Paper ID: 01

Measuring the Productivity of workers and Its Impact on Business performance: A Case Study of seven selected RMG Industries

Md. Golam Mahmood[1] , Muntasir Mustakin[2], Md Anas Sikder [3]

[1,2,3]Department of Industrial and Production Engineering, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh.
E-mail: mahmood2018334022@gmail.com, muntasirmustakin6170@gmail.com, anas44@student.sust.edu

Abstract

Bangladesh's economy greatly depends on the RMG sector, which contributes significantly to GDP and accounts for most of the gross export revenue. The main objective of this study is to analyze and measure the productivity of workers while exploring the relationship between worker's productivity and various business performance factors. The investigation was carried out in seven different RMG (Ready-Made Garments) industries located in Dhaka, Bangladesh. A total of 357 participants were selected at random for the study, and relevant data were collected through structured questionnaire-based interviews. Worker productivity was measured and analyzed using Kurosawa's structural approach. It was found that the maximum worker productivity was 33.00 unit/hr., and the minimum labor productivity was 22.6 unit/hr. In order to identify significant correlation between worker's productivity and business performance factors the Pearson's correlation formula was used. The results emphasize that there is a significant association between individuals' productivity and business performance factors.

Keywords: Kurosawa's approach, productivity, RMG , business performance.

1. Introduction

The RMG industries in Bangladesh plays a vital role in the nation's economy, contributing significantly to both employment and GDP. The production, distribution, and retailing of RMG Products has become an increasingly complicated and demanding industry globally due to significant shifts in the business environment that have boosted global competitiveness [1]. In any production-related organization, productivity enhancement is a primary goal. The standard measure of industrial efficiency is productivity. Businesses today face intense competition everywhere due to trade liberalization and globalization. Nearly every industry now faces external competition in both the production and service sectors. The productivity of laborers in these industries is confronted with numerous obstacles, despite its increasing significance. Issues such as inadequate training, poor working conditions, outdated technology, and non-compliance with health and safety regulations hinder efficiency [2]. Enhancing worker productivity is essential for the industry's future growth, competitiveness, and sustainability in both local and global markets.

2. Objective of the Study

The major purpose of this study is to examine and assess the productivity of workers and identify the connection between worker's productivity and business performance .
The specific objectives of this study are :-

I. To estimate the labor productivity of selected RMG manufacturing industries .
II. To identify the correlation between labor productivity and various business performance factors of seven selected RMG industries.

3.Productivity in Literature

Many of the research work on labor productivity highlights the need for a holistic, business-oriented approach to measurement beyond labor-centric measures. Productivity is the ability to produce work either meeting or surpassing company expectations. Increasing worker productivity requires significant effort from the organization [3]. Hilmola proposes a total productivity framework that encompasses labor, capital, materials, and energy, stating that for businesses to achieve higher quality and flexibility is necessary for long-term survival in the competitive market [4] . Zhang et al. is also important as it discusses the effect of health conditions such as arthritis on productivity, advocating that both absenteeism and presenteeism should be considered for accurate productivity

assessments since these will ultimately affect business performance [5]. Productivity dynamics have also been remodeled with the advent of modern work methods like remote work and digital tools [6]. Finally, the improvements in quality at least its influence manufacturing will make better business performance due to the increased productivity [7]. The garment industries in developing countries are more meticulous in their approach to procuring raw materials and minimizing delivery costs than in their approach to labor productivity, because of the availability of inexpensive labor [8]. Some researchers highlighted in their study that most Bangladeshi garment factory owners failed to find any causal relationship between labor regulations and production performance [9].Taken together, these studies illustrate the inter-relationships between productivity and business effectiveness that require a more multi-faceted view of examining worker productivity relative to its impact on organizational performance.

4. Methodology

Productivity assessment can be conducted by many methods. This study examines the labor productivity of some selected RMG industries. This work employed Dr. Kurosawa's structural method to assess labor productivity [10]. From his research [Kurosawa (1980)], individual labor productivity can be written as:

$$p_w = \frac{Output}{Input\ of\ Worker's\ Effort} \quad (1)$$

Where, Pw = A worker's productivity.

The framework of work hours utilized for productivity assessment according to the Kurosawa methodology is illustrated below:

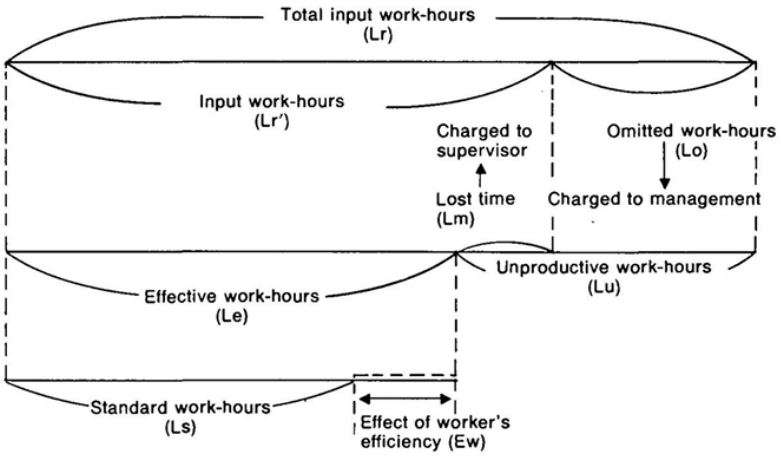


Figure 1: Structure of work hours in Kurosawa approach [8] .

Total input labor hours comprise normal working hours and overtime on a daily basis. Omitted work hours are breaks ensured by management. Such sort of break generally consists of of lunch break. The wasted time that may occur at a production may include the time necessary to acquire orders from the supervisor, prayer break, various breaks i.e. sipping water, tea breaks, talking etc. The assigned supervisor is responsible for these lost times. The equation for measuring the overall productivity is given below:

$$T_R = \frac{Q}{L_r} \quad (2)$$

Where, T_R is the overall employee productivity, Q is the total output and Lr is the total input work hour.

To evaluate the association between individual worker productivity and numerous corporate performance aspects, this study focuses on three major performance indicators: Operating Costs, Defects Rate, and Lead Time. A total of 357 workers participated in the research, responding to a self-administered questionnaire. The questionnaire was divided into two parts. The first part gathered basic information about the workers, including gender, age, education, experience, and working hours, while ensuring anonymity by not gathering names or identity data to promote honest responds. The second set contained questions about the business performance factors such as number of defects , total operating cost per product and Lead time . Correlation analysis was done to analyze the link between the independent variable—worker productivity—and the dependent variables: Operating Costs, Defects Rate, and Lead Time. The formula for Pearson's correlation is given below [11]:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)2\,][n\sum y^2 - (\sum y)2\,]}} \quad (3)$$

Where, r = Pearson correlation coefficient, n = sample size, x= dependent variable, y= independent variable

5. Data Analysis

Slovin's formula offers a method for estimating the required sample size in random sampling techniques [12]. In this study, Slovin's formula is used to determine the sample size from the total number of workers (approx. 1000) of the seven selected RMG industries in Dhaka, Bangladesh. Let's consider the level of confidence of this study to be 95.75 percent and the value of e will be 0.0425. So, by calculating and rounding to a whole number, the sample size is found to be 357. Slovin's formula is written as follows:

$$n = \frac{N}{(1+Ne^2)} \quad (4)$$

Where, the sample size n is determined based on the total population N and the acceptable margin of error e.
The basic information of the workers is summarized in the following table:

Table 1: Summary of workers basic information

Characteristics	Category	Number of Workers	Percentage(%)
Age (yr)	18-25	105	29.41
	26-30	86	24.08
	31-35	73	20.44
	36-40	81	22.68
Gender	Male	246	68.90
	Female	111	31.09
Education	HSC	125	35.01
	SSC	232	64.99
Work Experience	0-5	216	60.50
	6-10	67	18.76
	11-15	74	20.72

Equation (2) was used to calculate labor productivity. To determine the overall input work hour (Lr), regular time and overtime were added. Omitted work hours (lunch break) Lo was one hour and constant for all workers. Lost time included waiting for supervisor instructions, taking a tea and coffee break, drinking water, chatting, using the restroom, and other activities. Based on their own estimates, each employee's lost times were recorded. Because precise values are not maintained on file, the lost time L_m utilized in the computation is an approximated number. Each employee's lost time is made up of both overtime and normal hours. Every employee's regular and overtime production was recorded. The floor in-charge, supervisor, and employee estimates were consulted in order to get the approximate average value for each employee. The following formula was used to determine each worker's output [10]:

$$Q = (Q_t * O_o) + (R_o * 7) - (L_m * (\frac{R_o + O_o}{2})) \quad (5)$$

Where, Q is the output, Ot is overtime, O_o is overtime output, R_o is regular output and L_m is lost time.
By using equation 2 and 5 the productivity of the worker was calculated . The summary of the overall productivity is given in the below table:

Table 2. Summary of productivity of workers

Minimum Value	22.60
Maximum Value	33.00
Mean	27.87
Standard deviation	2.03

Among 357 data points, the top 20 instances with the highest productivity rates and their corresponding number of defective products were selected, and the relationship between these variables is illustrated in the figure (2) bellow:

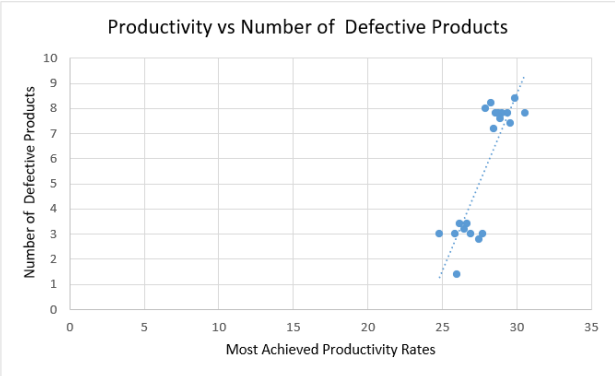


Figure 2: Correlation Between Productivity and Number of Defective Products.

From figure 2, the Pearson's correlation coefficient of 0.8484 was identified between the Most Achieved Productivity Rates and the Number of Defective Products. This value indicates a **strong positive correlation**, meaning as productivity increases, the number of defective products tends to increase as well. The plot visually shows the relationship, with the x-axis representing the Most Achieved Productivity Rates and the y-axis showing the Number of Defective Products. The trend line indicates the direction of the relationship, and its upward slope suggests that as the productivity rate increases, the number of defective products increases.

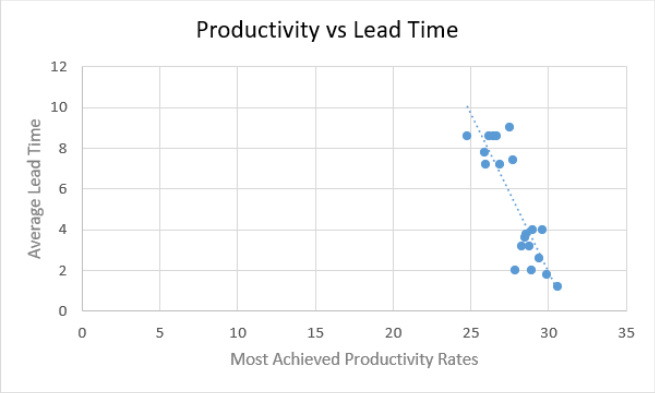


Figure 3: Correlation Between Productivity and Lead Time.

.

The Pearson correlation coefficient of -0.8577765 was determined between the Most Achieved Productivity Rates and the Average Lead Time in the above figure 3. A **strong negative correlation** between the two variables is indicated by a correlation of -0.8577765. This implies that the lead time tends to decrease significantly as productivity increases. The scatter plot demonstrates a negative trend, as most of the points exhibit a downward inclination, which supports the strong negative correlation. The dotted line indicates the line of best fit for this relationship, emphasizing the trend that lead time decreases as productivity increases.

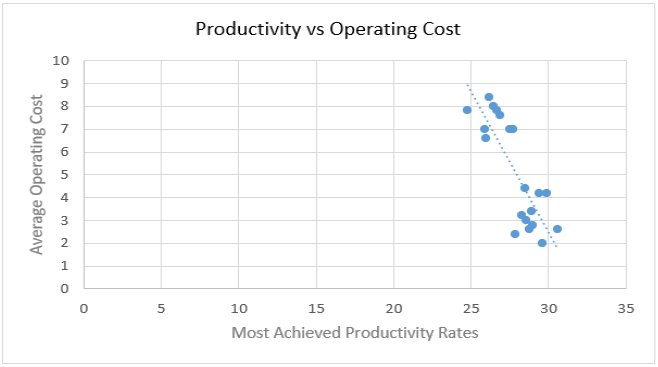


Figure 4: Correlation Between Productivity and Operating Cost.

From figure 4, the correlation between Most Achieved Productivity Rates and Average Operating Cost was -0.82753551 which indicates a **strong negative correlation**. This suggests that when productivity increases, the average operating cost decreases. The points are plotted in a downward slope which shows a clear negative trend between productivity and operating cost.

6. Discussion

The study demonstrates how lead time, operating expenses, and product quality are all impacted by productivity. There are more defective products produced as productivity rises. This indicates that as businesses strive for better output, they may face more faults or defects in their products. It implies that occasionally increased productivity may result in a compromise in quality, perhaps as a result of quality control systems finding it difficult to keep up with the accelerated speed of production.

On the plus side, shorter lead times result in higher productivity. Accordingly, the process grows faster overall as more products are produced in less time, enabling businesses to provide goods faster. Lead times should be shorter to better fulfill client demands and increase overall productivity. Operating costs can also be decreased through productivity. The cost of producing each unit decreases when more is made more effectively. This benefits the company since it saves money while increasing output and profits.

Based on the facts, it can be concluded that increased productivity leads to faster output and reduced costs. The drawback, as evidenced by the rise in defective items, is that product quality can decline. This emphasizes the importance of striking a balance between efficiency and quality.

Based on the response from the workers and an interview with certain management professionals, this study tries to find out a relation with higher productivity and others related attributes which is given below:

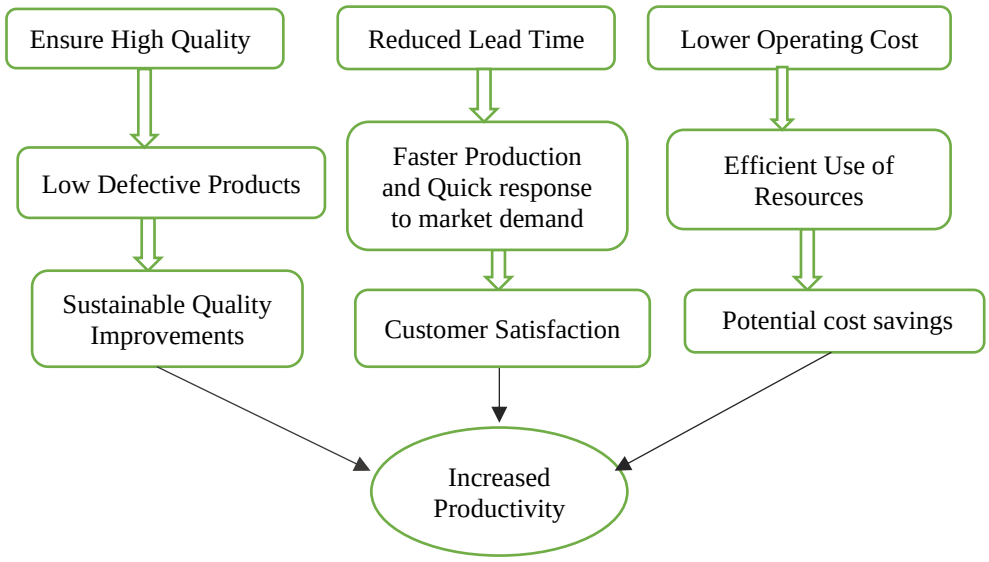


Figure 5: Relation with Productivity and various attributes

7. Conclusion

This study displays the intricate connections between productivity and important operational measures. A major discovery is the trade-off between productivity and quality, as demonstrated in the positive correlation with defective products. Increased output appears to lead to higher defect rates, showing that quality control mechanisms may fail under the pressure of high productivity targets. However, greater productivity offers significant advantages in terms of reducing lead times and cutting operating costs, which are vital for enhancing efficiency and competitiveness. The key problem found in this study is the balance between productivity and quality. As firms drive for more productivity to minimize costs and lead times, they may suffer quality challenges, as demonstrated in the growing quantity of defective products. Managing this trade-off is crucial, since severe flaws can balance the benefits of lower costs and faster manufacturing. Future study could focus on developing solutions that minimize error rates while maintaining high productivity. A balanced approach that integrates productivity with comprehensive quality standards will be vital to establishing sustainable operational excellence.

8.References

[1] M. A. H. Tarekul Islam, "Impact of ready-made garments (RMG) industries and sustainability: Perspective of the pandemic period in developing country," *Cleaner Engineering and Technology,* vol. 11, no. 2, pp. 81-92, 2022.

[2] C. L. K. B. K. P. K. Halder, "Evaluation of Factors Affecting the Productivity of RMG in Bangladesh: A Fuzzy AHP Approach," *International Journal of Research in Industrial Engineering,* vol. 7, no. 1, pp. 51-60, 2018.

[3] D. M. K. H. M. M. K. Mohammed Masum Billah, "Occupational Health Hazard, Reproductive Health and Domestic Violence against Women RMG Workers and their Effects on Workers' Productivity," *BUFT Journal of Business & Economics (BJBE),* vol. 4, pp. 1-24, 2023.

[4] O.-P. Hilmola, "Total productivity measurement and competitiveness: towards ensuring sustainable business performance in manufacturing organisations: a literature review," *Int. J. Process Manag. Benchmarking,* vol. 1, no. 1, pp. 45-51, 2005.

[5] D. B. e. al, "Measuring Worker Productivity: Frameworks and Measures," *J. Rheumatol,* vol. 36, no. 9, pp. 2100-2109, 2009.

[6] A. J. A. L. a. J. R. H. Laihonen, "Measuring the productivity impacts of new ways of working," *J. Facil. Manag.,* vol. 10, no. 2, pp. 102-113, 2012.

[7] S. K. J. K. D. P. a. A. K. S. A. Prakash, "Productivity, quality and business performance: an empirical study," *International Journal of Productivity Performance Management,* vol. 66, no. 1, pp. 78-91, 2017.

[8] Y. G. Mequanent Ewnetu, "Assembly operation productivity improvement for garment production industry through the integration of lean and work-study, a case study on Bahir Dar textile share company in garment, Bahir Dar, Ethiopia," *Heliyon ,* vol. 9, no. 7, pp. 40-46, 2023.

[9] R. B. K. Md. Arifur Rahman, "Attaining Productivity Enhancement Through Worker Satisfaction on Readymade Garments Sector of Bangladesh," *Applied Engineering,* vol. 4, no. 2, pp. 47-54, 2020.

[10] k. Kurosawa, "Structural approach to the concept and measurement of productivity," *Keizai Shushi,,* vol. 50, no. 2, pp. 96-135, 1980.

[11] Z. D. Y. X. M. F. Haomiao Zhou, "A new Sampling Method in Particle Filter Based on Pearson Correlation Coefficient," *Neurocomputing,* vol. 216, pp. 208-215, 2016.

[12] J. J. T. a. J. R. B. Punzalan, "On the Misuse of Slovin's Formula," *The Philippine Statistician,* vol. 61, no. 1, pp. 129-136, 2012.