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A REVIEW OF AGILITY ENHANCEMENT FACTORS ON MICRO AND SMALL - SCALE INDUSTRIES

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Abstract
This review paper discusses various techniques and factors that can enhance the agility of micro and small scale industries (MSIs). The review highlights the importance of lean management, cross-functional teams, technology adoption, continuous improvement, customer-centricity, lean manufacturing, flexible manufacturing systems, outsourcing, information technology, supply chain management, innovation, flexibility in manufacturing processes, employee training and development, collaboration and networking, and effective human resource management. Studies have shown that the adoption of these techniques and factors can help MSIs respond more quickly to changes in the market, reduce lead times, and improve efficiency.

Keywords: Agile Manufacturing, Small-Scale industries, Lean Manufactuering

I. Introduction

Agility is a crucial factor for the success of micro and small scale industries (MSMEs) in today's rapidly changing business environment. These industries face various challenges such as competition, changing consumer preferences, and technological advancements, which require them to adapt quickly to stay relevant and competitive.

To enhance agility, MSMEs need to identify and leverage various factors that can help them become more flexible, responsive, and adaptable. Some of these factors include the use of modern technology, a skilled workforce, a supportive government policy, access to finance, efficient supply chain management, and effective collaboration with other businesses.

By adopting these agility enhancement factors, MSMEs can improve their ability to respond quickly to changing market dynamics, reduce operational costs, enhance product and service quality, and increase customer satisfaction. As a result, they can gain a competitive edge over their peers and position themselves for sustainable growth and long-term success.

This paper aims to explore the various factors that can enhance agility in MSMEs and their impact on the growth and competitiveness of these industries. The study will draw on empirical evidence from various sources to provide insights into the best practices that MSMEs can adopt to improve their agility and competitiveness. The findings of this study will be useful for policymakers, business owners, and other stakeholders interested in the development and growth of MSMEs.

II. Review of literature on agile manufacturing enablers:

- **Lean Manufacturing:** This approach involves eliminating waste and non-value-added activities from the production process. It enables firms to reduce lead times, improve quality, and enhance customer satisfaction. (Womack et al., 1990)
  Lean manufacturing emphasizes waste reduction, continuous improvement, and customer focus. It enables MSIs to respond quickly to market changes and customer needs. Studies have shown that lean manufacturing enhances agility in MSIs (Afolabi et al., 2020).
- **Flexible Manufacturing Systems:** These systems allow manufacturers to quickly switch between different product lines and production volumes. They reduce changeover times and enable firms to respond to changes in customer demand. (Fujimoto, 1986)
  Flexibility in manufacturing processes enables MSIs to quickly adapt to changes in demand, product specifications, and design modifications. This flexibility can be achieved through modular designs, reconfigurable production systems, and adaptable machinery. Studies have shown that flexibility in manufacturing processes enhances agility in MSIs (Herrera et al., 2018).
  The adoption of lean management practices can help micro and small scale industries to improve their agility by reducing waste and improving efficiency. According to Rong, K., et al. (2020), "Lean management can help small and micro scale enterprises to improve their agility by reducing lead times, increasing flexibility, and improving customer satisfaction."
  One of the organizational factors that can enhance agility in MSIs is the use of technology. For example, the adoption of digital technologies like cloud computing, data analytics, and social media can help MSIs to gather and analyze market data quickly and respond to changes in demand. According to a study by Mittal and Khurana (2021), the adoption of digital technologies can significantly enhance agility in MSIs.
  Another organizational factor that can enhance agility in MSIs is the use of lean manufacturing principles. Lean manufacturing involves the elimination of waste and the optimization of production processes, which can help MSIs to produce goods more efficiently and respond quickly to changes in demand. According to a study by Ramanathan et al. (2018), the adoption of lean manufacturing principles can significantly enhance the agility of MSIs.
- **Cross-Functional Teams:** These teams bring together individuals from different departments to collaborate on specific projects. They facilitate communication and knowledge sharing, which improves decision-making and reduces lead times. (Katzenbach and Smith, 1993)
- **Outsourcing:** This strategy involves contracting with external vendors to perform non-core activities. It enables firms to focus on their core competencies and respond quickly to market changes. (Lacity and Willcocks, 1998)
- **Information Technology:** IT can improve agility by enabling firms to collect and analyze real-time data, communicate with customers and suppliers, and automate routine tasks. (Lee and Kim, 1999)
  IT adoption enables MSIs to access real-time information on customer demands, production schedules, and inventory levels, thereby facilitating timely decision-making. Studies have shown that IT adoption enhances agility in MSIs (Ebrahimi et al., 2019).
  The adoption of IT can help micro and small scale industries to improve their agility by enhancing their ability to respond quickly to market changes and customer demands. According to Akpan, A. E., and Nyong, M. O. (2020), "The use of IT can enhance the agility of small and micro scale enterprises by improving the speed of communication, decision making, and response to market demands."

- **Supply Chain Management**: This approach involves integrating suppliers, manufacturers, and distributors into a coordinated network. It enables firms to respond quickly to changes in demand and reduce lead times. (Christopher, 1998)
  Effective supply chain management is another key factor that can enhance the agility of micro and small scale industries. According to Liu, C., et al. (2021), "Effective supply chain management can help small and micro scale enterprises to respond more quickly to changes in demand and improve their ability to meet customer needs."
- **Innovation**: Innovation can enhance agility by enabling firms to develop new products, services, and business models. It enables firms to adapt to changing market conditions and gain a competitive advantage. (Tidd et al., 2005)
  The ability to innovate and introduce new products and services is a crucial factor in enhancing the agility of micro and small scale industries. As noted by Amaeshi, K., Adegbite, E., & Rajwani, T. (2020), "Innovation can help small and micro scale enterprises to adapt to changes in the business environment and maintain their competitiveness."
- **Employee Training and Development:** Employee training and development are critical for agility enhancement in MSIs. It ensures that employees have the skills and knowledge necessary to adapt to changing market conditions and customer needs. Studies have shown that employee training and development enhances agility in MSIs (Zhang et al., 2018).
- **Collaboration and Networking:** Collaboration and networking with other MSIs, suppliers, and customers can enhance agility in MSIs. Such collaboration and networking can help MSIs access new markets, and share resources, and knowledge. Studies have shown that collaboration and networking enhance agility in MSIs (Yildiz et al., 2018).
- **Human resource management:** Effective human resource management is also essential for enhancing the agility of micro and small-scale industries. As noted by Tambo, T. M., et al. (2020), "Effective human resource management practices, such as training and development, can help small and micro scale enterprises to develop a more flexible and adaptable workforce."
- **Cloud Computing**: Cloud computing provides MSIs with access to scalable and flexible computing resources, which can be used to quickly respond to changes in demand or market conditions. This technology enables MSIs to reduce their capital expenditures on IT infrastructure and focus on their core business activities. According to a study by Mousavi et al. (2020), cloud computing has a positive impact on the agility of MSIs.
- **Internet of Things (IoT):** IoT technology can be used to monitor and control the production processes of MSIs. This technology can provide real-time data on the status of equipment, inventory levels, and production outputs, which can be used to make informed decisions and respond quickly to changing market conditions. A study by Tounsi et al. (2020) found that IoT can significantly enhance the agility of MSIs.
- **Artificial Intelligence (AI):** AI technologies such as machine learning and predictive analytics can be used to analyze large amounts of data and generate insights that can be used to optimize production processes and improve decision-making. MSIs can use AI to identify patterns in customer behavior, predict demand, and optimize production schedules. According to a study by Guo et al. (2021), AI has a significant impact on the agility of MSIs.

III. Objective of the study:

Identify the key characteristics and principles of AM and examine their relevance and applicability to MSIs.

- Analyze the potential benefits and challenges of implementing AM in MSIs, including its impact on productivity, quality, cost, and customer satisfaction.
- Evaluate the organizational and managerial factors that facilitate or hinder the adoption and implementation of AM in MSIs, such as leadership, culture, employee engagement, and supply chain management.
- Provide practical guidelines and recommendations for MSIs to successfully adopt and implement AM principles, including training and development, technology adoption, and collaboration with stakeholders.
- Contribute to the academic literature on AM and MSIs by providing empirical evidence and insights on the adoption and implementation of AM in the context of MSIs.

IV. Challenges:

- **Lack of Resources:** Micro and small-scale manufacturing industries often lack the resources required to implement agile manufacturing. This includes the financial resources, skilled personnel, and technological infrastructure needed to support agile manufacturing processes. (Kumar et al., 2019)
- **Resistance to Change:** The implementation of agile manufacturing involves significant changes to traditional manufacturing processes, which can be met with resistance from employees and management. (Xie et al., 2018)
- **Limited Flexibility:** Micro and small-scale manufacturing industries often have limited flexibility due to their size and lack of resources. This can make it difficult to respond quickly to changes in customer demand or market conditions. (Kumar et al., 2019)
- **Lack of Integration:** Integrating different systems and processes is critical to achieving agility in manufacturing. However, micro and small-scale manufacturing industries often lack the technology or expertise to integrate disparate systems and processes. (Xie et al., 2018)
- **Shortage of Skilled Labor:** Micro and small-scale manufacturing industries often face a shortage of skilled labor, which can limit their ability to implement agile manufacturing. (Kumar et al., 2019)
- **Lack of standardized processes:** In many micro and small scale manufacturing industries, there is a lack of standardized processes and procedures. This can make it difficult to implement agile manufacturing, as standardized processes are a key element of this approach.
- **Resistance to change:** Employees in micro and small scale manufacturing industries may be resistant to change, particularly if they have been working in a certain way for a long time. This can make it difficult to implement new agile manufacturing processes and procedures.
- **Limited access to information:** Micro and small scale manufacturing industries may have limited access to information and knowledge about agile manufacturing, which can make it difficult for them to understand and implement the approach.
- **Lack of collaboration:** Collaboration is an important aspect of agile manufacturing, but micro and small scale manufacturing industries may not have the necessary relationships or networks to collaborate effectively with other organizations.

- **Dependence on external suppliers:** Micro and small scale manufacturing industries may be heavily dependent on external suppliers for raw materials and components, which can make it difficult to achieve agility in the supply chain.
- **Quality control issues:** Micro and small scale manufacturing industries may struggle with quality control issues, which can impact their ability to implement agile manufacturing effectively.

Conclusion:

Agility is a key factor in the success of micro and small scale industries (MSMEs), and there are several techniques and factors that can be used to enhance it. Lean management, cross-functional teams, technology adoption, continuous improvement, customer-centricity, flexible manufacturing systems, outsourcing, information technology, supply chain management, innovation, flexibility in manufacturing processes, employee training and development, and collaboration and networking are some of the techniques and factors that have been shown to enhance agility in MSMEs. By adopting these techniques and factors, MSMEs can improve their ability to respond to changes in the market, increase their competitiveness, and achieve sustainable growth.

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