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Esssentials of Technology Selection, Layout and SOPs in Production Planning : A Conceptual Review

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A B S T R A C T

This conceptual study seeks to investigate the interconnected roles of technology selection, facility layout design, and Standard Operating Procedures (SOPs) in the planning of products or services production. The goal is to provide a thorough understanding of how these three important components impact operational efficiency, quality, and production. The study takes a literature-based approach, analyzing prior research findings and practical examples to emphasize the impact of each element on production planning. The discussion demonstrates how picking proper technology improves production capacity, flexibility, and sustainability. Facility layout design, particularly when carried out utilizing the Systematic Layout Planning (SLP) method, promotes efficient material flow, reduces waste, and maximizes space usage. Standard Operating Procedures (SOPs) are emphasized as necessary for standardizing processess and increasing department cooper. This study makes a conceptual contribution by providing a framework for businesses to analyze and improve their production planning methods thorugh the combination of technology, layout, and SOP creation.

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INTRODUCTION

Manufacturing and service industries are facing increasingly complex challenges in the current era of globalization and digitalization. Many businesses must continuously innovate and improve their operational efficiency due to rapid technological developments, intense competition, and increasing consumer demands as well. Production planning is one of the important elements that determine how effective and efficient an organization is in producing goods or services. The formulation of *Standard Operations Procedures* (SOPs), facility layouts, and selected technologies are critical to improving productivity and ensuring the quality of products or services produced in an increasingly competitive and dynamic business environment (Gunawan & Sari, 2022).

In production planning, technology selection refers to the process of finding and applying the most suitable technology to support the manufacturing process of goods or services. In the process of making this decision, various technology alternatives are evaluated by considering factors such as capacity, flexibility, cost, sustainability, and the effect on product quality (Hidayat et al., 2021). For example in the manufacturing industry, choosing the right technology can significantly increase productivity, such as automation that enables mass production with lower error rates. There are new discoveries that the use of industrial robots and *Control Numerical Computer* (CNC) machines can improve efficiency and product quality (Santoso & Widjaja, 2022) . With the use of these involving *Artificial Intelligence* (AI) provides benefits for businesses to increase customers and predict market trends more accurately (Rahman et al., 2023).

In addition, an ideal layout also speeds up the production cycle and reduces displacement. Adopting a *lean manufacturing-based* layout has been proven to reduce waste and improve production efficiency in several sectors, such as automobile manufacturing (Suryadi et al., 2021). Therefore, the layout design strategy should not only consider production efficiency alone because it aims to optimize all operational systems carried out by a business to be able to provide a smooth and efficient production process. Added by Gunawan and Sari (2022), the right layout also has an impact on the welfare of workers because it can reduce fatigue due to long travel distances in the work process. Conversely, a poor layout can cause delays, longer waiting times, and waste of resources (Wijaya & Nugroho, 2020).

Standard Operations Procedures (SOPs) are also important because they contain written documents that outline the systematic steps required to carry out a particular process or activity. SOPs are essential for maintaining consistent operations, ensuring high quality standards, and improving workplace efficiency and safety. In the production industry, effective implementation of SOP procedures can help reduce uncertainty in the process, prevent human error, and ensure that each stage of production runs according to predetermined standards. SOPs also help with inter- departmental coordination that speeds up task completion time to increase overall productivity.

While prior studies have explored the significance of technology selection, facility layout design, and the development of Standard Operating Procedures (SOPs) in production planning, limited research has been conducted on how

these three parts interact as an integrated system. Most extant research focuses on technical implementation or case specific applications, rather than providing a coherent conceptual framework that integrates varios components holistically. As a result, there are few theoritical models that help decision-makers evaluate all of these issues while designing manufacturing operations.

The purpose of this conceptual article is to look at how technology, layout design, and the formulation of standard operating procedures (SOPs) relate to each other in the production planning of goods or services so that can close the gap before. It is also added that the purpose of the research is to provide a deeper understanding of how these three factors can affect the efficiency and effectiveness of the production process, as well as to provide strategic recommendations for companies that want to implement technology and SOPs.

THEORETICAL REVIEW

Technology Selection

Technology in the context of production refers to the use of tools, machines, systems, and processes to improve efficiency, quality, and output volume in the manufacture of goods or services. It consists of both hardware (automated machines) and software (computerized production management systems). In today's highly competitive and dynamic industrial world, technology is critical to achieving operational excellence and adapting to changing market demands. In the Indonesian context, a study by Muslim and Suharjito (2023) found that using genetic algorithms in facility layout optimization lowered material handling costs by 18.1%, emphasizing the essential relevance of selecting appropriate technology in local industrial contexts.

Furthermore, technology selection has a direct impact on manufacturing capacity and product quality. Santoso and Widjaja (2022) discovered that incorporating automated machinery such as CN and AI-based technology into Indonesian manufacturing considerably boosted production speed while preserving product quality. This suggests that technology selection influences both technical outcomes and strategic competitiveness. In addition, in the era of digital transformation and Industry 5.0, businesses must deploy technology that can respond to changing market challenges. Technology choices must take into account sustainainability and adaptibility to changing consumer expectations. As Rahman et. al (2023) point out, digital integration allows organizations to tailor services, improve responsiveness, and promote data-driven decision making.

Layout

Layout in production planning refers to the methodical organization of physical resources (machines, tools, and workstations) on a factory floor to facilitate the flow of materials, information, and labor (Kovács, 2023). An effective production layout is critical for decreasing transportation waste, eiminating production delays, and increasing process efficiency. In the Indonesian industrial

context, layout design has been identifies as a strategic aspect in boosing production performance. Nugeraho (2021) stated before that advocated using the Systematic Layout Planning (SLP) method to improve the tofu production facility layout that resulting in a better structured workflow and reduced material flow inefficiencies. SLP is a popular approach that starts with data collecting on operational linkages and goes to relationship diagramming and space allocating to provide realistic layout alternatives.

Similarly, Suseno and Fitri (2022) used SLP at a garment manufacturing comapny and found that correct layout restructuring significantly reduced material handling time while increasing output. As Gunawan and Sari (2022) pointed out, ergonomic and well-planned layouts can help to reduce worker tiredness and injury risk, especially in high-internsity production environments. Thus, layout design is more than just a technical exercise; it is a strategic decision with long-term operational and human consequences.

Standard Operations Procedures (SOPs)

Standard Operating Procedures (SOPs) are thorough written instructions designed to ensure consistency, quality, and safety in the performance of operational duties. SOPs serves as a key link between planning and implementation, instructing staf fon how to do tasks in a standardized and compliant manner. SOPs are becoming more widely recognized as a methods for improving organizational performance. SOPs must be properly designed and updated on a regular basis top reserve operational consistency and support continuous improvement initiatives in production environments. They also help to connect operational procedures with regulatory standards and quality assurance goals, making them an essential component in modern production planning.

Astuti and Wibowo (2021) study on SOP implementation in small-scale companies discovered that well-documented procedures enhanced staff performance, decreased production rework, and boosted customer satisfaction. Similarly Handayani et. al (2020) stressed the importance of SOPs in aligning operational workflows with ISO 9001:2015 standards, which is crucial for firms seeking international certification and recognition.

METHODOLOGY

This study employs a qualitative research method with a conceptual approach, concentrating on the exploration and synthesis of prior studies on production planning. This study seeks to gain a comprehensive understanding of how technology selection, facility layout design, adn the formulation of Standard Operating Procedures (SOPs) interact and contribute to effective production systems. This study being analyze from existing literature, which includes academic journals, case studies, and relevant theoritical frameworks. The qualitative character of this study allows for in-depth interpretation and critical examination of many perspectives, resulting in a structured conversion thet emphasizes the interconnectedness of different components. Thsi method

eaims to provide a theoritical framework for future empirical research and practical applications in production management.

RESULTS AND DISCUSSION

Technology Selection in Production Planning

The choice of technology must be clearly defined as certain products can be processed in more than one way. Often, one type of product can be made using more than one method, ranging from manual, semi-automatic, to fully automated processes. Therefore, choosing technology in production planning should take many things into consideration, not just technical matters. It needs to be balanced by considering cost efficiency, its production capacity, and the impact on the quality of the final product. In determining the desired level of mechanism and expected economic benefits are general benchmarks that can be used (Mukhsinun et al., 2023). For example, the use of automated technologies such as CNC machines or robotics can save time and reduce human error in large-scale production. In contrast, semi-automated or manual approaches may be more advantageous in small-scale production with high customization needs. According to Santoso and Widjaja (2022), factors to consider in technology selection include:

1. Suitability to production needs, referring to the characteristics of the products and production processes run by the company. This includes the ability of the technology to produce products with the required specifications, so that the technology is not too sophisticated but can match the market demand. This will determine the success of its implementation in the long run.
2. Scalability and flexibility refer to the technology's ability to scale up as demand grows and the way it can handle product variations without having to make major changes in the production system. This allows companies to respond quickly to market needs and improve competitiveness.
3. Cost efficiency refers to consideration of the total cost of ownership, which includes initial investment, operational costs during production, and maintenance costs. This is important in the technology selection process so as not to cause a financial burden in the long run.
4. Support for sustainability refers to supporting sustainable principles that should be adopted in the modern world, such as using efficient energy or minimizing production waste. This will improve the company's image in the eyes of consumers who meet environmental regulations in various countries.

Choosing the right technology is an important part of planning the production of goods or services. In addition to the technical process, this decision has an impact on strategic aspects such as cost efficiency, agility in responding to the market, product quality, and operational sustainability of the company. By considering factors such as the suitability of the technology to the production needs, scalability, and flexibility of the system to optimize its production process.

Therefore, technology selection must be carried out systematically and based on a thorough analysis in order to be able to support the company's operational and business strategies in the long term (Nikmah et al., 2023) . It can also meet industry needs and support overall business objectives. In the article of Lubis el. al (2024), stated one example of coconut fiber peeling machine technology as appropriate in Gajahrejo Village, Malang Regency. It uses an automatic stripping system that uses two toothed cylinders that rotate in opposite directions to efficiently tear and peel the coconut fiber.

Production Facility Layout

The importance of facility siting is that errors in siting can lead to increased costs. The location of production also greatly affects the market price, which is influenced by the distance between the production location and the market. Proper layout will also benefit a business in financial and non-financial terms because it can provide better service to customers and make it easier to get the desired workforce in quantity and competence. In addition, a good layout is one that uses space efficiently to perform processes in improving the quality of space and reducing material handling costs (Adiasa et al., 2020) . Layout planning is done to increase production capacity and allow the production process to run smoothly. The Systematic Layout Planning (SLP) method is intended to overcome various problems related to production material flow, warehousing transportation, supporting, to office operations (Nugeroho, 2021) . According to Suseno and Fitri (2022), there are stages of the procedure for forming the Systematic Layout Planning (SLP) method:

1. Collecting data and analyzing material flow, to evaluate the quantitative size of each material movement between departments or operational activities. Process flow maps, *form to charts*, and activity relationship maps are often used.
2. Analyzing activity relationships, to calculate the cost of moving materials and more qualitative in layout design and analysis using *Activity Relationship Chart* (ARC). This is the basis for creating alternative layouts with respect to modifications and practical constraints.
3. The creation of a room relationship diagram, to design the level of functional proximity between departments, work stations, or production units within a facility. This will help in developing an initial layout design that is based on the real needs between departments.
4. Calculating area requirements, to calculate the minimum area required for machines, work areas, and work safety and comfort. This creates a work area that can produce an optimal layout design in space utilization.
5. Formation of *block layout alternatives*, to form blocks of rooms based on the size and relative position between sections. Each alternative will be compared using criteria such as material flow, work safety, and future development potential.

Overall, facility siting and layout design are critical to speeding up the process of planning the production of goods or services. Decisions about location affect not only operating costs and selling prices, but also market access and other resources. Each step in the SLP method provides a systematic basis for producing

a facility design that meets actual production needs. This enables the company to overcome operational problems and improve its competitiveness in the long term as its strategic investment (Desviana & Firdaus, 2024).

Formulation of Standard Operations Procedures (SOPs)

Standard Operations Procedures (SOPs) are created to maintain the overall quality of the implementation of nursing actions and become a systematic guide to create consistency in the behavior of its members. SOPs are also created so that all members of the organization understand the roles and functions of each position in the organization. This ensures that all parties have the same standards in providing services to customers. Each policy can explain the duties, authorities, and responsibilities of each member of the organization, making it difficult to find obstacles in the implementation of procedures. According to Stella et. al (2022) SOP consists of three descriptions;

Standards which are the main reference used by each member in carrying out certain implementations, Operations which describe the flow of routine and non-routine work activities, and Procedures which are the stages of the implementation process that are clearly written and detailed. According to Rakhman (2023!), there are four stages in the implementation of SOP preparation:

1. Preparation, involving the formation of an SOP drafting team, determining the objectives of the SOP drafting, and identifying the scope of work processes to be standardized. It is important to involve related parties who understand the work process directly so that the SOPs prepared reflect real practices in the field.
2. SOP needs assessment, involves analyzing the needs and problems that exist in the work process to be SOPed. The results of this assessment are the basis for prioritizing the creation of SOPs in the most crucial areas.
3. Integration and management involves developing and implementing SOPs into work practices. This includes socialization, training, and testing of SOPs so that they can be integrated with the quality management system and company policies so as not to cause conflicts in their implementation.
4. *Monitoring* involves monitoring the performance of the SOP, evaluating the effectiveness and efficiency of the SOP, and revising the SOP if necessary. This *monitoring* is also the basis for periodically improving and updating SOPs to keep them relevant to changes in the organization, technology, or the latest regulations.

SOPs are created and implemented as an important part of planning the production of goods or services to improve operational efficiency and consistency. With SOPs, every component of the production system has clear work guidelines, from individual tasks to coordination between sections. The preparation process involves preparation, needs assessment, and ongoing supervision. So this makes the SOP in line with the dynamics and needs of production in its production planning.

CONCLUSIONS AND RECOMMENDATIONS

Planning the production of goods or services is a strategic process that includes selecting technology, designing facility layouts, and developing Standard Operations Procedures (SOPs). The speed, efficiency, and quality of production results will be influenced by the selection of the right technology. An ideal facility layout will facilitate material flow, minimize waste of time and space, and create a comfortable and productive work environment. Furthermore, a structured SOP will serve as a work reference to ensure that each task is performed consistently and in accordance with predetermined standards. Production planning can have difficulty in achieving operational goals and improving service quality in the absence of any of these components. These three elements before are intrinsically linked and must be approached in a unified manner to optimize the production system's performance. The choice of suitabel technology not only dictates production capacity and quality but also affects the arrangement and flow of operations. An effectively designed layout improves technological efficiency and facilitates seamless interdepartmental coordination. Simultaneously, SOPs serve as a cohesive operational framework that guarantees consistency, safety, and accountability in the execuation of both technological instruments and layout designes. Maximizing production plannig necessitates a comprehensive approach that acknowledges the interplay among these elements to facilitate sustaibale, efficient, and competitive business operations.

Based on the conceptual analysis offered, businesses should approach production planning holistically, incorporating technology selection, facility layout design, and the development of Standard Operating Procedures (SOPs). Each component should be coordinated to help achieve operational objectives such as efficiency, productivity, and quality assurance. Companies should prioritize cross-functional cooperation when deploying new technologies, ensure that facility layouts accomodate both existing workflows and future scalability, and create SOPs that are adaptable to continuing process modifications. Regular evaluations and updates on these factors are also required to remain competitive in a continually changing business environment.

FURTHER STUDY

Too deepen the conceptual insights given in this paper, future research should focus on empirical validation via case studies or fielwork in other industrial sectors. Studies could look into how the integration of technology, layout, and SOPs influences real-world production performance, as well as the contextual elements that influence its success. Furthermore, study can look into how digital transformation , such as the use of Industry 5.0 technology, automation, and data analytics, improves or challenges the integration of these three parts. Comparative studies of traditional and digitally enhanced production systems may also provide useful insights into establishing adaptive and future-ready production planning frameworks.

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