



# Optimizing Industrial Productivity Through Innovative Spatial Organization In Garment Processing Factories

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## ABSTRACT

This article explores the transformative potential of innovative spatial organization in optimizing industrial productivity, with a specific focus on garment processing factories. The traditional layout of industrial facilities often overlooks the impact of spatial design on operational efficiency. In this research, we delve into the key principles of spatial organization that can revolutionize the workflow and output of garment processing units. By integrating principles of lean manufacturing and human-centric design, the article proposes innovative spatial layouts that prioritize ergonomic workstations, efficient material flow, and streamlined processes. The study draws on case studies, industry best practices, and comprehensive literature reviews to underscore the tangible benefits of reimagined spatial organization in the garment manufacturing sector. The optimization strategies presented encompass efficient zoning of workstations, strategic placement of machinery, and the integration of smart technologies for real-time monitoring and data-driven decision-making. The article highlights how these spatial innovations can significantly reduce production cycle times, minimize errors, and enhance overall operational agility. Furthermore, the research explores the potential economic implications of improved productivity, such as increased output capacity, cost-effectiveness, and a more competitive market position. By fostering a symbiotic relationship between spatial organization and industrial efficiency, this article contributes valuable insights for stakeholders seeking to revolutionize garment processing factories and elevate their performance in the ever-evolving landscape of industrial production.

**Keywords:** Industrial Architecture, Garments, Garment Processing, Industrial Productivity, Technology Integration, Innovative Spatial Organisation.

## INTRODUCTION

In the dynamic landscape of industrial operations, the role of architecture extends beyond aesthetics; it becomes a pivotal factor in influencing productivity. The design of industrial spaces significantly shapes the way work is conducted, impacting efficiency, employee well-being, and overall operational success. The garment industry is one of the largest and most influential industries in the world, with a value of over \$2.5 trillion and employing an estimated 75 million people globally (The World Bank, 2022). It is one of the fastest evolving segments in global trade. The developed economies such as United States, European Union and Japan among others are the major consuming countries. As apparel manufacturing involves labor intensive processes, most of the production takes place in developing and least developed countries owing to lower labor cost. This has resulted in distinct separation of the value chain into production hubs and consumption centers. Global apparel trade has reached USD 443 Bn in 2015, and is expected to grow at a CAGR of ~5% over next five years. This growth can be accounted for increase in disposable incomes and urbanization in developing economies. (Ministry of Textiles, 2018).

Garment processing factories play a crucial role in this industry, transforming raw materials such as fabric and thread into finished garments that are sold to consumers. In garment production, until garment components are gathered into a finished garment, they are assembled through a sub-assembly

process. The production process includes a set of workstations, at each of which a specific task is carried out in a restricted sequence, with hundreds of employees and thousands of bundles of sub-assemblies producing different styles simultaneously (Chan et al, 1998). The joining together of components, known as the sewing process which is the most labour intensive part of garment manufacturing, makes the structure complex as the some works has a priority before being assembled (Cooklin,1991). Furthermore, since sewing process is labour intensive; apart from material costs, the cost structure of the sewing process is also important. Therefore, this process is of critical importance and needs to be planned more carefully (Tyler, 1991). As a consequence, good line balancing with small stocks in the sewing line has to be drawn up to increase the efficiency and quality of production (Cooklin, 1991; Tyler, 1991; Chuter, 1988). An assembly line is defined as a set of distinct tasks which is assigned to a set of workstations linked together by a transport mechanism under detailed assembling sequences specifying how the assembling process flows from one station to another (Tyler, 1991). In assembly line balancing, allocation of jobs to machines is based on the objective of minimizing the workflow among the operators, reducing the throughput time as well as the work in progress and thus increasing the productivity. Sharing a job of work between several people is called division of labour. Division of labour should be balanced equally by ensuring the time spent at each station approximately the same. Each individual step in the assembly of product has to be analysed carefully, and allocated to stations in a balanced way over the available workstations. Each operator then carries out operations properly and the work flow is synchronized. In a detailed work flow, synchronized line includes short distances between stations, low volume of work in process, precise of planning of production times, and predictable production quantity (Eberle et al, 2004).

The intense competition within the industry has led to a race to the bottom in terms of production costs, with factories often operating on low margins to meet the price pressures of global retailers and brands therefore enhancing efficiency in these settings is essential for staying competitive. One of the fundamental aspects of architectural influence on industrial productivity lies in the layout and flow of the workspace. A well-designed floor plan considers the sequence of processes, minimizing unnecessary movement and reducing bottlenecks. Efficient spatial organization enhances workflow, allowing for streamlined operations and improved productivity. This becomes particularly crucial in manufacturing environments, where the layout directly affects the speed and precision of production processes.

### **Aim**

The aim of this article is to investigate and propose innovative spatial organization strategies in garment processing factories, with a specific focus on optimizing industrial productivity. Through an exploration of principles derived from lean manufacturing and human-centric design, the research aims to provide actionable insights into reimagining the spatial layout of such facilities.

### **METHODOLOGY**

The research methodology employed in this study utilizes a qualitative approach, integrating both case studies and extensive literature reviews to delve into the intricate landscape of optimizing industrial productivity within garment processing factories. The case study component involves a meticulous selection process, targeting factories of varied sizes and operational models. Simultaneously, a robust literature review will be conducted, encompassing scholarly articles, industry reports, and pertinent books. This dual approach aims to synthesize existing knowledge and practices, identifying gaps in the literature and contributing novel insights. By triangulating findings from case studies and literature reviews, this research endeavors to offer a holistic perspective on spatial organization strategies, providing actionable recommendations to enhance industrial productivity in the dynamic context of garment processing factories.

### **RESEARCH FINDINGS**

#### **Case Studies**

Case studies are an important phase of research that provides knowledge on the project through gathering of relevant data on existing facilities. The case studies carried out in the course of the research are documented below.

1. OSC Garment Factory: OSC Garment Factory is located at Lagos State Nigeria and was established in the year 2009. It is a medium scale garment processing factory that covers an area of 900 square meters. Facilities included in the factory are; the Exhibition Area, Photo studio and a Production Hall.



Plate 1: Approach view of the Factory  
Source: Author's Field Study, 2023.

Plate 2: Interior View of the Factory Hall  
Source: Author's Field Study, 2023.

2. Ashillarozae Atelier is located in Lagos State, Nigeria. It is a medium scale factory that was established in the year 2015. It covers an area of 225 square meters and contains facilities such as the exhibition area, offices, production hall, storage areas, etc.



Plate 3: Interior view of the Factory  
Source: Author's Field Study, 2023

Plate 4: Interior View of the Factory Hall  
Source: Author's Field Study, 2023.

Functionality and flow was the primary observation made in case studies carried out, the designs of the factories did not adequately emphasize functionality and efficient spatial organization. The layouts were not carefully planned to optimize workflow which when implemented will ensure seamless movement between different areas and facilitating collaboration among various departments.

### **The Role of Innovative Spatial Organization in Influencing Industrial Productivity**

The field of architecture is crucial in influencing industrial productivity by shaping the physical environment where work occurs. One major strategy with which this is achieved is innovative spatial organisation. Considerations such as layout, lighting and ergonomics impact how smoothly operations run, ultimately affecting productivity.

Spatial planning involves identifying, grouping and linking spaces. Planning a layout involves the identification of spatial units and understanding their purpose, function and relationships to other units. Based on these relationships and functions, units can be grouped into zones of common function/identity. Understanding the logical progression of, and relationships between spaces will determine the circulation system and is an important aspect in creating an effective way finding system. (Ibiso, 2021).

#### **1. Layout Design and Workflow Efficiency:**

The spatial arrangement of machinery, workstations, and storage areas significantly influences the flow of work in garment processing. Implementing an efficient layout design that minimizes unnecessary

movement, reduces congestion, and streamlines the production process is paramount. This could involve strategic placement of cutting tables, sewing machines, and finishing stations.

**2. Automation Integration:**

Embracing automation technologies within the spatial organization can drastically improve productivity. Automated systems for material handling, cutting, and stitching can enhance precision and speed, reducing the reliance on manual labor and minimizing the risk of errors. This integration requires a well-thought-out arrangement of machinery to ensure seamless operation.

**3. Flexible Workstations:**

The nature of garment processing often involves diverse tasks, from cutting patterns to sewing and finishing. Designing flexible workstations that can be easily adapted for various processes allows for agile production. This adaptability enables factories to respond efficiently to changes in demand or product specifications.

**4. Employee Comfort and Safety:**

A well-organized spatial layout should prioritize the well-being of workers. Ensuring comfortable and ergonomic workstations can contribute to higher employee satisfaction and productivity. Additionally, a safe working environment reduces the risk of accidents and downtime, promoting a more consistent workflow.

**5. Inventory Management:**

Efficient spatial organization extends beyond the production floor to include storage areas. Implementing smart inventory management systems and organizing raw materials and finished products in a systematic manner can prevent delays caused by misplaced items and optimize the supply chain.

**6. Data-Driven Decision-Making:**

Incorporating sensors and data analytics tools into the factory's spatial organization can provide valuable insights. Real-time data on machine performance, production rates, and resource utilization empower decision-makers to identify bottlenecks, forecast production trends, and make informed adjustments to enhance overall efficiency.

**7. Collaborative Workspaces:**

Facilitating collaboration and communication among team members is crucial. Designing collaborative workspaces within the factory encourages effective communication, reduces delays in information flow, and fosters a sense of teamwork among employees.

These strategies mentioned above can be applied to the design of Garment Processing factories. Real-world examples of factories that have successfully implemented innovative spatial organisation for productivity optimization include; Swarovski Manufaktur, Austria, Cheng yang fashion house, Zhongshan, China, Prada fashion factory, Arezzo, Italy.



Plate 5: Interior view of Swarovski Manufaktur, Austria

Source: [www.archdaily.com](http://www.archdaily.com), Retrieved, 2023



Plate 6: Interior view of Swarovski Manufaktur, Austria

Source: [www.archdaily.com](http://www.archdaily.com), Retrieved, 2023.





Plate 7: Approach view of Cheng Yang Fashion House China

Source: [www.archdaily.com](http://www.archdaily.com), Retrieved, 2023



Plate 8: Exterior View of the Prada Fashion Factory, Italy

Source: [www.archdaily.com](http://www.archdaily.com), Retrieved, 2023

## CONCLUSION

Innovative spatial organization in garment processing factories is a multifaceted approach that involves careful consideration of layout, technology integration, and employee well-being. By embracing these strategies, factories can optimize their productivity, respond to market demands more effectively, and position themselves for long-term success in the competitive textile industry.

## RECOMMENDATIONS

1. Regularly Assess and Refine Spatial Organization: Recognize that the industrial landscape is ever-evolving. Regularly assess the spatial organization of the factory, seeking feedback from employees and stakeholders. This continuous evaluation allows for adaptations to meet changing market demands and technological advancements.
2. Implement Ergonomic Workstations: Design workspaces with a focus on ergonomics to enhance employee comfort and reduce the risk of injuries. Invest in adjustable furniture and tools that cater to the diverse tasks involved in garment processing, promoting a healthier and more productive workforce.
3. Explore Sustainable Practices: Consider integrating sustainable practices into spatial organization. This may involve optimizing energy usage, reducing waste, and incorporating eco-friendly materials. Sustainability not only aligns with modern consumer expectations but can also lead to long-term cost savings.
4. Invest in Automation Technologies: Embrace cutting-edge automation systems for material handling, cutting, and stitching processes. This not only accelerates production but also ensures precision and consistency, reducing the margin for errors and enhancing overall efficiency.
5. Create Collaborative Work Environments: Foster a culture of collaboration by designing workspaces that encourage effective communication and teamwork. This collaborative atmosphere not only improves information flow but also enhances problem-solving capabilities among team members.
6. Continuous Workforce Training: Prioritize ongoing training programs to familiarize the workforce with new technologies and processes. A well-trained team is more adept at utilizing innovative spatial organization to its full potential, ensuring a smoother transition and optimal productivity gains.
7. Stay Informed about Industry Innovations: Stay abreast of emerging technologies and industry best practices. Networking with other manufacturers, attending conferences, and engaging with industry experts can provide valuable insights that may inspire further innovations in spatial organization.

In essence, the recommendations revolve around a holistic approach that combines technological advancements, employee empowerment, and environmental consciousness. By implementing these strategies, garment processing factories can position themselves at the forefront of the industry, fostering sustained growth and competitiveness.

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