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Strategy for Productivity Improvement in a Readymade Garments (RMG) Manufacturing Factory

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Abstract

Productivity improvement is critical in manufacturing industries for sustaining competitiveness in labor-intensive such as the Readymade Garments (RMG) sector. This considered labor, machine, material, and capital productivity indicators to study the productivity performance at a garment company using a case study approach in one of the RMG factories. The results show low level of productivity in the factory compared to recognized industry benchmarks due to inefficiency in the labor productivity and machine utilization. Low productivity is primarily driven by gaps in workforce skills, poor line balancing, elevated levels of defects and rework, recurrent machine interruptions, inadequate supervisory effectiveness, and the minimal use of systematic work-study methods. In response to these issues, the study puts forward well-structured productivity enhancement strategies rooted in established industrial engineering principles.

Keywords
Productivity improvement, RMG industry, labor productivity, work study, line balancing

1. Introduction
In developing economic countries, Readymade Garments (RGM) industry considered as one of the major factors to increase the employment rate and to help countries, such as Bangladesh, to increase their GDP. However, these counties face a high competition in the global market due to cost of production, and customer requirements. In this type of industry, when the unit cost is directly impacted by the labor productivity, and material productivity. (ILO 1987) and (Stevenson 2018).

Productivity is defined as the ratio of the output over input, to measure how well all resources utilized in the production process. Which lead to different type of productivity level that should be measured such as labor, machines, materials, and capital are utilized (Sumanth 1984) and (Sink 1985). In RMG industry, worker skills, work method, line balancing, and application of industrial engineering techniques play significant rule in the productivity improvements (Niebel and Freivalds 2009) and (Wignarajah 2004).

Although many garment factories are equipped with modern machinery and hold recognized compliance certifications, productivity levels often remain low. This underperformance is largely attributed to reliance on traditional production practices and the limited application of systematic work study and line-balancing techniques. This study examines the productivity performance of a garment manufacturing company and develops actionable improvement strategies grounded in empirical data collected at the factory level. The contribution of this research lies in its integrated evaluation of labor, machine, material, and capital productivity using actual operational data, its explicit identification of operational and managerial factors underlying measured productivity gaps, and its formulation of practical improvement initiatives based on industrial engineering principles for labor-intensive garment production.

2. Problem Formulation

In manufacturing systems, cost efficiency, effectiveness, and long-term sustainability are directly impacted by productivity improvements. Within the industrial engineering narrative, productivity is usually defined as the relationship between the quantity of output produced and the resources consumed in its production. This measure captures the utilization of all different resources such as labor, materials, machinery, capital, and energy into value-producing the right outputs (Sumanth 1984) and (Sink 1985). Productivity Improvements occur either when output expands at a higher rate than input usage or when equivalent output levels are reached with consumption of fewer resources.

Productivity carries heightened significance in labor-intensive industries, where production performance is closely shaped by the way labor is organized, the efficiency of applied work methods, and the effectiveness of supervisory practices. According to the International Labour Organization, productivity represents the connection between the amount of output generated and the labor input expended, with particular attention given to the roles of work study techniques, workforce skill development, and supervisory capability in achieving improvement (ILO 1987). Beyond serving as a numerical indicator, productivity is also commonly interpreted as a comprehensive managerial orientation that integrates planning activities, performance monitoring, operational control, and continuous improvement initiatives (Sink and Tuttle 1989).

A critical difference between efficiency and productivity. Efficiency measures performance in comparison to a predetermined standard time, whereas productivity ensuring that right tasks are completed with optimal resource utilization and minimal waste (Niebel & Freivalds 2009). An operation may achieve high efficiency while remaining unproductive if non–value-adding activities are performed efficiently, highlighting the need for system-level productivity analysis.

Sumanth, D. J. (1984). In his book Productivity engineering and management defined different type of productivity measure that could be considered with an organization. These measures include partial, multi-factor, and total factor productivity. Where partial productivity defined as output to a single input, such as labor , material, or machines, and is generally considered for investigative purposes in industrial practice. While miltu factor considered some of the input resources to measure the productivity. One the other hand, total factor productivity compares output to the collective input of labor, capital, materials, and energy, presenting a comprehensive assessment of organizational productivity.

In the context of the RMG industry, employee skill levels, line balancing, machine availability, material flow stability, defect rates, and supervisory effectiveness all have direct impact on the productivity level. Traditional garment factory often suffer from high labor dependency, frequent style changes, and unstable workflows, which may have negative impact on productivity performance if not managed systematically (Niebel and Freivalds 2009) and (Wignarajah 2004).

Recent studies continue to confirm that productivity gains in RMG industry can be achieved when improvement efforts go beyond traditional time-and-motion analysis. One emerging direction is the use of standardized work supported by mistake-proofing systems, where visual and automation-based checks help reduce operator errors and stabilize sewing performance. Additionally, Vergara et al. (2025) reported measurable improvements when poka-yoke practices were reinforced through artificial vision technology, indicating that error prevention can directly translate into higher line productivity.

Other studies suggest that productivity is also highly sensitive to how work is distributed and synchronized across stations. By combining assembly line balancing with simulation-based evaluation, Teshome et al. (2024) found improvements in output and efficiency, showing that productivity is strongly linked to flow design and capacity matching. In addition, quality improvement has repeatedly been associated with productivity outcomes in sewing operations. For example, reducing defect levels has been shown to limit rework and avoid unnecessary interruptions, which in turn supports smoother production and better labor utilization (Lingkon et al. 2024). A similar conclusion was reported by Joy et al. (2024), who emphasized that TQM-oriented practices improve productivity while also strengthening cost performance.

Even with these contributions, the literature remains fragmented. Many published works evaluate improvement tools separately or focus on a narrow set of performance measures. Consequently, fewer studies provide factory-level assessments that integrate multiple productivity dimensions and connect performance gaps to operational, workforce-related, and managerial drivers. To address this limitation, the present study adopts a comprehensive, data-driven case analysis in a real RMG production environment.

3. Methods

To identify practical improvement opportunities, this project considers descriptive and analytical case study methodology to investigate the productivity performance within RMG industry. This project conducted in-depth investigation of production processes, resource utilization, and managerial practices within the RMG industry.

To ensure that this project considered different aspects of productivity analysis, Both primary and secondary data were used to ensure accuracy and completeness. Primary data were collected directly from the factory floor and operational departments, including:

- Hourly production output recorded by quality inspectors at the end of each production line
- Labor attendance records and working hours documented by the Human Resources department
- Machine availability and operating hours recorded by production supervisors

Secondary data were obtained from internal factory documents and departmental reports, including:

- Operation Bulletins (OBs) prepared by the Industrial Engineering (IE) and Production Planning and Control (PPC) departments, then Standard Allowed Minutes (SAM) values were calculated using operation bulletins, where each production operation was broken down into elemental tasks and assigned a standard time based on established work measurement practices. The total SAM for a garment was obtained by summing the standard times of all individual operations.
- Monthly labor, material, machine, and capital cost statements from the Accounts department.

4. Data Collections

Productivity was evaluated using multiple productivity indicators to obtain a comprehensive assessment of factory performance. The following indicators were calculated:

- Labor productivity (hour basis): ratio of achieved standard hours to total available labor hours
- Labor productivity (money basis): ratio of output value to labor cost
- Machine productivity: ratio of achieved standard hours to total available machine hours
- Material productivity: ratio of output value to material cost
- Capital productivity: ratio of output value to capital employed

Using multiple indicators allows identification of inefficiencies across different resource dimensions rather than relying on a single productivity measure.

A comparison calculated productivity values were compared with recognized industry benchmark standards for the RMG industry. This comparison offers framework for interpreting productivity gaps and identifying areas requiring improvement (Table 1).

Table 1. Productivity Measurement Variables

Indicator	Definition	Basis
Labor Productivity (Hour)	Achieved standard hours ÷ available labor hours	Time
Labor Productivity (Money)	Output value ÷ labor cost	Cost
Machine Productivity	Achieved standard hours ÷ available machine hours	Time
Material Productivity	Output value ÷ material cost	Cost
Capital Productivity	Output value ÷ capital employed	Cost

5. Results and Discussion

The factory has 1,448 workers who operates 699 sewing for 18 production lines. Monthly production capacity is approximately 315,000 pieces while the actual production is 198,533 pieces with an average SAM of 21.18 minutes. Following tables show the calculated productivity indicators and the comparison to the benchmark (Table 2- Table 4).

Table 2. Production and Input Data

Parameter	Value
Production Quantity	198,533 pieces
Average SAM	21.18 minutes
Labor Hours	175,120 hours
Machine Hours	143,440 hours
Labor Cost	$163,666
Material Cost	$ 177,867
Capital Employed	$ 286,415.85
Selling Price	1.15 $/piece

Table 3. Calculated Productivity Indicators

Indicator	Value
Labor Productivity (Hour)	40.02%
Labor Productivity (Money)	139.50%
Material Productivity	128.36%
Machine Productivity	48.86%
Capital Productivity	79.71%

Table 4. Productivity Comparison with Industry Benchmarks

Indicator	Actual	Benchmark
Labor Productivity (Hour)	40.02%	≥ 65%
Labor Productivity (Money)	139.50%	≥ 150%
Material Productivity	128.36%	≥ 150%
Machine Productivity	48.86%	≥ 75%
Capital Productivity	79.71%	≥ 115%

Tables above show that all productivity indicators fall below acceptable target levels. With the most significant gaps occurred in labor productivity and machine productivity, demonstrating inefficient utilization of human and technical resources. The low labor productivity (hour basis) indicates that available labor time is not utilized in the best way and converted into productive output. As result, machine productivity is directly impacted by low labor productivity, as idle labor often results in underutilized machines and disrupted production flow. Similarly, material productivity below benchmark levels suggests losses due to defects, rework, improper handling, and inefficient cutting and sewing processes. Also, capital productivity is considerably lower than industry benchmark, suggesting that the factory's investment in machinery and infrastructure is not being fully utilized due to operational inefficiencies.

Analysis of operational data and production practices identified several interrelated causes contributing to low productivity:

Human-Related Factors

- Workers lack sufficient skill levels for critical and complex operations
- Absence of structured and continuous training programs
- High rework and defect rates caused by inadequate workmanship
- Low awareness of standard work methods and quality requirements

Process and Method-Related Factors

- Ineffective line balancing leading to bottlenecks and idle time
- Frequent style changeovers without adequate preparation and planning
- Limited application of method study to simplify and standardize work
- Absence of systematic work measurement to control standard times

Machine-Related Factors

- Frequent machine disturbances and breakdowns
- Insufficient preventive maintenance practices
- Poor synchronization between machine capacity and labor allocation

Material Handling and Flow Issues

- Improper material handling and internal transportation
- Delays due to unavailability of materials at workstations
- Increased wastage caused by poor storage and handling practices

Management and Supervisory Factors

- Supervisors lack sufficient technical and industrial engineering knowledge
- Weak production control and monitoring mechanisms
- Limited accountability for productivity performance at line and department levels

6. Conclusions

This project examined productivity levels in a labor-intensive RMG industry through a detailed, factory-wide case study. By evaluating key indicators related to labor, machinery, materials, and capital. the investigation showed that the overall productivity remains noticeably below common industry benchmarks, even though the facility operates with modern equipment and holds required compliance certifications. The results show that the most significant limitations are linked to labor output and the effective use of machines. Low labor performance and weak machine utilization lead to idle capacity and poor resource exploitation, which ultimately reduces material efficiency and capital returns.

Importantly, these losses are not mainly caused by technology gaps. Instead, they stem from operational and managerial weaknesses such as limited worker skill levels, lack of organized training programs, poor line balancing practices, repeated style changeovers, high defect rates that generate rework, and frequent machine interruptions. In addition, insufficient supervisory competence and the minimal use of structured industrial engineering methods further worsen productivity outcomes.

Overall, the results suggest that long-term productivity growth in garment manufacturing cannot rely only on investing in new technology. Sustainable improvement requires a disciplined industrial engineering foundation. This includes formalizing work study and measurement activities, conducting continuous line balancing, upgrading operator and supervisor capabilities, strengthening preventive maintenance routines, and improving production planning along with material flow coordination across the factory.

In summary, the study confirms that productivity gains in the RMG sector depend on aligning people, processes, and management practices within a clear productivity improvement system. The case evidence also offers actionable lessons that can be adapted by other garment manufacturers facing similar efficiency challenges in highly competitive international markets.

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Ahsan Habib is an Assistant Professor in the Department of Textile Engineering Management at the Bangladesh University of Textiles (BUTEX), currently on study leave while pursuing a Ph.D. in Textile Engineering at Çukurova University, Adana, Türkiye. He obtained his B.Sc. and M.Sc. degrees in Textile Engineering from the Bangladesh University of Textiles. His research mainly focuses on sustainable yarn development, hybrid and multi-core spun yarn structures, recycled cotton utilization, circular economy approaches in yarn production, and the performance evaluation of yarns and fabrics. Dr. Habib has authored numerous scientific publications in internationally recognized journals related to textile materials, sustainable production, and innovative yarn structures. In addition to his academic research, he previously worked in the textile industry in production planning and management roles, gaining practical experience in manufacturing operations and process efficiency.

Ahmed Hamzi is an Assistant Professor in the Department of Industrial Engineering at Jazan University. He holds a B.S. in Industrial Engineering from King Fahd University of Petroleum and Minerals, an M.S. from Northern Illinois University, and a Ph.D. from Texas Tech University. His research primarily focuses on production and operations planning, with a particular emphasis on healthcare process improvement, provider workload, and productivity. Dr. Hamzi has contributed to numerous research projects and collaborations with both government and private sectors. Additionally, he has led workshops in the areas of processes reengineering, operations management, continuous improvement, and entrepreneurial management consulting.

Md. Tamim Hossain is a hardworking and reliable professional with experience in general work, warehouse operations, and customer service. He currently works as a Sales Manager at Copenhagen Tourist Point in Copenhagen, Denmark. He holds a Master of Business Management from Bangladesh University of Textiles (BUTEX) and a Bachelor of Science from BGMEA University of Fashion and Technology (BUFT), Bangladesh. His skills include stock handling, shelf filling, warehouse operations, basic cash handling, and maintenance tasks. He is proficient in basic digital tools such as Microsoft Office, email management, and inventory scanning devices. Rahman is known for his punctuality, teamwork, and ability to work under pressure while maintaining a positive attitude in practical and customer-oriented environments.

Osman Babaarslan is a Professor in the Department of Textile Engineering at Çukurova University, Adana, Türkiye. He received his higher education in textile engineering and completed advanced studies at the University of Leeds. His research mainly focuses on yarn manufacturing technologies, innovative yarn structures, textile engineering, and yarn quality analysis. Prof. Babaarslan has published numerous scientific papers in internationally recognized journals and has contributed extensively to research in the field of textile engineering. He is actively involved in academic research, graduate supervision, and international collaborations related to yarn development and textile materials.