



Agile Manufacturing: Building Flexibility in Operational Management

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Article Info	ABSTRACT
<p>Corresponding Author: Imam Wibowo E-mail: wibowoimam253@gmail.com</p>	<p>This research aims to investigate the application of the Agile Manufacturing approach in the context of operational management and how it can help organizations increase their flexibility in facing dynamic changes in the business environment. This research methodology includes a literature study to understand the concept of Agile manufacturing using a qualitative descriptive approach. The research results show that the integration of agile manufacturing, lean manufacturing, digital technology and employee development concepts has a positive impact in building adaptive and efficient operational management. Research findings confirm that the combination of lean principles with an agile manufacturing approach creates a solid foundation for responsibility for change and operational risk management. The use of digital technology is proven to provide greater visibility into the supply chain, facilitate real-time monitoring and speed up decision making. In addition, employee development has proven to be a key factor in improving individual skills and establishing a company culture that supports adaptability.</p> <p>Keywords: Agile Manufacturing, Lean Manufacturing, Digital Technology, Employee Development, Responsibility for Change</p>

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INTRODUCTION

World development is currently experiencing rapid acceleration, especially in the industrial sector which is a pillar of the global economy. This dynamic creates increasingly fierce competition between various industries and companies that are trying to be at the forefront of the market (Sri Adiningsih, 2019). Efforts to achieve competitive advantage are a necessity, encouraging companies to continue to innovate and adapt to changes that occur. In this context, the role of management becomes crucial in directing strategic steps, both in the areas of production/operations, marketing, human resources and finance (Fatimah & Azlina, 2021).

In facing the challenges of global competition, operational management is a key factor that supports the overall strategy of an organization or company (Rusdiana, 2014). Operational management is not only related to production efficiency, but is also closely related to the application of the latest innovations and technology in business processes. Many organizations and industries place operational management as the main focus in developing their strategic models (Adam, 2021). By prioritizing these aspects, companies can increase their competitiveness through operational efficiency, responsibility to market changes, and development of innovative products or services (Ariani, 2011).

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In facing the challenges of increasingly fierce competition, companies are now taking strategic steps by looking for solutions that can maintain their competitiveness in the market (Pramudya, 2023). Determining competitive priorities is the main basis for this effort, with a focus on responsiveness to consumer needs and desires, introduction of new products, efficient delivery, operational flexibility, and product quality (Huda & Martanti, 2018). This paradigm reflects a change in the way companies view the key factors that can differentiate them from competitors.

As business competition becomes more intensive, the paradigm for achieving competitive advantage undergoes a significant transformation (Adinoto, 2010). It is no longer enough to just be responsive to consumer needs, companies must be proactive in understanding and anticipating market needs (Rangkuti, 2017). Close integration with consumers is key, with companies not only serving as providers of products or services, but also as partners who help identify consumer problems and needs. This strategic capability to be proactive is very dependent on good integration and coordination throughout the company's value chain (Nugroho & Fadhilah, 2023).

Agile manufacturing emerged as a strategic concept in operational management that was developed through the synthesis of skills or core competencies from a number of companies (Booth, 1996). In this model, the company combines its operations (venturing) based on the specific expertise of each partner, optimizing the use of facilities and resources. Ivar Gutmans (1997) explains that in the context of agile manufacturing, organizations or companies are expected to create processes, equipment and training that enable them to respond quickly to customer needs and market changes. While maintaining control over costs and quality, agile manufacturing is the basis for achieving excellence in a competitive business environment.

Agility in operational management is emerging as a new paradigm that is becoming an urgent need to achieve excellence in an increasingly competitive business environment. Previously, lean manufacturing or lean production had been a significant change from the mass production model (Nuroji, 2023). Lean manufacturing emphasizes increasing flexibility and efficiency, by reducing all forms of waste. However, with changing market dynamics and constant changes in customer needs, agile manufacturing is emerging as an evolutionary step from lean manufacturing (Nurlaila et al, 2023). By maintaining a focus on efficiency and flexibility, agile manufacturing requires organizations to become more responsive and adaptive to rapid change, while maintaining control over costs and quality. Thus, the evolution from lean manufacturing to agile manufacturing reflects the continuing need to face challenges in a dynamic business environment (Ririyani & Singgih, 2015).

The world of economics and business is currently faced with complexity which is explained by the VUCA concept, namely Volatility, Uncertainty, Complexity and Ambiguity. As described by Jatmika & Puspitasari (2019), Volatility reflects the dynamics of rapid change in various aspects, including social, economic and political. Uncertainty indicates difficulty in predicting ongoing issues and events, while Complexity refers to a situation that is very complex because it involves many elements that are difficult to resolve. Ambiguity, according to Supriyanto et al (2019), describes a situation that is still uncertain and clarity is questionable. Top of Form

In facing complex and dynamic VUCA challenges, the role of agile manufacturing becomes increasingly crucial for companies (Zebua et al, 2023). Agile manufacturing emerged as a strategic approach that allows companies to adapt and transform in

situations full of uncertainty and rapid change (Alteza, 2005). Through operational agility and responsibility to market changes, agile manufacturing enables companies to remain competitive and innovative. The ability to adapt processes, products and strategies quickly makes agile manufacturing the key to success amidst the complexity of VUCA (Tussifah, 2017).

The aim is to understand and analyze the implementation of the Agile Operations concept in the context of operational management, as well as identify its impact on the operational flexibility of an organization. This research aims to provide in-depth insight into how implementing Agile Operations can increase organizational responsibility and adaptability to changes in the dynamic business environment. It is hoped that the benefits of this research will provide practical guidance for organizational leaders in building operational foundations that are more agile, responsive and able to compete in a competitive market.

METHOD

This research uses qualitative methods to analyze socio-political phenomena in society. This method was chosen because the author wanted to understand the relationship between variables in more depth, as stated by Yulianah (2022). Qualitative research is often used to describe events chronologically, explain complex relationships between variables, and investigate meanings or values that emerge in society. The choice of this method allows researchers to explore and collect information from informants as they are, according to their own views. By giving respondents the opportunity to share their thoughts, this research ensures that the responses given are comprehensive and accurate according to the language and views of the informants.

RESULTS AND DISCUSSION

Agile manufacturing, as a manufacturing methodology, features a primary focus on rapid response to customer needs and desires. In today's fast-paced business environment, speed and agility are the foundations of competitive advantage. By adopting this approach, companies are able to respond quickly to changing customer demands, design new products, and optimize production processes. Agile manufacturing is not just about operational efficiency, but also about the ability to adapt with flexibility to dynamic market changes. This creates opportunities for companies to become more agile, competitive and relevant in the context of ever-evolving global competition.

Companies that adopt agile manufacturing are in a much better position to take advantage of emerging opportunities quickly and respond more effectively to changing customer demands. The ability to quickly change production processes, integrate product innovations and respond to market changes provides significant competitive advantages. Agile manufacturing creates an environment where companies can become more responsive, adaptive, and can leverage speed as a key differentiation. Thus, this approach is not just a production method, but a strategy that leads to the development of sustainable competitive advantages in a dynamic and rapidly changing business era.

Agile manufacturing can build flexibility in operational management by implementing several principles and practices that support responsibility for rapid change. Here are some ways how Agile Manufacturing can build flexibility into operational management:

Close Team Collaboration

Agile manufacturing is not just a production methodology; it creates a solid foundation through the pillars of close, multidisciplinary team collaboration. In this context, team building is not only about gathering individuals who have technical skills, but also carries a spirit of responsiveness to change. A team consisting of various backgrounds and skills provides a rich perspective, enriches solutions, and increases the company's adaptability to market dynamics and changing production needs.

This close collaboration is realized through effective communication between team members. Open and transparent communication is a key element in ensuring every team member is fully involved in fast decision making. So, it is not just a gathering of competent individuals, but also a synergy between them. Teams that can communicate smoothly and support each other are able to respond to change more effectively, so that the process of adapting to production needs or market dynamics is not a separate task, but rather the result of effective collaboration. In this way, the collaboration pillar becomes a solid foundation in Agile Manufacturing, enabling companies to not only survive uncertainty, but also thrive through continuously adapting competitive advantage.

Modular Product Design

Agile manufacturing, as a concept that defines speed and flexibility in operations, encourages the implementation of modular product design. Modular design provides a strong foundation for achieving faster development and change. The modules in the product can be viewed as separate components that can be integrated or replaced easily. This approach gives companies the freedom to respond dynamically to customer needs and market changes without disrupting the entire production process. With modular design, each product element becomes independent, allowing for rapid adaptation without having to change the entire structure or production chain.

Modular design in the context of agile manufacturing provides significant advantages in product development. The ability to replace or add modules without disrupting the overall function of the product allows companies to respond quickly to market trends, customer feedback or technological innovations. Additionally, modular design facilitates iterative product development, where companies can release changes or improvements incrementally, optimizing development speed and reducing risk.

Implementing modular product design in agile manufacturing can also provide operational efficiencies and significant cost reductions. By separating product elements into modules, companies can optimize the production of each module separately. This not only allows for a more efficient production process, but also reduces the costs of product changes or upgrades. By reducing complexity in product design or configuration changes, companies can increase their agility without sacrificing operational efficiency. Thus, modular product design becomes a strategic pillar in creating a responsive, adaptive and economical production system.

Flexible Production Process

Flexibility in operational management is crucial in facing changing market dynamics. One of the keys to achieving this flexibility is through the implementation of production technology that can be quickly reset. Factories equipped with easily adaptable production equipment allow companies to change and adjust their production processes without experiencing significant reductions in productivity. Reconfigurable production technologies

include machines and equipment designed to quickly switch between different types of products or adjust production capacity according to changing demand.

By having reconfigurable production facilities, companies can respond more efficiently to changes in market or customer demand. For example, when there is a sudden increase in demand for a product or when there is a need to introduce a new product, the company can quickly change the production setup without taking a long time. This not only allows companies to optimize emerging market opportunities quickly, but also reduces the risk of losing market share due to production delays.

Reconfigurable production technologies also facilitate product innovation and efficient customization. Companies can quickly test and implement product design changes, improve features, or even put new products into production lines. This opens up opportunities for experimentation and continuous improvement, allowing companies to stay relevant and competitive in an ever-evolving market. Therefore, investment in reconfigurable production technology not only increases operational flexibility, but also becomes a fundamental strategy for building competitiveness in a dynamic business era.

Use of Digital Technology and Sensors

Adopting digital technology and sensors in production processes is a revolutionary step that not only improves operational efficiency, but also provides greater visibility into the entire supply chain. This technology integration allows companies to monitor production activities in real-time, providing a comprehensive picture of performance and inventory status. With data obtained directly from the production line, companies can identify potential changes or problems quickly.

Collecting and analyzing data in real-time is key to establishing greater visibility. Digital technology and sensors allow companies to detail every stage of production, from procurement of raw materials to delivery of the final product. By analyzing data accurately, companies can identify trends, prevent potential risks, and respond to market dynamics more proactively. Decisions can be made more quickly and accurately, minimizing potential losses or imperfections in the supply chain.

The main advantage of digital technology and sensors in production processes is the ability to respond proactively to changes or challenges. For example, if a delay in the supply of raw materials is detected or if there is a fluctuation in customer demand, the company can immediately take corrective steps or design an alternative strategy. This proactive responsibility helps companies to remain adaptive and flexible in the face of market uncertainty, creating conditions that support competitive advantage in an ever-changing business environment. Thus, the adoption of digital and sensor technologies is not just about operational efficiency, but also about creating a solid foundation for proactive responsibility in operational management.

Lean Manufacturing Principles

One of the main principles of lean is reducing waste, including overproduction, waiting time, defects, over-processing, inventory, motion, and transportation. Integration of this principle in a company's operations helps identify and eliminate activities that do not add value. In this way, companies can increase their operational efficiency, optimize the use of resources, and produce products or services at lower costs.

The application of lean principles also supports responsibility for changes in company operations. Lean encourages rapid adaptation to changes in demand or market conditions. By minimizing waste and speeding up production cycles, companies become more agile in

matching output to actual demand, reducing the risk of overproduction, and increasing the ability to respond to changing customer needs.

The integration of lean principles in agile manufacturing operations creates a powerful combination. While agile manufacturing emphasizes flexibility and responsibility to change by building agile teams and modular production management, lean principles provide a foundation for efficiency and waste elimination. This combination allows companies to achieve high operational efficiency while remaining responsive to market changes, creating a sustainable competitive advantage. Thus, integrating lean principles in agile manufacturing operations not only provides synergy between the two approaches but also creates efficient, responsive and value-oriented operations.

Employee Training and Development

Providing training and development to employees is a critical strategy to ensure that companies can build flexibility in their operational management. In a dynamic business environment, where constant change is the norm, employees who have relevant skills and can adapt quickly become an invaluable asset.

Employee training and development is the main basis for improving the skills needed to face operational dynamics. By providing training according to needs, companies can ensure that employees have the necessary technical and soft skills. These skills include effective communication, leadership, problem solving, and creativity, all of which support flexibility and adaptability in the face of operational change.

Skilled and quickly adaptable employees are not only key players in daily operations, but also important agents of change. They can provide valuable insight and innovation needed to improve operational efficiency and respond to market changes. Through continuous training and development, the company paves the way for employees to continue to develop and adapt to the demands of an ever-changing business environment.

Investing in employee development is not just about enhancing individual skills, but also establishing a company culture that encourages flexibility and continuous learning. By creating an environment where self-development is valued, employees feel encouraged to continue learning and growing. This helps create an organization that can quickly respond to market changes, drive innovation, and build a foundation of flexibility in fundamental and ongoing operational management. Thus, employee training and development becomes a key step to ensure that companies not only survive, but thrive in a dynamic business environment.

CONCLUSION

In aligning operational concepts, it can be concluded that integration between agile manufacturing, lean manufacturing, use of digital technology, and employee development is crucial for building a solid foundation in operational management. All these concepts and practices together aim to create operations that are efficient and responsive to changes in the dynamic business environment. Flexibility and responsibility to change emerge as key focuses in this approach. The integration of lean principles in agile manufacturing operations, supported by the application of digital technology, creates a solid foundation for improving operational efficiency. Skilled and adaptive employees play a central role as agents of change, helping to strengthen the company's responsiveness to market dynamics and changing customer needs. Employee development not only acts as an investment in

individual skills, but also shapes a company culture that supports continuous learning and flexibility. Employees who are skilled and can adapt quickly not only carry out operational tasks, but also become catalysts for innovation and positive change within the company. The use of digital technology and sensors plays a critical role by providing greater visibility into the entire supply chain. This not only enables real-time monitoring of production activities, but also facilitates fast and accurate decision making.

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