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AI-Driven Technology Readiness and Lean Manufacturing for Enhancing FMCG SME Performance in Bogor, Indonesia

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Abstract

The purpose of this study is the technology readiness strategy and the implementation of lean manufacturing for small and medium enterprises (SMEs) in Fast-Moving Consumer Goods (FMCG) companies for processed taro products in Bogor. Bogor City is known as the largest taro production center in Indonesia. The method used is data triangulation, a technique for checking data validity by comparing and confirming information from various angles. SWOT analysis is a strategic planning tool to evaluate internal strengths and weaknesses, as well as external opportunities and threats, and to design effective business strategies. The results of the study indicate that the technology readiness strategy has been able to implement digitalization of marketing and interaction with consumers for purchasing patterns, supply chain efficiency, and demand accuracy. Meanwhile, lean manufacturing, through quality control, product innovation, and process efficiency, improves customer satisfaction and loyalty performance. The SWOT strategy found strengths in local brands and distinctive packaging, weaknesses in limited production capacity, opportunities in healthy local culinary trends, and threats from the emergence of many competitors and product substitutions. The study shows that FMCG SMEs in the combination of technology readiness and lean manufacturing strengthen performance in terms of competitiveness and consumer loyalty.

Keywords: *technology-readiness; consumer- loyalty; lean- manufacturing; SMEs; performance supply chain.*

INTRODUCTION

Indonesia, with a population of 297.3 million by 2023, the fourth-largest in the world (Edy et al., 2023), offers significant potential for developing the food processing industry. Supported by consistent economic growth and increasing purchasing power, demand for processed food products in Indonesia continues to

grow. According to data from the Indonesian Ministry of Industry, this sector is showing a positive growth trend (Nasution et al., 2020).

By 2024, the number of Small and Medium Enterprises (SMEs) in Indonesia is expected to exceed 65 million units. This sector plays a significant role in the national economy, employing approximately 97% of the workforce and contributing 60.51% to Gross Domestic Product (GDP). The distribution of SMEs is dominated by the wholesale and retail trade sector, with over 14 million units, followed by the accommodation and food and beverage sectors (Ministry of SMEs, 2024).

SMEs play a vital role in the economy through job creation, contribution to tax revenue, increased exports and foreign exchange earnings, distribution of goods, and development of human resources (Maemunah et al., 2018). Furthermore, SMEs have proven to be a driving force for national economic growth, while also spurring local entrepreneurship and innovation. In Indonesia, this sector demonstrated resilience in the face of the 1997 monetary crisis and the 2008 global crisis, making strengthening sustainable competitiveness a key requirement for survival in a dynamic business environment full of uncertainty and increasingly fierce competition (Siti Maemunah, 2019b).

Bogor is known as an agricultural city and a producer of taro (Sulthanah et al., 2016). Taro production reaches thousands of tons per year, which is then developed into typical souvenir products such as Bogor taro cakes (Assegaf et al., 2022). SMEs operating in the Bogor taro processed food sector fall into the FMCG category because the product is quickly produced, quickly consumed, has a short distribution cycle, and relies on dynamic consumer preferences (Nguyen et al., 2022).

The main challenge is competition with similar products (typical Bogor souvenirs). Second is fast distribution so that taro products reach consumers. Third is innovation in flavor, packaging, and promotion to maintain the market. Competition in FMCG Taro SMEs in Bogor is related to competitive business patterns, connected to the target market and able to integrate with the market (Farida & Setiawan, 2022; Siti Maemunah & Ramdhany, 2025; Yuniwati, 2024). The existence of global economic changes has made competition in the food industry, especially taro, increasingly fierce. Competition in the FMCG SME industry, especially taro cake sales, is very fierce, given the ease of taro cake production, so that many new producers have emerged (Madhani, 2018; Syam et al., 2022). The competition in question is the rapid development of technology, production costs and marketing costs of new products to compete in the market. Large companies have begun to emerge adding to the problems of FMCG SMEs such as Lapis Talas Sangkuriang Bogor, Lapis Talas Bogor Utan Kayu, and Rumah Talas Bogor (Triyadi, 2023).

Lean manufacturing helps with production efficiency, quality control, and waste reduction (Latifah Ahmad & Nita Kusumawati, 2020; Zekhnini et al., 2024).Technology readiness strategies and lean manufacturing must be supported as key to business sustainability and competitive advantage, not only domestically but also internationally (Bachtiar et al., 2021; Fadil, 2015; Poulsen & Lema, 2017).

Winning the competition is the main challenge faced by Bogor FMCG SMEs, technology readiness strategies and lean manufacturing to improve competitive business performance. Business strategy and business performance must be consistent with the company as a whole and the company's business environment (Husna et al., 2025; Meyer et al., 2021; Panya & Marendi, 2021). Adopting the opinion of (Ali et al., 2019; Dsilva & Subramanian, 2021; Ragazou et al., 2022)competitive advantage and preserving scarce resources and improving business performance are the company's goals.

LITERATURE REVIEW

Technology Readiness Strategy

Technology readiness strategy is needed to develop a new knowledge base to retain consumers and commercialization that produces and sells products and processes (Saleha et al., 2022; Sony & Aithal, 2020; Ungson & Wong, 2014). FMCG Taro Bogor SMEs can develop through a new knowledge base to retain consumers. Technology readiness strategy is known as a competitive advantage in companies and

commercialization that produces and sells products and processes of Taro Bogor products (Wahyuningtyas & Ananto, 2020).SMEs in general at the manager level do not have enough time to make assumptions about the threat of FMCG SME companies from competitors (Fadil, 2015; Febriyantoro & Arisandi, 2019), (Gupta, 2021). FMCG Taro Bogor SMEs need a technology readiness strategy as the ability to face threats, adapt to the market, implement new ideas and win successful products, and succeed in front of competitors (Wahyuningtyas & Ananto, 2020).

The success of the Bogor Taro FMCG SME depends on infrastructure, including a technology readiness strategy (Cahyadi et al., 2022; Gardiner & Reefke, 2019; Maemunah, 2019a; Maemunah et al., 2018) and knowledge management processes (Pilelienė et al., 2024; Sculley, 2014). Technology readiness improves performance, resulting in new products or processes, and promising business strategies that are superior and competitive in the future (Fadil, 2015; Kristinae et al., 2020; Siti Maemunah, 2024). Innovative and high-quality products generate performance, such as customer loyalty. Customer loyalty impacts company performance (Karatas-Cetin, 2021; Shaiq et al., 2020; Zahrah et al., 2023).

Consumer Loyalty

The Bogor Taro FMCG SMEs meets needs and maintains consumer loyalty through product, service, and technology readiness business strategies (Darmayanti & Dwipayana, 2023; Siagian & Maharijaya, 2018). The basic focus of the technology readiness strategy is basic digitalization, the technology used by the Marketplace to record transactions on e-commerce (Gatto & Re, 2021; Mohammadian et al., 2022; Nguyen et al., 2022). The second readiness strategy focuses on system integration, the technology used by chat e-commerce, with the aim of operational efficiency and multichannel sales channels (Fonseca, 2018; S. Maemunah & Susanto, 2019; Sullivan et al., 2018). The third is inventory forecasting, which aims to predict demand to improve the performance of the Bogor Taro FMCG SMEs (Ariyanti et al., 2024; Purwaningsih et al., 2022; Sulthanah et al., 2016). The fourth is the innovation and sustainability technology readiness strategy, which aims to achieve distribution efficiency and environmentally friendly packaging technology (Gatto & Re, 2021; Rakhmasari & Dharmayanti, 2023). The fifth is the start of cashless transactions with QRIS (Dini et al., 2022; Nurunisa & Dewi, 2021).

Lean manufacturing

Lean manufacturing at the FMCG Talas Bogor SME can help improve the efficiency of logistics and supply chain processes (Maemunah et al., 2021; Piwowar-Sulej & Iqbal, 2024; Rahman, 2019)(Mydyti, 2021; Papakyriakou & Barbounakis, 2022). Lean manufacturing is a system of continuous improvement in the daily activities of production, product delivery, service delivery, and information. The initial concept of lean practice stems from the Toyota Production System, which identifies value-added activities and reduces or eliminates waste (Christopher, 2023). Lean practices create value for customers by minimizing waste (Muda), disorder (Mura), and overload (Muri), through continuous improvement techniques, such as Kaizen, PDCA, and Six Sigma. The latest development in Lean manufacturing, Lean Industry 4.0 (LI4), places greater emphasis on cost efficiency, learning, industry engagement, competency, and behavior (Hines et al., 2025; Qureshi & Mewada, 2025). According to Gatell & Avella, 2024 adding LI4 encourages the creation of lean leadership and lean culture.

SMEs

SMEs has the goal of managing resources to achieve common goals through established mechanisms. Researchers in the strategic management literature have explored sources of sustainable competitive advantage regarding performance excellence (Alon et al., 2018; Parakhina et al., 2017; Yanine et al., 2020). The literature highlights the resource-based strategic perspective of the company. One view holds that an industry is the source of advantage, while the other holds that a company's internal resources are the primary source of profit (S. Ali et al., 2021; Mohammadian et al., 2022). Business performance is an

organization's performance as the level of achievement (performance) of the organization in carrying out activities within a certain period (one year).

Performance Supply Chain Management

Performance reflects a company's success or failure in its business (Kerievsky, 2023; Solis et al., 2023). Business performance is the level of achievement in carrying out work and is the accumulated performance of all organizational units. Based on research conducted by (Chahal et al., 2016; Prim et al., 2023), performance in the small business sector is influenced by two main factors: external and internal environmental factors. Internal factors include human resources, including owners, managers, and employees; financial aspects; technical aspects of production; and marketing. External factors include government policies; socio-cultural and economic aspects; and the role of government institutions, universities, the private sector, and NGOs (Pironti et al., 2020). Meanwhile, research by (Barón et al., 2020; Toke & Kalpande, 2019; Zekhnini et al., 2024) revealed that each stage of a company's growth is the result of two environments in which the company operates: the internal and external environments. Furthermore, performance is supported by well-functioning coordination between marketing and non-marketing activities (Gatto & Re, 2021; Maemunah & Rayyan, 2025).

Success in improving performance depends on the ability to manage both internal and external factors through environmental analysis and the development and implementation of business strategies (Maheshwari et al., 2023; Ungson & Wong, 2014). This success will be achieved if there is a balance between the internal and external environments through the implementation of appropriate methods. Analysis of both the internal and external environments can be used as a basis for planning and determining company strategy (Ilham et al., 2019; Naufal Eryogia et al., 2024; Yanine et al., 2020). This position will enable companies to compete and grow their businesses.

METHODOLOGY

The method used data triangulation. The first data source was the owner of the Bogor Taro FMCG SME, which focused on technology readiness strategies, production constraints, and product innovation (Febriyantoro & Arisandi, 2019). The second data source was employees, to understand production implementation, technical constraints, and inventory management (Thangavel et al., 2021). The third data source was consumers/customers, to determine satisfaction with taste, price, packaging, and loyalty (Karatas-Cetin, 2021). The fourth data source was suppliers, to determine taro raw material availability, price, and supply quality (Mohammadian et al., 2022; Saleha et al., 2022). The fifth data source was related agencies/distributors, to understand regulatory support, promotion, and distribution. Focus Group Discussions (FGDs) were conducted with logistics experts (Siti Maemunah et al., 2021). The FGDs aimed to uncover complex business realities, such as differences in perspectives between owners and consumers, and to provide a basis for strategies for technological readiness for packaging innovation, distribution strategies, and digital promotion (Mohammadian & Rezaie, 2020).

A SWOT analysis was conducted by drawing conclusions from interviews for strengths and weaknesses, and from journal and media literature for opportunities and threats. Each SWOT factor was calculated using an Internal Factor Analysis Summary (IFAS) and an External Factor Analysis Summary (EFAS). The IFAS and EFAS were obtained by multiplying priority weights by the assessment level. The weighting ranges from 1.0 for very important to 0.0 for very unimportant. The assessment ranges from 5.0 for very good to 0.0 for very poor. The IFAS and EFAS continue with competency mapping using a Cartesian diagram and determining the dominant factor strategy (Rakhmansyah et al., 2022).

SWOT is used to identify internal factors, namely strengths and weaknesses with external factors, namely opportunities and threats in business strategy (Naufal Eryogia et al., 2024). According to (Benzaghta et al., 2021) The SWOT matrix and IFAS and EFAS analysis are used to create strategies by utilizing strengths and opportunities, and minimizing weaknesses and threats (Rakhmansyah et al., 2022). According to (Qu, 2025) the Bogor Taro FMCG SME is expected to conduct a SWOT analysis to implement

the right marketing strategy and remain competitive. The internal and external environments are the first steps in analyzing technology readiness and lean manufacturing to identify and capitalize on opportunities. The external environment is used to examine both opportunities and threats the company may face (Helms & Nixon, 2010; Khiew et al., 2020; Rakhmansyah et al., 2022). The results of these two analyses are then entered into the Internal Factors Evaluation (IFE) and External Factors Evaluation (EFE) matrices. These matrices describe the company's strengths, weaknesses, opportunities, and threats, which are then weighted and rated to obtain a total score (Siti Maemunah et al., 2023; Osita et al., 2014).

The total IFE and EFE scores are then mapped into an IE (Internal–External) Matrix. The IE Matrix shows the company's position based on the horizontal (IFE) and vertical (EFE) axes mapped onto a Cartesian diagram (Simanjuntak et al., 2024).The next step is to formulate alternative strategies based on the company's position in the IE Matrix by utilizing the SWOT Matrix. The SWOT Matrix helps determine strategies that maximize strengths and opportunities while minimizing weaknesses and threats (Setyorini et al., 2016). Lean & Digital Integration utilizes real-time data to support lean manufacturing decision-making.

All tables and figures must be centred and title should be on top. Number all tables and figures with Arabic numerals in the order in which the tables are first mentioned in text. Use font size 9.5 pt for contents in tables and figures and 8pt for notes and source. All illustrations (charts, figures and graphs) in the text will be printedin black and white coloured. Example: This present study utilizes the daily data of the stock market prices of the nine stock markets which includes NYSE Composite (United States), S&P/TSX Composite (Canada), Indice de Precios y Cotizaciones (Mexico), SSE Composite (China), Nikkei 225 (Japan), Hang Seng Index (Hong Kong), FTSE 100 Index (United Kingdom), CAC 40 (France), and DAX (Germany).

RESULTS AND DISCUSSION

The results of a focus group discussion forum attended by five Indonesian logistics experts in their fields concluded that the obstacles faced by SMEs in Indonesia are generally limited capital, government regulations, including taxes, and distribution. The implementation of digital technology applications can help with inventory and procurement management, as well as accounting and finance. According to the research conducted (Mohammadian et al., 2022; Tan & Taeihagh, 2020; Tarmizi et al., 2020; Ungson & Wong, 2014) this condition is supported by the existence of technology readiness strategy applications to assist marketing through social media or electronic procurement (e-procurement).

According to (Liu et al., 2024; Rahman, 2019)The implementation of Lean Manufacturing can be done by analyzing the 5S in warehousing (Seiri, Seiton, Seiso, Seiketsu, Shitsuke), also known as 5R in Indonesia (Ringkas, Rapi, Resik, Rawat, Rajin) in the workplace, as well as the implementation of Plan, Do, Check, and Act. This PDCA cycle is a quality management method to improve logistics and operational processes, which is very important for FMCG SMEs that require high product turnover and efficiency. Further interviews with FMCG producers at the SMEs level and logistics experts resulted in a SWOT formulation for Bogor taro producers. Table I shows the important factors in the SWOT followed by weighting and ranking assessments shown in Tables II and III. The strategy for FMCG actors in Bogor taro cake producers was created based on Figure I Cartesian Diagram.

Table 1: SWOT Analysis

Strength	**Weakness**
▪ A well-known brand, because it is a pioneer of the Bogor taro cake industry. ▪ Competence of human resources in producing.	▪ A trial and error mentality, no long-term planning and strategy. ▪ The distribution channel depends on the old distributor. ▪ High transportation costs.

▪ Ease of obtaining a supply of taro and other spices in Bogor and its surroundings.	▪ Marketing of taro cake products and brand image introduction. ▪ Finances are limited. ▪ Manual administration.
Opportunity ▪ The taro cake market is still open, especially outside Bogor. ▪ Direct distribution channels through *e-commerce platforms.* ▪ Support from central and local governments, private institutions. ▪ Support from financial institutions from banks, financial services, NGOs, local governments. ▪ The use of digital technology to help marketing and operations. ▪ Lean *manufacturing* application to lower the waste rate.	**Threats** ▪ Competition is increasing because of the lace barrier to entry into the taro cake industry. ▪ The supply of raw materials depends on the season. Suppliers have not taken advantage of proper warehousing and distribution systems. ▪ Low public awareness of healthy food and domestic products.

Table 2: IFAS Matrix

Strength	Weight	Rating	Score
A well-known brand, as a pioneer in the Bogor taro cake industry.	0,16	4,31	0,6896
Human resource competency in production.	0,14	3,79	0,5306
Ease of obtaining supplies of taro raw materials and other spices in Bogor and its surroundings.	0,14	3,76	0,5264
Sub Total	**0,44**		**1,7466**
Weakness	**Weight**	**Rating**	**Score**
Trial and error mentality, no long-term planning and strategy.	0,02	1,18	0,0236
Distribution channels depend on the old distributor.	0,10	2,42	0,2420
Production capacity	0,14	4,88	0,6832
High transportation costs.	0,08	3,65	0,2920
Marketing of taro cake products and brand image introduction.	0,08	3,45	0,2760
Limited finance.	0,06	3,18	0,1908
Manual administration.	0,06	3,81	0,2286
Sub Total	**0,54**		**1,9362**
TOTAL	**0,98**		**3.6828**

The Weaknesses subtotal (1.9362) is greater than the Strengths subtotal (1.7466), indicating that the Weaknesses factor is more dominant, with a difference of 0.1896. Based on the data in Table 2, the Weaknesses factor is strongly influenced by factors such as lack of mental readiness for entrepreneurship, lack of planning and strategy, lack of distribution and marketing networks, and limited funding sources. However, these weaknesses are offset by the product's strength, namely consumer perception that taro cake is an authentic product of Bogor and West Java. The main weakness lies in its high production capacity.

Table 3: EFAS Matrix			
Opportunity	**Weight**	**Rating**	**Score**
Marketing of taro cake products and brand image introduction.	0,14	4,23	0,5922
Marketing of taro cake products and brand image introduction.	0,12	3,76	0,4512
Support from central and regional governments, private institutions.	0,10	3,47	0,3470
Financial institutional support from banks, financial services, NGOs, local governments.	0,10	3,77	0,3770
Utilizing digital technology to assist marketing and operations.	0,06	3,21	0,1926
Lean manufacturing applications to reduce waste.	0,06	3,5	0,2124
Sub Total	**0,58**		**2,1724**
Threats	**Weight**	**Rating**	**Score**
Competition is increasing due to low barriers to entry in the taro cake industry.	0,16	3,52	0,5632
Raw material supplies are seasonal, and suppliers have not yet utilized appropriate warehousing and distribution systems.	0,12	4,09	0,4908
Low public awareness of healthy domestic food products.	0,02	2,38	0,0476
Sub Total	**0,30**		**1,1016**
TOTAL	**0.88**		**3,2740**

The subtotal of Opportunity factor 2,1724 is greater than the subtotal of Threat factor 1,1016, with a difference of 1,0708. The biggest opportunity is the opening of markets outside Bogor, Jakarta, and West Java, as well as being a threat to many new producers due to the low barriers to entry into this industry.

The Cartesian diagram in Figure 1 shows that the position of Bogor taro cake FMCG producers is in quadrant II, namely the stabilization area, meaning that the actor still has to maintain his industry in the midst of a large number of substitution products. Manufacturers must start preparing for the use of digital technology to help with marketing and administration. Waste due to the accumulation of raw materials due to seasonal supply and finished goods stocks that have a short expiration period must be overcome by implementing *lean manufacturing*, to maintain quality, while increasing efficiency and production capacity. SME industry players in the field of taro cakes must be able to take advantage of the quality and perception of Bogor taro, apply technology in production and marketing, and collaborate with more established food and retail industry players.

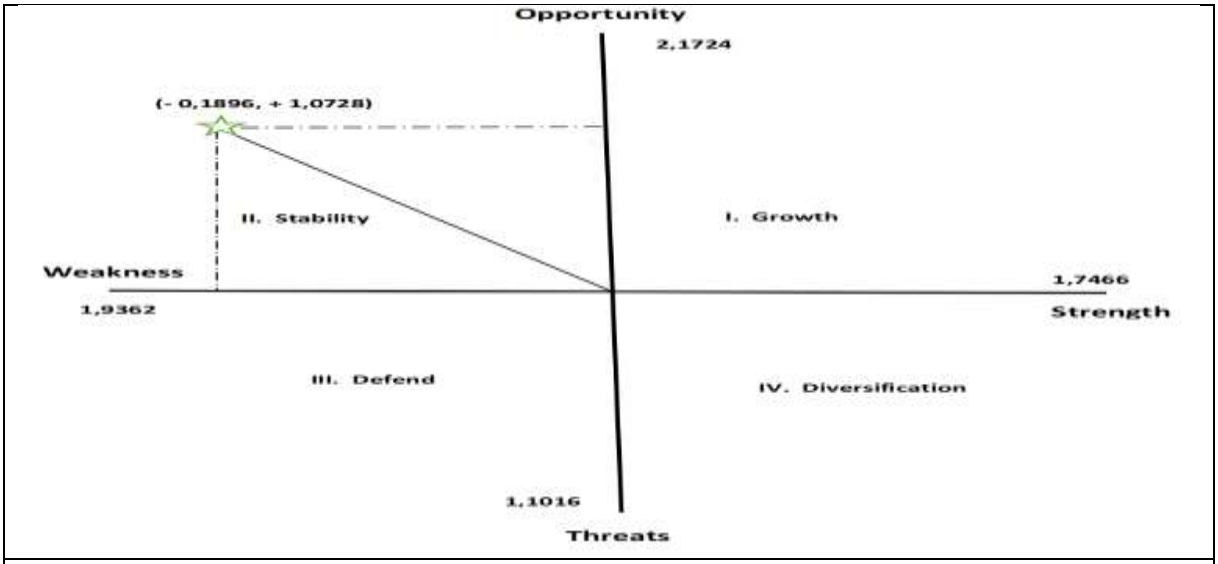

Figure 1: Diagram Cartesian

A combined analysis of IFAS and EFAS was also carried out to see the dominant impact of internal and external factors, as can be seen in Table 4 (Benzaghta et al., 2021).

Table 4: Combination of IFAS and EFAS

IFAS / EFAS	Strength 1,7466	Weakness 1,9362
Opportunity 2,1724	SO strategy 3,9190	**WO strategy** **4,1086**
Threat 1,1016	ST strategy 2,8482	WT strategy 3,0378

The largest combined strategy is the WO strategy, which means that the perpetrator must be able to take advantage of existing opportunities (Threats) to cover the weakness factor. The most appropriate action plan is the use of digital technology to improve marketing and lean practices to maintain quality and increase efficiency.

CONCLUSION

The technology readiness strategy to support Talas Bogor's FMCG SMEs must be willing to change and adapt to remain competitive and superior in the market. The strategy of readiness, technology is driven by many factors gradually, improvement through innovation, changes and improvements to existing designs and introducing significant new concepts from the past. Creating a competitive advantage in Talas Bogor FMCG SMEs is necessary to maintain a competitive advantage and meet consumer needs. Talas Bogor's FMCG SMEs in the plan to adopt a digital technology readiness strategy are determined by technology infrastructure, human resource competence, government policies, and costs. Direct sales from producers or distributors to consumers or end users are possible with the emergence of *e-commerce platforms*, which greatly support the sales of Talas Bogor's FMCG SME products. *Lean manufacturing* needs to be given counseling to SME FMCG producers in the city of Bogor and its surroundings, so that they can continue to maintain product quality and performance increase in consumer satisfaction and loyalty.

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