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Efficiency and productivity improvement strategy of a selected garments factory in Bangladesh

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Abstract

At present, RMG export from Bangladesh is 81.23% of the total export. According to BGMEA, there are 4482 garments factories in Bangladesh in the year 2016-17 and they employ about 4 million workers. This paper aims to find out the relation between incentives schemes that creates employee motivation and productivity of organizations. The workers in RMG sectors are not satisfied with their salary. On the other hand, management wants high production in low cost and shortest time possible. Management in RMG sectors directly and indirectly forces workers to do overtime duty which sometimes breaks the labor law to achieve the high production quota. A sound wage incentive plan beneficial for both producer and workers were suggested in this study. In this paper, lean tools were used to improve productivity and efficiency in sewing section of a selected garments factory. The main wastes that decreases production rate in the sewing section were identified. Profit margin can be maximized by reducing these wastes. The cost of goods sold before and after applying the lean tools and wage incentive were calculated. The calculation indicated that the application of lean tools and wage incentives reduced cost of goods sold rather than 4 hours production of a garment factory. The application of lean philosophy and a sound wage incentive plan creates a better achievement of high efficiency and productivity of worker.

Keywords: Wage incentives, productivity, efficiency, RMG sector.

Introduction

Manufacturing sectors are changing dramatically with the opening of the economy in Bangladesh in recent years that has brought higher employment opportunities, increase in income level and the emerging of a competitive environment in the country. The main objective of the industries is to increase the efficiency and productivity within the existing cost. Whereas, incentive plan is implemented to motivate as well as increase the satisfaction level and reduce the turnover rate among the employees. So a proper planned incentive plan can be beneficial for both the management and the workers. An incentive program is a formal scheme used to promote or encourage specific action or behavior by a specific group of people during a defined period of time. An incentive plan is designed to supplement base pay and fringe benefits. A financial incentive may offer stock options or a cash bonus and a non-financial incentives plan offers benefits such as additional paid vacations which can be given as a group reward or individual reward[1]. Wage incentives may be classified into two broad categories. They are shown in Figure-1.

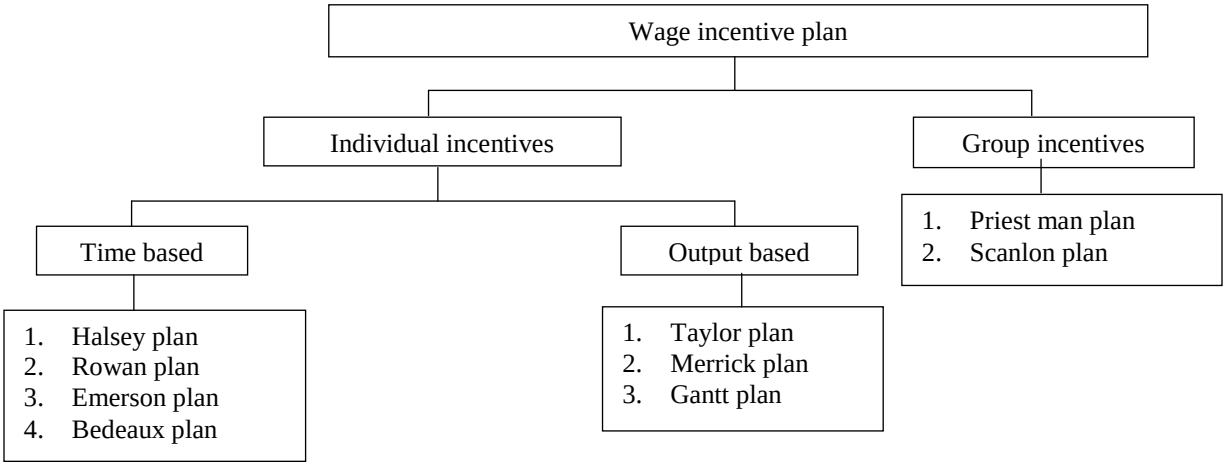

Figure-1: Wage incentive plan types[2].

Productivity is defined as the efficient use of resources i.e. labor, capital, materials, energy, information etc. in the production of goods and services which express the relationship between the output generated by a production or service system and the input provided to create this output[3]. The output are the finished goods that do not have defects in them.

Efficiency means the production of high-quality goods in the shortest possible time[3]. It can be expressed using the below equation:

Efficiency = (Actual Output/Standard Output)* 100% (1)

In manufacturing industries, two basic types of wastes (material waste and time waste) are encountered. Profit can be maximized by minimizing all the wastes. Shorter lead time which can be achieved by eliminating non-value adding activities from the process. Lean management is a systematic approach to identifying and eliminating wastes through continuous improvement by following the product at the pull of the customer in pursuit of perfection[4]. The key principles of lean manufacturing are: recognition of waste, standard processes, continuous flow, pull-production, quality at the source and continuous improvement[5]. Lean identifies the commonly identified 7 wastes like transportation, inventory, motion, waiting, over processing overproduction and defects in any process[6]. Objective of this study is to introduce lean manufacturing philosophy and wage incentive plan and analyze the combined effect on the sewing section of a ready-made garments.

A report titled "Lean Manufacturing Principle Guide" was published by National Steel and Shipbuilding Co under University of Michigan. The study focused on different lean manufacturing tools and their implementation in waste reduction and productivity improvement[7].

A paper titled A New Cost Management and Accounting Approach for Lean Enterprises was published by Ward et el.. The paper introduced a new way of costing and accounting that is necessary to show the changes which was come with lean manufacturing[8].

A research paper published by Ugwu Ude and M.A. Cocker titled Incentives Schemes, Employee Motivation and Productivity in organizations in Nigeria: Analytical Linkages. The paper tried to find the relation between incentive schemes and employee motivation and productivity in organizations and help management to design and administrate the best incentive schemes by providing useful information[9].

A journal paper published by Loyola et al. in the International Review of Economics and Finance studied about manipulation of profit data to obtain bonuses. In order to avoid such conundrum, the authors proposed an agency model that will analyze how compensation plans should be designed to counteract perverse incentives while preserving the primary managerial incentives to select optimal investment projects[10].

In a journal article by Bernal et al. in the Journal of Health Economics titled, In-kind incentives and health worker performance: Experimental evidence from El Salvador, the authors tested the results of in-kind team incentives on health worker performance[11].

Methodology

The sewing section of two RMG factories were selected for study. In sewing section, the bottleneck problem is much severe. Related study on lean manufacturing and wage incentives from various books and research paper were collected. After surveying the sewing floor in the garments factory and assessing the current condition, a set of questionnaires was prepared based on the investigation and theoretical study. Then entire sewing section was again surveyed. Two types of data were collected i.e. field data and company data. Field data was collected from the responses of workers, operators, supervisors and quality checkers. Company data was collected by interviewing production manager, planning department engineers and quality control manager. The collected data were sorted and arranged for further study and analysis. Tables and graphs were used to analyze the quantitative data. Results from overall analysis were also given. Necessary guidelines were provided to make necessary improvement of efficiency in the sewing section possible.

Results and discussion

The two factories from where data were collected are: Factory-A and Factory-B. The data collection and analysis are discussed in detail in this section.

Efficiency calculation for factory A: Efficiency can be calculated from equation 1. And the standard output is calculated using the below equation[12]:

Standard Output = (Total working hour* 60/SMV) (2)

Standard minute value or SMV is the summation of all types of value added operation time for producing a product in a particular department. A product has different SMV value in different department. There are 59 lines in 6 floors in the sewing section of factory A. The average efficiency of the lines is shown in Table-1.

The average efficiency of the entire sewing section is 50.07%. Three of the lines in the section are out of service at present.

Incentive program at factory a: According to the suggested incentive plan, a total of 52,500 Tk would have to be paid in incentive. Among the 59 lines, 6 lines would be chosen based on their efficiency. All the 84 operators and 6 supervisors in

those 6 lines will get an incentive of 500 taka and 750 Tk each respectively. Helpers in the line are not considered as they are low skilled. 1 floor from the 6 floors will be chosen as the best floor. The quality manager, assistant production manager and production manager each will get a reward of 2,000 Tk, 1,000 Tk and 3,000 Tk each respectively. The incentive program started in October 2017. The efficiency of the sewing department before and after the incentive program is compared.

Comparing Efficiency and Productivity before and after the Incentive Program: The efficiency from May 2017 to September 2017 is considered as efficiency before the incentive program. The efficiency from October 2017 to January 2018 is considered as the efficiency after the incentive program. The comparison is shown in the Figure-3.

From Figure-3, the efficiency before the wage incentive program which is from May-17 to Sep-17 is comparatively low than the efficiency after the wage incentive program which is from Oct-17 to Jan-18. The average efficiency before the wage incentive program is 49.48% and after the program the average is 52.49%.

The productivity was calculated using the ration of output and input. The productivity before and after the incentive program is also compared. It is shown in the Figure-4.

Table-1: Average efficiency of the lines in factory A.

Line name	Avg. efficiency (%)	Line name	Avg. efficiency (%)	Line name	Avg. efficiency (%)
MU-1	57.4	1-7	54.25	3-9	47.4
MU-2	56.16	1-8	57.32	4-1	37.25
MU-3	0	1-9	48.33	4-2	52.69
MU-4	50	2-1	40.38	4-3	57.27
MU-5	52.86	2-2	41.95	4-4	47.28
MU-6	47.97	2-3	48.76	4-5	49.63
MU-7	67.98	2-4	52.18	4-6	57.42
MU-8	55.39	2-5	0	4-7	51.37
MU-9	44.65	2-6	40.67	4-8	47.54
MU-10	48.64	2-7	37.92	4-9	48.92
MU-11	51.79	2-8	37.97	5-1	49.67
MU-12	42.37	2-9	33.98	5-2	42.31
MU-13	43.8	3-1	39.34	5-3	54.85
MU-14	51.8	3-2	49.08	5-4	59.96
1-1	49.59	3-3	36.98	5-5	64.37
1-2	48.52	3-4	53.7	5-6	64.88
1-3	48.94	3-5	47.19	5-7	51.36
1-4	68.97	3-6	0	5-8	67.04
1-5	54.55	3-7	43.97	5-9	57.39
1-6	51.49	3-8	47.84		

Table-2: Wage incentive plan for A.

Person	Number	Total amount of incentive (Tk)
Operator	6 best line (14 in each line)	500×14×6= 42,000
Helper	Not considered	N/A
Supervisor	6 best line (1 in each line)	750×6= 4,500
Quality manager	1 best floor	2,000
Assistant Production Manager	1 best floor	1,000
Production Manager	1 best floor	3,000

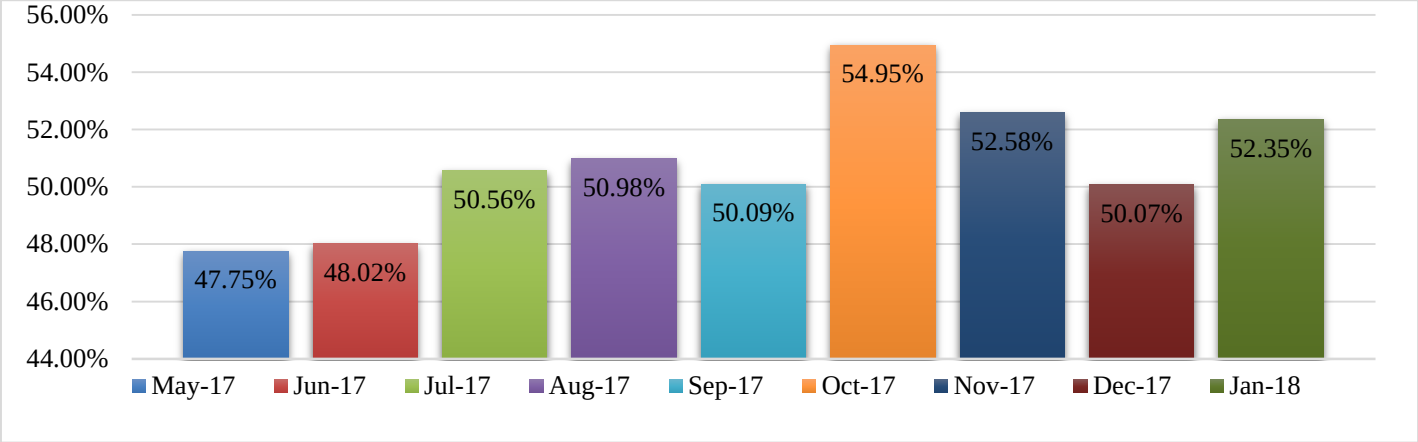

Figure-3: Efficiency comparison before and after wage incentive.

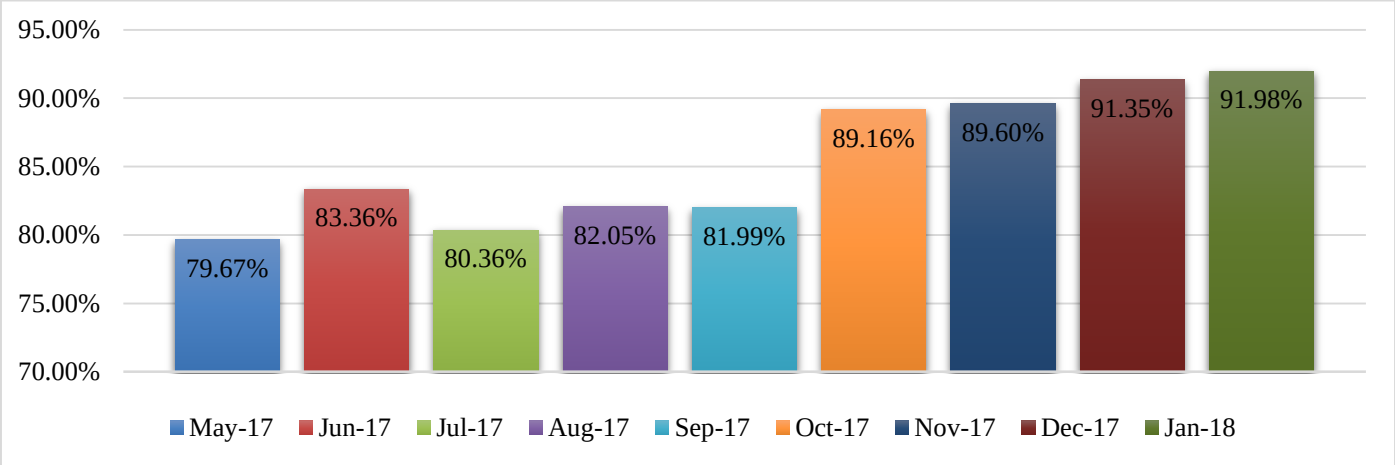

Figure-4: Productivity comparison before and after wage incentive.

The average productivity from May-17 to Sep-17 before the wage incentive is 81.49%. After the wage incentive program, the average productivity from Oct-17 to Jan-18 is 90.52%. So, both the efficiency and productivity were improved after introducing the wage incentive program. As the efficiency and productivity both improved, the production loss decreased. Average production loss per month before wage incentive were 99,739 pieces. After wage incentive the average production loss per month were 62,881 pieces.

Efficiency calculation and method of giving wage incentive in factory B: There are 29 teams in the sewing section of factory B. The average efficiency calculate for each of the teams are shown in Table-3.

The average efficiency of the sewing department is 64.1%. For starting the incentive program in factory B the following method was considered. The base efficiency was fixed as 55%. Any team that can achieve more than 55% efficiency will get 2 Taka per percentage of efficiency for the 8-hour work period per day. The sample calculation for team 1, 2, 3 and 15 is shown in Table-4.

All teams will get wage incentive in similar way.

Cost of goods sold before and after wage incentive in factory B: The wage incentive program was introduced in January 2017. Before the program the cost of goods sold in December 2016 will be compared with the cost of goods sold in December 2017 which is after the incentive program. The cost of goods sold is shown in the Table-5.

Table-3: Average efficiency of the teams in factory B.

Team no.	Operator	Efficiency %	Team	Operator	Efficiency %
01	8	60.97	16	10	60.79
02	10	64.19	17	10	55.56
03	10	63.7	18	9	67.19
04	10	67.67	19	10	70.97
05	8	64.32	20	10	77.18
06	8	65.04	21	9	68.55
07	10	61.95	22	8	66.41
08	10	67.28	23	10	60.07
09	10	67.3	24	10	61.29
10	10	54.26	25	10	59.59
11	9	62.36	26	10	64.33
12	10	60.14	27	10	65.04
13	10	59.35	28	10	65.93
14	10	63.55	29	8	69.91
15	8	64.04			

Table-4: Sample calculation for wage incentive at factory B.

Team	Member	Average efficiency per day %	Efficiency for incentive	Incentive per day in Tk	Incentive per worker
1	8	60.97	60.97-55=5.97	5.97×2×8 hour = 96	96/8=12
2	10	64.19	64.19-55=9.19	147.04	14.7
3	10	63.7	63.69-55=8.69	139.04	13.9
15	8	64.04	64.04-55=9.04	144.64	18.08

The goods sold in December 2016 were 622,325 pieces. The goods sold in December 2017 were 756,000 pieces. So, the cost of goods sold per unit in December 2016 was Tk 208.47 and in December 2017 it was Tk 204.5. After introducing the wage incentive, the cost of goods decreased which means the wastes and non-value adding activities were reduced.

Reasons for less efficiency in factory A: The average efficiency in factory A is 52.49% and in factory it is 64.1%. As the efficiency is lower in factory A, the reasons for low efficiency is identified in this section. Efficiency is directly proportional to working hour. So if the waste of time during work hour can be reduced, it will increase the efficiency of the factory. The cause and effect diagram below will show the factors which are responsible for waste of time in factory A.

Management should focus to mitigate these problems otherwise the incentive plan will not bring much positive result. However, if these problems are solved and workers can work without interruptions then it will be possible to gain much higher efficiency and productivity level.

The 7 wastes of lean were also analyzed. The problems and their possible solutions are given in Table-6.

Table-5: Cost of goods sold before and after wage incentive.

Before wage incentive		After wage incentive	
Factors	Cost (Tk)	Factors	Cost (Tk)
Labor cost	1,161,000	Labor cost	1,162,100
Overtime cost	813,090	Overtime cost	380,140
Incentive cost	0	Incentive cost	110,780
Raw materials	118,241,750	Raw materials	143,640,000
Labor cost in other section	3,819,500	Labor cost in other section	3,819,500
Overhead cost	5,200,500	Overhead cost	5,002,415
Inventory cost	500,000	Inventory cost	500,000
Total	129,735,840	Total	154,614,935

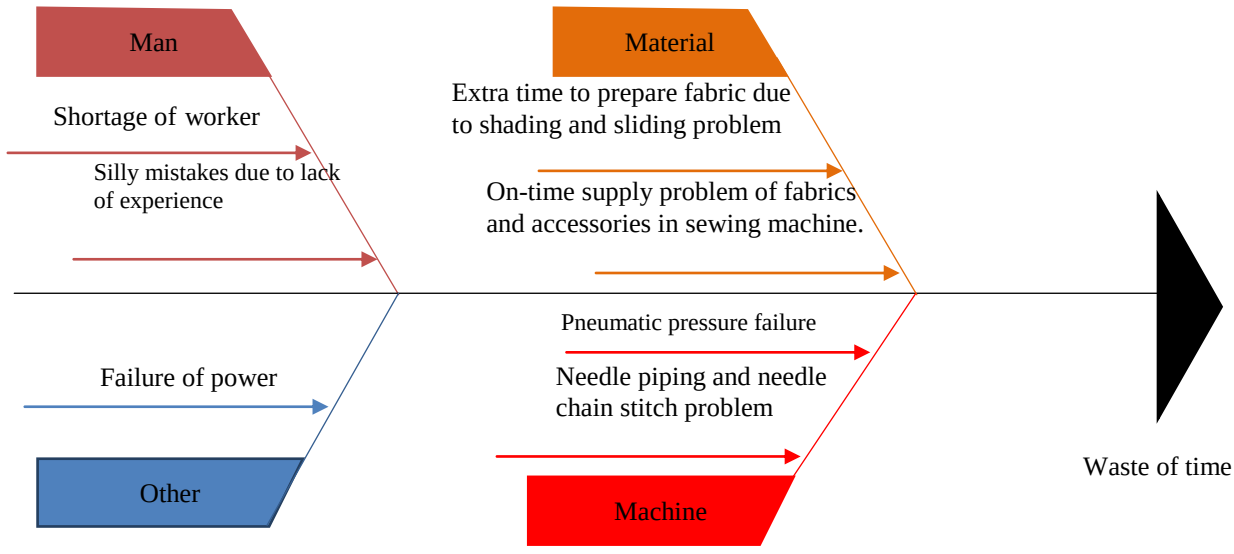

Figure-5: Cause and effect diagram of waste of time.

Table-6: Main 7 lean waste and possible solutions.

Waste	Reasons	Possible solutions
Transportation	Poor layout of cutting, assembly, inspection and finishing section.	Focused factory network
Inventory	Inventories in the form of raw materials, WIP or finished goods.	JIT production
Motion	Excess motions to pick, locate and fabrics under needle and pushing job to next stage.	Group technology
Overproduction	Capacity imbalance between cutting and sewing.	JIT production
Over processing	Duplicate no. of check points, repacking, cutting extra threads.	Quality at the source.
Waiting	Poor line balancing, idle time due to shortage or breakdown.	Kanban production minimized set up time.
Defect	Shade variation, dirty spot, shrinkage etc.	Quality at the source.

These wastes need to be eliminated from the process to increase the available work hour and efficiency further.

Improvement Strategies: Layout in the sewing department of factory A: Straight line layouts are followed by sewing department in a garment. Straight line is difficult to balance. Every operator's participation is necessary to perform task. A new line layout was proposed for factory A. The proposed line is a parallel line layout which will give following benefits: better human relation, improved operator expertise, lean team build up, less in-process inventory and material handling, faster production set up and reduction in area. The current line layout and proposed layout is shown below:

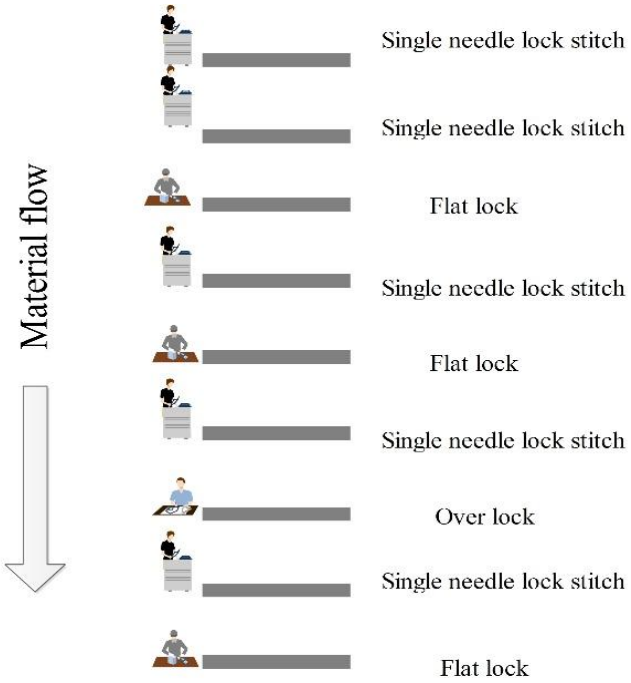

Figure-6: Current layout in factory A.

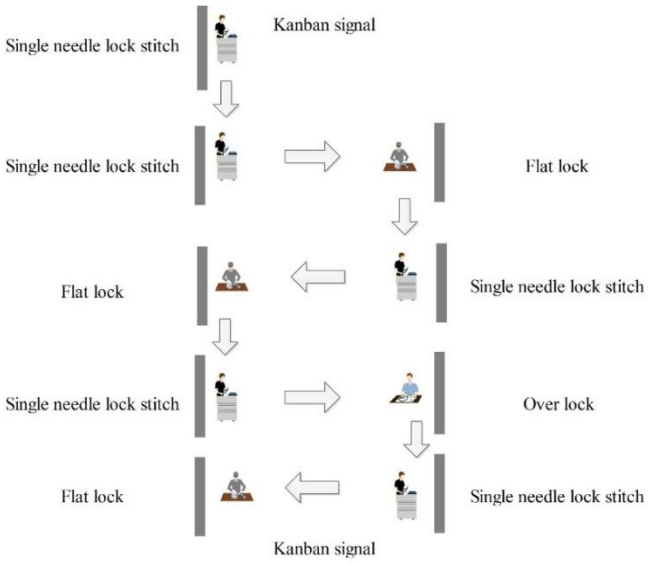

Figure-7: Proposed layout for factory A.

Selection of wage incentives: Wage incentive can be given in any form that the organization and the employee feel suitable. Some basic types of wage incentives are cash, merchandize, raffle draw, medical facilities, vacation, recognition etc. The opinions of the workers in the sewing section were taken about the suitable form of incentives which is shown in the Figure-8.

As most of the workers chose "Cash", a proposed plan to provide cash incentive to the workers was given. The procedure that should be followed is shown in Figure-9.

In this study, Merrick's multiple piece rate plan was used. At this plan, workers have to achieve 83% efficiency to get incentives. However, in Bangladesh workers in garments sector is unable to achieve such standard output. So, this plan was modified after consulting with management and target was set to 55%. From expert opinion, it is desirable and profitable for RMG sector to earn 50% efficiency for sewing department. The proposed rate of incentive suggested is summarized in Table-7.

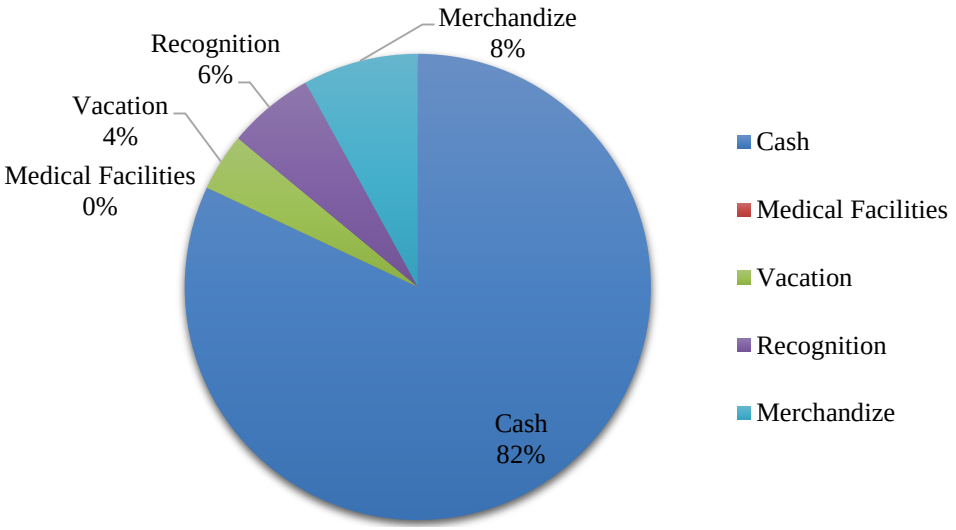

Figure-8: Response of workers toward types of wage incentive.

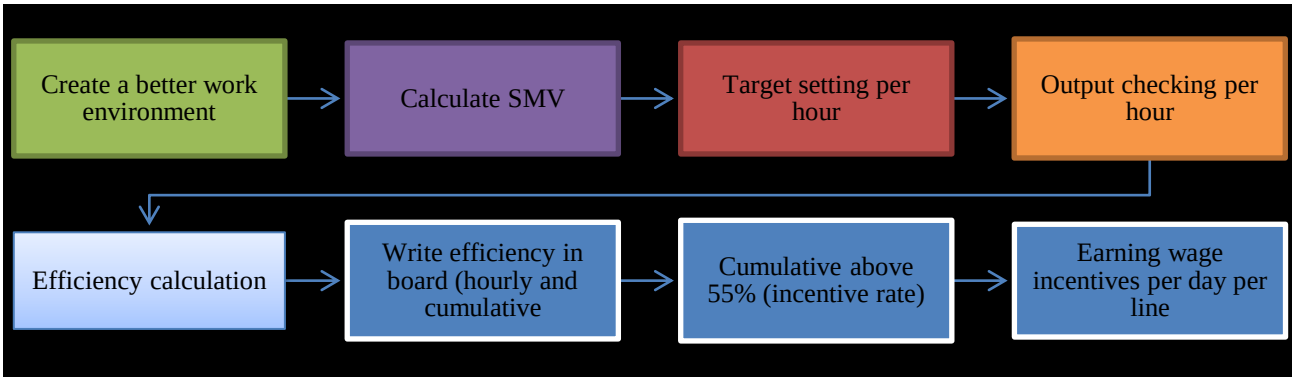

Figure-9: Wage incentive procedure.

Table-7: Wage incentive rate.

Efficiency level %	Incentive given per efficiency per hour in taka	Efficiency level %	Incentive given per efficiency per hour in taka
55-54	2	75-79	5.25
55-59	2.5	80-84	6.25
60-64	3	85-89	7.25
65-69	3.75	≤90	8.5
70-74	4.5		

By providing a properly structured wage incentive program will ensure co-operation from employees, less supervision, increased efficiency and productivity. As a result, there will be less wastes and higher utilization of resources.

Discussion: The sewing section of two factories were analyzed in this study. In the sewing section, there were 5 floors and 59 lines in factory A from which 3 lines are out of service and 29 teams in factory B. The efficiency which was calculated using SMV of factory B is comparatively higher than A. Factory B already implemented lean manufacturing tools in their factory. As a result, in this study improvement strategy using lean tools were only discussed for factory A. However, the proposed wage incentive plan is for both the factories and they can be

benefitted if they can implement the wage incentive program properly. Due to sensitivity of the data, the cost of goods was not calculated for factory A as management were unwilling to give those specific data. The calculation from factory B showed that after implementing the wage incentive program the cost reduced which suggests improvement of efficiency and less wastes of resources. Wage incentives work as a motivating factor and it is a good technique to get effective outcome from the employees.

Conclusion

The garments sectors in Bangladesh are boosting this country's GDP and economy. And the efficiency of labor is very important factor for achieving competitive advantages. On the other hand, employment of unskilled labors results in low productivity. The labor productivity of Bangladesh is lower than her main competitors i.e. Sri Lanka, Hong Kong, China etc. As labor is already cheap in this country, improving the labor productivity will give Bangladesh a huge advantage over other countries.

Based on the current study, some future studies can be undertaken. This study was only focused on the sewing section. Further study can be done on the other sections of the garments factory. This study was one in knit composite factories. Other types of factories i.e. woven etc. can be considered for future work. Possibility of implementing other lean tools like OEE analysis, value stream mapping, Kaizen etc. can be studied in future.

References

1. Barron S. H. (2016). Barron's Business Dictionary. www. answers.com/topic/incentive-pay. 28th December 2016.

2. Khanna O. P. (2010). Industrial Engineering and Management. Dhanpat Rai Publications, India.

3. Prokopenko J. (1992). Productivity Management: A Practical Handbook. International Labor Office, Geneva.

4. Shigeo, S. (1996). Quick Changeover for Operators. Productivity Press.

5. Jacobs, F. R. and Chase, R.B. (2013). Operations and Supply Chain Management. McGraw-Hill, New Delhi.

6. Stevenson, W. (2008). Operations Management. McGraw-Hill, New Delhi.

7. Liker, J. K. & Lamb, T. (2000). Lean Manufacturing Principles Guide. Version 0.5. A Guide to Lean Shipbuilding: Michigan University, ANN Arbor.

8. Ward, Y., & Graves A. (2005). A new cost management & accounting approach for lean enterprises. University of Bath School of Management, Working Paper Series, 2004-05.

9. Ude, U., & Coker, M. (2012). Incentive schemes, employee motivation and productivity in organizations in Nigeria: Analytical Linkages. *Journal of Business and Management*, 1(4), 32-39.

10. Loyola, G. & Portilla, Y. (2020). Managerial compensation as a double-edged sword: Optimal incentives under misreporting. *International Review of Economics & Finance*, 66(2), 09-19.

11. Bernal, P. & Martinez, S. (2020). In-kind incentives and health worker performance: Experimental evidence from El Salvador. *Journal of Health Economics*. 70.

12. Anonymous (2017). Online Clothing Study. http://www. onlineclothingstudy.com. 18th August, 2017.