



Analysis of major defects and finding their root causes in a sewing section of a selected Garments factory in Bangladesh

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Abstract

Bangladesh is in lead position in RMG industries. To ensure sustainable economic growth and compete in the global market, the industries should utilize their resources properly and minimize the defects rate to secure maximum defect free production. In this research, the defects in the sewing section of a RMG factory were identified and studied. Various lean and quality control tools such as Pareto analysis, 5 whys, check sheet etc. were used to find out the significant defect types among the many defect types and the root causes behind these defects. By performing Pareto analysis it was found that the 79% of total defects were happening due to 8 frequent defect types. The reasons that reduce productivity were isolated using cause and effect diagram and 5 whys. Questionnaires and observations were used in this research based upon brainstorming with the workers as well as management. This research recommended that worker's efficiency was associated with proper workstation, supervision and training. Based on that, the recommendations for reducing defects were formed. For proposing the ergonomic workstation, necessary data were collected from the workers using anthropometric measurements. Findings of this research can be useful for the RMG factories upon future implementation.

Keywords: Defect, Root cause, Ergonomic workstation, Pareto analysis, Five why's analysis.

Introduction

Currently exporting over 132 countries around the world, Bangladesh is now the second largest exporter of ready-made garment products. It's estimated to double from 2010 to 2015 and nearly triple by 2022¹. According to Export Promotion Bureau (EPB) data, Bangladesh's export earnings from the RMG sector stood at \$30.61 billion, posting 8.76% growth in the last fiscal year which is 1.51% higher than the target for FY18 of the total amount². But economists say this growth is not up to mark, considering the industry's true potential. Proper and efficient utilization of resources is needed to be planned to reach its true potential. Wastes, mainly defects hinder to reach the target.

Bangladesh has an advantages of low wages with respect to other countries like Vietnam, Cambodia, and China etc³. But Bangladeshi RMG products cannot enjoy competitive price advantage for a number of reasons. Currently, the textile industry's garment units of Bangladesh produce about 500,000 tons of waste material annually which can sometimes be as much as 47% of the total raw material input of production⁴. According to research, 100% respondents face problems in production, followed by 75% in quality, 25% in backward linkage, and 25% in price⁵. So, wastes are one of the major obstacles to achieve the target. About 6.37 percent of waste was leftover from sewing and 0.09 percent from quality control⁶.

The global market for RMG products has become more competitive than ever as some new countries like Cambodia, Sri-Lanka, Pakistan, Turkey, etc. are emerging in the world market with RMG products⁴. So, to sustain the RMG sector in international market, it is necessary to analyze the quality of our existing facility and try to improve them to compete on global platform. In this industry, product quality can be calculated by different kind of scale⁷. According to Atilgan, "If in the past were accepted levels of 1.5 or 4% defects, today there are companies that measured their production error in percentages per million"⁸.

Defects are all those non-conformances that are not acceptable by the end customer like the imbalanced shape of the garments. In a defective garment, there may be more than one defect. Defects maybe result of some technical deficiency of the production system which can be categorized as machines, method, materials, operators etc. Sewing section joins together the fabrics with the help of different types of sewing machine, threads and needle. And for any kind of process variation following frequent defects may be occurred:

Pleat: When the fabric does not place plane after stitching.

Broken Stitch: Where a "splice" occurs on the stitch line

Drop stitch/Skipped stitch: Irregular stitching along the seam.

Uneven Stitch: Where the stitching line are not even.

Oil spot: Where oil spot appears during sewing fabric. This is unwanted and reduces the acceptance rate of the product.

Uncut Thread: where some excess unnecessary thread is present.

Open seam: It means stitch gap or missing during joining.

Other common defects are wavy/staggered stitching, seam slippage, puckering/ sharing/ loose, tension bad, improper stitch balance, over stitch, stitch breakage, tension loose / low⁹.

The objectives of this research were to measure the defect rate of specific sewing section in selected garments factory, to identify the significant defects and their root causes using related QC tools and to suggest possible solutions as well as recommendations to reduce the defects.

Methodology

The research has emphasized mainly on measuring the number of defects and finding their root causes. The research methodology adopted for this research was brain storming, physical inspection and interview of workers and supervisors.

The selected garments industry was suffered from a vast number of defective products. So, the reasons behind the problem were needed to be identified and analyzed to find the solution. Some initial investigation, more books form different writers, research papers were studied. It gave the idea to choose the proper methods for the research. Then the factory was visited to get further information, to observe the processes and made some initial discussions with line inspector to identify the factors that were relevant with low productivity. A set of questionnaires was prepared based on the experience in factory visit and literature review. 150 workers have answered the questionnaires. Based on the answers from the questionnaires the next steps were decided.

Data of defective items for a single type of product which data were retrieved from production lines of the industry with the help of quality department by using check sheet which can be defined as a document used to collect qualitative or quantitative data in real time at the location where the data is generated. The causes of poor process performance were discussed with line supervisors and the industrial engineers of the factory by formatting a team for brainstorming. After data collection, they were analyzed by using several tools and techniques. They are:

Pareto Analysis: Pareto analysis is a simple technique for identifying top portion of causes that need to be solved to be addressed to resolve the majority of problem. By using the approach, the factors which have greatest impact can be prioritized. Pareto analysis is useful where many possible courses of action are competing for attention.

A fishbone diagram: It also called a cause and effect diagram, is a visualization tool for categorizing the potential causes of a problem in order to identify its root causes.

The defect is shown as the fish's head, the ribs branch off the backbone for major causes, with sub-branches for root-causes, to as many levels as required.

5 whys: It is a lean tool which is also used in this research to find out the root cause behind the defects by repeating the question "Why?" Each answer forms the basis of the next question. Several changes were recommended based on the analysis.

Overview of the factory: The research was conducted in knit based Ready-Made factory. Three basic sections of the factory were- Cutting, Sewing and Finishing. In this research the defects of sewing were analyzed. The sewing section uses a line layout. In the line a center table was placed in between two rows of sewing machines. All operators sat on workstation facing same direction. Operators picked bundles from center table and after stitching dispose bundles on the center tables.

Analysis of the defects using cause and effect diagram: Data Collection: This research used data for a lot of one specific garments item (T-shirt) which was produced for 10 days by using 10 sewing lines. Firstly, the data for the occurring defects were collected from check sheets which were prepared by the end line quality inspectors.

Table-1: Overview of the collected data.

Items	T-shirt
Total number of lines	10
Total checked	105353
Defects found	4403

The Table-2 shows the defects occurring in the industry and the total number of defects for each defect type. The total number of defects was 4403. DHU stands for defects per hundred units.

DHU of overall production= Total defects / total production = $(4403/105353) = 0.0417928 = 4.18\%$

Pareto Analysis: In Pareto chart visually depicts which data groups are more significant. The Pareto chart alone with the physical outlook of the defects is shown in Figure-1.

The Figure-1 shows that 79% of total defects whose amount is 3466 out of 4403 defects were of 8 defect types. So those defects can be identified as vital defects responsible for the total defects.

Worker Survey: The response of worker was collected from 150 workers from whose 93 were female and 57 were male

working in sewing section of the factory based on 5 liking parameters were selected. The responses are expressed in percentage which are shown in Table-3.

These opinions of the workers of the sewing floor were about their working condition. Their responses helped us to find out the recommendations to improve the condition.

Cause and Effect Diagram: Cause & Effect diagram identifies potential causes under 4 M's categories (Man, Machine, Method and Material) on the basis of root causes identified by the online inspection, physical observation and questionnaires.

Root cause analysis: Brainstorming: In the process Round Robin method was carried out with the presence of Industrial Engineer, factory manager, end line quality inspector, line supervisor and some operators. They are encouraged to suggest as many ideas as possible, no matter seemingly how bizarre. Their shared thoughts and ideas were listed on a document for further analysis.

Five Whys Analysis: Its primary goal is to find the exact reason that causes a given problem by asking a sequence of "Why" questions.

Defect name	Total	Percent defective
Oil spot	830	18.85%
Uncut thread	725	16.47%
Up-down	434	9.86%
Broken stitch	384	8.72%
Pleat	352	7.99%
Open seam	311	7.06%
Skip stitch	226	5.13%
Un-even	204	4.63%
Dirty spot	156	3.54%
Join stitch	152	3.45%
Rawedge	142	3.23%
Reverse	98	2.23%
Level fault	92	2.09%
Improper tuck	89	2.02%
Drop stitch	65	1.48%
Twisting	50	1.14%
Slanted	41	0.93%
Needle cut	19	0.43%
Shading	12	0.27%
Wrong spi	12	0.27%
Thread mistake	5	0.11%
Thread tension	3	0.07%
Puckering	1	0.02%

Table-2: Total Number of Defects Found for T-shirt.

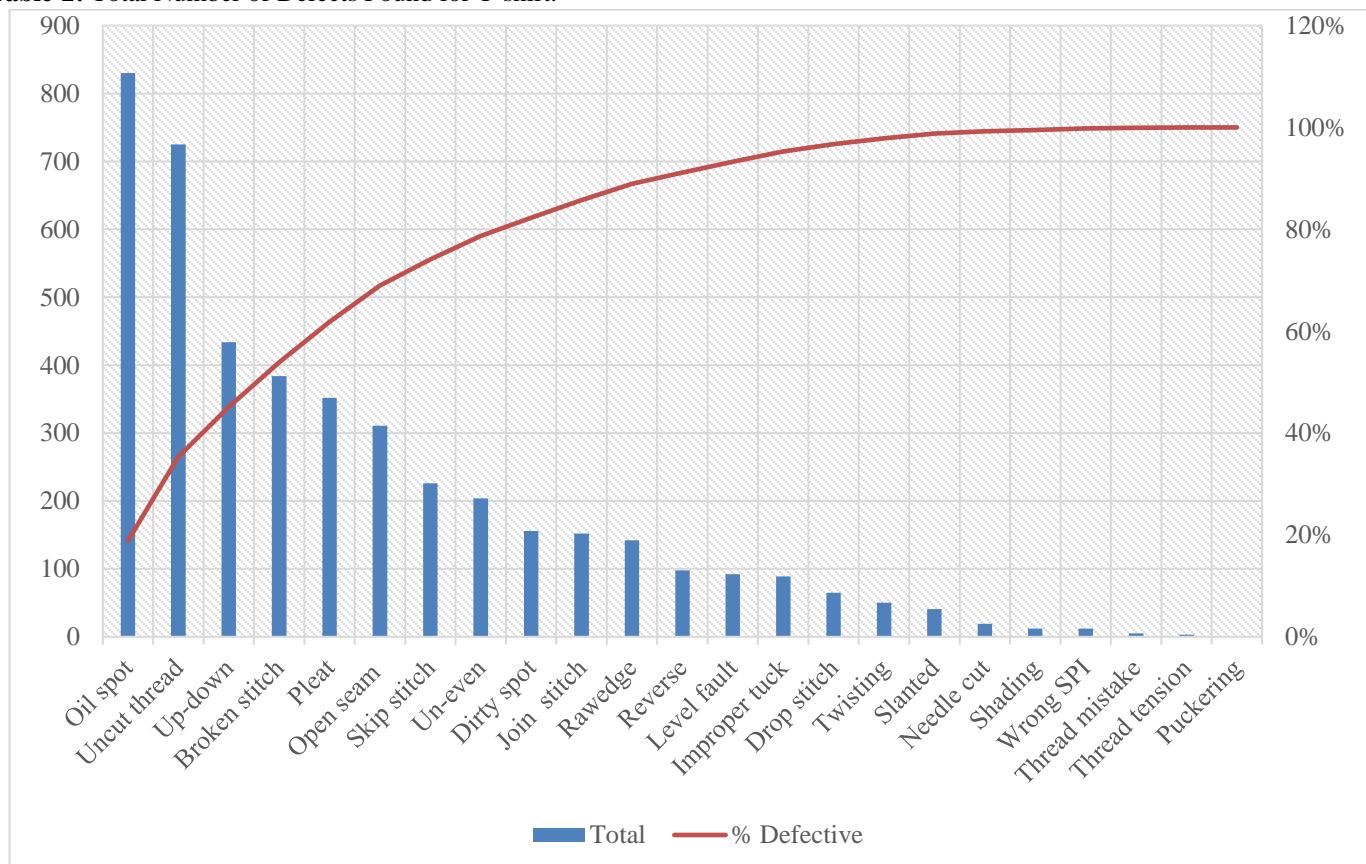


Figure-1: Pareto chart for the defects occurred in factory.

Table-3: responses of worker.

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
More supervision is needed	10	37	26	19	8
The authority provides frequent skill enhancement training	5	8	27	56	4
Enough breaks to reduce fatigue	0	9	3	78	10
Working posture affects the worker's health	0	93	0	7	0
Sitting arrangement is considered as a reason of back pain	6	24	43	18	9
Workstation is comfortable	0	2	6	76	16
You are comfortable with the current work chair	0	3	4	63	30
You are comfortable with the current working table	0	3	10	57	30
You have to bend too much to operate	27	46	16	9	2
Floor supervisor knows the work well	6	46	31	23	4

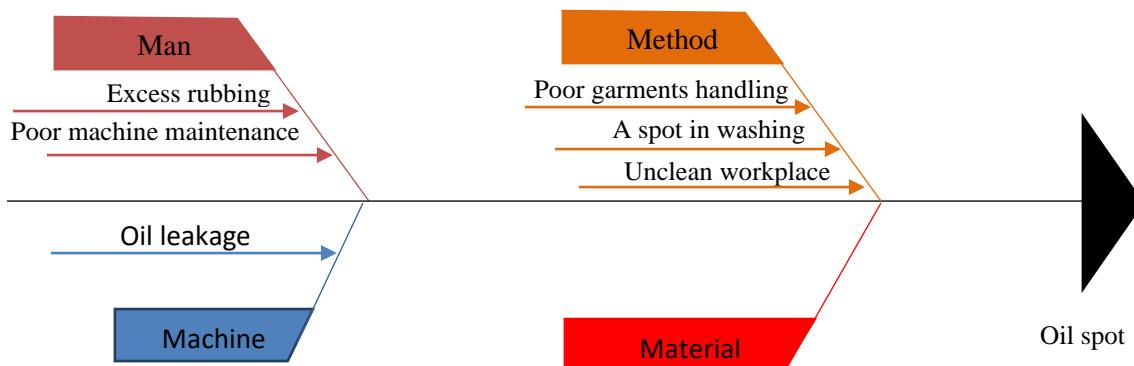


Figure 2: Cause & Effect diagram for oil spot.

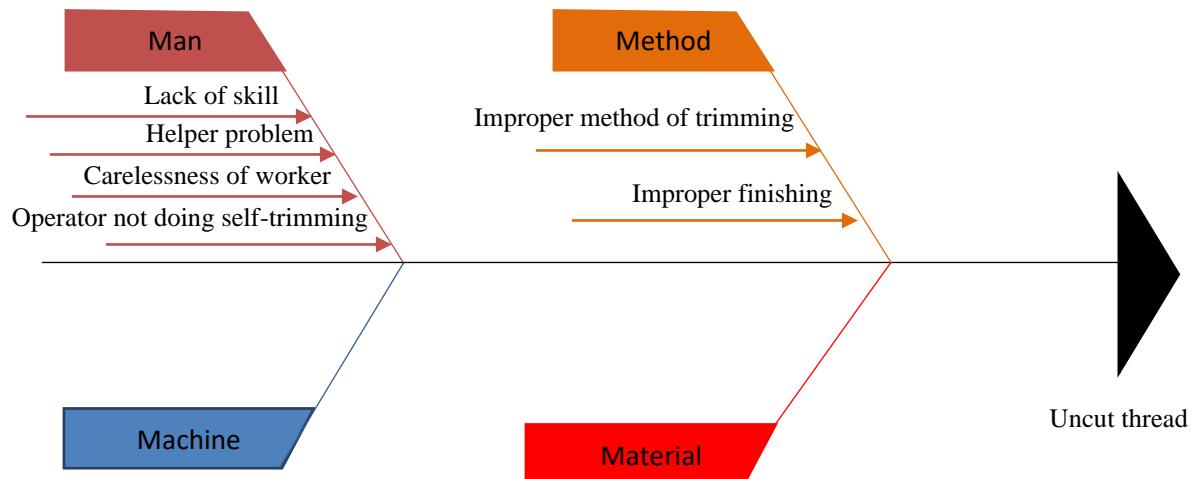


Figure 3: Cause & Effect diagram for uncut thread.

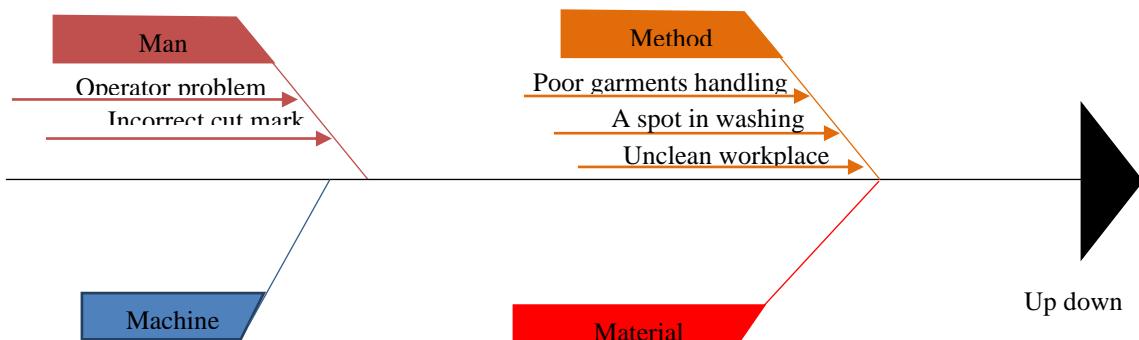


Figure 4: Cause & Effect diagram for up-down.

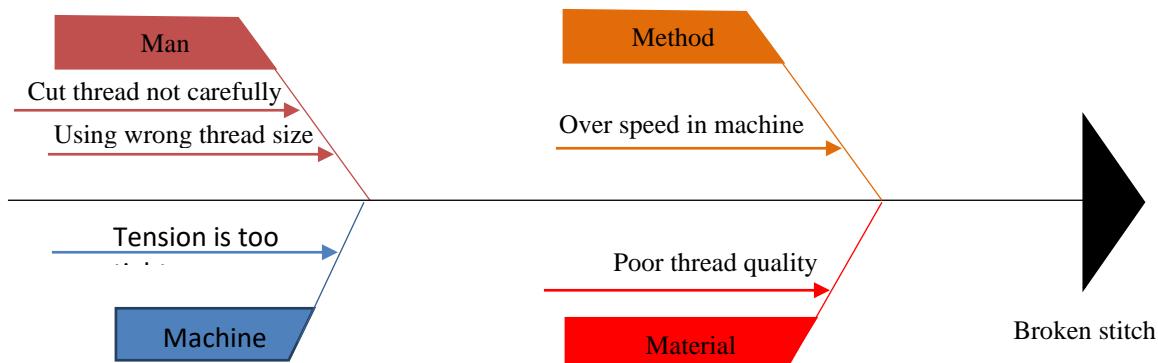


Figure 5: Cause & Effect diagram for broken stitch.

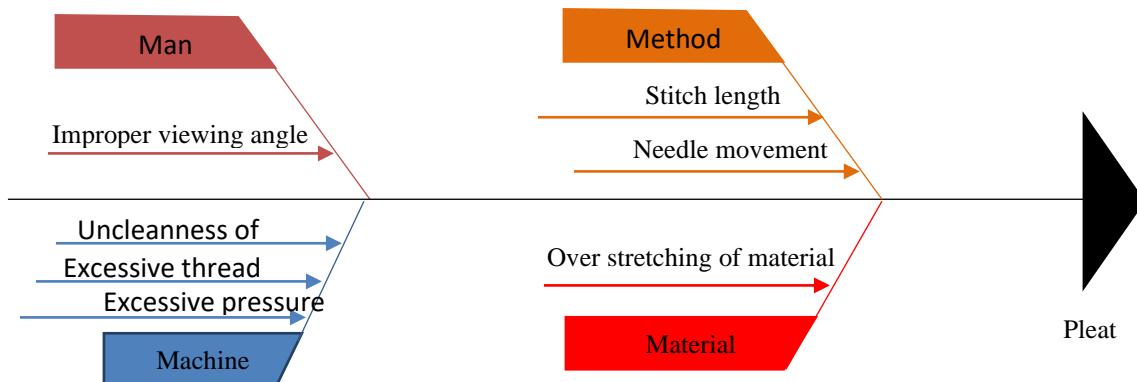


Figure 6: Cause & Effect diagram for pleat.

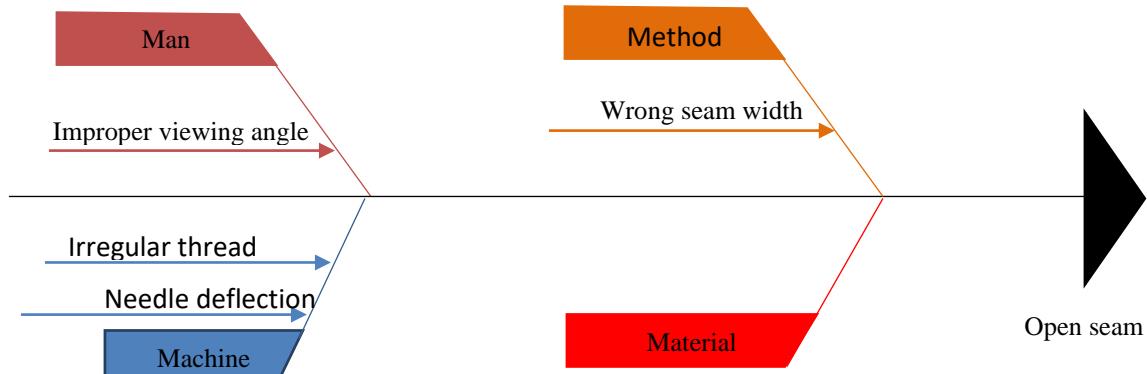


Figure-7: Cause & Effect diagram for open seam.

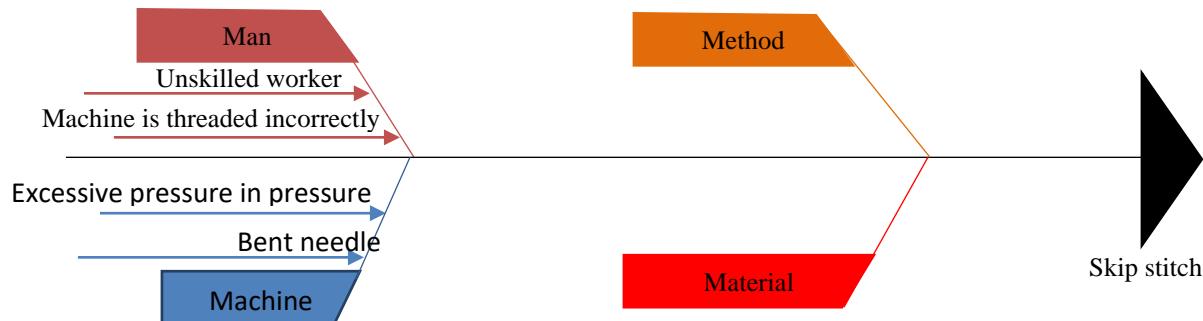


Figure-8: Cause & Effect diagram for skip stitch.

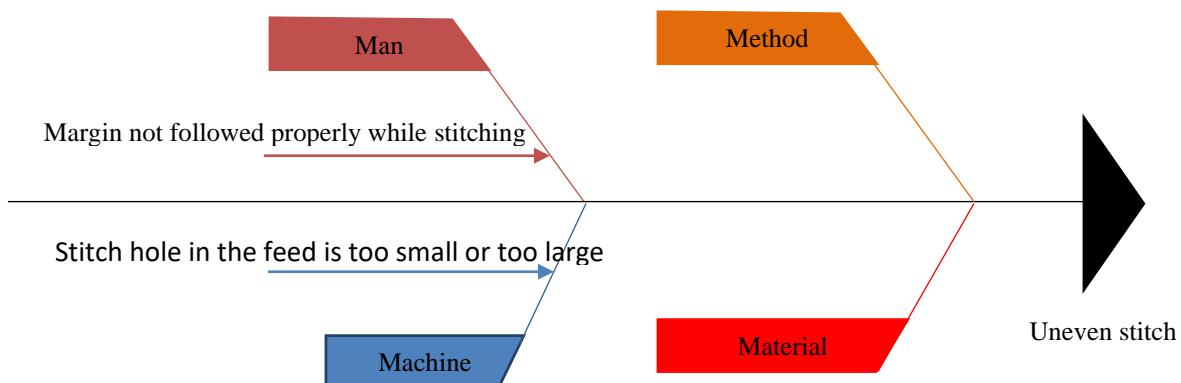


Figure-9: Cause & Effect diagram for uneven stitch.

Table-4: Root causes of oil spot.

Causes	Man		Method			Machine
Oil spot	Excess Rubbing	Poor machine maintenance	Poor garments handling	Unclean workplace	A spot in washing	Oil leakage
1 st why	Unclean hand	Carelessness of the worker	Garments are passed in improper way	Dirty surroundings	Ratio of ingredients in washing agent isn't proper	Excess lubrication
2 nd why	Handling the clothes repetitively	Supervisors not monitoring properly	Garments are passing by rubbing	Workplace are not being cleaned by the workers	Operator doesn't maintain the ratio	Operator doesn't know required amount
3 rd why	No proper system to deliver the clothes from one station to another	Negligence from the supervision	Garments are pushing forward on desk	Worker being reluctant to keep the workplace clean	Don't value the importance of ratio of ingredients	No standard is used properly
4 th why	Workstation doesn't have any option to deliver clothes	Less involvement of the top management	No alternative is used	Less awareness	Lack of knowledge	Lack of skill
5 th why	Non-ergonomic station	Non active top management	non sincere top management	Lack of knowledge	Lack of training	Lack of training
Root Cause	Non-ergonomic station	Insincere top management	No good handling alternatives	Lack of training	Improper training	Insufficient training

Table-5: Root causes of uncut thread.

Causes	Man				Method	
Uncut thread	Operator	Carelessness of worker	Lack of skill	Operator not doing self-trimming	Improper method of trimming	Improper finishing
1 st why	New operator requires time to get the skills	Absent minded	Not being specialized in the tasks on hand	Uncut threads are unnoticed	Trimming isn't done properly	Threads are spread randomly
2 nd why	Frequent operator turnover	Lack of concentration	Not knowing the proper steps of operating the machine	Less concentration of the operator	Lack of worker skill.	Needle is not working properly
3 rd why	Operator quit job for various pain from fatigue.	Less motivation.	Less awareness	Reduction in concentration due to uncomfortable workstation	Worker isn't instructed properly	Poor maintenance
4 th why	Bad posture occurs	Fatigue	Lack of knowledge	Uncomfortable workstation	Supervisor doesn't instruct	Lack of skill
5 th why	Having no ergonomic workstation for the worker	Not having enough breaks in between the working hour	Insufficient training	Non-ergonomic workstation	Supervisor doesn't emphasize on it	Amateur worker
Root Cause	No ergonomic workstation	Less interval between working hours	Lack of training	Non-ergonomic workstation	Lack of supervision	Insufficient training

Table-6: Root causes of Up-down.

Causes	Man			Method	
Up-down	Operator problem		Incorrect cut mark	Cutting problem	Improper handling of the cut piece
1 st why	New operator requires time to get the skills		Carelessness of the worker	Doesn't maintain the dimensions in cutting	Garments are passed in improper way
2 nd why	Frequent operator turnover		Being less careful during measurement	Improper height of working table	Garments are passing by rubbing
3 rd why	Operator quit the job for various pain from		Less concentration	Table height isn't fit the worker	Garments are pushed forward on desk.
4 th why	Bad working posture		Fatigue	Table isn't height adjustable	No alternative is used
5 th why	Having no ergonomic workstation for the worker		Not having enough breaks between the working hour	Height adjustable table isn't provided	Top management isn't sincere about it
Root Cause	No ergonomic workstation		Less interval between working hours	Absence of ergonomic workstation	Absence of good handling alternatives

Table 7: Root causes of broken stitch

Causes	Man		Method	Material	Machine
Broken Stitch	Using wrong thread size	Cut thread carelessly	Over speed in machine	Poor thread quality	Tension is too tight
1 st why	Thread size doesn't match the desired one	Worker missed the uncut threads	Machine speed isn't adjusted regularly	Poor quality thread is supplied	Machine isn't adjusted correctly
2 nd why	Inability of the worker to detect the mistake	Worker being careless	Maintenance team doesn't check regularly	Same supplier is used.	Operator doesn't know to adjust
3 rd why	Improper viewing angle on the table top	Lesser attention during work	They treat it as unnecessary work	Quality inspection isn't done regularly	Proper guidance isn't provided
4 th why	No option for tilting the top of the work table	Fatigue	Lack of motivation	Improper procurement process is followed	Supervisor doesn't instruct worker properly to adjust
5 th why	No angle adjustment on the top of the table	Lesser breakers during work hours	Lack of leadership	top management doesn't give importance	Supervisor doesn't emphasize on it
Root Cause	Need of an alternative workstation	Insufficient work breaks	Supervision problem	Unawareness of top management	Improper supervision

Table-8: Root causes of pleat.

Causes	Man	Method		Machine			
Pleat	Improper viewing angle	Stitch length	Uncleanliness of the machine	Excessive pressure	Over stretching of the material	Needle movement	Excessive thread tension
1 st why	Improper height	Short	Dirty surroundings	Fluctuation in presser foot lever.	Intentional pushing of thread.	Improper interaction of hand wheel clutch.	Machine isn't adjusted correctly
2 nd why	Workstation doesn't fit the worker	workers being less conscious	Workplace are not being cleaned by the workers	Problem in mechanism.	Try to hurry.	Improper function of the gears.	Operator doesn't know how to adjust.
3 rd why	Same dimension of workstation is used	Less knowledge regarding measurement	Worker being reluctant to keep the workplace clean	Pressure dial isn't working properly.	Worker negligence.	Irregular lubrication.	Proper guidance isn't provided.
4 th why	Workstation isn't height adjustable	Training isn't provided	Less awareness	Worn out machine components.	Lack of motivation	Leakage	Supervisor doesn't instruct worker properly
5 th why	Proper workstation isn't provided	Unwillingness of the Management	Lack of knowledge	Worn out machine.	Improper supervision.	Lack of supervision.	Supervisor doesn't emphasize on it.
Root Cause	Absence of Ergonomic workstation	Less emphasize on training	Less training	Worn out machine.	Lack of supervision.	Irregular maintenance.	Improper supervision.

Table-9: Root causes of open seam.

Causes	Man	Method	Machine	
Open seam	Improper viewing angle	Wrong seam width	Needle deflection	Irregular thread tension
1 st why	Improper Height	Less width than required is used	Pulling the fabric at higher speed than machine	Thread flow isn't simultaneous
2 nd why	Workstation doesn't fit the worker	Improper view	Worker try to hurry	Thread flow between bobbin and spool fluctuates
3 rd why	Same dimension of workstation is used	Improper viewing angle	Worker negligence	Tension devices not working properly
4 th why	Workstation isn't height adjustable	Improper height of table	Lack of motivation	Tension devices are worn out
5 th why	Proper workstation isn't provided	Workstation doesn't fit the worker	Improper supervision	Less maintenance
Root Cause	Absence of Ergonomic workstation	Absence of Ergonomic workstation	Lack of supervision	Less maintenance

Table 10: Root causes of skip stitch

Causes	Man		Method	Machine	
Skip stitch	Unskilled operator	Machine is threaded incorrectly	Too long stitch for fabric	Excessive pressure in pressure foot	Bent needle
1 st why	New operator requires time to get the skills	Incorrectly threaded in bobbin	Worker uses same stitch length for every fabric.	Fluctuation in presser foot lever	Pulling the fabric at higher speed than machine
2 nd why	Frequent operator turnover	Unawareness of worker	Worker doesn't know the proper stitch length for different fabric	Problem in mechanism	Worker try to hurry
3 rd why	Old operator quit the job for various pain from bad posture	Worker doesn't take it seriously	Supervisor doesn't instruct them properly.	Pressure dial isn't working properly	Worker negligence
4 th why	Bad posture occurs due to non-ergonomic workstation	Lack of motivation	Supervisor doesn't give importance to it.	Worn out machine components	Lack of motivation
5 th why	Having no ergonomic workstation for the worker	Lack of supervision	Lack of awareness of supervisors.	Worn out machine	Improper supervision
Root Cause	No ergonomic workstation	Lack of supervision	Lack of supervision	Worn out machine	Lack of supervision

Frequency of the Root Causes from 5 Whys Table: The Table-12 highlights the significant root causes while showing the frequency.

Figure-10 depicts 8 prominent root causes are the main reasons of occurring defects in factory. From them three of the most prominent root causes are selected. And based on the analysis a proposal of an ergonomic workstation, several recommendations for the supervision problem and training would be given.

Data collection for the ergonomic workstation:

Anthropometric Measurement: Anthropometric measurements assess the dimension of the human body to design workstation which ensures human comfort. As main motto of anthropometric design is “Let the small person reach, let the large person fit”¹⁰, 5th percentile and 95th percentile value was calculated from the mean value and standard deviation.

$$5^{\text{th}} \text{ percentile} = \text{mean} - \text{standard deviation} * 1.65$$

$$95^{\text{th}} \text{ percentile} = \text{mean} + \text{standard deviation} * 1.65^{10}$$

Table 11: Root causes of uneven stitch

Causes	Man	Method
Uneven stich	Margin isn't followed properly	The stitch hole in the feed dog is too small or large
1 st why	Margin measurements for stitch weren't checked	Proper stitch hole in feed dog isn't provided as required.
2 nd why	Carelessness of the supervision	Operator doesn't change feed dog regularly as needed
3 rd why	Supervisors often overlooks measurement mistakes of the operators	Operator doesn't know the importance of it.
4 th why	Management not being strict while following the rules and regulations	Lack of instruction from top management.
5 th why	Neglecting the rules and regulations	Unawareness of top management.
Root Cause	Improper supervision	Unawareness of top management.

Table-12: Frequency table.

Reason	Pleat	Skip stitch	Uneven stich	Open seam	Oil spot	Uncut thread	Stripe up-down	Broken Stitch	Frequency
Non-ergonomic workstation	1	1		2	1	2	2	1	10
Supervision problem	2	3	1	1		1		2	10
Lack of training	2				3	2			7
Insufficient work breaks						1	1	1	3
Unawareness of top mgt			1		1			1	3
Worn-out machine	1	1							2
Irregular maintenance	1			1					2
Absence of good handling alternatives					1		1		2
Total	7	5	2	4	6	6	4	5	39

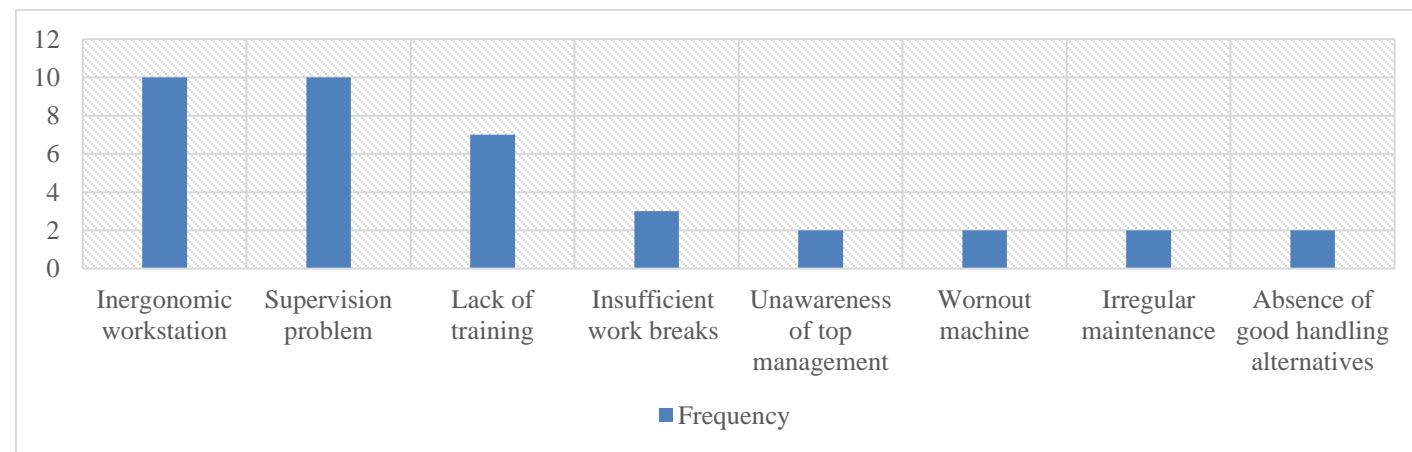


Figure 10: Frequency histogram.

Data Collection: To calculate the sample size of workers Slovin's formula is used. It is computed as,

$$n = N / (1+N*e^2).$$

Where, n = sample size, N = total population and e = error margin / margin of error¹¹. 95% confidence level was taken to measure sample size. So, margin of error, $e = 1-0.95 = .05$ for 57 male, the sample size, $n = 57 / (1+57*.05^2) = 49.89 = 50$ for 93 female, the sample size, $n = 93 / (1+93*.05^2) = 75.45 = 75$

So, 50 male and 75 female workers of the factory were involved in data collection. 6 anthropometric measurements are measured. Anthropometer and soft metric tape are used to measure. All the data are shown in the index in centimeter unit.

Alternative Design of Chair and Table: As indicated by the root causes of the defects the workstation is not ergonomic. So the calculations for alternative design are:

Seat Height (SH): It can be defined as the vertical length measured from floor level to the topmost point of the seat. Buttock Popliteal height is used to determine the range of seat height for adjustable chairs¹⁰. But Buttock popliteal height (BPH) need to be adapted to allow knees to be flexed so that the lower legs can form angle 5° to 30° with vertical axis¹². 5cm correction for pedal height is inserted as the measured pedal height is 5cm from ground. Therefore, the seat height is $(BPH+5) \cos 30^\circ \leq SH \leq (BPH+5) \cos 5^\circ$.

$$\begin{aligned} SH (\text{minimum, maximum}) &= ((37.45+5) \cos 30, (49.54+5) \cos 5^\circ \\ &= (36.76, 54.33) \text{ cm}. \end{aligned}$$

Seat depth (SD): The horizontal distance from the back to the front of the sitting surface of the seat. In literature Buttock-popliteal length is used to determine the length of the seat pad¹⁰. Therefore, 5th percentile of women measurement of buttock

popliteal length distribution is considered. So the seat depth = 36.61 cm.

Seat Width (SW): The horizontal length measured from the outer left side to outer right side of the top surface of seat. And hip breadth is used to determine the breadth of chairs and whole-body access for clearance¹⁰. So maximum value of hip breadth is used to design Seat Width (SW). Therefore 95th percentile of female worker measurement was considered in this purpose. Therefore, the seat width = 44.95cm.

Backrest height (BH): It can be measured vertically from the topmost point of seat to the top point of the backrest. It is recommended to keep the backrest at most on the upper edge of the scapula which is 60% to 80% of shoulder height¹². Objects located above shoulder height are difficult to lift. So there is also an increased risk of dropping items¹⁰. Therefore, backrest height is, $0.6*SSH \leq BH \leq 0.8*SSH$.

$$\text{So } BH \text{ (minimum, maximum)} = (0.6*46.56, 0.8*67.76) = (27.94, 54.2) \text{ cm}.$$

Table height (TH): It is measured from the floor to the top surface of table. Elbow-floor height should be adopted so that it becomes minimum when shoulders are not flexed and maximum when shoulders are at 25° flexion and 20° abduction (elbow rest height x 0.8517 + shoulder height x 0.1483)¹³. For maximum dimension calculation 95th percentile of male dimension and for minimum dimension calculation 5th percentile of female were used.

Elbow height from ground = elbow rest height x 0.8517 + shoulder height x 0.1483.

$$\text{For female, minimum table height} = SEH + (BPH + 5) * \cos 30^\circ = 17.97 + 36.76 = 54.73 \text{ cm}.$$

$$\text{For male, maximum table height is} = (BPH + 5) \cos 5^\circ + 0.8517 * SEH + 0.1483 * SSH = 91.82 \text{ cm}.$$

Table-13: Data table of anthropometric measurement.

Anthropometric measurement	Male Percentile				Female Percentile			
	5 th Percentile	95 th Percentile	Mean	SD	5 th Percentile	95 th Percentile	Mean	SD
Buttock popliteal height	36.78	49.54	43.16	3.87	37.45	45.35	41.4	2.39
Buttock popliteal length	38.92	50.12	44.52	3.39	36.61	48.17	42.39	3.50
Hip breadth	20.89	41.11	31	6.12	19.53	44.95	32.24	7.71
Sitting shoulder height	49.96	67.76	58.86	5.39	46.56	63.52	55.04	5.14
Sitting elbow height	12.58	32.26	22.42	5.96	17.97	28.91	23.44	3.32
Thigh clearance	8.35	21.85	15.1	4.09	8.1	21.32	14.71	4.01

Results and discussion

The productivity of selected garments industry was analyzed. Two types of data from the production floor was obtained to analyze the defects in the production line. The analysis that was performed in the industry was focused on the labor productivity and the factors that influenced them.

In the research work it was found that the defect rate of the factory was higher (4.18% DHU) and 8 types of defects made 79% of total defects. Only 8 root causes were responsible for the defect occurrence from which 3 were prominent causes. These were non ergonomic workstation, supervision problem and lack of training of the worker.

The factors were identified from the response of the workers to the questionnaires. In order to make sure the responses were as much honest as possible; the workers were ensured that their names or any other information that are associated with their identity wouldn't be collected. From the response of the workers, some scope for improvement was identified. Production data were collected from the management. The occurrences of defects were shown in a pareto chart along with the physical outlook of the defects. The cause and effect diagram helped to mark down the root causes of the defects. Interviewing the employees and the management personnel helped to identify the possible solutions to reduce those root causes. Based on the responses from the workers and management staffs and observation in the industry, the factors and causes associated with low productivity were identified. It was not possible to implement any solutions or productivity improvement techniques as there were difficulties taking permission from top management.

In the analysis it was found that the workstation was not ideal for increasing the productivity and reduction in defects. The proposed measurements for the workstation (working table and chair) are: i. Seat Height (SH): (min, max) = 36.76, 54.33 cm, ii. Seat depth (SD): 36.61 cm, iii. Seat Width (SW): 44.95 cm, iv. Backrest height (BH): (min, max) = 27.94, 54.2 cm, v. Table height (TH): (min, max) = 54.73, 91.82 cm

When the supervision from the management doesn't perform perfectly, there are some unexpected results come out such as chaos in the production floor which connect to the damage of quality of the product. So some solutions of supervision problem may be to develop an incentives framework according to the quality of the product for the supervisor, to provide proper training to supervisor to motivate and develop their supervision skills and to take feedback from the workers about supervision in regular interval.

Some solutions of training problems are to make the top management understands about the importance about training, to motivate the worker to participate in training program, to give an incentive for participation the training program.

Conclusion

Quality of the final products is one of the prime factors for an RMG industry for sustaining in global market. As quality of final products increases, customer satisfaction increases as well as production cost decreases which helps the industry to build up good reputation in global market.

In this research paper, the defect analysis of a sewing section of a selected RMG factory as well as possible solutions was presented. The analysis consisted of the defect rate analysis for a single type of product. A systematic and data driven analysis approach was followed for defect minimization. Primary data are collected from the factory by physical inspection, questionnaires and check sheet. Workers and line inspector helped to collect the necessary data. Some secondary data were collected from online which used to find out root causes of the defects.

The objectives of the research were to identify significant defects and their root causes in the sewing section of the selected RMG factory and to suggest possible solutions and recommendations to reduce the defects. In the analysis it was found that the occurrences of defects were high. So, Pareto analysis was done to find vital defects and 8 vital types defects were identified which resulted in 79% of total defects whose amount is 3466 out of 4403 defects. By using cause and affect diagram and five whys analysis 8 root cause were identified from them 3 were prominent. Thus, the objectives of the research were accomplished.

To do the research work some obstacles were faced. These obstacles resulted in some limitations in the research work as well as new opportunities for future study. As implementing the recommendations will incur cost and time it was not possible for management to implement the changes in the factories. The recommendation of the research work can be implemented and monitored the result. This research work was mainly concentrated on the sewing section of a selected garment factory for only one product. So study in other sections of this factory except sewing section such as cutting and finishing as well as all sections of other factories will make the research work more effective to minimize the defects and show the entire real scenario of the labor productivity in RMG sector in Bangladesh.

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