes 4.63 minutes and 9 workers where these workers cost is only $805. For six lines that need 54 workers and$4830.

From this comparison using high tech instead of semi-automatic sewing machine can save 1.57 minutes SMV from this process, 54 workers and $4338 for collar, cuff and flap making. Secondly, from the data of conventional pocket joining it indicates that it takes 2.5 minutes and 6 workers where these workers cost is $511. For a floor of six lines that need to 36 workers and $3066. Again for high tech machine for completing same task it takes 1.2 minutes and 2 workers where these workers cost is only $180. For six lines it necessitate to 12 workers and $1080. From this comparison using high tech instead of semi-automatic sewing machine can save 1.3 minutes, 24 workers and $1986 for pocket joining. Thirdly, from the data of conventional sleeve placket creasing it indicates that it takes 0.75 minutes and 2 workers where these workers cost is $170. For a floor of six lines that takes 12 workers and $1020. Again for high tech machine for completing same task it takes 0.163 minutes and 1/3 workers where these workers cost is only $30. For six lines it takes 2 workers and $180. From this comparison using high tech instead of semi-automatic sewing machine can save 0.587 minute, 10 workers and $840 for Sleeve placket creasing. Finally, conventional button attaching it indicates that it takes 1 minute and 4 workers where these workers cost is $336. For a floor of six lines that need 24 workers and $2016. Again for high tech machine for completing same task it takes 0.27 minute and 2/3 workers where these workers cost is only $60. For six lines that require to 4 workers and $360. From this comparison using high tech instead of semi-automatic sewing machine can save 0.73minute, 20 workers and $1656 for button attaching.

Table 14 Total SMV, manpower and salary diminution from comparison

Process	SMV save	Worker save	Salary save
Collar, cuff & flap making	1.57	54	$4,338
Pocket joining	1.3	24	$1,986
Sleeve placket creasing	0.587	10	$840
Button attaching	0.73	20	$1,656

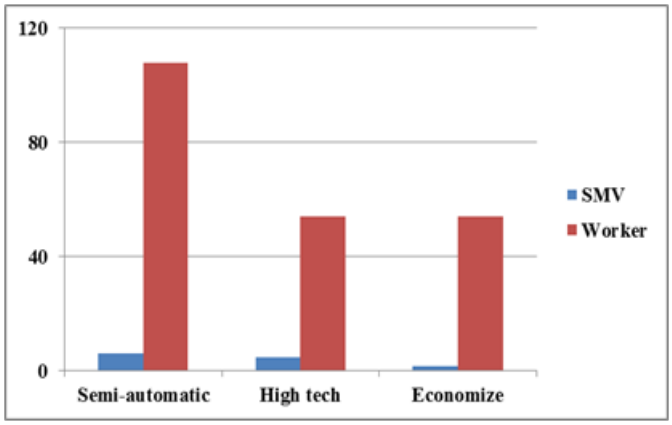

Figure 1 Comparison of collar, cuff & flap making.

Conclusion

This allows the conclusion that using high tech machine in sewing section instead of semi-automatic leads to huge manufacturing savings for the industry. Higher productivity can directly conceivable by the reduction of SMV and economically by reducing manpower as well. This may be considered a promising aspect by implementing high tack machines for production time saving from collar cuff & flap, pocket joining, sleeve placket creasing and button attaching. This may be considered a further validation of different garments manufacturing.

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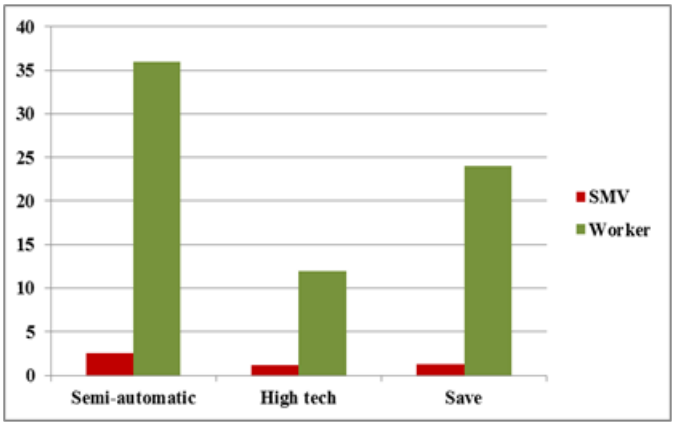

Figure 2 Comparison of pocket joining.

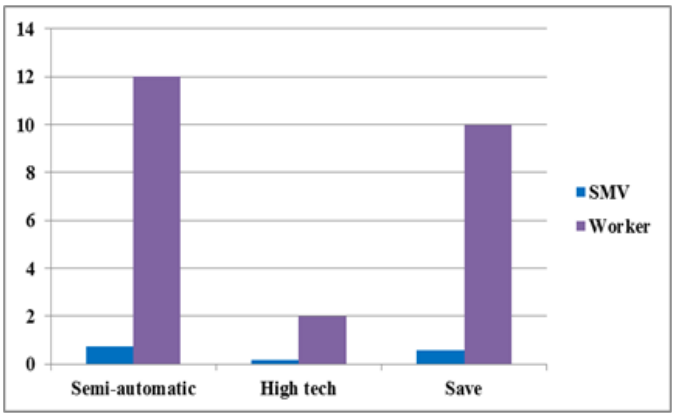

Figure 3 Comparison of sleeve placket creasing.

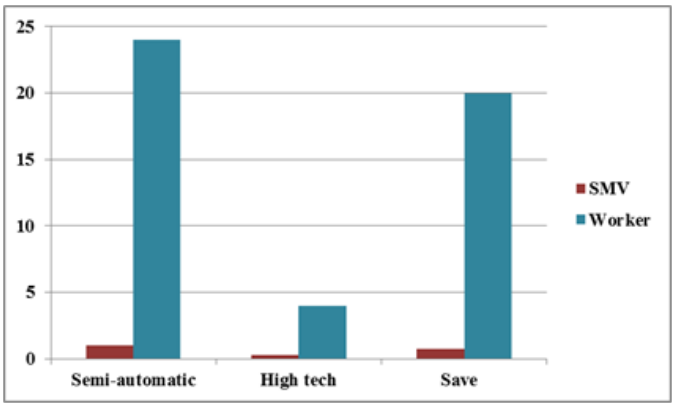

Figure 4 Comparison of button attaching.

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Conflicts of interest

Author declares there is no conflict of interest in publishing the article.

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